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Development and Validation of a Socio-Dental Impact Locus of Control (SILOC) Scale

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Abstract

Purpose: To develop a Socio-Dental Impact Locus of Control Scale (SILOC) and to study its relationship with oral health status as well as dental attendance.

Materials and methods: In the pilot study, 100 students returned completed forms containing the Multi Dimensional Health Locus of Control (MHLC) and the (SILOC) scale. In the main study, 509 adolescent school children from three schools returned completed forms containing the SILOC scale and were examined for oral health status and dental attendance.

Results: The SILOC scores highly correlated with the MHLC scores. A Cronbach's alpha of 0.75 showed its internal consistency. Those with higher SILOC scores had greater levels of caries, plaque, gingivitis, and a history of postponing needed dental visits. Multiple logistic regression analysis after adjusting for potential confounders showed that those with high SILOC scores were more likely to be having caries (OR=3.32, p<0.001), plaque (OR=1.83, p=0.026), gingivitis (OR=1.80, p=0.012) and a history of 'Postponement of needed dental treatment' (OR=4.5, p<0.001) as compared to the others.

Conclusion: The SILOC scale showed satisfactory reliability and validity in measuring Locus of Control orientation in relation to socio-dental impacts in an Indian adolescent population.

Keywords: Socio-dental impacts; Locus of Control

Introduction

Health Locus of Control (HLC) is a construct that refers to how individuals perceive the sources regulating their health [1]. It is a product of Rotter's [2] social learning theory, which states that "an individual learns on the basis of his or her history of reinforcement". Through a learning process, individuals will develop the belief that certain outcomes are a result of their action (internals) or a result of other forces independent of themselves (externals). Early HLC studies measured these beliefs on an Internal-External axis [3]. This scale of health beliefs ranged from Internal HLC, where control for one's health resides within the individual, to External HLC, where control resided elsewhere. Levenson [4] argued that understanding and prediction could be improved by studying fate and chance expectations separately from external control and powerful others and offered an alternative model that asserts that there are three independent dimensions: Internality, Chance, and Powerful Others. According to Levenson's model [4], one can endorse each of these dimensions of locus of control independently and at the same time. Although these three dimensions are traditionally treated as independent, studies have revealed correlations between the three factors [5,6].

This approach to social cognition models has been criticized for taking too narrow an approach to health and because the amount of variance explained is low [7]. Several researchers have used the basic scales but found the scales needed to be modified to measure specific diseases or conditions such as diabetes, headaches, and adolescent depression [8-10].This was successful within the context used in individual studies. However, because each study adapted the scales differently, little comparison between studies is possible [11]. Another disadvantage is that, although the multidimensional scales provide more in depth assessment, they take more time to administer, and are difficult to score in a clinical setting [12]. Previous studies have shown a relationship between locus of control and oral health status, but the

findings have been contradictory [11,13,14]. Similarly previous studies have shown a relationship between locus of control and oral health behaviors as well [15-18] but with equally contradictory results [19-21].

These contradictory results could be due to a 'one size fits all' approach to the use of Generic Locus of Control (LoC) scales across different clinical situations and cultures. Some studies suggested that people's general health beliefs were inherent to their culture and played a key role in influencing their health care seeking and health behaviors and hence, any health intervention must factor in, an understanding of culture, tradition, beliefs, and patterns of family interactions [22].

A flexible locus of control scale specific to oral health that can be modified in accordance with cultural beliefs of the target population has not been previously reported in the literature. Such a scale can be of help for oral health planners in deciding the type and level of intervention required to bring about a positive change in oral health attitudes in specific populations. While numerous scales that use the socio-dental approach for needs assessment have been developed, no attempt has been made to assess the locus of control in terms of socio-dental impacts. The objectives of this study were to develop a

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Socio-Dental Impact Locus of Control (SILOC) scale and to study the relationship between SILOC scale and oral health status.

Materials and Methods

This study was done among school going adolescents aged 15-17 years, of Udupi district in the coastal region of South India. It consisted of two parts: the pilot study for validation of the SILOC scale and the main study to evaluate the association between SILOC and oral health status.

Pilot study

The theoretical framework for the proposed questionnaire was derived from the WHO International classification of functioning, disability and health [23]. The definition and sub categorization of 'Disability' was considered as per the International Classification of Diseases. Disability was an umbrella term for impairments, activity limitations and participation restrictions caused by, in our case, poor oral health. 'Impairment' has been defined as a loss or abnormality in body structure or physiologic function, in our case, of the oral cavity. 'Activity limitations' are difficulties faced by an individual in doing routine activities and 'Participation restrictions' are the problems a person may face in involving himself or herself in life situations and interacting with the society, which is otherwise considered normal for a healthy individual, because of poor oral health.

A 15 item SILOC questionnaire was initially developed. This questionnaire was translated independently twice into the local language, first by a dentist with extensive knowledge of both English as well as the local language and second, by a professional translator. Both translations were merged into one version. This version was back translated into English to test the conceptual validity. However since translation alone did not ensure that the local version was culturally appropriate, qualitative interviews with a focus group of 20 respondents were conducted to establish the conceptual equivalence and content validity of the SILOC.

Validation was done by conducting a study among 120 adolescents of 15-17 years age, studying in a pre-university college in Udupi district. After discounting those who returned incomplete forms or refused to participate, the sample size consisted of 100 adolescents. The adolescents were administered the Socio-Dental Impact Locus of Control Scale (SILOC) and a previously validated Indian version of the Multidimensional Health Locus of Control Scale (MHLC) for assessing criterion validity [24]. Responses to the items were analysed to identify which items may be dropped from the scale. When there was high correlation between similar items, one item was removed after examining its effects on the scale's internal consistency.

The final version of the SILOC scale contained seven items (Table 1). The first two items of the final questionnaire assessed the level of the individual's ownership for his or her oral health status; items three and four, for the impairment caused by caries or missing teeth or periodontal disease, item five, for the oral activity limitation, and items six and seven for the restriction in participation and interaction with the society caused by poor oral health. The responses were in the Likert format (1 to 5) with the lower scores signifying 'internality' and the higher scores pointing to an 'external' locus of control. The scoring range ranged from seven to thirty five.

Main study

The target population for the second part of the study consisted of 630 adolescents aged 15-17 years, attending three pre-university colleges, one each from the three administrative zones of Udupi District. All the students who were present on the day of the examination were invited to participate in the study. After discounting those who were not present on the day of the examination and those who refused to give informed consent, the final sample size was 509 students. Ethical Clearance was obtained from the Kasturba Hospital ethics committee prior to the study.

The participating adolescents were subjected to an interview, where, in addition to their socio demographic data and previous dental treatment history, the Socio-Dental Impact Locus of Control Scale (SILOC) was administered. The participants were later subjected to a clinical examination where caries, plaque and gingival status were assessed. Socioeconomic status was assessed by using the revised Kuppuswamy Scale [25]. This widely used Indian scale, divided the population into 5 groups ranging from 1; the highest SES group to 5; the lowest, based on their educational level, occupation and income. Dental attendance was assessed by asking a single question as to whether the respondent had previously postponed visiting the dentist for getting needed dental treatment. We hypothesized that those with a more external locus of control would show irregular dental attendance.

The sample population was subjected to a whole mouth clinical examination where they were examined for dental caries [26], plaque and gingivitis. Plaque was considered as present, if it was seen visibly or by probing with an explorer on any of the tooth surfaces in the mouth. Bleeding on probing was considered as an indication of gingivitis, if observed along any tooth surface of the mouth. Furthermore, the level of plaque and gingivitis was quantified by measuring them according to the criteria of the plaque and gingival index [27,28]. The tooth worst affected by plaque accumulation and gingival bleeding was considered for the quantitative assessment. The grading for plaque and gingivitis ranged from 0 to 3 respectively.

Statistical analysis

Cronbach's Alpha was used to measure the internal consistency of the questionnaire. Spearman's Rank correlation coefficient was used to correlate the SILOC scores with MHLC scores. Paired 'T' test was used to compare the SILOC scores when checked for test retest reliability and also against oral health status. The interquartile range of the respondent scores for the SILOC was used to classify the population into Low, Moderate and High LoC groups. ANOVA with Tukey's post hoc was also used to compare the mean SILOC scores against oral health status. To study the association between Locus of Control and oral health status and dental attendance, a multiple logistic regression model was employed. All the statistical analysis was done with SPSS version 16 (SPSS Inc, Ill, Chicago, USA). A p value of ≤ 0.05 was considered statistically significant.

Results

Pilot Study

The mean MHLC scores for Internal, Powerful and Chance locus of control was 25.36 ± 6.50, 17.8 ± 7.3 and 16.8±6.29 respectively. The mean SILOC score was 8.39 ± 3.40.The correlation coefficient between the SILOC and Internal, Powerful and Chance locus of control of MHLC was found to be -0.317 (p= 0.001), 0.192 (p=0.055) and 0.471(p<0.001) respectively. The SILOC scores were classified into Low (≤ 7), Moderate (8-10) and High (≥ 11) for comparing against the mean Internal, Powerful others and Chance scores of the MHLC. We found that the mean Internal LoC was highest (26.73 ± 6.29) for the 'Low' SILOC group and the mean 'Chance' LoC was lowest (16.09 ±

No.	Items
1	Who is responsible for keeping my teeth healthy?
2	If I have good oral health, who should get the credit?
3	If I get tooth decay or ache, who is to blame?
4	If I have missing teeth, or sensitive teeth or bleeding/ swollen gums, who is to blame?
5	If I have difficulty in eating, speaking, chewing and enjoying food because of problems with my teeth or mouth, who is to blame?
6	If I have difficulty in smiling, mixing with friends or indulging in social activities because of problems with my teeth, who is to blame?
7	If people make fun of me because of the condition of my teeth and mouth, who is to blame?
Scores	**Responses**
1	Only me, no one else
2	Mainly me, but also my family*, teachers, dentist and friends to a small extent
3	Mainly my family*, teachers, dentist, and friends but also to a small extent, myself
4	Mainly fate or god but also my family*, teachers, dentist and friends to a small extent
5	Fate or god only. Definitely not me

(*) =Family, as in Parents, grandparents, siblings, and other relatives

Table 1: The Questionnaire items and responses for the SILOC scale.

MHLC Scales	SILOC Scores	N	Mean	SD	p-value	post-hoc test
Internal	Low	77	26.73	6.29	<0.001	Low> medium, high
	Medium	10	21.60	6.75		
	High	13	20.1	3.21		
Chance	Low	77	16.81	6.23	0.277	NA
	Medium	10	14.80	6.71		
	High	13	19.00	6.16		
Powerful others	Low	77	16.09	6.30	<0.001	High>Low
	Medium	10	20.30	8.72		
	High	13	26.00	5.90		

p≤0.05: Significant

Table-2: Relationship between MHLC scores and the SILOC scores in the study population.

6.30) for the 'High' SILOC group as shown by ANOVA and post hoc tests (Table 2).

The questionnaire was re-administered to a group of 20 children after a week for test retest reliability. The mean SILOC score of the group at the test and retest stage was 8.68 ± 2.85 and 8.04 ± 2.03 respectively, the differences between which were not statistically significant. Also a statistically significant correlation (r= 0.72, p<0.001) was found between the two sets of responses. The Cronbach's alpha for the SILOC was 0.75. The examiners underwent calibration training for the clinical indices under the supervision of an expert. The Kappa coefficient for intra and inter examiner variability ranged from 0.78 to 0.92 respectively.

Main study

The sample population consisted of 509 students whose age ranged from 15 to 17. The frequency distribution of the students' variables showed that 77.4% belonged to the lower socioeconomic status, and 71.1% had plaque and 42% had gingivitis. Although the caries prevalence was 52.25%, a majority of the students had DMFT scores of less than five. SILOC scores were classified into Low (≤ 7), Moderate (8-10) and High (≥ 11) and the proportion of the population in these three groups were 45.4%, 22.58% and 31.8% respectively. A majority of the adolescents (76.8%) reported that they had postponed visiting a dentist for getting dental treatment.

Mean SILOC scores were compared against caries, plaque, gingivitis experience as well as Socioeconomic Status (SES) and 'postponement of dental treatment'. We found that the mean SILOC scores were significantly higher among those with caries (p<0.001), plaque (p<0.05), gingivitis (p<0.05) and those who admitted that they

had postponed getting needed dental treatment (p<0.001). Males reported significantly higher SILOC scores than females (p<0.001) (Table 3).

Multiple logistic regressions was done to study the role of SILOC as a risk indicator for oral problems like caries, plaque accumulation, gingivitis and also 'postponement of dental treatment' after adjusting for possible confounders like age, gender and socioeconomic status (Table 4). Those with high SILOC scores were significantly more likely to be having caries (OR=3.32, p<0.001), plaque (OR=1.83, p=0.026), gingivitis (OR=1.80, p=0.012) as well as a history of 'postponement of needed dental treatment' (OR=4.5, p<0.001) as compared to the others.

Discussion

The objectives of this study were to develop an socio-dental impact locus of control scale (SILOC) which was short, easily adaptable to different age groups and populations, that combined the advantages of the one-dimensional and multidimensional scales by incorporating the three sub categories of Internal, Powerful others and Chance in a one-dimensional scale and to study the relationship between SILOC and oral health status and attendance (as assessed by the respondents' history of postponing visiting the dentist for getting needed dental treatment) in an Indian population.

Our study showed the SILOC to be valid and reliable to assess the locus of control orientation of an Indian adolescent population. A more external locus of control as shown by higher SILOC scores was associated with higher dental neglect, caries, and plaque and gingivitis prevalence as well as with a tendency to postpone needed dental treatment. Previous research has shown that an external locus of control was associated with poorer oral health indicators [11,13,14] as

Variables	Prevalence	N	Mean SILOC
Caries experience	Caries Present	266	10.9 ± 4.3
	Caries Absent	243	8.8 ± 3.3
	P value		<0.001
Plaque experience	Plaque Present	362	10.4 ± 4.2
	Plaque Absent	147	8.9 ± 2.9
	P value		<0.001
Gingivitis	Gingivitis Present	220	10.7 ± 4.4
	Gingivitis Absent	289	9.4 ± 3.6
	P value		<0.001
Socio economic status	Very low(5)	277	10.32 ± 4.16
	Others(1-4)	232	9.52 ± 3.75
	P value		0.02
Gender	Male	307	10.4 ± 4.2
	Female	202	9.3 ± 3.6
	P value		0.005
Postponement of dental visit	No	118	12.18 ± 4.33
	Yes	391	9.29 ± 3.64
	P value		<0.001

p≤0.05: Significant
Table 3: Mean SILOC scores in relation to oral health status, socioeconomic status, gender and history of 'Postponement of dental visit'.

Dependent variable	Predictor variable-SILOC	p-value	OR	95% Confidence Interval	
				Lower Bound	Upper Bound
Caries	High	<0.001	3.326	2.043	5.415
	Moderate	0.101	1.516	0.922	2.491
	Low	Ref			
Plaque	High	0.026	1.837	1.077	3.132
	Moderate	0.379	0.797	0.480	1.321
	Low	Ref			
Gingivitis	High	0.012	1.802	1.139	2.851
	Moderate	0.252	0.747	0.453	1.231
	Low	Ref			
Postponement of dental visit	High	<0.001	4.553	2.304	8.998
	Moderate	<0.001	4.276	2.082	8.784
	Low	Ref			

p≤0.05: Significant
Ref: Reference category

Table 4: Multiple logistic regression analysis to assess the relationship of dependent variables with Socio-dental impact locus of control.

well as poorer dental attendance [17,29,30], which were in agreement with the findings of our study. These factors were considered for validation of the SILOC as they have been shown to be associated with locus of control in the past. Females demonstrated lower SILOC scores signifying greater internality than males which were in agreement with the findings reported by Peker and Bermek [30]. These findings may be explained by the fact that females tend to have better health compliance than males.

Some of the possible advantages of the SILOC scale are that, it can be adapted for use in different age groups and cultures by modifying the responses. For example, in our study, for 'Powerful others', we included the 'family, teachers, friends and dentist' as people who would wield a powerful influence on their lives. Family was an umbrella term which included parents, grandparents, siblings and other relatives. The reason for this was the fact that the extended family occupies a central position in Indian society by providing material, moral and emotional sustenance and support to all its members. Hence the role of the family influence on individual attitudes cannot be overestimated. Similarly,

for 'Chance' LoC, the responses were 'Fate' and/or 'God'. An individual who has an external locus of control would blame his fate for his oral problems. Other cultures may have different people or concepts to fit into the 'Powerful others' and 'Chance' LoC and the responses can be modified to suit them. The responses were negatively worded as "who is to blame" rather than a more neutral" Who is responsible", as both are used interchangeably in the local language and roughly carry the same meaning. Since the study population consisted of adolescents, it was thought as more appropriate to use the negative response to reflect the adolescent angst.

This study constituted an attempt to develop a simple, short, likert scale to assess the LoC orientation of a target population in relation to socio-dental impacts, so as to help planners design specific interventions to reduce the oral disease burden. It would be inappropriate to place too much importance to locus of control as the most important construct to predict health attitudes and behavior and besides, early studies have shown that HLC predicted health behaviors only in those who highly valued their health [31,32]. However it has to be conceded that since this study had a cross sectional design, it is difficult to establish a causal relationship between the SILOC and the socio demographic and oral health indicators and behaviors. Furthermore, the long term stability of the SILOC orientation of a target population obtained by our scale is yet to be ascertained through longitudinal studies. Further research is needed to validate this scale in different cultures and age groups.

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