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Original Research

Locus of control and its association with oral health among 12 and 15 year olds in Bhopal city, Central India

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Abstract

Objectives: The aim of the study was to describe the health locus of control and to determine its association with oral health for 12 and 15 year old children from Bhopal City, Central India.

Methods: A total of 462 children were examined; 259 children from the 12- year age group and 203 from 15 year age group. The eleven-item health locus of control questionnaire (HLC) was used to assess health locus of control and to determine its association with oral health. Eleven questions had a scoring range from 6 to 66. Individuals were classified as internal or external based on the median score; internals scoring above 33 and externals scoring below or equal to 33. Oral hygiene index simplified and WHO's dentition status were used to estimate oral hygiene and dental caries status.

Results: Results highlighted that students with higher external scores are more prone towards poor oral hygiene and increased caries levels. Internal's appear more likely to engage in positive health and had better oral hygiene and lower dental caries levels. Significant negative correlation was noted between internal health locus of control and DMFT scores. ($r = -0.42$; $p < 0.001$). A positive significant correlation was also noted between external health locus of control and DMFT scores. ($r = 0.38$; $p < 0.001$)

Conclusion: Internal's appear more likely to engage in positive health and had better oral hygiene and lower dental caries levels. These beliefs may be useful for planning oral health promotion programs and for formulating advice given by oral health professionals about their patients' oral health behaviors.

INTRODUCTION

Health is one of the many areas in which there has been a significant amount of interest in relating locus of control (LOC) beliefs to a variety of relevant behaviors. Locus of control in social psychology refers to the extent to which individuals believe that they can control events that affect them. Health locus of control (HLC) is a construct that refers to how individuals perceive the sources regulating their health. HLC is based on the assumption that health related locus of control scale would provide more sensitive predictions of relationship between internality and heath behaviors [1].

Locus of control is a product of Rotter's social learning theory. Early HLC studies measured these beliefs on an Internal-External axis. This scale of health beliefs ranged from Internal HLC, where control for one's health resides within the individual, to External HLC, relative powerlessness where control is external to the individual [2]. Individuals with a high internal locus of control believe that events result primarily from their own behavior. Literature indicates that internals are more likely to engage in wide range of health enhancing behaviors than those who believe in chance or social influence on health. Those with a low internal locus of control believe that powerful others, fate, or chance primarily determine events [3-10].

Better understanding of HLC may enable clinicians to tailor their counseling to suit their patient's health beliefs. HLC is a relatively stable measure in a healthy population [1]. Previous researches have shown that low socioeconomic status, female gender, non-white ethnicity, old age and low education are associated with increased External HLC [9]. Health-related locus of control is significantly associated with a variety of health behaviors and outcomes including knowledge about diseases, ability to stop smoking, adherence to a medical regimen, effective use of birth control, getting preventive inoculations, wearing seat belts, and getting regular dental checkups [3-10].

There have been few studies reported in the literature on the relationship between locus of control and oral health, but the findings have been contradictory [9-10]. Therefore if the association is understood, then parents, school officials and health professionals can be made more aware of the circumstances that might lead to the adoption of particular locus of control belief which may aid in improving the overall oral health of the community.

As an independent variable, it is important to note that there is no theoretical reason to expect locus of control to predict health behavior. Hence, the purpose of this study was to investigate the correlates of the HLC subscales with oral health status. The specific aim of the study was to analyze the health locus of control and to determine its association with oral health among 12 and 15 year old school children from Bhopal City, Central India.

METHODS

Study design and subjects

The target population for the cross-sectional study was 12 and 15 year old school children from Bhopal City, an urban area in Central India. According to the estimated prevalence in the pilot study and assuming a standard error of 5%, the sample size derived was 246 and 196 subjects for 12 and 15 year children. It was decided to select five schools from the sixteen government schools to achieve the desired sample size. Five schools were randomly selected by lottery method and all the 482 children from the study age group were invited to participate in the study. At the end of the study, a total of 462 children were examined; 259 from the 12- year age group and 203 from 15 year age group; response rate being 96%. The school teacher along with the survey team requested all the children to participate. All the children did agree to participate; therefore, the response rate being so high. Almost all the children who were invited to participate in the study were present on the days of examination.

Questionnaire

The 11-item Health Locus of Control (HLC) Scale developed in 1976 by Wallston, was a health-specific version of Rotter's 1966 Internal-External Scale (I-E scale), which was used to classify individuals as internals or externals [7]. This was actually based on the belief that locus of control is a unidimensional construct. However, later it became clear that locus of control was multidimensional; internality and externality were basically uncorrelated rather than being opposite ends of the same pole. The same individual always scores on both scales (more or less) and that a high score in one scale does not necessarily yields a low on the other. The multidimensional HLC construct is an improvement over the classic unidimensional conceptualization; it measures health beliefs with a tripartite approach by differentiating External HLC into Powerful others HLC (eg, physicians) and Chance HLC [8]. The three dimensions are traditionally treated as independent factors, though studies have revealed modest between-factor correlations [4-5]. The acceptable validity and reliability of the HLC scale have been well-documented over its 30-year history [6].

The eleven-item health locus of control questionnaire (HLC) was used to assess health locus of control [7]. There were 5 questions which were used to assess the IHLC (Internal health locus of control) (Questions 1,2,8,10,11) and 6 questions for EHLC (External health locus of control) evaluation (Questions 3,4,5,6,7,9). External HLC comprises of Chance HLC and Powerful others HLC. Three questions was used to assess Chance health locus of control (CHLC) (Questions 3,5,9) and three questions were used for evaluation of Powerful others HLC (PHLC) (Questions 4,6,9). The HLC Scale was scored so that high scores indicated agreement with internally worded beliefs. Individuals with scores above the median were labeled "health-internals"; who believe that the locus of control for health is internal and that one stays or becomes healthy or sick as a result of his or her own behavior. At the other end of the dimension, scoring below the median, were the health-externals, they were presumed to have generalized expectancies that the factors that determine their health are ones over which they have little control; i.e., external factors such as luck, fate, chance, or powerful others.

Based on the pilot study a six point Likert scale was used instead. Respondents rate each item on the HLC using a six point (1 to 6) scale; thus, scale of eleven questions had a scoring range from 6 to 66. Higher subscale indices reflect stronger perception of control in the given dimension. Individuals were classified as internal or external based on the median score; internals scoring above 33 and externals scoring below or equal

to 33. Reverse scoring was done for questions assessing external locus of control scores.

Till date there are no reports on the validation of an Indian version of HLOC questionnaire. English version of the questionnaire was used in the study as all the schools in the city are English medium and / or have English as a compulsory subject. The questionnaire was simple enough to be understood by the children of the selected age group. The questionnaire was used and pretested on a random sample of school children to ensure practicability, validity and interpretation of responses. The reliability of questionnaire was assessed using Cronbach's alpha internal consistency coefficient.

Clinical examination

All the subjects were examined under adequate illumination (lighting conditions). Type III examinations were used for data collection. Clinical examination using a mouth mirror and dental probe under adequate illumination is referred to as Type III examination [11]. Clinical data were collected for oral hygiene and dental caries status.

Simplified oral hygiene index (OHI-S) developed in 1964 by John C. Greene and Jack R. Vermillion was used to evaluate oral hygiene status [12]. OHI-S has two components, the simplified debris index (DI-S) and the simplified calculus index (CI-S). Each of these indexes, in turn is based on numerical determinations representing the amount of debris or calculus found on the preselected tooth surfaces. The six surfaces examined for the OHI-S are selected from four posterior and two anterior teeth. The designated tooth to be examined were 16,11,26,36,31,46. Only fully erupted permanent teeth were scored. Natural teeth with full crown restorations and surfaces reduced in height by caries or trauma were not scored instead an alternative tooth is examined. Alternative teeth for first molars are second and third molar of the same quadrant. Similarly alternative tooth for central incisors are the adjacent centrals. For each individual, the debris and calculus scores were added and divided by the number of tooth surfaces recorded. The OHI-S value ranges from 0 to 6, which were interpreted as: good (0 to 1.2), fair (1.3 to 3) and poor (3.1 to 6).

WHO's criterion was used for detection of dentition status [13]. The examination was conducted with a plane mouth mirror and a dental probe. A systematic approach was adopted for assessment of dentition status. The examination proceeded in an orderly manner from one tooth or tooth space to the adjacent tooth or tooth space. A tooth was considered present in mouth when any part of it was visible. If permanent and primary tooth occupied the same tooth space, status of permanent tooth was recorded. Decayed, missing and filled teeth scores were calculated using DMFT index. The D component was used to describe decayed teeth. Caries was recorded as being present when a lesion in a pit or fissure or on a smooth surface had a detectable softened floor, undermined enamel, softened wall or a temporary filling. On proximal surfaces, the probe had to enter a lesion with certainty. A tooth was considered missing, if there was a history of extraction due to pain and / or the presence of a cavity. The M component was used to describe missing teeth due to caries. The F component was used to describe teeth that have been previously filled as a result of caries involvement.

The survey was scheduled between the months of October 2010 and Feb 2011. Information on demographic characteristics of participants was collected by means of personal interviews administered by the examiner. All examinations were performed by a single examiner and duplicate examinations were conducted on one of every ten subjects throughout the survey. The dental team comprised of the examiner assisted by a recording clerk.

Training and calibration

Three day training session for standardization and calibration of data collection methods was organized. Training session consisted of review of the criteria used followed by clinical examination. Calibration of examiner was conducted by examining a total of 20 children twice for oral hygiene and dental caries, with a 60 minutes interval between the examinations. Intra-examiner reliability was assessed using kappa statistic which was in range of 0.88 – 0.92 for both the parameters studied, showing a high degree of conformity in the observations. Recorder was instructed in the coding systems of the indices used in the study. The recorder subsequently practiced these by recording findings during the calibration of examiner.

Informed consent

University clearances were granted for the study. Permission was sought from district educational officers and from Principals of selected schools. Informed written consents were taken from parents and school children prior to carrying out the survey.

Statistical analysis

All collected data were entered into spreadsheets. SPSS software version 16 was used for statistical analysis. Chi Square test was used to compare between categorical variables. Internal and external health locus of control scores were calculated. Mann-Whitney test was used for comparisons of health locus of control scores (Internal and External) with quantitative variables. Mean OHI(S) and DMFT scores were calculated for the two target age groups. Kendall's tau-

b correlation tests were used to correlate health locus of control scores (Internal and External) with OHI-S and DMFT scores. $p < 0.05$ was considered as statistically significant.

RESULTS

A total of 462 children were examined; 259 were from the 12- year age group and 203 children from 15 year age group. The number of boys and girls were 273 (59%) and 189 (41%) respectively (Table 1). Table 2 presents mean health locus of control scores for each question.

Table 1. Age and Gender distribution of study subjects

Age group	Gender		Collective
	Boys (%)	Girls (%)	
12 years	151 (58.3%)	108 (41.7%)	259
15 years	122 (60%)	81 (40%)	203
Total	273 (59%)	189 (41%)	462

A minimum mean score of 2.89 ±1.58 and 1.89 ±1.27 and a maximum mean score of 4.65 ±.95 and 4.70 ± .87 were recorded for the 12 and 15 year age groups respectively. Mean OHI (S) score of 1.56 ± 1.94 and 1.60 ± 1.67 for the 12 and 15 year age groups were recorded. Mean DMFT scores of 1.26 ± 1.32 and 1.34 ± 1.44 were also revealed for the two age groups respectively. A non significant increase in IHLC and EHLC scores, OHI (S) and DMFT scores were noted when comparing 12 and 15 year age groups (Table 3).

A negative significant correlation was noted between internal health locus of control and DMFT scores ($r = -0.42$; $p < 0.001$). Significant positive correlation was noted between EHLC and OHI (S) scores ($r= 0.15$; $p <0.05$) and DMFT scores ($r = 0.38$; $p < 0.001$) (Table 4). The results demonstrate that as the score increases in the external belief scale then there is also a slight increase in OHI (S) scores. The level of this correlation is weak therefore a low r value and a week statistical significance.

Table 2. Health Locus of Control among study subjects

HLC Questionnaire	Mean (SD) (Based on 6 point scale)*		
	12 years	15 years	Collecti ve
1. If I take care of myself, I can avoid illness.	4.65 (0.95)	4.70 (0.87)	4.66 (0.96)
2. Whenever I get sick it is because of something I've done or not done.	3.32 (1.10)	3.58 (0.93)	3.43 (1.03)
3. Good health is largely a matter of good fortune.	4.57(1.07)	4.02 (1.41	4.33 (1.26)
4. No matter what I do, if I am going to get sick I will.	3.15 (1.26)	2.94 (1.38)	2.94 (1.38)
5. Most people do not realize the extent to which their illnesses are controlled by accidental happenings.	3.15 (1.28)	3.34 (1.31)	3.34 (1.31)
6. I can only do what my doctor tells me to do.	4.22 (1.15)	4.21 (1.0)	4.21 (1.08)
7. There are so many strange diseases around that you can never know how or when you might pick one up.	3.15 (1.26)	3.94 (1.19)	3.50 (1.26)
8. When I feel ill, I know it's because I have not been getting the proper exercise or eating right.	4.16 (1.12)	4.01 (1.22)	4.09 (1.17)
9. Whether you keep your teeth or lose them is mostly a matter of luck.	2.89 (1.58)	1.89 (1.27)	2.45 (1.53)
10. Bad oral health results from one's own carelessness.	4.22 (1.32)	4.46 (0.97)	4.32 (1.18)
11. I am directly responsible for my oral health.	4.35 (1.06)	4.53 (0.94)	4.52 (0.94)

* Minimum possible mean score: 1, Maximum possible mean score: 6

Table 3. Mean Health locus of control (HLC), OHI(S) and DMFT among study subjects

Variables	12 years	15 years	Collective	p Value
Internal HLC	4.15 ± 1.48	4.24 ± 1.21	4.19 ± 1.34	0.81
External HLC	3.39 ± 1.78	3.48 ± 1.21	3.43 ± 1.49	0.52
i) Powerful HLC	4.20 ± 1.48	4.21 ± 1.02	4.21 ± 1.25	0.74
ii) Chance HLC	2.58 ± 2.08	2.75 ± 1.4	2.67 ± 1.74	0.48
Distribution of study subjects based on Health Locus of Control				
Variables	**12 years**	**15 years**	**Collective**	**p Value**
Internal HLC n (%)	199 (76.8%)	147 (72.4%)	346	< 0.001**
External HLC n (%)	60 (23.2%)	56 (27.6%)	116	< 0.001***
Mean OHI (S) and DMFT scores among study subjects				
Variables	**12 years**	**15 years**	**Collective**	**p Value**
Mean OHI (S)	1.56 ± 1.94	1.60 ± 1.67	1.58 ± 1.91	0.65
Mean DMFT	1.26 ± 1.32	1.34 ± 1.44	1.30 ± 1.38	0.48

* p < 0.05 (statistically significant but weak associations)

**p < 0.01 (highly statistically significant)

***p< 0.001 (very highly statistically significant)

Table 4. Correlation between Health locus of control (HLC), OHI (S) and DMFT

Variables	Correlation coefficient (r)	p Value
Internal HLC-DMFT	- 0.42	< 0.001***
External HLC -DMFT	0.38	< 0.001***
Internal HLC-OHI (S)	- 0.07	.086
External HLC – OHI (S)	0.15	< 0.05*

*p < 0.05 (statistically significant but weak associations)

**p < 0.01 (highly statistically significant)

***p < 0.001 (very highly statistically significant)

DISCUSSION

In the present study the health locus of control was assessed among 462 children aged 12 and 15 years in Bhopal city, using eleven-item health locus of control questionnaire (HLC). The results reveal a high Internal locus scores among both the age groups; higher scores being noted among 15 year olds when comparing the two age groups.

Acharya (2008) conducted a study to appraise the effect of different stages of professionalization on the health locus of control among Indian dental students and concluded that the mean score for the Internal subscale was consistently higher than the mean scores for external HLC [14]. Literature suggests that the health locus of control beliefs can be used to predict health practices and outcomes in the long run, that they are amenable to change, and that those who report more internal health locus of control are more likely to proactively seek health-promoting information and skills, realize for themselves the link between their lifestyle and health, and purposefully engage in initiatives associated with psycho-social and developmental well-being [15]. In the present study a non-significant increase in OHI (S) and DMFT scores were noted when comparing the two age groups. Significant positive correlation was noted between external health locus of control, OHI (S) scores and

DMFT scores. Chase et al (2004) [3] and Brandao et al (2006) [10] reported no relationship between oral health status and locus of control while significant associations similar to the present study were reported by Acharya et al (2011) [16] and Lencova et al (2008) [17]. Self-rated oral health, socio-demographic factors, and oral health behaviors were significantly associated with oral health control beliefs in a study conducted by Peter and Bermek (2010) using multi dimensional oral health locus of control scale [18].

Researchers have linked internal locus of control to positive health beliefs and behaviors, yet not all attempts to correlate the two have been successful. [16] Therefore, rather than associating the already proven oral health behaviours and oral health, the present study was designed to assess, whether or not, the general health-related locus of control is also associated with oral health outcomes. That is the reason also why we chose to measure controllability in a general way (i.e. Health Locus of Control) rather than in a more specific way (i.e. perception of control over dental behaviors). Since oral health is a part of general health and targeting general health behavior may also lead to overall health improvement of an individual; including oral health. This may seem even more appropriate for countries with deficient healthcare workers.

Wolfe et al (1996) reported a shift in locus of control, from external to internal as a result of oral hygiene interventions [19]. Therefore providing children with advice and reinforcements may change their perceptions of controllability [20]. English version of the questionnaire was used in the study as all the schools in the city have English as a compulsory subject and the students had a good knowledge in the language. Confounders such as oral hygiene practices, sugar consumption and utilization of dental care have not been considered separately as they directly or indirectly are associated with health belief and behavior of an individual [10,14,17]. In an effort to further investigate interactions of the risk factors involved in the etiology of oral diseases, research has focused on socioeconomic factors as these could act as indirect causal agents. When considering socio-economic indicators as risk factors, it has been recognized that children's oral health is related to their families' socioeconomic status (SES) and their mother's education level [19]. The study was conducted in mixed areas of the city. Although, government schools mainly attract children from lower and middle SES, yet the possibility of few belonging to higher SES cannot be ruled out. The effects of these factors were not taken in consideration and could be considered as the limitation for the study. Results are compared with studies which consist of populations of other ages and disease groups therefore it is also important to consider these differences.

The health locus of control scale is recommended in conjunction with behavioral measures to evaluate the success of health education programs. Since it is true that internal's appear more likely to engage in positive health and sick-role behaviors, it is apparent that the health locus of control emphasizes the importance of the health educators need to involve themselves in training patients to hold more internal beliefs.

A plethora of evidence linking the growing recognition that the school system has an important role to play together with the family and community in enhancing favourable health and developmental outcomes for young people, suggest that education content, methods and values can provide necessary traction and leverage for promoting adolescents' self-development and thriving in the world [21]. It is logical to expect that school teachers could help shape perceptions of internal (health) locus of control and enhance protective resources among school-aged adolescents by building on students' strengths and resources with timely and supportive feedback; to help students maintain good oral health.

CONCLUSION

Internal's appear more likely to engage in positive health and had better oral hygiene and lower dental caries levels. These beliefs may be useful for planning oral health promotion programs and for formulating advice given by oral health professionals about their patients' oral health behaviors.

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