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Periodontal screening during an oral public health promotion campaign: a study among health consumers

Oddy Folgerts[1,2], Yvonne A.B. Buunk-Werkhoven[3] and Ronald Batenburg[4]

[1]*Independent Researcher, Amsterdam, The Netherlands;* [2]*Dutch Dental Hygienists' Association (Nederlandse Vereniging van Mondhygiënisten; NVM-mondhygiënisten), Utrecht, The Netherlands;* [3]*SPOH ARTS – International Oral Health Psychology, Amsterdam, The Netherlands;* [4]*Netherlands Institute for Health Services RESEARCH; NIVEL, Utrecht, The Netherlands.*

Introduction: Diseases such as periodontal disease and halitosis have a negative impact on both the economy and the quality of life worldwide; thus, poor oral health has become a public health concern. The aim of this study was to characterise the oral health status of visitors to a public health consumer's exhibition using demographic and social characteristics and consumers' periodontal health condition. **Methods:** During this cross-sectional study in 2010–2014, 1,223 visitors completed a questionnaire. The periodontal condition of 760 participants was screened by dental hygienists of the Dutch Dental Hygienists' Association using the Dutch Periodontal Screening Index (DPSI). **Results:** A total of 1,029 visitors with a mean age of 45.38 years were included. The numerically lowest mean level of DPSI (2.59) occurred in 2014, whereas the numerically highest mean of DPSI (3.67) occurred in 2012. Each year, the DPSI scores were not normally distributed and were significantly higher for men than for women. Significant differences between DPSI score and age and between DPSI score and education were observed. **Conclusion:** Differences in DSPI score related to age and education were found. This means that specific groups of people with poorer oral health, mostly elderly or less-educated people, may need adjusted target interventions to prevent oral diseases. Insights into the benefits of public awareness and the development of optimally targeted interventions are needed for oral health promotion and the prevention of oral diseases.

Key words: *Oral health, oral health promotion, preventing oral diseases, dental hygienist, Dutch Periodontal Screening Index*

INTRODUCTION

Optimal oral health can be considered a fundamental component of general health, including physical and mental well-being. Oral health is considered a multifaceted phenomenon, including the ability to speak, smile, smell, taste, touch, chew and swallow, as well as the ability to express a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex. In addition, oral health is influenced by the values and attitudes of individuals and communities and reflects the physiological, social and psychological attributes that are essential to quality of life[1]. However, oral diseases cause problems that have a large impact on the global economy and society and on an individual's quality of life[2]. In particular, in the last few years, the negative impact of poor oral health on the quality of life of the elderly has become a public health matter[3]. Poor oral health resulting from a lack of oral health care has consequences, such as chewing problems, and it also increases the vulnerability of older people[4]. Furthermore, another common oral condition – halitosis – has a substantial economic impact as it affects social communication[5,6]. The global prevalence of halitosis ranges from 15% to 93%, and in a Dutch study, almost 90% of subjects reported regularly experiencing halitosis[7]. However, the highest burden of oral diseases is periodontitis; it is the sixth most common disease worldwide and associated with diseases such as diabetes[8–10]. In the Netherlands, gingivitis, known as the stage preceding periodontitis, was found in 94% of the population and almost 10% of the public has severe periodontitis[11,12]. It is therefore no wonder that an increasing amount of information on the prevention of oral diseases has become available and that public health researchers not only have shown an increasing interest in oral health status but are also interested in the prevention of oral diseases[13].

Recently, it was concluded that the promotion of oral health and the prevention and early detection of oral diseases bring economic benefits; treatment costs are lower and there is less loss of productivity because of absenteeism[2]. According to the World Health Organization, health promotion is the most cost-effective way of improving oral health and preventing oral diseases[14]. However, in the Netherlands to date, an optimal target intervention in the evidence-based promotion of oral health and in the evidence-based prevention of oral diseases is not yet available. Oral health-related interventions need to be specifically adjusted to, or designed for, the target population[13,15–17]; therefore, for the development of interventions, it is necessary to gain insight into the oral health status of the general Dutch public[18]. Because oral health is influenced by social conditions[19], this study aimed to: (i) obtain insight into the determinants of the oral health status of visitor to a public health consumer's exhibition using demographic and social characteristics; and (ii) screen the consumers' periodontal condition.

METHODS

This cross-sectional study for research with human subjects was conducted according to universal ethical principles. Visitors participated on a voluntary basis, participants were informed about what participation entailed and no pressure was placed on participants to take part in the periodontal screening by qualified dental hygienists of the Dutch Dental Hygienists' Association. These dental hygienists conducted the periodontal screening using a natural routine method based on their own professional daily practice experience, without mutual calibration. The ethical board, the Central Committee on Research Involving Human Subjects, affirms that research which requires completion of a questionnaire for one occasion does not fall under the scope of the Medical Research Involving Human Subjects Act[20]. Furthermore, the study was conducted in accordance with the Declaration of Helsinki, an extensive formal written informed consent was waived and thus only verbal informed consent was obtained.

Sample

In the third week of January 2010, 2011, 2012, 2013 and 2014, out of an average of 40,000 overall visitors, a total of 1,223 visitors to a public health consumer's exhibition 'De Nationale Gezondheidsbeurs' in Utrecht[21] were invited to participate in the study. Because of the health promotion context in which the visitors were situated, all people who wanted to participate were included in the sample. As this approach can be considered as a type of convenience sampling, sample size calculation is not required.

Questionnaire

In 2009 the first version of the questionnaire was developed by a former colleague of the first two authors. From 2011 onwards, a revised version of the questionnaire was developed by the first author by adding questions on gender, age and level of education of the participants. In addition, questions about visits to oral health professionals and oral health behaviour (e.g. opinions and preferences), as used in a Dutch study on the determinants of oral hygiene behaviour[15], were included. Age was divided into three categories: 'young' (18–44 years); 'moderate' (45–64 years); and 'old' (65–85 years). The ordinal levels of education were categorised as 'low', 'middle', 'high' and 'other'. In the Dutch educational system, a 'low' educational level refers to primary school and vocational training (Voorbereidend middelbaar beroepsonderwijs (VMBO), Middelbaar algemeen voortgezet onderwijs (MAVO)); a 'middle' educational level refers to advanced vocational training (Hoger Algemeen Voortgezet Onderwijs (HAVO), Voorbereidend Wetenschappelijk Onderwijs (VWO), Middelbaar algemeen voortgezet onderwijs (MAVO)), and a 'high' educational level refers to higher professional and scientific education. In this study, the 'other' category refers to alternative forms of education or no education. To gain more insight into who exactly provided oral health care among consumers, two questions about visits to oral health professionals were, only in the 2014 questionnaire, divided into 'attendance to a dentist' and 'attendance to a dental hygienist'. These questions and other items were open-ended, multiple choice or to be answered on specific rating scales. In 2010–2013 the questionnaire included 19 queries, and in 2014 two queries were added as described above. As face validity and experiences from the repeated data collection were satisfactory, no further validation was performed.

The Dutch Periodontal Screening Index

Participants' periodontal condition was measured using the Dutch Periodontal Screening Index (DPSI) (22), which indicated moderate to severe periodontitis. The DPSI scores were determined for each sextant on the basis of the site with the most severe condition. For practical use in Dutch oral health services, a common description of the values is as follows: DPSI score 0: 'healthy gum'; DPSI score 1 and 2: 'gingivitis'; and DPSI score 3−, 3+ and 4: 'an advanced stage of periodontal diseases'[22].

Statistical analysis

The IBM Statistical Package for Social Sciences 23.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis. Frequency distributions were created from the qualitative variables, and means, including SD, were calculated from quantitative variables. The assumption of normality was evaluated using the Shapiro–Wilk test and visual inspection of the histograms, normal Q-Q plots and box plots. Moreover, the assumption of homogeneity of variances was tested using Levene's test. As the variables did not demonstrate normality, the Mann–Whitney *U*-test and Kruskal–Wallis test were used for all analyses.

RESULTS

Response characteristics

A total of 1,029 visitors were included in this study; the mean (SD) age of the participants was 45.38 (16.09) years, with a range of 18–83 years. Visitors who had not given permission for publication of their data were excluded from the dataset of 1,223 participants. *Table 1* shows the distribution of three demographic variables for the participants in the total sample and within the years 2010–2014. A comparison with the general data from the 'De Nationale Gezondheidsbeurs' in Utrecht showed that the sample '2010–2014' reflects both the mean age and gender[21].

According to year, the dataset was built as follows. In 2010, 226 participants were included in the study, with a mean (SD) age of 44.40 (16.67) years and a range from 18 to 80 years. In 2011, 210 participants were included [mean (SD) age = 44.83 (14.56) years; range: 18–76 years]. In 2012, 150 participants were included [(mean (SD) age = 46.31 (16.68) years; range: 18–80 years]. In 2013, 203 participants were included [mean (SD) age = 45.97 (16.28) years; range: 18–77 years]. In 2014, 240 participants were included [mean (SD) age = 45.70 (16.33) years; range: 19–83 years].

In 2014, 274 (25.8%) visitors reported no attendance to a dental hygienist in the 5 years before data collection. One-third (33.3%) visited a dental hygienist 1–2 times, and almost one in five (18.3%) visitors visited 3–5 times. More than one in five (22.5%) visited a dental hygienist more than five times. Furthermore, dental visits in the 5 years prior to the data collection in 2014 were reported as follows: 0.8% never attended a dentist; 5.4% visited 1–2 times; 15.5% visited 3–5 times; and 78.2% attended >5 times. Three-quarters (76.8%) of the visitors reported that their last visit to a dentist was for a periodic oral health screening. Other reasons reported for visiting a dentist were as follows: a follow-up treatment (16.0%); and related to an emergency treatment for current complaints (7.2%).

DPSI score

The periodontal condition of 760 participants was screened by dental hygienists using the DPSI[21,23]. *Table 1* shows the distribution of the DPSI scores for the participants in the sample and within the years '2010–2014'.

Table 1 Distribution of the variable Dutch Periodontal Screening Index (DPSI) and three demographic variables for participants in the total sample and by year (2010–2014)

Variable			2010		2011		2012		2013		2014	
n			226		201		107		90		127	
Mean			3.37		3.43		3.67		3.16		2.59	
SD	Total (2010–2014)		1.17		1.27		1.17		0.38		1.35	
	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*
DPSI												
0	2.5	19	0.9	2	1.4	3	0.9	1	6.7	6	5.5	7
1	3.9	30	1.8	4	2.9	6	0	0	2.2	2	14.2	18
2	22.8	173	23.9	54	21.4	45	18.7	20	20.0	18	28.3	36
3–	29.5	224	27.9	63	29.5	62	25.2	27	31.1	28	34.6	44
3+	16.4	125	23.5	53	14.3	30	21.5	23	18.9	17	1.6	2
4	24.9	189	22.1	50	30.5	64	33.6	36	21.1	19	15.7	20
Gender												
Men	21	216	24.3	55	25.6	53	19.7	29	13.4	27	22.1	52
Women	77.8	801	75.7	171	74.4	154	80.3	118	86.6	175	77.9	183
Age												
Young (18–44 years)	44.5	458	44.7	101	45.2	95	41.3	62	44.8	91	45.4	109
Moderate (45–64 years)	43	442	42.0	95	47.1	99	44.7	67	40.9	83	40.8	98
Old (65–85 years)	12.5	129	13.3	30	7.6	16	14.0	21	14.3	29	13.8	33
Education												
Low	11.8	121	8.6	19	7	14	9.5	14	25.2	51	9.7	23
Middle	35.6	366	41.2	91	47.8	96	45.3	67	24.3	49	26.7	63
High	46.6	480	43.9	97	44.8	90	41.2	61	50	101	55.5	131
Other	4	41	6.3	14	0.5	1	4.1	6	0.5	1	8.1	19

The numerically lowest mean level of DPSI (2.59) occurred in 2014, whereas the numerically highest mean of DPSI (3.67) occurred in 2012.

DPSI score by demographic and social groups

DPSI and gender

The descriptive statistics associated with the variables DPSI and gender are reported in *Table 2*. Women had the numerically lowest mean DPSI score (3.19), and men had the numerically highest mean DPSI score (3.55). Additionally, the assumption of homogeneity of variances was tested, and the results of Levene's test ($F_{(1,749)} = 6.35$, $P < 0.01$) indicated that the differences in mean scores between male and female participants must be carefully interpreted. Therefore, a Mann–Whitney *U*-test was performed. A Mann–Whitney *U*-test indicated that the DPSI score was greater for men than for women ($U = 42{,}976$, $P < 0.001$).

DPSI and age

The descriptive statistics associated with the variables DPSI and age were also reported in *Table 2*. It can be seen that the 'young' group was associated with the numerically lowest mean DPSI score (2.81), and the 'old' group was associated with the numerically highest mean DPSI score (3.95). The assumption of homogeneity of variances was satisfied based on Levene's test ($F_{(2,757)} = 1.15$, $P = 0.314$). Therefore, a Kruskal–Wallis test was performed, and the test showed a statistically significant difference between DPSI score and age [$H(2) = 90.90$, $P < 0.001$].

DPSI and level of education

The descriptive statistics associated with the variables DPSI and level of education are also reported in *Table 2*. It can be seen that a 'high' level of education was associated with the numerically lowest mean DPSI score (3.15), and a 'low' level of education was associated with the numerically highest mean DPSI score ($M = 3.62$). The assumption of homogeneity of variances was satisfied based on Levene's test ($F_{(3,736)} = 0.13$, $P = 0.94$). Therefore, a Kruskal–Wallis test was performed, and the results showed a statistically significant difference between DPSI scores and level of education ($H(3) = 9.40$, $P = 0.024$).

Table 2 Descriptive statistics of participants who were screened for the Dutch Periodontal Screening Index (DPSI): gender, age and education

Variable	*n*	Mean (DPSI)	SD
Gender			
Male	178	3.55	1.35
Female	573	3.19	1.27
Age			
Young	347	2.81	1.23
Moderate	324	3.58	1.20
Old	89	3.95	1.28
Education			
Low	67	3.62	1.32
Middle	295	3.32	1.28
High	346	3.15	1.30
Other	32	3.25	1.31

DISCUSSION

The aim of this study was to gain greater insight into determinants of the oral health status of visitors to a public health consumer's exhibition using demographic and social characteristics and by screening the consumers' periodontal health condition. Five years' (2010–2014) worth of data were used, which were collected during a public health campaign to promote oral health. The dental hygienists of the Dutch Dental Hygienists' Association measured the participants' periodontal condition using the DPSI, and the periodontal condition of visitors was indicated on a scale from healthy gum to severe periodontitis. No systematic differences were found in the DPSI scores over the years, although the five samples from 2010 to 2014 differed in size and distribution. The demographics and social characteristics of this population are inextricably connected with the DPSI scores. Whereas the DPSI scores were not equal across the variables gender, age and educational levels, it seems that men, visitors with a 'low' educational level and older participants have poorer periodontal conditions. According to previous studies, women take better care of their oral health[16,24], and men are more likely to develop periodontal disease than are women; periodontitis was found to be highest in men[3,25]. Two other studies showed that a low level of education is associated with the progression of periodontal disease, and periodontitis is highest in adults with less than a high school education[26,27]. The result regarding the periodontal condition of the 'old' age group could be explained by the fact that the periodontal condition deteriorates over time. Almost 35% of those aged ≥65 years who have natural dentition have moderate or severe periodontal disease. As increased numbers of elderly individuals are retaining their natural dentition, the need for oral health care in this group also increases. This phenomenon applies especially to frail elderly individuals, as medication use and the presence of systemic diseases render them more vulnerable to oral diseases[28].

The present study has some limitations. First, the total sample size used in this study was not calculated:

women are somewhat overrepresented and the sample was relatively small, as the one-way ANOVA required normally distributed data to ensure a representative distribution of the population. Second, although there was no calibration among the dental hygienists of the Dutch Dental Hygienists' Association, the use of the DPSI as a measurement to screen the periodontal condition – by categorising using scores – provides only a single indicator of the severity and extent of the periodontal problems. It is not valuable or sufficient to use only the DPSI as a diagnostic instrument for the general status of the oral health of a target population, as nothing is included about caries risk or other oral diseases. However, this periodontal index is commonly used in oral health practices in the Netherlands, so it appears to be a useful tool for screening and indicating the periodontal condition of the public[23]. Third, although 1,029 respondents participated in the study, DPSI scores were only provided for 750 visitors. Issues of generalisation are of concern: perhaps those missing DPSI scores are different from those whose scores are reported. This possibility arises especially involving the differences in DPSI scores across the years studied and reported, as well as in the associations between DPSI scores and gender, age and level of education.

The results of the present study provide insight into the periodontal condition, as part of the oral health status of the visitors of a Dutch public health consumer's exhibition. Moreover, this study supports the findings of previous studies which showed that prevention of oral health diseases should include oral health-promotion and oral disease-prevention interventions specifically designed for the target population[15,16,24,29]; specific groups with poorer oral health may need adjusted target interventions to prevent oral diseases[13]. This study shows that male participants, participants with a low level of education and older participants had higher DPSI scores, which suggests that specific types of oral health interventions may be suitable for these groups. Therefore, this study provides additional evidence for the development of oral health-promotion and oral disease-prevention interventions. Dental hygienists, as highly work-engaged professionals[30] specialising in preventive oral health care, could play a significant role in promoting oral health and preventing oral diseases. After all, in a context without dental hygienists, preventive oral health care is below international standards[17].

Further research investigating the oral health status and the demographic and social characteristics of groups with poorer oral health is warranted. Studies with a larger sample size representing the Dutch population, and more accurate measurement tools, are also needed to generalise or translate these study outcomes into the development of optimal oral health promotions and interventions for oral disease-prevention in the Netherlands.

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Conflict of interest

All authors declare no competing interests.

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Correspondence to:
Oddy Folgerts,
Maassluisstraat 574 A, 1062 GZ,
Amsterdam, The Netherlands.
Email: oddy_f@hotmail.com