Self perceived oral health and quality of life of middle school students in Liberia and the USA – does culture matter?

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Abstract

Aims: To assess self perceived oral health and oral health-related quality of life (OHRQoL) of middle school students in Liberia and the USA (Aim 1), to compare the responses of these two groups of students (Aim 2), and to explore whether self perceived oral health and OHRQoL are related among the adolescents in these two countries (Aim 3). ***Methods:*** Questionnaire data on OHRQoL were collected from a convenience sample of 406 students (36.5% male / 63.5% female; average age = 14.51 years; SD = 2.586) in nine middle schools in Monrovia, Liberia, and from 453 black students (42.3% male / 57.7% female; average age = 12.74 years; SD = 1.023) in six middle schools in socio economically disadvantaged neighborhoods in the USA. ***Results:*** Compared to middle school students in the USA, Liberian students had a tendency to describe their oral health as more positively (4 point scale from 1 = "not healthy" to 5 = "very healthy": 3.18 vs. 3.06; p = .092) and they had a higher variance in their responses (1.428 vs. .487; p < .001). However, the Liberian students reported on average more oral health-related pain, more temporomandibular joint related symptoms, and more negative consequences of their oral health status than the students in the USA. Self perceived oral health correlated with oral health-related quality of life sub scores as well as with the total OHRQoL score in both countries (Liberia: r = -.37; p<.001 / USA: r = -.26; p<.001). ***Conclusions:*** Cultural influences on the responses to questions concerning self perceived oral health and OHRQoL should be studied. Assessing oral health-related quality of life indicators can contribute to a more differentiated understanding of self perceptions of oral health-related experiences of middle school students in different cultural settings.

Key Words: Oral health quality of life, children, Liberia and USA.

Introduction

Liberia is a relatively small country in the Western part of Africa. In 2004, Liberia had a population of about 3,367,000 citizens and ranked as number 127 in population size among the 193 nations of the world [1]. Liberia is one of the poorest countries in the world with a GDP per capita of US$ 140 [2]. In November 2004, more than 80% of the population in Liberia lived on less than $1 per day and 52% lived in extreme poverty. The unemployment rate was 85%. Only 3% of the population was over 65 years old, but 43% were under 15 years of age [1]. Health statistics show that the mortality rate is only 41 years for men and 44 years for women [3]. According to UNICEF, Liberia's infant and under age five-years-old mortality rates are among the five highest in the world [4]. More than 15% of Liberian children die before they reach their first birthday. In the year 2000, 45.3% of children under the age of five years were stunted for their age and 22.8% were underweight for their age [3]. Overall, approximately 40% of the population does not have access to safe water, and 75% does not have access to adequate sanitation [4].

Considering these general statistics, an exploration of oral health-related matters becomes interesting. Concerning oral health care services, the World Health Organization (WHO) estimated that Liberia had just one dentist per one million people in 2004 compared to six dentists per 10,000 citizens in the USA [5]. This statistic implies that there are currently only three dentists practicing in Liberia and they all practice in the capital city, Monrovia.

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Recent data on the oral health status of Liberian citizens are not available due to the devastation of the health infrastructure during the recent civil war. However, the average Liberian has little or no access to dental care, which results in thousands of Liberians living with constant pain due to tooth decay.

While there are no objective oral health data available from Liberia, data are available in the USA. For example, statistics from the 1988 – 1994 NHANES III data set showed that caries affected 52% of children between six and eight years of age and 61% of adolescents by the age of 15 years [6]. More recent data showed that the percentage of untreated dental decay among 12 to 19 year old adolescents was 18.5% [7]. However, these data also showed that the percentages of poor adolescents in the USA with untreated caries were significantly higher (27.5%) and that the highest percentages of untreated caries were found in poor adolescents from underrepresented minority backgrounds (Non-Hispanic black: 30.3%; Mexican-American: 29.9%) [7]. Data in the USA will therefore be collected from black middle school students in socio economically disadvantaged neighborhoods [7].

In addition to caries, several other oral health concerns need to be considered, namely juvenile periodontitis (rapidly aggressive, early onset periodontitis) [8], malocclusion [9], and temporomandibular disorders (TMD) [10-14]. While periodontal diseases are not as common as caries, affecting less than 1% of children in the USA, they are equally devastating [8]. In addition, children affected by periodontal diseases are more likely to have reoccurrences as adults.

Concerning the prevalence of malocclusion in children, a recent study in the USA with 1,566 preadolescent children (9 to 11 years of age) showed that based on oral screenings 14.1% of children required orthodontic treatment and 3% greatly required treatment [9].

Finally, temporomandibular disorders in children are a largely overlooked health concern. However, the few available publications strongly suggest considering the importance of these issues [10-14]. For example, in one study, List et al. (1999) showed that 7% of 12 to 18 year old adolescents were diagnosed with TMD pain, with 21% of these respondents reporting that they had pain in the head, 12% in the temples, and 3% in their face, temporomandibular joint, or jaws at least one time per week or more often [2]. In another, Nilsson et al. (2005) reported that 4.2% of the 28,899 adolescents in their study (age group: 12 – 19 years) reported TMD pain [14]. Again, there is evidence to suggest that the prevalence rates for this disorder differ for different racial/ethnic groups and that black children report more TMD symptoms than white children [11].

A reflection on these different aspects of oral health leads to the conclusion that a general indicator of self perceived oral health is not providing insights into which aspects of an adolescent's oral health might contribute to overall self reported oral health assessments. However, measures of oral health-related quality of life do contain questions that reflect the consequences of different oral health-related issues [15]. For example, consequences of caries can be measured with responses to such questions as "Do your teeth hurt you now?" or "Do your teeth hurt when you eat something sweet?". Consequences of temporomandibular disorders would be reflected in responses to questions such as "Does it hurt when you open your mouth wide?" and "Do you hear a noise (clicking) when you open your mouth wide and close it?". And considerations of malocclusion are likely to affect the responses to a question such as "Do you have a nice smile?" [16].

Filstrup et al. (2003) showed that even younger children's oral health-related quality of life can be reliably and validly measured both with surveys for the young patients themselves as well as with parents' proxy ratings of their children's OHRQoL [16]. They therefore developed a scale that can be used with children as young as five years of age [16]. Subsequently, other researchers [17, 18, 19] have developed and validated oral health-related quality of life measures for older children/adolescents. Overall, this research with children and adolescents showed that oral health-related quality of life can be assessed by the children and adolescents themselves and that it is correlated with objective oral health indicators.

Aims

Against this background this study explored whether self assessed OHRQoL is also correlated with subjective oral health self assessments. Its aims were to assess the Liberian middle school students' self reported oral health and oral health-related quality of life, to compare it with the responses of socio economically disadvantaged black stu-

dents in the USA, and to explore the degree to which oral health and quality of life are related in these two groups of respondents.

Methods

This research was approved by the Institutional Review Board (IRB) for the Health Sciences at the University of Michigan in Ann Arbor, Michigan. The school administrators of the private schools in Liberia and the superintendent of the school district in South Carolina, USA, gave their written approval that this study could be conducted in their schools.

Respondents: Data were collected from a convenience sample of 406 middle school students (36.5% male / 63.5% female; average age = 14.51 years; SD=2.586) in grades 6 to 8 in nine middle schools in Monrovia, Liberia, and from 453 black middle school students (57.7% female/42.3% male; average age =12.74 years; SD=1.023) in six predominantly black middle schools in Columbia, South Carolina, USA. It is important to note that the respondents in the USA attended schools with an average of 83% of the students on free school lunches (range: 69.71% to 95.65%). This fact indicates that the large majority of the US respondents were socio economically disadvantaged [20].

Procedure: After gaining approval from the school administrators in Liberia and the USA as well as from the Institutional Review Board for the Health Sciences at the University of Michigan, the students were asked to take a letter with information about the research and a consent form home to their parents / guardians and ask them to sign the consent form. The students then returned the signed consent forms to their teachers. The students whose parents gave written consent that their children had permission to participate in the study were then asked if they gave their assent to respond to a survey. If the students gave their written assent, they received a questionnaire in their classrooms and were asked to respond to this survey anonymously.

Material: Given that half a million of children in Liberia do not attend school and that two thirds of the students are being taught by poorly qualified teachers [4], it seemed advisable to select an OHRQoL scale that was easy to self administer and respond to. The Michigan Oral Health-related Quality of Life Scale – Child Version [16] is such a scale because it requires the respondents to respond merely with a "yes" or "no" response to simple questions. The scale was part of a self-administered questionnaire that had two more sections. Section 1 was concerned with the students' background (such as age, gender, and grade in school); Section 2 asked the students to self assess their own oral health and to describe their oral health-related behavior (e.g., frequency of brushing, visits to a dentist); Section 3 consisted of the revised version of the Michigan Oral Health-related Quality of Life Scale – Child Version [21]. This scale consists of 10 questions (see table 2 for the wording of the questions) which are answered with "yes" (=1) or "no" (=0). A "yes" response to the item "Do you have a nice smile?" indicates a positive OHRQoL, while "yes" responses to all other items indicate negative OHRQoL. Before adding up the number of "yes" responses in order to compute an OHRQoL Total Index, the responses to the positively worded item are recoded ("0=1" and "1=0"). The OHRQoL Total Index can therefore range from 0 to 10. The reliability of this index was determined by computing an intraclass correlation coefficient. This coefficient was .776 ($p<.001$). In addition, three sub indices were computed. The "yes" responses to the first four items in table 2 were added up to create a Pain Index (intraclass correlation coefficient = .668; $p<.001$). The "yes" responses to the two items "Does it hurt when you open your mouth wide?" and "Do you hear a noise (clicking) when you open your mouth wide and close it?" were added to create a TMD Index (intraclass correlation coefficient = .385; $p<.001$). The "yes" responses to the items concerning the consequences of poor oral health (namely concerning waking up at night, having pain in school, or missing school because of a tooth ache) were added up to compute a Consequences Index (intraclass correlation coefficient = .741; $p<.001$).

Statistical analyses: Descriptive statistics were used to provide an overview of the findings. The frequencies of the "Yes/ No" responses of the students in Liberia and the USA were compared with chi square tests and their average responses to the self perceived oral health question and their OHRQoL indices were compared with independent sample t-tests. Pearson correlation coefficients were computed to analyze the relationships between self perceived oral health and oral health-related quality of life indicators.

Results

The first aim was to assess the responses of the middle school students in Liberia concerning their self perceived oral health and oral health-related quality of life. *Table 1* provides information about the frequencies of self reported oral health respons-

es and Table 2 provides the students' responses concerning their oral health-related quality of life. The answers to the question "How healthy are your teeth and gums?" were given on a four point answer scale which ranged from 1 = "not healthy" to 4 = "very healthy". As can be seen in *Table 1,* while 53% of the Liberian children rated their oral health as very healthy, quite a substantial percentage (16%) of children reported that their oral health was not healthy or did not answer this question (15.5%). *Table 2* shows that significant percentages of Liberian students reported that they had pain at the time they answered the survey (18.3%), when they eat something hot or cold (41.1%), when they eat something sweet (37%) and when they chew or bite (35.6%). While only 12.2% of the children reported pain when opening their mouth wide, more than 3 out of 10 students (31.3%) responded that they heard a noise (clicking) when opening their mouth wide and closing it. More than a third of the students (36%) reported that at times a tooth ache wakes them up at night and nearly a third reported that a tooth ache hurts them sometimes when they are in school (32.9%). More than one in four students reported that a tooth ache kept them at home from school at times (26.3%). However, only 14.7% of the students did not think they had a nice smile.

Table 1. *Self reported oral health responses of middle school students in Liberia and the USA*

How healthy are your teeth and gums?*	**1 = "Not healthy"**	**2**	**3**	**4 = "Very healthy"**	**No answer**	**Mean**	**Variance**
Liberia	N = 65 16%	N = 24 5.9%	N = 39 9.6%	N = 215 53%	N = 63 15.5%	3.18	1.475
USA	N = 6 1.2%	N = 86 17.9%	N = 263 54.3%	N = 125 25.9%	N = 4 .8%	3.06 p = .092	.698 p < .001

Table 2. *Oral health-related quality of life (OHRQoL) responses of middle school students in Liberia and the USA*

Questions:	**Liberia**	**USA**	**p**
a. Do your teeth hurt you now?	Yes = 18.3%	Yes = 10.1%	<.001
b. Do your teeth hurt when you eat something hot or cold?	Yes = 41.1%	Yes = 27.6%	<.001
c. Do your teeth hurt when you eat something sweet?	Yes = 37.0%	Yes = 15.2%	<.001
d. Do your teeth hurt when you chew or bite?	Yes = 35.6%	Yes = 9.7%	<.001
OHRQoL - Pain Index* (Sum of a to d)	**Mean = 1.31** **SD = 1.275**	**Mean = .62** **SD = .993**	**<.001** **<.001**
e. Does it hurt when you open your mouth wide?	Yes = 12.2%	Yes = 5.2%	<.001
f. Do you hear a noise when you open your mouth wide and close it?	Yes = 31.3%	Yes = 17.8%	<.001
OHRQoL - TMD Index** (Sum of e and f)	**Mean = .44** **SD = .645**	**Mean = .23** **SD = .76**	**<.001** **<.001**
g. Does a hurting tooth ever wake you up at night?	Yes = 36.0%	Yes = 15.8%	<.001
h. Does a tooth ever hurt you while you are in school?	Yes = 32.9%	Yes = 21.6%	<.001
i. Does a hurting tooth ever keep you home from school?	Yes = 26.3%	Yes = 13.6%	<.001
OHRQoL - Consequences Index (Sum of h to i)***	**Mean = .93** **SD = 1.162**	**Mean = .51** **SD = .919**	**<.001** **<.001**
j. Do you have a nice smile?	No = 17.4%	No = 19.8%	n.s.
OHRQoL - Total Index**** (Sum of a to i and recoded j)	**Mean = 2.85** **SD = 2.605**	**Mean = 1.54** **SD = 1.897**	**<.001** **<.001**

Legend:
The oral health-related indices were computed by adding the "Yes" responses to certain items:
* OHRQoL - Pain Index: Sum of "Yes" responses to items a to d.
** OHRQoL - TMD Index: Sum of "Yes" responses to items e and f.
*** OHRQoL - Consequences Index: Sum of "Yes" responses to items g to i.
**** OHRQoL - Total Index: Sum of "Yes" responses to items a-i, recoded j.

A comparison of the Liberian and US students' frequencies of self reported oral health responses showed that these responses differed in several ways. A chi square test showed that the frequencies of responses of the Liberian students and the US students in the 4 answer categories differed significantly (chi square = 258; d.f.= 3; p<.001). Compared to the responses in the USA, a higher percentage of children in Liberia answered either that their self reported oral health was "not healthy" (Liberia: 16% vs. USA: 1.2%) or "very healthy" (53% vs. 25.9%), resulting in a significantly larger variance in the responses of the Liberian children compared to the responses of the US students (1.428 vs. .487; p<.001). However, despite this high percentage of "very healthy" responses in Liberia, there was a tendency that on average the Liberian students reported more healthy teeth than the US students (3.18 vs. 3.06; p=.092).

Table 2 provides an overview of the oral health-related quality of life (OHRQoL) responses of the respondents in Liberia and the USA. Chi square tests showed that the US students' responses were less likely to indicate poor oral health-related quality of life for all but one item compared to the Liberian students. The responses that did not differ were for the question "Do you have a nice smile?". Less than one in five students in both countries did not perceive that they had a nice smile (Liberia: 17.4%; USA: 19.8%).

In addition to comparing the responses to each item, independent sample t-tests were used to compare the average total OHRQoL scores as well as the average sub index scores. As can be seen in Table 2, the Liberian respondents reported significantly more pain (out of a maximum of 4 points: 1.31 vs. .62; p<.001), more TMD problems (out of a maximum of 2 points: .44 vs. .23; p<.001), and more negative consequences of poor oral health (out of a maximum of 3 points: .93 vs. .51; p<.001) compared to the US students. Overall, the respondents in Liberia had an average total score of 2.85 compared to a score of 1.54 of the respondents in the USA (p<.001) when the responses to all ten items were summed up.

Table 3 provides the results concerning the relationships between the respondents' self reported oral health assessments and their oral health-related quality of life scores. In Liberia and in the USA, the self reported oral health assessments correlated significantly with the total oral health-related quality of life index (Liberia: r=-.372; p<.001 / USA: r=-.262; p<.001). The more positively the respondents evaluated their oral health, the less negatively they evaluated their oral health-related quality of life. The same significant relationships were also found for the responses in each country between the self perceived oral health scores and the subcategory indices: The poorer the respondents in Liberia assessed their teeth and gums, the worse their pain related quality of life was (r = -.419; p < .001), the more TMD problems they reported (r = -.134; p = .015), the more negative consequences they had (r = -.211; p < .001), and the less nice they evaluated their smile (r = .356; p < .001). This same pattern of findings was also found in the responses of the students in the USA.

Table 3. *Correlations between the OHRQoL Indices and the self reported oral health assessments*

	Self perceived oral health	
	Liberia	**US**
OHRQoL - Pain*	-.419 (p<.001)	-.221 (p<.001)
OHRQoL - TMD**	-.134 (p=0.015)	-.104 (p=.024)
OHRQoL - Consequences***	-.211 (p<.001)	-.119 (p=.011)
Nice smile*****	-.345 (p<.001)	-.223 (p<.001)
OHRQoL - Total Index +	-.372 (p<.001)	-.262 (p<.001)

Legend:
The oral health-related indices were computed by adding the "Yes" responses to certain items in Table 2:

* OHRQoL – Pain Index: Sum of "Yes" responses to items a to d in Table 2.
** OHRQoL – TMD Index: Sum of "Yes" responses to items e and f in Table 2.
*** OHRQoL – Consequences Index: Sum of "Yes" responses to items g to i in Table 2.
**** Responses to the question" "Do you have a nice smile?"(1 = "No" / 0 = "Yes")
\+ OHRQoL – Total Index: Sum of "Yes" responses to items a-i, recoded j in Table 2.

Discussion

Before discussing the results of this study, it is crucial to draw attention to the fact that this study did not include representative samples of middle school students from the USA and Liberia. The results should therefore not be interpreted as describing middle school students' self perceived

oral health and OHRQoL in these countries in general. Given the way the two samples were identified, it is quite obvious that population data of middle school students would show poorer oral health and OHRQoL for the Liberian population at large and better average scores in the US middle school population. While there are no accurate data available concerning the enrollment percentages of children in primary education in Liberia [1,4,5], previous investigators have described how large percentages of children do not receive an education in Liberia or are taught by unqualified teachers [4]. The middle school students from Liberia who participated in this study could therefore be described as educationally advantaged, because they attended private middle schools in Monrovia, the capital of Liberia. In contrast, the middle school students from the USA attended schools in socio economically disadvantaged neighborhoods. Based on previous findings, it can therefore be assumed that the black middle school students from these socio economically disadvantaged neighborhoods in the USA might have poorer oral health and OHRQoL compared to children from non underrepresented minority and/or from higher socio economic backgrounds [6, 7].

However, while inferences to middle school students in Liberia in general cannot be drawn, the data nevertheless tell an interesting story. Only 20.3% of the Liberian respondents reported that they ever had seen a dentist before, while 90.1% of the middle school students in the USA reported having seen a dentist before ($p<.001$).

Given that there are only three practicing dentists in Liberia [1] it is not surprising that only one in five Liberian respondents (20.3%) had seen a dentist before. However, the fact that one out of ten middle school students in the USA (9.9%) had never seen a dentist before is noteworthy. This fact might be related to the poor oral health-related quality of life that the students in the US sample reported. A total of 10.1% of the respondents in the USA reported that they had pain at the time when they responded to the survey, 27.6% when they eat something hot or cold, and 15.2% when they eat something sweet. In addition, 15.8% reported that they cannot sleep through the night because of a tooth ache, 13.6% that they miss school because of a hurting tooth, and 21.6% that a tooth hurt them at times when they are in school.

While these percentages are quite alarming, the percentages of respondents in Liberia who reported impaired oral health-related quality of life are even more alarming. In Liberia, 18.3% of the students reported that they had a tooth ache at the time of the survey, 41.1% that their teeth hurt them when they eat something hot or cold, and 37% when they eat something sweet. In addition, large percentages of children in Liberia reported TMD related symptoms such as pain when opening the mouth wide (12.2%), pain on the sides of the face when chewing on tough food (48.7%), and hearing a noise (clicking) when opening the mouth wide (31.3%). The consequences of poor oral health in Liberia are also quite alarming: 36% of the children reported that a hurting tooth wakes them up at night, 26.3% that a hurting tooth kept them home from school at times, and 27.6% kept them from paying attention while in school. These findings clearly point to the devastating consequences of poor oral health already in adolescence – and to the potential of a negative trajectory of these respondents' oral health status.

However, the data also showed a true paradox: The middle school students in Liberia described their own oral health as significantly more positively, but their oral health-related quality of life as significantly worse than the middle school students in the USA. Could it be that the respondents in Liberia assess their own oral health status in comparison to older family members and thus perceive their own oral health as relatively better? This question cannot be answered without collecting objective oral health data. However, the fact that in both groups of respondents self perceived oral health and oral health-related quality of life are significantly correlated points to the validity of self perceived oral health ratings. Even if the middle school students in Liberia reported better average oral health than the middle school students in the USA, the differences in these oral health ratings of the respondents in the two groups were mirrored by differences in their oral health-related quality of life.

The practice to collect self perceived oral health data when objective oral health data are not available is not new. For example, it has been used in a study of Chinese urban adolescents [22]. However, based on these findings it seems crucial to not merely collect self perceived oral health ratings, but in addition to also assess oral health-related quality of life indicators to show the significant consequences that poor oral health has on patients' quality of life. Potentially, such indicators could paint a more powerful picture of the severity of oral

poor health and could thus alert policy makers to the importance of creating early prevention programs and programs that assure access to oral health care services.

For example, the oral health-related quality of life data collected in kindergarten and elementary schools in the USA led to the development of a website for kindergarten and elementary school teachers with resource materials that will allow them to integrate oral health education into their educational efforts (http://www.dent.umich.edu/teachoralhealth/). These efforts aim at involving teachers in the prevention of oral disease and good oral hygiene practices. While these efforts are of great importance in the USA, creating school-based oral health promotion programs in Liberia and other non industrialized nations as well as promoting good oral hygiene practices in educational settings from an early age on, could be make a real difference in these countries.

Conclusions

Oral health-related data based on objective oral health screenings from Liberia or other non industrialized nations might be difficult to obtain. However, the results of this study show that self assessments of oral health and oral health-related quality of life can be obtained from citizens as young as 10 years of age and can provide insights into the oral health-related situation of these respondents.

The findings clearly show that poor oral health has a significant impact on patients' quality of life and can prevent students from sleeping through the night, attending school, and paying attention when in school.

These findings should alert paediatric dentists to the importance of assessing TMD symptoms in their patients. Overall, oral health-related quality of life assessments may be useful when advocating for children's needs for oral health care services.

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