Community Dent Oral Epidemiol 2004; 32: 19–24

Community Dentistry and Oral Epidemiology

Why are we 'weighting' An assessment of a self-weighting approach to measuring oral health-related quality of life

Colman McGrath[1] and Raman Bedi[2]

[1]Periodontology and Dental Public Health, Prince Philip Dental Hospital, University of Hong Kong, Hospital Road, Hong Kong, [2]WHO Collaborating Centre for Disability, Culture and Oral Health, National Centre for Transcultural Oral Health, Eastman Dental Institute for Oral Health Care Sciences, University College London, London, UK

McGrath C, Bedi R. Why are we 'weighting' An assessment of a self-weighting approach to measuring oral health-related quality of life. Community Dent Oral Epidemiol 2004; 32: 19–24. © Blackwell Munksgaard, 2004

Abstract – *Objective:* To determine whether or not self-weighting at an item level contributes to the performance of an oral health-related quality-of-life measure. *Design:* Data were collected in two national surveys conducted a month apart, one using the 'weighted' measure and the other an 'unweighted' version of the UK oral health-related quality-of-life measure. In addition, sociodemographic and self-reported oral health status were recorded. *Results:* The UK oral health-related quality-of-life measure discriminated between groups based on age group (<65, 65 and older) and social class (higher and lower) irrespective of the version of the questionnaire used. Both versions also showed significant associations with self-reported oral health: denture status ($P < 0.01$) and number of teeth possessed ($P < 0.01$). In addition, both versions demonstrated predictive ability in identifying those in prosthetic need (<20 teeth and without recourse to a denture, $P < 0.01$). *Conclusion:* Weighting the UK oral health-related quality-of-life instrument does not improve the psychometric properties of the instrument and thus raises questions about the value of self-weighting at an item level.

Key words: psychometric performance; quality of life; weighting methods

Dr Colman McGrath, Periodontology & Dental Public Health, Prince Philip Dental Hospital, University of Hong Kong, Hospital Road, Hong Kong SAR, China
e-mail: mcgrathc@hkucc.hku.hk

Submitted 9 October 2001;
accepted 1 October 2002

Assessing the impact of oral health on quality of life has emerged, as an important part of oral health needs assessments and evaluation of outcomes of oral health care (1). Wherefore a plethora of oral health-related quality-of-life instruments have been developed to assess the physical, social and psychological consequences of oral health (2). These instruments vary in underpinning conceptual framework, dimensions, domains, number and type of items as well as scoring methods (3).

Many instruments simply involve summing up the item scores, each of which has been given an equal weight, for example the Geriatric Oral Health Assessment Index (GOHAI) (4). However, some items may be more important to the underlying concept of oral health-related quality of life, and therefore should contribute more to the total score (5). Consequently, several instruments incorporate a 'weighing' scoring system that permits an assessment of the importance or severity of oral health effects on quality of life have been developed (6–8).

Different approaches have been utilised to generate 'weights'. In some situations, 'set fixed weights' have been ascribed for particular items, generated from the views of a judging panel using Thurstone's method of paired comparisons, for example, the Oral Health Impact Profile (OHIP) (9). Although this approach benefits only from affecting the complexity of computing overall scores and not from length of questionnaire, there is little evidence that it enhances indicator's performance over simple summing of response codes (10).

Others have argued that applying 'set weights' is inappropriate because it fails to capture the salience of an event from an individual's perspective (11). To this end, self- or individual-weighting approaches

have been employed. One approach has been to apply self-weighting at a domain level, for example, the Dental Impact on Daily Living (DIDL) scale (7). However, this too had little impact on the indicator's performance (12). This in part may have been related to the fact that the differential weighting contributes little to the performance of the measures with a large number of items (13).

Another approach has been to apply individual weighting for each item. For example, the UK Oral Health related Quality-of-Life measure (OHQoL-UK(*W*)©) (14). This method has benefited some generic health-related quality-of-life measures (15). However, it brings with it complexities in scoring the instruments and inevitably adds to the length of a questionnaire. This has many drawbacks in terms of costs and burden to participants, and may limit its use in the national epidemiological surveys or in the clinical environment. Despite the inherent logic of this approach, it is imperative that the effects of weighting of individual items among oral health-related quality-of-life scales be empirically assessed.

This study is aimed to determine the performance of 'weighted' and 'unweighted' version of the UK oral health-related quality-of-life measure in two national surveys. To compare the discriminant ability of both versions in order, to identify the variations in oral health-related quality of life among subgroups of the population based on sociodemographic and self-reported oral health status factors, in addition to comparing their predictive validity in assessing those with high prosthetic need. It sets out to answer whether self-weighting at an item level contributes to the measurement of oral health-related quality of life.

Methods

Study group

The vehicle for this study was the Office for National Statistics (ONS) surveys in the UK and conducted with the assistance of ONS staff. The study group was composed of two random probability samples of UK adults selected from the UK postcode address file 1 month apart in 1999.

Data collection

The UK oral health-related quality-of-life instrument's items were derived from the public perceptions in the UK of how oral health influences quality of life (16). This identified 16 key areas of oral health-related quality of life such as comfort, eating, speaking, social life, etc. (see publication for further details). Employing the 'weighted' version, OHQoL-UK(*W*)©, participants are asked: ''what effect does the condition of your teeth, gums, mouth and/or denture have on your (*one of sixteen key areas*)'' ''Good, none or bad'' Then asked ''How would you rate the impact of this effect on your overall quality of life'' ''None, little, moderate, great or extreme'' In that way, incorporating an individual or self-weighting system. Each item can be scored on a scale from 1 to 9, a 'bad effect' of 'extreme impact' scores 1, a 'good effect' of 'extreme impact' scores 9, 'no effect' of 'no impact' is given a score of 5. Summing up individual item responses can generate an overall OHQoL-UK(*W*)© score with possible scores ranging from 16 to 144. A total score of the questionnaire represent a measure of the single construct of oral health-related quality of life. The psychometric properties of the instrument, validity (construct and criterion) and reliability of the weighted version were assessed in a local UK survey (14).

Employing the simpler unweighted version, OHQoL-UK©, participants were simply asked, ''what effect does the condition of your teeth, gums, mouth and/or denture have on your (*one of sixteen key areas*)'' ''Very bad, bad, none, good or very good'' Responses are scored from 1 (very bad) to 5 (very good) and overall OHQoL-UK© scores can range from 16 to 80. Its psychometric properties, validity (construct and criterion) and reliability (internal and test retest), have been assessed (17).

The ratings of the unweighted and weighted versions are somewhat different. The unweighted version is not concerned with rating the impact of effects and also employs a 5-point rather than a 3-point Likert scale for the rating of 'effects'. The 5-point Likert rating of 'effects' was recommended for the unweighted version of the measures so as to provide a broader range of responses rather than simply 'bad, none and good' but not used in the weighted version where the additional 'impact rating of effects' already adds complexity to the measure (17).

Trained ONS interview staff sought to carry out a face-to-face interview with an adult respondent at each household were selected. Participants were asked about how they perceived their oral health as affecting their quality of life, employing either the weighted or unweighted version of the indicator. In addition, some sociodemographic information such as age, gender and social class was collected. Social class was assessed using the UK Registrar's General

Classification of Social Class, based on occupation of head of household. Also, some proxy oral health information (self-reported number of teeth possessed and denture status) was collected.

Data analysis

The response rate of both surveys was calculated and the sociodemographic and the self-reported oral health status of the two groups were compared. OHQoL-UK(*W*)© and OHQoL-UK© scores were computed and distribution of scores were explored. Variations in the OHQoL-UK(*W*)© and the OHQoL-UK© scores in relation to sociodemographic factors (age, gender and social class), self-reported oral health status (number of teeth possessed), denture status and prosthetic need (possessing less than 20 teeth without recourse to a denture) were investigated in bivariate analysis.

Subsequently, summary binary variables were created based on median population values of the OHQoL-UK(*W*)© and OHQoL-UK© scores called 'enhanced oral health-related quality of life' (1 = above median populations scores, 0 = median or below). These binary variables were utilised as the dependent variables in the separate logistic regression analyses. The combined effect of sociodemographic factors (age, gender and social class) and proxy oral health measure (prosthetic need) on 'enhanced oral health-related quality of life' was explored in the logistic regression analysis (forward: wald).

Results

Response rate

The response rate of both omnibus surveys was similar, 70% for the 'weighted' study and 69% for 'unweighted' study. In both surveys, approximately 2% of the oral health-related quality-of-life interviews were discarded because of incomplete responses to the questions, resulting in an overall response rate of 68 and 67%, respectively. The survey groups shared similar sociodemographic characteristics in terms of age group, gender and social class ($P > 0.05$), and similar self-reported oral health status, number of teeth possessed, denture status and prosthetic need ($P > 0.05$; Table 1).

Table 1. Response rates and profile of the study groups

	'Weighted' (number (%))	'Unweighted' (number (%))
Response rate		
Selected addresses	3000 (100)	3000 (100)
Eligible addresses	2667 (100)	2718 (100)
Couldn't be contacted/ refused	812 (30)	834 (31)
Interviews achieved	1855 (70)	1884 (69)
Discarded QoL interviews	54 (2)	46 (2)
Sociodemographic profile		
Age group		
16–64-year-olds	1384 (77)	1422 (77)
Aged 65 and older	417 (23)	416 (23)
Gender		
Male	813 (45)	818 (45)
Female	988 (55)	1020 (55)
Social class		
Higher (I–IIINM)	999 (56)	991 (54)
Lower (III–VM)	737 (41)	781 (43)
Uncategorized	65 (04)	66 (04)
Oral health status		
Possess denture		
No	1224 (69)	1267 (69)
Yes	557 (31)	571 (31)
Number of teeth		
20 or more	1256 (70)	1283 (70)
Less than 20	545 (30)	555 (30)
Prosthetic need (<20 teeth and no denture)		
Yes	1699 (94)	1725 (94)
No	102 (06)	113 (06)

Perceived impact of oral health on quality of life

In both surveys, the majority of the public perceived their oral health as impacting on their quality of life, 73% (1307) in the 'weighted' survey and 75% (1378) in the 'unweighted' survey ($P > 0.05$). Both measures had low-floor and ceiling effects; in both the 'weighted' and 'unweighted' study, 1% (13 and 15, respectively) had lowest possible scores and 2% (29 and 34, respectively) had highest possible scores.

Sociodemographic variations

In both the surveys, sociodemographic disparities were apparent. Age group ($P < 0.01$) and social class ($P < 0.01$) variations in oral health-related quality of life were evident (Table 2). Older adults (aged 65 and older) were less likely to enjoy 'enhanced' oral health-related quality of life compared to younger adults (<65-year-old), being more likely to have OHQoL-UK(*W*)© and OHQoL-UK© scores below the national median values, having accounted for other factors (Table 3). Also, people from lower social class backgrounds (manual and unskilled workers) were less likely to enjoy 'enhanced' oral health-related quality of life compared to those from higher social classes (professional and nonmanual workers), having OHQoL-UK(*W*)© and OHQoL-UK© scores below national median values (Table 3).

Table 2. Variations in oral health-related quality of life: bivariate analysis

	'Weighted scores' (mean (SD))	'Unweighted scores' (mean (SD))
Sociodemographic profile		
Age group (year-olds)		
16–24	91.86 (17.62)*	58.14 (9.56)*
25–44	91.37 (17.33)	57.13 (10.47)
45–54	90.09 (18.21)	56.01 (11.00)
55–64	89.41 (17.13)	54.77 (10.20)
65–74	87.33 (14.97)	53.37 (8.18)
Aged 75 and older	86.65 (12.61)	51.55 (7.55)
Gender		
Male	89.09 (16.43)ns	55.10 (9.59)ns
Female	89.93 (16.50)	55.83 (10.42)
Social class		
Higher (I–IIINM)	91.46 (17.26)*	56.41 (10.49)*
Lower (III–VM)	87.37 (15.30)	52.53 (7.94)
Oral health status		
Possess denture		
No	91.10 (17.08)*	56.66 (10.37)*
Yes	86.08 (14.45)	52.88 (8.82)
Number of teeth		
20 or more	91.51 (17.08)*	56.89 (10.23)*
Less than 20	85.65 (14.45)	52.27 (8.87)
Prosthetic need (<20 teeth and no denture)		
Yes	82.86 (14.40)*	50.95 (9.74)*
No	89.95 (16.51)	55.79 (10.02)

*$P < 0.01$, ns = not significant, $P > 0.05$.

Oral health variations

Self-reported number of teeth possessed ($P < 0.01$), denture status ($P < 0.01$) and prosthetic need ($P < 0.01$) were associated with OHQoL-UK(*W*)© and OHQoL-UK© scores (Table 2). Furthermore, having accounted for sociodemographic factors, those with 'prosthetic need' (claiming to possess less than 20 teeth and without a recourse to a denture) were less likely to enjoy enhanced oral health-related quality of life compared to others in the population (possessing more than 20 teeth or having less than 20 teeth but recourse to a denture; Table 3).

Discussion

The response rate to both surveys was high and was in keeping with the other national oral health surveys conducted in the UK. Despite the additional burden of 'weighting' each of the 16 individual items, it did not appear to influence the number of oral health-related quality-of-life interviews that were incomplete and needed to be discarded. This suggests that length of instrument may have little effect on overall response rate.

The perceived impact of oral health on quality of life (% perceiving one or more effects) was large (over 70%) and similar in both surveys among the UK residents sharing similar characteristics, suggesting that versions of the measurement tool is unlikely to influence perceived impact. Interestingly too, irrespective of the version of the instruments used, low floor (% with lowest possible scores) and low-ceiling effects (% with highest possible scores) were observed, suggesting that both versions should be able to detect deterioration and improvements in the population.

The different Likert rating of 'effects' (3 vs. 5) used with the 'weighted' and 'unweighted' had little influence on perceived impact of oral health on quality of life (% perceiving one or more effects) or in the distribution pattern of scores (% with lowest or highest possible scores) and is thus likely to have little influence on the performance of the measure.

Sociodemographic variations in oral health-related quality of life were apparent irrespective of version of questionnaire employed. In both surveys, age group was strongly associated with oral

Table 3. Variations in oral health-related quality of life: regression analysis

	Dependent variable				
Enhanced OHQoL	Regression coefficient	Standard error	Odds ratio	95% CI	*P*-value
Weighted study					
Recourse to denture (0 = no, 1 = yes)	−0.78	0.22	0.46	0.30, 0.71	<0.001
Age group (0 ≤ 65, 1 = 65+)	−0.30	0.12	0.74	0.59, 0.93	<0.01
Social class (0 = lower, 1 = higher)	0.41	0.10	1.50	1.23, 1.83	<0.001
Gender (0 = male, 1 = female)					0.08
Unweighted study					
Recourse to denture (0 = no, 1 = yes)	−0.71	0.12	0.49	0.30, 0.71	<0.001
Age group (0 ≤ 65, 1 = 65+)	−1.02	0.10	0.36	0.23, 0.57	<0.001
Social class (0 = lower, 1 = higher)	0.51	0.10	1.66	1.37, 2.01	<0.001
Gender (0 = male, 1 = female)					0.12

health-related quality-of-life scores. Furthermore, findings from the regression analysis indicated that older people (65 years and older) were less likely to be among those in the UK enjoying enhanced oral health-related quality of life (above median of the UK population values), having accounted for gender, social class and oral health status (recourse to a denture). Similarly, social class background was strongly associated with impact of oral health on quality of life, as assessed by both versions, and these variations remained evident, having accounted for age, gender and self-reported oral health status. The effects of age and social class background on oral health impact on quality of life in the UK are widely accepted (18, 19) and the findings of this study demonstrate not only the construct validity of both versions of the UK oral health-related quality of life measure but also their similar discriminant validity.

The influence of gender on perceived impact of oral health on quality of life is conflicting. Both surveys failed to identify gender disparities in oral health-related quality of life among the UK adults. This is in keeping with findings of other studies conducted in the UK on the impact of oral health on quality of life (18, 19).

Information on oral health status relied on self-reported number of teeth possessed and information regarding whether they possessed dentures or not, while it is plausible that variations existed between patients, self-reporting and the 'actual' situation. The literature suggests that the public are, in fact, very adept at reporting their denture status and the approximate number of teeth they possess (20, 21). Moreover, findings from the recent (1998) clinical adult dental health survey indicated that most of the public are retained their natural teeth and did not possess removable dental prosthesis (22).

Oral health-related quality-of-life scores were associated with number of teeth possessed and denture status irrespective of version of the questionnaire employed. The effects of tooth loss on quality of life are widely reported (23). Furthermore, both versions were able to predict that those with high prosthetic, those who claimed they had less than 20 teeth and did not have recourse to a removable dental prosthesis, would have poorer oral health-related quality of life and this remained evident having accounted for sociodemographic factors.

The study concludes that both versions of the UK oral health-related quality-of-life indicator have similar psychometric properties in terms of their discriminant and predictive validity when employed in cross-sectional population-based surveys. This suggests that the self-weighing approach at an individual item level yields no additional benefits. However, further work may be required to determine the value of weighting when specific clinically-evaluated conditions are assessed or in longitudinal treatment studies.

References

1. Buck D, Newton, JT. Non-clinical outcome measures in dentistry: publishing trends 1988–98. Community Dent Oral Epidemiol 2001;29:2–8.
2. Slade GD, editor. Measuring oral health related quality-of-life. Chapel Hill: University of North Carolina, Dental Ecology; 1997.
3. McGrath C, Bedi R. A review of the influences of oral health on the quality of life. Int J Health Educ 1999;37:116–9.
4. Dolan TA, Peek CW, Stuck AE, Beck JC. Three-year changes in global oral health rating by elderly dentate adults. Community Dent Oral Epidemiol 1998;26: 62–9.
5. McGrath C, Bedi R. The importance of oral health to older people's quality of life. Gerodontology 1999;16:59–63.
6. Slade GD. Assessing change in quality of life using the Oral Health Impact Profile. Community Dent Oral Epidemiol 1998;26:52–61.
7. Sheiham A, Steele JG, Marcenes W, Tsakos G, Finch S, Walls AW. Prevalence of impacts of dental and oral disorders and their effects on eating among older people: a national survey in Great Britain. Community Dent Oral Epidemiol 2001;29:195–203.
8. Leao A, Sheiham A. Relation between clinical dental status and subjective impacts on daily living. J Dent Res 1995;74:1408–13.
9. Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. Community Dent Health 1994;11:3–11.
10. Allen PF, Locker D. Do item weights matter An assessment using the oral health impact profile. Community Dent Health 1997;14:133–8.
11. Bowling A. What things are important in people's lives A survey of the public's judgements to inform scales of health related quality of life. Soc Sci Med 1995;41:1447–62.
12. Leao A, Sheiham A. The development of a socio-dental measure of dental impacts on daily living. Community Dent Health 1996;13:22–6.
13. Streiner D, Norman G. Health measurement scales: a practical guide to their development and use. Oxford: Oxford University Press; 1989.
14. McGrath C, Bedi R. An evaluation of a measure of oral health related quality of life OHQoL-UK(*W*)©. Community Dent Health 2001;18:138–43.
15. Jansen SJ, Stiggelbout AM, Nooij MA, Kievit J. The effect of individually assessed preference weights on the relationship between holistic utilities and non-preference-based assessment. Qual Life Res 2000;9: 541–57.

16. McGrath C, Bedi R, Gilthorpe MS. Oral health related quality of life – views of the public in the United Kingdom. Community Dent Health 2000;17: 3–7.
17. McGrath C, Maududi ST, Bedi R. Evaluation of OHQoLUK© – an oral health quality of life measure. J Dent Res 1999;79:206–504.
18. Tickle M, Craven R, Worthington HV. A comparison of the subjective oral health status of older adults from deprived and affluent communities. Community Dent Oral Epidemiol 1997;25:217–22.
19. Nuttall NM, Steele JG, Pine CM, White D, Pitts NB. The impact of oral health on people in the UK in 1998. Br Dent J. 2001;190:121–6.
20. Gilbert GH Duncan RP, Kulley AM. Validity of self-reported tooth counts during a telephone screening interview. J Public Health Dent 1997;57:176–80.
21. Axelsson G, Helgadottir S. Comparison of oral health data from self-administered questionnaire and clinical examination. Community Dent Oral Epidemiol 1995;23:365–8.
22. Kelly M, Steele J, Nutall N, Bradnock J, Morris J, Pine C, et al. Adult dental health survey – oral health in the United Kingdom 1988. London: The Stationery Office; 2000.
23. McGrath C, Bedi R. Can dentures improve the quality of life of those who have experienced considerable tooth loss J Dent 2001;4:243–6.