

An exploratory study on cultural variations in oral health attitudes, behaviour and values of freshman (first-year) dental students

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Objective: To identify similarities and differences in oral health attitudes, behaviour and values among freshman dental students. **Design:** Cross-cultural survey of dental students. **Setting:** 18 cultural areas. **Participants and Methods:** 904 first-year dental students completed the Hiroshima University-Dental Behavioural Inventory (HU-DBI) translated into their own languages. Individual areas were clustered by similarity in responses to the questions. **Results:** The first group displayed an 'occidental-culture orientation' with the exception of Brazil (Cluster 1 comprised: Australia, United Kingdom, Ireland, Belgium and Brazil, Cluster 2: Germany, Italy, Finland and France). The second group displayed an 'oriental-cultural orientation' with the exception of Greece and Israel (Cluster 3 comprised: China and Indonesia, and Cluster 4: Japan, Korea, Israel, Hong Kong, Malaysia, Thailand and Greece). Australia and United Kingdom were the countries that were most alike. Ireland was the 'neighbour' to these countries. Greece and Malaysia had similar patterns of oral health behaviour although geographic conditions are very different. Although it was considered that in Hong Kong, occidental nations have affected the development of education, it remained in the oriental-culture group. Comparison with the data from the occidentals indicates that a higher percentage of the orientals put off going to the dentist until they have toothache ($p < 0.001$). Only a small proportion of the occidentals (8%) reported a perception of inevitability in having false teeth, whereas 33% of the orientals held this fatalistic belief ($p = 0.001$). **Conclusions:** Grouping the countries into key cultural orientations and international clusters yielded plausible results, using the HU-DBI.

Key words: Oral health attitudes/behaviour, cross-national comparison, cluster analysis, occidental- and oriental- culture differences, dental students

Dental health practices are predominantly learned from a combination of sources; the dental profession at the dental office, through school programmes, or from parents at home. In countries with similar social systems the basis for health care is usually the same. Comparison of countries having different bases for health care and different languages is much more complicated and time-consuming. Honkala and Freeman¹ examined the results of many studies concerned with oral hygiene behaviour from different European countries and reported that tooth brushing as a health behaviour is influenced by both environmental and social factors that affect the incidence of gingivitis and periodontal disease in the countries examined. Terms used to describe behaviours like tooth brushing frequency are easy to translate and understood similarly everywhere. All methods for collecting cross-cultural data on oral health behaviour have limitations. In recent years, however, international relationships in dentistry have grown stronger through global access to journals, books, academies, seminars, researcher exchange programmes, etc. Global dental education and health promotion are also being developed through curriculum and the medium of the World Wide Web². The host nations of this global curriculum in oral health are currently from Western, industrialised nations.

Kawamura *et al.*³ reported that significant cultural differences in oral health attitudes, behaviour and values were found in freshman dental students among Japan, Hong-Kong, and West China. They also reported that it was possible to distinguish US dental hygiene students from their Korean peers with a probability of more than 90% by using the Hiroshima University-Dental Behavioural Inventory (HU-DBI)⁴. In a sample of Anglo-Americans, Mandarin Chinese and Scandinavians, Moore *et al.*⁵ reported preferred pain description for tooth drilling, childbirth labour and injections varied significantly by ethnicity. Otuyemi *et al.*⁶ reported that the perceptions of dental aesthetics of Nigerian students were very similar to those of the US groups. Although much published research has been concerned with oral hygiene habits among young people⁷⁻¹², no published studies have identified subgroups of countries based on oral health attitudes/behaviour. The advancement of a global health education curriculum, may however be restricted by cultural variations in perspectives on oral health. The aim of this research was to examine systematically the cultural variations in attitudes/behaviour of freshman dental students across 17 different nations (18 cultural areas) using the same instrument – the 20-item HU-DBI.

Material and methods

Substantial portions of the original dataset have been published previously^{3,13-17}. Data have been used from

empirically derived subgroups of first-year dental students responding to the 20 items of the HU-DBI. The original questionnaire of the HU-DBI was written in Japanese. The HU-DBI comprises 20 items dealing mainly with oral health attitudes and tooth brushing behaviour¹⁸. The first data for this survey were collected in Japan and Australia¹³. In the second phase, 15 countries and Hong Kong participated in the survey. The oral health attitudes/behaviour in the first survey and those in some of the second survey have been reported earlier¹³⁻¹⁷.

The English version of the HU-DBI was translated into other languages (Flemish, Portuguese, French, German, Greek, Italian, Korean, Malay, and Thai) and back-translation was done by bilingualists (except for Flemish and Malay) between 1990 and 1992. In the first step of the present study, the nine translated versions were compared with the English version by the co-authors. Back-translation was not used during this process. Then, data for testing the reliability of the translations were collected from bilingualists of each country. They were asked to answer the English version and then their mother-tongue version of the HU-DBI separately at different times (intervals of 3–24 hours). Reliability of the translated version was measured by percentage coincidence. In the second step, the subjects were a convenience sample of 1,196 freshman dental students enrolled in 18 dental schools. The mother-tongue version was administered to freshman dental students at each school, all at the beginning of the academic year. Participation in the project was voluntary, and no information about their academic records was gathered from the students. The participation rates for enrolled students varied between 52% (Malaysia) and 100% (Belgium and Brazil). The mean response rate was 76% (with a total of 904 respondents).

The hierarchical cluster analysis procedure was used to provide distance or similarity measures for defining how different or alike two countries are¹⁹. When two cases are very similar, the distance measure value is small and the similarity measure value is large. This cluster analysis compared the 18 areas (17 nations) with respect to the variables assessed in the HU-DBI. Mean percentages of 'agree' responses for each item in HU-DBI were used in cluster analysis as individual representative values. The squared Euclidean distance and the complete linkage method were used in the analysis of clustering. The squared Euclidean distance between, for example, two cases (A and B) on three variables (x_1, x_2, x_3) is computed by: $(x_{1A} - x_{1B})^2 + (x_{2A} - x_{2B})^2 + (x_{3A} - x_{3B})^2$. Then the distances were rescaled to numbers between 0 and 25. Group and cluster means were compared by t-test and ANOVA respectively. Statistical analyses were conducted using SPSS 10.0J (SPSS Inc., Chicago, IL, USA).

Table 1 Distribution of respondents by country and sex

Country (year surveyed)	Number [*]	Response rate	Sex			Mean age ^{***}
			Male	Female	Unknown	
Australia ('91)	45 (53)	85%	23	22	0	19.0±3.6
Belgium ('98)	14 (14)	100%	5	8	1	18.4±1.3
Brazil ('00)	60 (60)	100%	27	33	0	–
China ('97)	39 (59)	66%	19	20	0	19.7±1.3
Finland ('98)	26 (31)	84%	9	15	2	21.6±1.8
France ('99)	90 (98) ^{**}	92%	39	51	0	19.6±0.6
Germany ('98)	66 (98)	67%	33	33	0	22.3±3.6
Greece ('98)	84 (123)	68%	45	39	0	19.3±1.0
Indonesia ('90)	59 (98)	60%	22	37	0	–
Hong Kong ('98)	43 (46)	93%	17	21	5	18.9±0.8
Ireland ('98–99)	19 (31)	61%	6	13	0	19.0±0.5
Israel ('99)	58 (97)	60%	20	32	6	21.2±1.8
Italy ('99)	24 (30)	80%	13	11	0	23.2±4.8
Japan ('97)	58 (60)	97%	36	22	0	20.1±4.1
Korea ('98)	63 (80)	79%	48	14	1	22.0±4.8
Malaysia ('99)	47 (91)	52%	6	41	0	19.6±0.7
Thailand ('98)	60 (73)	82%	16	44	0	18.0±0.7
UK ('98)	49 (54)	91%	20	27	2	18.4±0.9
Total	904 (1196)	76%	404	483	17	20.0±2.9

^{*} Parentheses indicate the number of enrollment.

^{**} Year 2 students are regarded as freshmen in dental faculty in France.

^{***} Mean ± S.D.

Table 2 Agglomeration schedule – Clusters of countries according to similarities of oral health attitudes/behaviour of freshman dental students

Stage	Case number [*]		Coefficient of distance ^{***}	Stage case first appears		Next stage
	First case ^{**}	Case combined		First case	Case combined	
S- 1	1	18	0.18	–	–	S- 3
S- 2	8	16	0.30	–	–	S- 6
S- 3	1	11	0.48	S- 1	–	S- 9
S- 4	9	12	0.58	–	–	S- 8
S- 5	7	13	0.61	–	–	S-11
S- 6	8	17	0.73	S- 2	–	S- 8
S- 7	14	15	0.90	–	–	S-13
S- 8	8	9	0.95	S- 6	S- 4	S-13
S- 9	1	2	1.17	S- 3	–	S-14
S-10	5	6	1.19	–	–	S-11
S-11	5	7	1.48	S-10	S- 5	S-16
S-12	4	10	1.60	–	–	S-15
S-13	8	14	1.63	S- 8	S- 7	S-15
S-14	1	3	1.93	S- 9	–	S-16
S-15	4	8	2.37	S-12	S-13	S-17
S-16	1	5	2.67	S-14	S-11	S-17
S-17	1	4	4.24	S-16	S-15	–

^{*} Case; 1: Australia, 2: Belgium, 3: Brazil, 4: China, 5: Finland, 6: France, 7: Germany, 8: Greece, 9: Hong Kong, 10: Indonesia, 11: Ireland, 12: Israel, 13: Italy, 14: Japan, 15: Korea, 16: Malaysia, 17: Thailand, 18: United Kingdom.

^{**} The number of the first case in a cluster to assign a number to the cluster.

^{***} The squared Euclidean distance and complete linkage method were used.

Results

There was a high level of reliability between bilinguals' responses to the questionnaires in the English compared with their mother-tongue versions. The number of times that the percentage coincidence was less than 70% were: two items in Flemish (Item No.10, 13), one in Portuguese version (Item No.7), one in German (Item No.13), two in Greek (Item No.6, 14), zero in Italian, one in Korean (Item No.6), two in

Malay (Item No.1, 15), and zero in the Thai version[†].

Table 2 presents the Agglomeration Schedule according to similarities of oral health attitudes/behaviour of freshman dental students. First, case 1 (Australia) was joined with case 18 (United Kingdom), with a distance of 0.18. Next, case 8 (Greece) was joined with case 16

[†]Detailed information on variations in populations is available from the senior author.

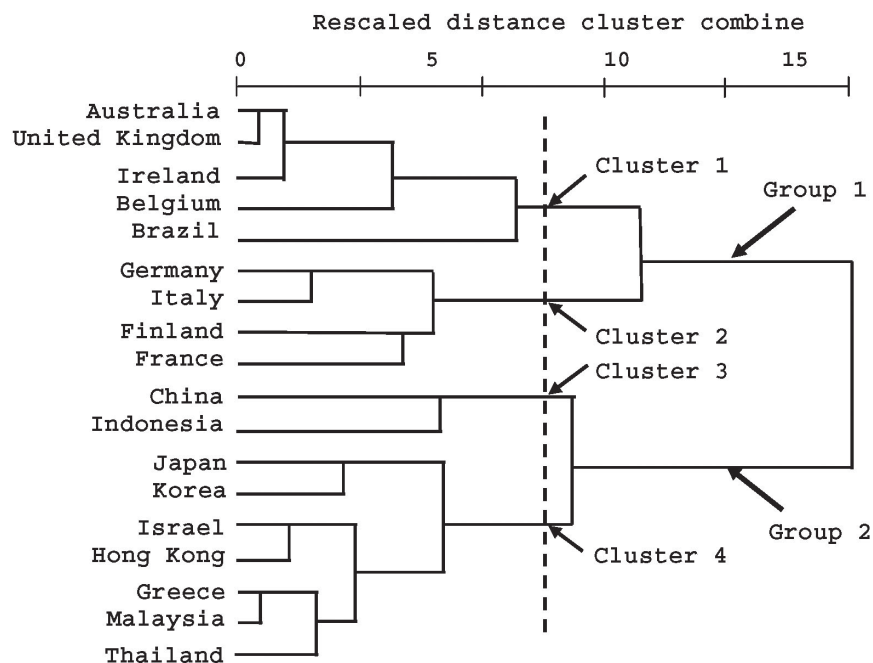


Figure 1. Dendrogram using the complete linkage method between countries. Countries were classified on the basis of 20 items of HU-DBI. The squared Euclidean distance and the complete linkage method were used in the clustering.

(Malaysia), with a distance of 0.30. At stage 3, case 11 (Ireland) was joined with the first two. The average of Ireland's distance with the first two countries was 0.48. At stage 4, case 9 (Hong Kong) and case 12 (Israel) was joined with a distance of 0.58 (these two cases did not appear again until stage 8). Case 2 (Belgium) was added to Cluster 1 at stage 9 with an average distance of 1.17, and case 3 (Brazil) was added at stage 14 with an average distance of 1.93. Case 4 (China) was joined with case 10 (Indonesia) with a distance of 1.60.

Figure 1 presents a dendrogram using the complete linkage method between countries. Clearly, there were two groups of countries: an upper group (Group 1) including Australia, United Kingdom, Ireland, Belgium, Brazil, Germany, Italy, Finland and France; and a lower group (Group 2) including China, Indonesia, Japan, Korea, Israel, Hong Kong, Greece, Malaysia and Thailand. Australia and the United Kingdom were the countries that are most alike. Germany, Italy, Finland and France were within the same membership range of the upper group and labelled within Cluster 2. China and Indonesia, labelled Cluster 3, were the most distant members of the lower group. Countries in the upper group largely belonged to those nations with an 'occidental culture orientation' and were described as 'Occidentals'. Countries in the lower group tended to belong to nations with an oriental culture background and were described as 'Orientals'. Three exceptions to these groupings were Greece, Israel and Brazil.

Table 3 presents percentage of 'agree' response by

cultural group and by derived cluster, according to similarities of oral health attitudes/behaviour. Significant differences between the Occidentals and the Orientals were found for seven items out of 20. The most striking results were that the students among the Orientals tended to 'put off going to the dentist until they have toothache' ($p < 0.001$), and to have 'fatalistic beliefs' regarding the value oral health prevention ($p < 0.01$), compared with those among the Occidentals. The Oriental group also tended to have little experience of disclosing solution ($p < 0.01$) and more experience of 'noticing dental plaque' in their mouth ($p < 0.05$). Significant differences among the four clusters were also found for seven items. The percentage of 'noticing dental plaque' in Cluster 3 (Indonesia and China) was the highest among the four clusters ($p < 0.001$). Students of these two countries were also more worried about the colour of their gums ($p < 0.05$). Students belonging to Cluster 2 (Germany, Italy, Finland and France) had better oral health attitudes/behaviour compared with those of the three other clusters. 'Checking their teeth in a mirror after brushing' seemed to be universal within this cluster. Also, freshman dental students did not 'usually use a child-sized toothbrush' in almost all countries.

Discussion

Cluster analysis is a multivariate procedure for detecting groupings in the data. The objects in these groups may be cases or variables. A cluster analysis of cases

Table 3 Questionnaire items of the HU-DBI and percentage of 'agree' response by country group according to similarity of oral health attitudes and behaviour of freshman dental students

No. Item descriptions	Group 1		Group 2		P
	Cls 1 (5)	Cls 2 (4)	Cls 3 (2)	Cls 4 (7)	
1. I don't worry much about visiting the dentist.	63	49	90	66	0.226
2. My gums tend to bleed when I brush my teeth.	8	15	35	27	0.068
3. I worry about the color of my teeth.	77	54	78	62	0.576
4. I have noticed some white sticky deposits on my teeth.	17	13	92	46	0.010
5. I use a child sized toothbrush.	6	7	5	6	0.849
6. I think that I cannot help having false teeth when I am old.	9	8	35	33	0.001
7. I am bothered by the color of my gums.	26	25	68	27	0.853
8. I think my teeth are getting worse despite my daily brushing.	23	19	35	27	0.205
9. I brush each of my teeth carefully.	68	66	37	51	0.030
10. I have never been taught professionally how to brush.	36	26	32	36	0.323
11. I think I can clean my teeth well without using toothpaste.	5	11	10	12	0.890
12. I often check my teeth in a mirror after brushing.	77	71	66	70	0.837
13. I worry about having bad breath.	77	60	85	65	0.669
14. It is impossible to prevent gum disease with toothbrushing alone.	42	40	91	69	0.006
15. I put off going to the dentist until I have toothache.	15	12	53	47	0.000
16. I have used a dye to see how clean my teeth are.	39	35	14	14	0.009
17. I use a toothbrush which has hard bristles.	28	27	12	23	0.674
18. I don't feel I've brushed well unless I brush with strong strokes.	24	22	35	33	0.052
19. I feel I sometimes take too much time to brush my teeth.	29	16	25	31	0.081
20. I have had my dentist tell me that I brush very well.	49	58	40	37	0.033

* Probability (Upper: *t*-test, Lower: ANOVA)

Cls 1: Australia, United Kingdom, Ireland, Belgium, Brazil. Cls 2: Germany, Italy, Finland, France.

Cls 3: China, Indonesia. Cls 4: Japan, Korea, Israel, Hong Kong, Greece, Malaysia, Thailand.

resembles discriminant analysis in one respect – the researcher seeks to classify a set of objects into groups or categories, but in cluster analysis, neither the number nor the members of the groups are known. That is, in cluster analysis, researchers can begin with no knowledge of group membership and often do not know just how many clusters there are. A cluster analysis of variables resembles factor analysis because both procedures identify related groups of variables. However, factor analysis has an underlying theoretical model, while cluster analysis is more *ad hoc*. Clustering is therefore a good technique to use in exploratory data analysis when the researcher suspects the sample is not homogeneous¹⁹. It is acknowledged however, that

convenience sampling may over-estimate the impact of certain areas. As this was an explorative study, and one restricted to freshmen students, this weakness in design was believed acceptable.

Comparisons of individual items among the 18 cultural areas demonstrated two major groups described as an 'Occidental-culture' group and an 'Oriental-culture' group, together with four subgroups or clusters. The Oriental group was characterised by: dental visits with a painful tooth; perception of inevitability in having false teeth; and, disbelief of the effectiveness of mechanical tooth cleaning on gingivitis. On the other hand, the Occidentals group shared characteristics such as: a positive attitude/behaviour in

oral self care; using disclosing solution; removal of dental plaque; brushing teeth carefully; and, reinforcement regarding their brushing behaviour by dentists.

In Japan, dental providers in general practices are generally oriented toward curative care²⁰. In spite of their Western-oriented education, there was a remarkable similarity in the direction of dental visiting patterns between the students across countries regardless of whether they lived in Japan, Hong-Kong, or Korea. Although the data were presented, more than half of the students in all three cultures reported that they put off going to the dentist until they had a toothache (56%, 67%, and 65% respectively) and their Chinese peers (64%). This finding was consistent with that of Kiyak²¹. Asians in the U.S. knew little about dental disease, but were motivated to maintain their teeth by a concern for aesthetics, appearance, and pain. The Asian ways of dealing with health and disease are different from traditional Western concepts in that most of the health beliefs and practices are learnt and practised in the home, and professional help is only sought when home remedies fail. The strong reliance on self-care may on the one hand undermine the effectiveness of organised oral health care by delaying dental visits or on the other hand make these 'unnecessary'.

Not surprisingly, Australia and the United Kingdom were 'neighbours' regarding oral health attitudes/behaviour of freshman dental students using the HU-DBI. Korea and Japan had the same situation. They are neighbours geographically and historically in East Asia: there has been a unique medical treatment system influenced by Chinese medicine for more than 700 years. Although Western medicine and dentistry were introduced to Japan and Korea after the Second World War²², the two countries belonged to the Oriental culture group, regarding oral health attitudes/behaviour. Italy was the nearest oral health neighbour with Germany. Similar values were found between subjects from Greece, Malaysia and Thailand. Greek and Malaysian subjects had similar patterns of 'agreement' responses except for Item 20 (Greece 60%, Malaysia 34%, data not shown).

Ismail *et al.*²³ reported that for 'developing' countries, sugar consumption explained about 26% of variation in the DMFT scores whereas for 'developed' countries, the average sugar consumption was not a significant determinant of DMFT scores (explaining less than 15% of the variation). While tooth brushing behaviour is an important factor in periodontal health, there are few readily accessible data sources in the world. Health education that is community-based, and founded on the principles of a community development approach, is more likely to modify and change health behaviour. This approach concentrates on discovering the needs and the psychosocial structure of the community and takes into account the social and environmental factors affecting health behaviour²⁴.

Incorporating social and environmental influences into a health education programme allows for new ideas and health behaviour to be accommodated within existing social norms, family attitudes and behaviours, and helps to reduce the effect of negative social factors. Data from Australia and the United Kingdom indicate that non-alcoholic beverages contribute between 20 and 29% of the sugar-consumed daily. Germany, Australia and the United Kingdom were the major consumer of carbonated soft drinks, with sales figures in 1992 almost twice that of other areas of the world. China and Indonesia were the lowest users of the countries included in the present analysis²³.

Today, television and radio advertising are major sources of information in all societies. Additionally, religious customs, food preferences, education, migration and women's employment are important determinants of nutritional intake in some cultures. The results of the present study would suggest grouping nations and their health education somewhat differently, in order that the appropriate 'cultural' approaches to health education and health promotion may have a more pervasive influence on changing attitudes and behaviour.

This study is exploratory and thus has a number of limitations. Firstly, Australian data were collected in 1991. Although there was a 10-year difference in time lag between the collections of data in Australia and Brazil, the effects on self-care of Australian students is asserted as minimal as there has been no major change in Australian dental curricula and values until quite recently. Secondly, the response rates in Malaysia, Indonesia and Israel were less than 60%. Students having a negative attitude toward dental health care would be unlikely to have responded to the questionnaire. Therefore, the real state of oral self-care of the students of the three countries may be overestimated. Thirdly, some items translated into students' mother-tongues had a low percentage coincidence with their English equivalents. Similarly in studies involving several countries the management of the survey may lead to inconsistency in data collection.

Although direct comparisons of behaviours among countries have to be made with caution, there were considerable differences in oral health attitudes/behaviour among freshman dental students in the 18 cultural areas. Grouping the countries into key cultural orientations and international clusters yielded plausible results, using the HU-DBI, and suggested the need for further research into the application of curricula to nations where cultural variations in oral health attitudes and behaviours have major historical legacies.

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