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Impaired oral health-related quality of life in Hungary

GYULA SZABÓ[1], MIKE T. JOHN[2], ILDIKÓ SZÁNTÓ[1], GYULA MARADA[1], DÓRA KENDE[1] & ANDRÁS SZENTPÉTERY[3]

[1]*Department of Prosthodontics, School of Dentistry, University of Pécs, Pécs, Hungary,* [2]*Department of Diagnostic and Biological Sciences, School of Dentistry, University of Minnesota, Minneapolis, MN, USA, and* [3]*Department of Prosthodontics, School of Dentistry, Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany*

Abstract

Objectives. To describe the prevalence of impaired oral health-related quality of life (OHRQoL) in the adult Hungarian population and to determine population-based norms for three Hungarian versions of the Oral Health Impact Profile (OHIP-H). ***Material and methods.*** In a survey of 1059 randomly selected subjects, OHIP responses, age, gender, and denture status [natural dentition or fixed partial dentures (FPDs), removable partial dentures (RPDs), or complete dentures (CDs)] were collected. Study outcomes were item prevalence and OHIP summary score frequency ('norms'). ***Results.*** The prevalence of OHIP items ranged from 2% to 43%, with a mean item prevalence of 14%. The distribution of summary scores was characterized by decile norms. Median scores for OHIP-H49, the 49-item questionnaire, were 6 OHIP units for subjects with FPDs, 10 OHIP units for subjects with RPDs, and 6 OHIP units for subjects with CDs. The median scores were 0, 0, and 1 OHIP units for the 14-item OHIP-H, and 0, 0, and 0 OHIP units for the five-item OHIP-H. ***Conclusions.*** Our sample demonstrates substantial OHRQoL impact in the Hungarian general population. The derived norms provide a framework for interpretation of data in future studies using the Hungarian OHIP versions, as well as data on how oral conditions and cultural factors affect perceived oral health when compared with international findings.

Key Words: *Norms, oral health, Oral Health Impact Profile, oral health-related quality of life, quality of life*

Introduction

It is increasingly acknowledged that, in addition to physical signs of oral disease, dental patients' perception of the impact of their condition is important. Therefore, the concept of oral health-related quality of life (OHRQoL) has gained widespread acceptance. Although numerous instruments have been developed and often several different language versions of a particular questionnaire have been introduced, it is rarely acknowledged that questionnaire scores *per se* have only limited meaning. An Oral Health Impact Profile (OHIP) score of 40 units, to use one of the internationally widely used instruments as an example, is difficult to interpret. This difficulty is in contrast to physical indicators of oral health, where interpretation is more straightforward, i.e. most dentists know what a mouth opening of 35 mm means for the patient's health.

To interpret OHRQoL scores, so-called 'norms' are needed. Norms indicate how frequently a particular score value is present in the target population and they therefore provide a frame of reference for the questionnaire scores in a particular population (most frequently, the general population). For OHRQoL instruments, population-based norms are available for the UK oral health-related quality of life measure (OHRQoL-UK) [1] and for the German version of OHIP [2]. However, OHRQoL impairment and the derived norms are influenced by several factors, most notably, the physical state of oral health in the particular population and sociocultural factors. Therefore, even if two regions or countries were equal regarding the frequency of oral disease, perceived oral health measured by OHRQoL scores would not necessarily be the same in the two populations. For the OHIP, available German population-based norms may not be generalized to other non-German

Correspondence: Gyula Marada, DDS, Department of Prosthodontics, School of Dentistry, University of Pécs, Dischka Gy. Street 5, H-7621 Pécs, Hungary. Tel: +36 72 535 920. Fax: +36 72 535 905. E-mail: marada.gyula@pte.hu

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populations, and therefore to understand OHRQoL in a Hungarian population it is necessary to derive norms for the three available Hungarian OHIP versions with 49, 14, or five items [3,4]. In addition, the study design for norming the instruments would also allow assessment of the perceived oral health burden in the general population using the concept OHRQoL. Population-based data describing OHRQoL in Hungary are currently lacking.

The aim of this study was to characterize the prevalence of impaired OHRQoL in randomly selected Hungarian adults and to derive population-based norms for the Hungarian versions of the OHIP.

Material and methods

Subjects and sampling

A prevalence study of 1059 randomly selected persons (age range 16–90 years; mean ± SD age 46.4 ± 17.9 years; 50.4% women) was conducted between March 2005 and July 2006 at the X-ray screening service located in Pécs, a medium-sized city (population 157,000 according to the 2004 census) in southwest Hungary. The study sample was a simple probability sample without clustering and stratification. The sampling method has been described previously [5]. Because the lung screening conducted at the X-ray service was mandatory and none of the participants refused to complete the questionnaire, the response rate was 100%. All participants signed an informed consent form. The Institutional Review Board of the University of Pécs approved the project.

Data collection

The long Hungarian version of the OHIP (OHIP-H) with 53 items (including the four special German items) [4] was completed by subjects as a self-administered questionnaire, with help provided by trained staff when necessary. OHIP response categories referring to the impact of a given OHIP item in the last month were 0 ('never'), 1 ('hardly ever'), 2 ('occasionally'), 3 ('fairly often') and 4 ('very often'). Three questionnaire summary scores were derived: (i) OHIP-H49, which represents the sum of the 49 items contained in the English version [6]; (ii) OHIP-H14, which represents the total score for the 14-item OHIP (OHIP-14) described by Slade [7]; and (iii) OHIP-H5, which represents the sum score for a five-item instrument [8]. In addition to the OHIP responses, information about age, gender, and denture status [natural dentition or having fixed partial dentures (FPDs), having removable partial dentures (RPDs), or having complete dentures in both jaws (CD)] was collected using a separate questionnaire. In terms of denture impact, single complete dentures were considered similar to RPDs; for this reason, 17 subjects with single complete dentures were included in the RPD category.

Data analysis

Study outcomes were item prevalence with 95% confidence interval (CI) and the distribution of the three OHIP summary scores. Item prevalence was calculated for *any* impairment (OHIP response categories 'hardly ever' to 'very often') and for *frequently* occurring problems (response categories 'fairly often' or 'very often') for the complete sample and for the three denture status categories. Item weights were not used, as previous studies have not provided evidence for their usefulness [9,10]. Norms were presented as deciles of the score distribution. Because of the importance of denture status [11], norms were stratified according to this variable. The OHIP medians of the denture groups were compared using a median test. The internal consistency of scores was measured by Cronbach's alpha to characterize the reliability of scores [12]. For OHIP-H49, alpha = 0.94 (lower limit of 95% CI 0.93), for OHIP-H14, alpha = 0.85 (lower limit of 95% CI 0.84), and for OHIP-H5, alpha = 0.58 (lower limit of 95% CI 0.55).

The statistical software package STATA (Release 9.0; Stata Corp., College Station, TX) was used.

Missing data

Datasets were almost complete. Ten subjects (0.94%) failed to answer one question, and two subjects (0.19%) failed to answer two questions. The dataset was completed using statistical methods to impute missing items [2].

Results

The age and gender distributions of the sample were similar to those for the population of the city of Pécs [13]: 50.4% of the subjects were women; the mean (±SD) age of the sample was 46.4 ± 17.9 years. When categorized by denture status, 783 study participants (73.9%) had natural dentitions or wore FPDs (mean ± SD age: 40.3±15.8 years), 179 (16.9%) wore RPDs (mean ± SD age: 62.7 ± 10.5 years), and 97 subjects (9.2%) were edentulous and wore CDs (mean ± SD age: 65.7 ± 10.8 years).

OHIP item prevalence

On the 53-item OHIP questionnaire, the prevalence of *any* positive response to the OHIP items (response categories 'hardly ever' to 'very often') ranged from

2% to 43% across OHIP items, with a mean of 14% (Table I). CIs for all items were ±6% or less. Three of the six most prevalent impairments related to functional limitation: 'Food catching' (43%), 'Noticed tooth that doesn't look right' (42%), and 'Dentures not fitting' (31%). Up to 15% of the subjects reported *frequently* occurring impairments (response categories 'fairly often' or 'very often'), with CIs for the frequently occurring impairments of ±5% or less. Seven items ['Dentures not fitting', 'Food catching', Noticed tooth that doesn't look right', 'Appearance affected', 'Worried', 'Sensitive teeth', and 'Discomfort (dentures)'] were reported as frequently occurring by ≥10% of the subjects. However, more than half of all the OHIP items had a 'frequently occurring' prevalence of ≤3%.

For subjects with natural dentitions or FPDs, the most frequently reported items for *any* OHRQoL impact were 'Noticed tooth that doesn't look right' (48%) and 'Sensitive teeth' (48%). Participants with RPDs mentioned 'Food catching' (58%), 'Noticed tooth that doesn't look right' (37%), and 'Dry mouth' (37%) most often. Subjects with CDs reported 'Take longer to complete a meal' (59%), 'Painful gums' (56%), and 'Food catching' (46%) most often (Table II).

OHIP summary scores (norms)

Decile norms for OHIP-H49, -H14, and -H5 are provided in Table III. Median values (50th percentile) were 7 units for the longest OHIP (OHIP-H49) and 0 units for both short OHIP instruments; the 90th percentiles were 33, 7, and 4 units for the OHIP-H49, -H14, and -H5, respectively.

OHRQoL was different among denture groups. Subjects having their own teeth or FPDs (FPD group) presented the least impaired OHRQoL. When OHRQoL was measured with the long instrument (OHIP-H49), the median score for this group was 6 OHIP units. This median was the same as the median for complete CD subjects. RPD wearers had a median OHIP-H49 score of 10 units. However, RPD and CD subjects presented higher 90th percentile values than subjects with FPDs (39 and 30 units, respectively), which indicates that subjects with missing teeth had more substantial OHRQoL impairment. The OHIP-H49 median score for the RPD group was significantly different from that for subjects with natural dentition or FPDs ($P = 0.007$) or from CD wearers ($P = 0.02$).

Norms for OHIP-H14 and -H5 showed similar patterns in all three denture categories for subjects in the middle and at the tails of the score distribution. In general, distributions obtained with the shorter instruments suggested that subjects with removable or complete dentures had more oral health-related problems than subjects with natural teeth or FPDs. However, the differences between RPD and CD wearers were not as large in absolute values as for the long OHIP, and they were not consistent across instruments.

Discussion

This is the first study to present population-based data from Hungary about perceived oral health measured by OHRQoL instruments. The perceived OHRQoL-related burden from oral diseases in Hungary observed in this study was substantial and complements surveys collecting mainly physical oral health measures [14]. The population-based norms produced from this study for all three Hungarian OHIP instruments will serve as a frame of reference for OHIP scores obtained in future Hungarian OHRQoL studies. They also provide data on how oral conditions and cultural factors affect perceived oral health when compared with international population-based findings.

Prevalence studies face considerable challenges. The sampling frame needs to cover the target population adequately. For example, telephone lists are frequently used as the sampling frame and, therefore, can lead to non-coverage error because unlisted numbers and multiple phone numbers cause possible bias [15]. Even in an ideal sampling frame, non-participation can distort prevalence results considerably, because it is generally assumed that study participation is influenced by health status. In addition, item non-responses (in other words, particular responses that are missing for a participating subject) are another source of errors unrelated to sampling. All of these sources of bias do not necessarily lead to invalid survey results, but in most settings the magnitude and direction of the distortion are not known [16]. The present study eliminated most of the possible bias because subjects were selected from a medical screening registry, participation in the medical screening process from which the study subjects were selected was mandatory, and the number of missing answers was negligible. None of the previous population-based OHRQoL studies in Australia [17], the UK [1], Finland [18], the USA, Canada [19], or Germany [20,21] had achieved this level of methodological rigor. In addition, the distributions of age, gender, and socioeconomic variables for the population of Pécs are similar to the distributions of these variables throughout Hungary, which provides the potential to apply our study results to the general Hungarian population.

Our results revealed that oral health problems were prevalent in the Hungarian population studied. This finding is in line with a previous national survey in Hungary which stated that "The population's need for

Table I. Past-month period prevalence estimates for any OHRQoL impairment (responses of 'hardly ever', 'occasionally', 'fairly often', or 'very often' combined) and for frequently occurring impairment ('fairly often' or 'very often') for all items (items highlighted in gray are on the OHIP-H14; items in italics are on the OHIP-H5).

	Prevalence of impairment on item [% (95% CI)]		
Item[a] (Item No.)	Dimension OHIP-E [6]	Any impairment	Frequent impairment
Prevalence of any impairment >30%			
Food catching (7)	1	43 (40–46)	14 (12–16)
Noticed tooth that doesn't look right (3)	1	42 (39–46)	14 (12–17)
Sensitive teeth (13)	2	41 (38–44)	10 (9–12)
Worried (19)	3	35 (32–38)	13 (11–15)
Dry mouth (53)	8	35 (32–38)	9 (8–11)
Dentures not fitting (9)	1	31 (25–37)	15 (11–20)
Prevalence of any impairment 21–30%			
Painful gums (15)	2	27 (25–30)	6 (5–8)
Toothache (14)	2	27 (24–30)	5 (4–7)
Appearance affected (4)	1	25 (23–28)	14 (12–17)
Joint noises (52)	8	25 (22–28)	6 (5–8)
Takes longer to complete meal (51)	8	24 (21–26)	9 (7–11)
Breath stale (5)	1	24 (21–26)	5 (4–7)
Discomfort (dentures) (18)	2	21 (17–27)	10 (7–14)
Prevalence of any impairment 10–20%			
Difficulty chewing (1)	1	18 (16–21)	8 (7–10)
Avoid eating (28)	4	17 (15–20)	4 (3–5)
Painful aching (10)	2	17(15–20)	4 (3–6)
Uncomfortable to eat (16)	2	16 (14–19)	4 (3–5)
Sore spots (17)	2	16 (14–19)	4 (3–5)
Self-conscious (20)	3	15 (13–17)	4 (3–6)
Avoid smiling (31)	4	14 (12–17)	5 (4–7)
Unable to eat (dentures) (30)	4	13 (10–18)	3 (1–6)
Unable to brush teeth (27)	4	12 (10–14)	2 (1–3)
Appearance uncomfortable (22)	3	12 (10–14)	4 (3–5)
Speech unclear (24)	4	11 (10–13)	3 (2–5)
Upset (34)	5	11 (9–13)	3 (2–5)
Tense (23)	3	10 (9–12)	4 (3–5)
Sleep interrupted (33)	5	10 (8–12)	2 (1–3)
Prevalence of any impairment <10%			
Been embarrassed (38)	5	9 (7–11)	3 (2–4)
Sore jaw (11)	2	9 (7–11)	3 (2–4)
Less flavor in food (26)	4	9 (7–10)	2 (1–3)
Avoid eating with others (50)	8	8 (7–10)	1 (1–2)
Difficult to relax (35)	5	8 (7–10)	2 (1–3)
Taste worse (6)	1	8 (6–10)	3 (2–4)
Less tolerant of others (40)	6	8 (6–9)	1 (1–2)
Irritable with others (42)	6	7 (7–10)	1 (1–2)
Trouble pronouncing words (2)	1	7 (6–9)	2 (2–4)
Depressed (36)	5	7 (6–9)	2 (2–3)
Headaches (12)	2	7 (6–9)	2 (1–3)

Table I. (*Continued*).

Item[a] (Item No.)	Prevalence of impairment on item [% (95% CI)]		
	Dimension OHIP-E [6]	Any impairment	Frequent impairment
Financial loss (45)	7	7 (5–8)	2 (1–3)
Unable to enjoy people's company (46)	7	6 (5–8)	1 (1–2)
Others misunderstood (25)	4	6 (5–8)	1 (0–1)
Miserable (21)	3	6 (5–8)	3 (2–4)
Digestion worse (8)	1	6 (5–8)	2 (1–3)
Health worsened (44)	7	6 (5–8)	1 (1–2)
Interrupt meals (32)	4	6 (5–8)	1 (1–2)
Concentration affected (37)	5	6 (5–8)	1 (1–2)
Diet unsatisfactory (29)	4	5 (3–6)	1 (0–1)
Trouble getting along with others (41)	6	5 (4–7)	1 (1–2)
Life unsatisfying (47)	7	5 (3–6)	1 (1–2)
Avoid going out (39)	6	4 (3–5)	1 (1–2)
Unable to work (49)	7	3 (2–4)	1 (0–1)
Difficulty doing jobs (43)	6	3 (2–4)	0 (0–1)
Unable to function (48)	7	2 (1–3)	1 (0–1)

[a]Sorted according to the item prevalence of any impairment.

treatment at all levels (restorative, periodontal and prosthetic) was enormous" [14]. When examining the prevalence of *any* positive response to OHIP items, the subjects in this study were most concerned about 'Food catching', 'Noticed tooth that doesn't look right', 'Sensitive teeth', 'Worried', 'Dentures not fitting', or 'Dry mouth', with all these problems mentioned being in at least 30% of the sample population. All of these problems were also mentioned as frequently occurring (responses of 'fairly often' or 'very often') by at least 10% of the population (except for 'Dry mouth', 9%). In addition, other problems mentioned as frequently occurring by at least one in 10 subjects were 'Dentures not fitting', 'Discomfort (dentures)', and 'Appearance affected'. Beyond painful conditions, denture-related problems and appearance-related concerns emerged in this study as important for this Hungarian population. When frequently occurring problems were used to define which oral health problems impacted the population most, the items that were most commonly reported as frequently occurring were largely similar to those mentioned most often as having any occurrence. These findings are compatible with previous results where dichotomous answers used to derive prevalence figures were found to represent the ordinal OHIP item response adequately [22].

In a national prevalence study in Germany, similar results have been reported in terms of important oral health-related problems; specifically, subjects commonly mentioned 'Dentures not fitting' (59%), 'Discomfort with dentures' (51%), 'Food catching' (46%), 'Sensitive teeth' (39%), and 'Breath stale' (39%) [20]. These responses and those in the present study indicate that denture-related problems are prevalent in both the German and Hungarian populations. It is interesting to note that *any* problems with dentures were mentioned more often in the German population, but that *frequently* occurring denture-related problems were reported more often in the Hungarian population.

Another recent national oral health survey, the Fourth German Oral Health Study (DMS IV), studied OHRQoL using a 14-item German version of the OHIP, the OHIP-G14 [21]. The DMS IV studied OHRQoL in adults aged 35–44 years and seniors aged 65–74 years. The two most prevalent items reported were 'Uncomfortable to eat' and 'Painful aching' (prevalence of any impact: 25–35%). Our Hungarian study showed a lower prevalence for these problems (16–17%). However, in the context of the OHIP-H14, these two items were the most prevalent in our sample. These results may indicate that the rank order of OHRQoL problems for two European countries, Germany and Hungary, is not substantially different. In a recent Korean study, the items 'Breath stale', 'Food catching', 'Sensitive teeth', 'Toothache', and 'Tense' were observed with highest prevalence, lending support to the notion of the importance of these problems across populations [23].

When our population-based subjects (in other words, subjects who were not seeking dental treatment) were compared with clinical patients seeking prosthodontic treatment in Germany [24], eating and

Table II. Past-month period prevalence estimates for any OHRQoL impairment in subjects with natural dentition or FPDs, RPDs, and CDs.

Item[a] (Item No.)	Prevalence of impairment on item [% (95% CI)]		
	Natural dentition or without partial dentures (FPD; *N* = 783)	Removable dentures (RPD; *N* = 179)	Complete dentures (CD; *N* = 97)
Difficulty chewing (1)	15 (13–18)	27 (21–35)	30 (21–40)
Trouble pronouncing words (2)	5 (3–6)	15 (10–21)	14 (8–23)
Noticed tooth that doesn't look right (3)	48 (44–51)	37 (30–45)	10 (5–18)
Appearance affected (4)	27 (24–31)	23 (17–30)	14 (8–23)
Breath stale (5)	26 (23–29)	21 (15–27)	12 (7–21)
Taste worse (6)	5 (3–6)	13 (9–19)	22 (14–31)
Food catching (7)	39 (35–42)	58 (51–65)	46 (36–57)
Digestion worse (8)	5 (4–7)	9 (5–14)	12 (7–21)
Dentures not fitting (9)	–[b]	30 (24–37)	32 (23–42)
Painful aching (10)	19 (16–22)	11 (7–16)	21 (13–30)
Sore jaw (11)	9 (7–11)	7 (4–12)	9 (4–17)
Headaches (12)	8 (6–10)	3 (1–6)	5 (2–12)
Sensitive teeth (13)	48 (45–52)	29 (23–36)	3 (1–9)
Toothache (14)	32 (28–35)	17 (12–24)	6 (2–13)
Painful gums (15)	23 (20–26)	33 (26–40)	56 (45–66)
Uncomfortable to eat (16)	13 (11–16)	22 (16–29)	27 (18–37)
Sore spots (17)	16 (13–19)	13 (9–19)	24 (16–33)
Discomfort (dentures) (18)	–[b]	20 (15–27)	24 (16–33)
Worried (19)	39 (36–43)	25 (19–32)	19 (11–28)
Self-conscious (20)	15 (13–18)	15 (10–21)	11 (6–19)
Miserable (21)	6 (5–8)	8 (5–13)	4 (1–10)
Appearance uncomfortable (22)	12 (9–14)	14 (9–20)	8 (4–16)
Tense (23)	10 (8–12)	12 (8–18)	10 (5–18)
Speech unclear (24)	9 (7–11)	19 (14–26)	21 (13–30)
Others misunderstood (25)	5 (4–7)	9 (5–14)	8 (4–16)
Less flavor in food (26)	5 (4–7)	13 (9–19)	24 (16–33)
Unable to brush teeth (27)	14 (11–16)	11 (7–17)	2 (0–7)
Avoid eating (28)	13 (11–16)	28 (22–36)	32 (23–42)
Diet unsatisfactory (29)	4 (3–5)	8 (5–13)	3 (1–9)
Unable to eat (dentures) (30)	–[b]	14 (9–20)	12 (7–21)
Avoid smiling (31)	16 (13–18)	13 (9–19)	7 (3–14)
Interrupt meals (32)	4 (3–6)	9 (5–14)	16 (10–25)
Sleep interrupted (33)	11 (9–13)	8 (4–13)	3 (1–9)
Upset (34)	10 (8–13)	16 (11–22)	7 (3–14)
Difficult to relax (35)	8 (6–10)	9 (6–15)	8 (4–16)
Depressed (36)	6 (4–8)	15 (10–21)	5 (2–12)
Concentration affected (37)	7 (5–8)	6 (3–11)	1 (0–6)
Been embarrassed (38)	8 (6–10)	13 (8–19)	9 (4–17)
Avoid going out (39)	4 (3–5)	4 (2–8)	6 (2–13)
Less tolerant of others (40)	8 (6–10)	8 (5–13)	5 (2–12)
Trouble getting along with others (41)	5 (4–7)	6 (3–10)	5 (2–12)
Irritable with others (42)	8 (6–10)	8 (4–13)	7 (3–14)

Table II. (*Continued*).

Item[a] (Item No.)	Prevalence of impairment on item [% (95% CI)]		
	Natural dentition or without partial dentures (FPD; N = 783)	Removable dentures (RPD; N = 179)	Complete dentures (CD; N = 97)
Difficulty doing jobs (43)	3 (2–5)	4 (2–8)	1 (0–6)
Health worsened (44)	6 (5–8)	6 (3–10)	5 (2–12)
Financial loss (45)	6 (5–8)	8 (4–13)	7 (3–14)
Unable to enjoy people's company (46)	6 (4–7)	9 (5–14)	5 (2–12)
Life unsatisfying (47)	4 (3–6)	7 (4–11)	4 (1–10)
Unable to function (48)	2 (1–3)	2 (1–6)	0 (0–4)
Unable to work (49)	3 (2–5)	3 (1–7)	1 (0–6)
Avoid eating with others (50)[c]	6 (4–7)	12 (8–18)	21 (13–30)
Take longer to complete meal (51)[c]	17 (14–20)	35 (28–42)	59 (48–69)
Joint noises (52)[c]	28 (25–32)	14 (9–20)	16 (10–25)
Dry mouth (53)[c]	34 (30–37)	37 (30–45)	40 (30–51)

[a]Sorted according to item number.
[b]Not applicable to subjects without removable/complete dentures.
[c]The last four items (50–53) under the heavy horizontal line are the four specific German items.

chewing were found to be a major concern only in the treatment population. In the German patient population, four out of the five most prevalent items were concerned with disturbed eating and chewing ('Difficulty chewing', 'Take longer to complete a meal', 'Uncomfortable to eat', and 'Unable to eat (Dentures)'). In contrast, these items were not observed among the first five most prevalent items in the present population-based Hungarian study. Although prosthodontic patients represent only a proportion of dental patients, differences between German and Hungarian subjects may exist. The differences in the findings of these two studies may indicate that the profile of subjects' problems in the general population and in dental patient populations is different.

It is of note that the fifth most prevalent item in the present study, 'Dry mouth', is not part of the original 49 items in the English version of the OHIP [6]. This particular item was found to be important in the development of the German OHIP version [10], and is therefore one of four items added as culture-specific items for OHIP-G. Two other items found to be important in the German population ('Take longer to complete a meal' and 'Joint noises') were also found in our study to have considerable prevalence in Hungary (24% and 25%, respectively). Our results demonstrate the usefulness of the inclusion of these additional OHIP items in the Hungarian version of the OHIP.

When the construct OHRQoL as a whole is characterized by the OHIP summary score, we are able to compare our study results with several population-based studies. German median OHIP-49 scores were different from our results, with 5 units for subjects with natural teeth or FPDs, 15 units for RPD subjects, and 23 units for CD subjects [2]. These results indicate an overall difference in OHRQoL burden and a different impact across denture categories in the German and Hungarian populations. Based on median OHIP-H49 scores, subjects in Hungary suffer fewer problems when compared with the German population.

Denture status had a substantial influence on OHIP scores in our population. When looking at the deciles of the score distributions, the highest OHIP-H49 scores were observed among RPD wearers; CD wearers had lower OHIP scores than RPD wearers, but higher scores than subjects with natural dentition or FPDs. The pattern of OHIP-H14 and -H5 scores differed somewhat from that of the long instrument; however, in all samples the FPD group (those with natural dentition or FPD wearers) had the lowest OHIP scores. The literature provides strong evidence that denture status or the related variable number of teeth is a strong predictor for OHRQoL [25–28]. Previous studies have shown that number of teeth are significantly associated with OHRQoL. For example, national samples in the UK and Australia found that the OHIP-14 score was increased (meaning that more problems were reported) for subjects with only 1–8 remaining teeth (10.0 OHIP units in Australia; 6.6 units in the UK) compared with subjects with 25–32 remaining teeth (6.7 units in Australia; 4.9 units in UK) [28]. Although these effects were statistically significant, tooth loss (together with age, denture status, and gender) explained only a small fraction of the variance in OHIP scores (≈5%). However, in other population-based studies targeting subjects ≥50 years of age, the

Table III. Decile norms with 95% CIs for OHIP-H49, -H14, and -H5 summary scores.

Percentile	Natural dentition or without partial dentures (FPD; *N* = 783)	Removable dentures (RPD; *N* = 179)	Complete dentures (CD; *N* = 97)	Overall (*N* = 1059)
OHIP-H49 score (95% CI)				
10	0 (0–1)	0 (0–1)	0 (0–2)	0 (0–1)
20	2 (2–2)	2 (1–3)	2 (1–3)	2 (2–2)
30	3 (3–4)	4 (3–6)	3 (2–4)	3 (3–4)
40	5 (4–5)	7 (4–9)	4 (3–6)	5 (4–5)
50	6 (6–7)	10 (7–11)	6 (4–8)	7 (6–8)
60	9 (8–10)	12 (10–16)	8 (6–12)	9 (8–10)
70	11 (10–13)	17 (14–20)	12 (8–15)	12 (11–14)
80	17 (16–20)	25 (18–33)	16 (13–33)	18 (17–20)
90	30 (24–35)	39 (32–59)	39 (20–62)	33 (29–37)
OHIP-H14 score (95% CI)				
10	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
20	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
30	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
40	0 (0–0)	0 (0–0)	0 (0–1)	0 (0–0)
50	0 (0–0)	0 (0–1)	1 (0–2)	0 (0–0)
60	1 (0–1)	1 (1–2)	2 (1–3)	1 (1–1)
70	2 (1–2)	2 (2–4)	3 (2–5)	2 (1–2)
80	3 (2–4)	5 (3–8)	5 (3–7)	3 (3–4)
90	7 (5–8)	11 (8–14)	8 (6–15)	7 (6–8)
OHIP-H5 score (95% CI)				
10	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
20	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
30	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
40	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
50	0 (0–0)	0 (0–0)	0 (0–1)	0 (0–0)
60	0 (0–0)	1 (0–2)	1 (0–2)	0 (0–0)
70	1 (1–1)	2 (1–3)	2 (1–3)	1 (1–2)
80	2 (2–2)	4 (3–4)	4 (2–6)	2 (2–3)
90	4 (3–4)	5 (4–7)	6 (4–10)	4 (4–5)

number of missing teeth explained 18% of the variance in OHIP scores [27]. The OHIP summary score was correlated (r = 0.42/0.43) with the number of missing teeth, the number of functional units, or the number of posterior functional units. Other instruments (for example, the Geriatric Oral Health Assessment Index) produced similar results, with correlation coefficients of 0.33 [26]. Some of these results incorporate age, socioeconomic status, and other OHRQoL predictors, and adjust for the influence of these variables. Therefore, these results may support the clinical experience that FPDs are a more natural means of replacing missing teeth than removable and complete prostheses (RPD and CD) [25,29]. In general, population-based surveys need to contain key indicators of physical oral health, such as the number of (missing) teeth or the proportion of edentulous subjects, to be comparable. In addition, we recommend that standardized measures such as the self-report of oral health status [28–30] be incorporated. Furthermore, the OHIP, with instruments ranging from 49 to five items, provides another useful and more comprehensive measure to describe oral health from the patient's perspective.

Derived norms not only describe the mean or median of the OHRQoL impairment as a measure of the central tendency of scores, but also aim to characterize the full distribution of OHIP scores. This concept is particularly important, because this study and others [2,31] have shown that OHRQoL scores are not normally distributed in the general population. Therefore, mean and SD values for OHRQoL instruments are of limited value. We chose decile norms rather than methods that have been used

in other instruments. For example, the Short Form-36 uses '*norm-based scoring*'; this type of scoring uses linear transformations of scores to a mean of 50 and an SD of 10, in a particular target population, such as the general US population [32]. Although we acknowledge the advantages of norm-based scoring (enhanced interpretability and compatibility of results), we wanted to avoid assumptions underlying score standardization in smaller groups of subjects.

Scores are often normed according to gender and age strata. The strongest influence on OHIP scores came from denture status, which is confounded with the number of (missing) teeth. Therefore, we decided to stratify OHIP norms in this study according to a three-category denture status variable. We believe this categorization is easy and intuitively interpretable. Our norming sample fulfills criteria used for HRQoL instruments [33].

Conclusions

In the absence of agreed criteria for interpreting (oral) health measures, normative data provide a useful framework for interpreting scale scores. We have provided population-based data for a sample of Hungarian citizens, but certainly norms for specific patient populations need to follow. These patient populations would complement comparisons of individual respondents' scores (or average scores for a group of respondents) with those for the general population by providing the opportunity for comparison with other meaningful populations with specific oral diseases.

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