Social inequality in perceived oral health among Sri Lankan adolescents

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Objectives: to assess socio-economic inequalities in two perceived oral health outcomes namely perceived oral health status and perceived oral impacts among adolescents in Sri Lanka. ***Design***: A cross-sectional study where the data where collected by means of structured questionnaires to the children and their parents. ***Participants***: A total 1,225 15-year-old adolescents attending state, private and international schools in the Colombo district of Sri Lanka. ***Results***: Inverse social gradients in perceived oral health status and perceived oral impacts were observed in relation to six socioeconomic indicators in the bivariate analyses. Adolescents from lower social positions had significantly reported more oral impacts and had rated their oral health as poor. But it was mainly the indicators of family material affluence that emerged as significant predictors of perceived oral health outcomes in the logistic regression analyses. ***Conclusion***: The study demonstrates the existence of significant social gradients in perceived oral health outcomes among adolescents from a developing country. Further studies to assess causes of social gradients in perceived oral health outcomes are recommended.

Key words: Adolescents, oral impacts, perceived oral health status, social inequality

Introduction

Since the publication of the Black Report in the United Kingdom (Townsend and Davidson, 1982), the relationship between socioeconomic inequalities and health status has been widely investigated. The evidence shows that socially advantaged groups with higher incomes; educational attainment and occupational prestige tend to enjoy better health than their socially disadvantaged counterparts. A similar pattern has been observed with respect to oral health. Socioeconomic status has been recognized as a dominant determinant of oral health inequalities with lower socioeconomic groups having poorer oral health compared to higher socioeconomic groups (Hejern *et al.,* 2001).

Self-reported assessments of oral health have also received considerable attention in recent years. It has been documented that socioeconomic status is an important predictor of perception of oral health (Atchison and Gift, 1997). Thus perceived oral health outcomes such as perceived oral health status and perceived oral impacts have been assessed for socioeconomic disparities and the findings indicate the existence of social gradients in relation to these outcomes (Sanders and Spencer, 2004).

Studies on social inequalities in health outcomes have mainly emanated from affluent countries. In fact Marmot, a pioneer researcher in the field of social inequalities in health has suggested that it is timely to convene researchers from developing countries to examine the associations between social inequalities and health (2004). As such studies have not been conducted in Sri Lanka, the aim of the present study was to assess socioeconomic inequalities associated with two perceived oral health outcomes namely perceived oral health status and perceived oral impacts in adolescents.

Methods

The data for the present paper were obtained from a larger study that was conducted to assess socioeconomic inequalities in oral health. The methodology and results pertaining to social gradients in perceived oral health outcomes are presented here.

The target population was 15-year-olds attending schools in the Colombo district of Sri Lanka. As 15-year-olds constitute one of the index age groups stipulated by the WHO, it was considered appropriate to select this group for the study. Schools in Sri Lanka are classified into three categories: state, private and international. Those students residing outside the Colombo district, not living with at least one parent and with learning difficulties were excluded from the sample. Hypothesis test for two population proportions was used to calculate the sample size. Using the caries prevalence rates of students whose fathers were professionals (41.93%) and non-professionals (68.54%) which were obtained from a pilot study, a level of significance of 5% and a power of 90%, a minimum of 72 students were needed per socioeconomic group. As there were six socioeconomic groups, the minimum sample size required was 432. A stratified cluster sampling method was used to select the sample. Thus it was necessary to make allowance for the design effect which was considered as two. After making adjustments for the design effect and compensate for

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non-responses (30%) the sample size required was 1,123. This was increased to 1,225 for practical purposes.

As 15-year-olds are aggregated in the grade 10 class, this class was considered as the unit of cluster while the average size of a class (30) was considered as the cluster size. Thus 41 clusters were necessary to obtain the sample (1,225/30=41). For practical purposes the number of clusters was increased to 42. Since there were considerable variations in the number of grade 10 classes (1-8) and the number of students in a class (20-40) in the three types of schools, the clusters were allocated disproportionately for better representation (Moser and Karlton, 1971). Thus the number of clusters allocated to state, private and international schools were 30, 9 and 3 respectively. Selection of clusters was done in two stages. In the first stage 32, 11 and 5 state, private and international schools with grade 10 classes were randomly selected from the respective sampling frames. At the second stage, clusters were identified from the selected schools. Two clusters per school were randomly selected from state schools with ≥5, private schools with ≥4 and international schools with ≥2 grade 10 classes while one cluster each was selected from all other schools. All students who satisfied the inclusion criteria were included in the sample.

The data were collected by means of structured questionnaires to the students, their parents and a clinical examination. The questionnaire to the students was intended to obtain information related to perceived oral health outcomes such as perceived oral health status and perceived oral impacts, oral health behaviours, the availability of certain household items and the number of siblings. The parental questionnaire included questions on occupation, education status, income, number of occupants and the number of bedrooms in the house, household assets and dwelling structure. Parental occupation status was classified according to the method used in the Census of Population and Housing of 2000 (Department of Census and Statistices, Sri Lanka, 2001) and included six groups. However for the purpose of analysis only five groups were considered. The income categories were selected according to the monthly income deciles given in the Household Income and Expenditure Survey 2002 (Department of Census and Statistics, Sri Lanka, 2003). For the purpose of this study, the deciles were collapsed into five groups and adjusted using a conversion factor to account for the official poverty line of 2002. Three socioeconomic indicators based on household material affluence were also used. The asset index developed and validated for Sri Lanka by Thalagala [2004] which considers 30 household and dwelling structure variables was used in this study. It is based on the sum of standardised asset item weights and is computed by summing up the standardised score for each asset item. The sample is later divided into quintiles. An asset score for each student was computed and the sample was then divided into five asset groups based on the cut-off points for wealth quintiles given by Thalagala [2004]. Accordingly the asset index categorised the sample into five asset groups of different size. The Family Affluence Scale (FAS) developed by Currie *et al.*, (1997) considers the ownership of car/van, telephone and a single bedroom per child. If the item is available, the score of 1 is given.

Thus the FAS would range from 0-3 per subject. Crowding index was defined as the number of occupants per bedroom and was computed by dividing the number of occupants by the number of bedrooms.

Perceived oral health status was assessed on a 3-point scale: good, fair and poor. A Sinhalese translation of a modified version of the Oral impacts of Daily Performance Index (OIDP) was used to assess oral impacts (Adulyanon and Sheiham, 1997). The OIDP index assesses oral impacts associated with 8 daily performances. The students were asked to indicate how often (frequency) they had experienced each impact item on a 5 point scale: 0=never; 1=hardly ever; 2=occasionally; 3= fairly often and 4=very often. Because of its better reproducibility, the OIDP score for a student was calculated using the frequency score (Adulyanon and Sheiham, 1997): by summing the frequency codes for the 8 items. The OIDP score for a student would therefore range from 0-32.

Stata 6.0 statistical software was used for data analysis. The associations between the various socioeconomic indicators were examined using the Spearman's rho test. The nonparametric test for trends was performed to test for trends in perceived oral health status across ordered socioeconomic groups. As the OIDP scores were not normally distributed, Mann-Whitney test was used to test the difference in OIDP scores between two groups whilst for groups with more than two ordered categories the Jonckheere- Terpstra test was used. For the multiple logistic regression analyses perceived oral health status was dichotomised as 0 if "good/fair" and 1 if "poor" while perceived oral impacts was dichotomised as 0 if OIDP score=0 and 1 if OIDP score>0. In the multiple logistic regression analyses the backward selection option was used, applying $P<0.05$ as the criterion for retaining in the model.

The psychometric properties of the FAS and the Sinhala version of the modified OIDP index using the frequency scale were assessed in a pilot study and were found to be valid and reliable for use among Sri Lankan adolescents.

Ethical approval for the study was obtained from the Ethics Committee of the Faculty of Medicine, University of Colombo. Informed written consent was obtained from all participating children and their parents. Permission to conduct the study was obtained from the Director of Education and the principals of the respective schools.

Results

When calculating the sample size allowance was made for non-responses (30%). However unexpectedly there was a 100% response rate. Hence the sample included in the study was equal to the calculated sample size of 1,225.

Of the 1225 adolescents included in the sample 63% were girls. The majority constituted of Sinhalese (81%) whereas Tamils, Muslims and other ethnic groups constituted 11%, 7% and 1% of the sample respectively. Also, 69% of the sample attended state schools while 28% and 9% attended private and international schools respectively.

The correlations (Spearman's rho) between the 7 socioeconomic indicators were assessed and the highest

correlation was between father's occupation and household income (Spearman's rho=0.66) whilst the lowest correlation was between father's occupation and sibling index (Spearman's rho=0.04). All correlations were low to moderate and there did not appear to be any potential problem of collinearity between indicators. There were significant inverse relationships between caries experience, tooth brushing frequency, use of dental services and the seven socioeconomic indicators.

Table 1 shows the distribution and the backward selection multiple logistic regression analysis of poor perceived oral health. Bivariate analysis revealed that there were significant inverse relationships between all socioeconomic indicators and poor perceived oral health. Except in relation to the asset index, students who belonged to the lowest stratum of a given socioeconomic indicator had perceived their oral health status as poor compared to those who belonged to the highest stratum. As revealed by the multivariate logistic regression analysis the asset index, the FAS and the level of education of father had significant effects on poor perceived oral health. Compared to students from families who possessed all three items of the FAS, those from families who did not possess any of the items were more likely to perceive their oral health as poor (OR=1.68, 95% CI: 1.18-2.38). Also students belonging to second, third and fourth groups of the asset index were more likely to perceive their oral health as poor compared to students from the least poor group.

With respect to OIDP scores, bivariate analysis revealed statistically significant inverse gradients in relation to all socioeconomic indicators except the sibling index. In the multiple logistic regression analysis household income, household crowding, family affluence and father's education emerged as significant predictors of perceiving oral impacts. Compared to students belonging to the highest stratum of a given indicator, those in the lower strata were more likely to perceive oral impacts (Table 2).

Discussion

It has been observed that associations between socioeconomic inequalities and health outcomes vary according to the socioeconomic indicator used and the health outcome considered (MacIntyre *et al.,* 2003). Also, the current recommendation is to use multiple indicators of socioeconomic status as it would permit obtaining maximum information as possible (Braveman *et al.,* 2005). Taking these factors into consideration, it was decided to use multiple indicators of social stratification in the present study. In addition to the conventional measures of socioeconomic status, three indicators of household material affluence were used. The low to moderate associations between the seven indicators indicate that they measure different domains of the multi-dimensional construct of socioeconomic status and thus these indicators are not interchangeable.

Bivariate analysis revealed the existence of a social gradient in perceived oral health status. In their study, Okullo *et al.* (2004) reported that Ugandan adolescents who had parents with high levels of education were less likely to be dissatisfied with their oral health compared to those who had parents with low levels of education.

Inverse gradients in perceived oral health have also been reported in relation to parents' level of education and family income among Chinese adolescents (Jing *et al.,* 2005) and with respect to social class among Brazilian adolescents (Pattussi *et al.,* 2007). On the other hand a social gradient was not observed in relation to self-rated state of teeth among Indian school children (David *et al.,* 2006). This indicates that social inequality in perceived oral health among adolescents is not a common occurrence in all developing countries.

Similar to perceived oral health status, perception of oral impacts also followed a social gradient. An inverse gradient in oral impacts was evident in relation to all socioeconomic indicators except the sibling index. Lopez and Baelum, (2007) have also observed social gradients in the reporting of oral impacts among Chilean adolescents.

There are two explanations for the observed social gradient in perceived oral health outcomes. Firstly, in this study the caries experience as well as the burden of untreated dental caries was higher in adolescents from low social classes compared to those from high social classes. It has been documented that a high prevalence of untreated dental caries is associated with poor perceived oral health (Pattussi *et al* 2007). Secondly, oral health promoting behaviours such as routine dental attendance and diligent oral self-care have been shown to be associated with inverse gradients in oral impacts (Sanders and Spencer, 2006). It was evident from the results of this study that oral health promoting behaviours such as frequency of tooth brushing and use of dental services increased significantly with the increase in social status. Thus it is possible that these differences may have contributed to the observed social gradients in perceived oral health outcomes. Behavioural/life style is considered as one of the four explanations for health inequalities in the Black's report (Townsend and Davidson, 1982).

Although bivariate analyses revealed strong inverse associations between socioeconomic indicators and perceived oral health outcomes, the total variance in perceived oral health outcomes explained by the multivariate models were less than 10%. Similarly in a study on Australian adults, Sanders and Spencer (2004) have reported that multivariate models containing demographic and socioeconomic variables accounted for only 4% and 7% of variations in social impacts and poor self-rated oral health respectively. It is plausible that the effect of socioeconomic indicators on perceived oral health outcomes is not direct but mediated by other variables such as psychosocial factors. In fact Sanders and Spencer (2005) having observed socioeconomic gradients in relation to both self-rated oral health and psychological factors concluded that the impact of socioeconomic status on perceived oral health outcomes are moderated by psychosocial factors particularly a sense of personal control. Moreover, in addition to socioeconomic factors, clinical and psychosocial factors have been shown to be associated with self-rated oral health in adolescents (Pattusi *et al.,* 2007). Thus it is possible that the predictive powers of these models may have increased if clinical and psychosocial factors were included in the logistic regression models.

Table 1. Frequency distribution and backward selection multiple logistic regression analysis of poor perceived

Variable	Poor perceived oral health (%)	Adjusted#	
		OR	95%CI
Father's occupation			
Unemployed (30)	33.3		
Labourer/business-lower (526)	28.0		
Clerical/technical/business-middle (266)	17.3		
Professional/managerial/business-upper (325)	11.7		
	$p < 0.01$**		
Father's education			
Up to 5 years (352)	32.1		
6-12 years (649)	16.6	0.70	0.52-0.95
Diploma/degree (155)	12.9	1.00	
	$p < 0.01$**		
Mother's education			
Up to 5 years (386)	28.0		
6-12 years (746)	18.2		
Diploma/degree (89)	12.4		
	$p < 0.01$**		
Household income (rupees)			
< 3565 (109)	35.8		
3565-6288 (216)	29.2		
6289-9057 (216)	20.4		
9058-13703 (224)	21.9		
>13703 (460)	13.0		
	$p < 0.01$**		
Family affluence scale			
No items (312)	32.4	1.67	1.18-2.38
One item (355)	19.7		
Two items (380)	17.4		
All three items (178)	10.1	1.00	
	$p < 0.01$**		
Asset index			
Poorest (23)	13.0		
Second (127)	33.9	2.03	1.23-3.36
Third (228)	29.8	2.00	1.32-3.01
Fourth (222)	24.8	1.89	1.28-2.81
Least poor (625)	13.8	1.00	
	$p < 0.01$**		
Crowding index			
>2 /bed room (380)	27.4		
Up to 2 / bed room (845)	17.9		
	$p < 0.01$*		
Sibling index			
>2 siblings (201)	27.9		
Up to 2 siblings (875)	19.7		
No siblings (149)	18.1		
	$p = 0.02$**		

For logistic regression analysis the dependent variable- perceived oral status dichotomised as 0=if good/fair and 1 if poor
Pseudo R^2 =0.05
*p value χ^2 test; ** p value nonparametric test for trends
model adjusted for gender and ethnicity

Table 2. Frequency distribution and backward selection multiple logistic regression analysis of oral impacts

Variable	OIDP score (Mean rank)	Adjusted#	
		OR	95%CI
Father's occupation			
Unemployed (30)	672.4		
Labourer/business-lower (526)	644.7		
Clerical/technical/business-middle (266)	505.3		
Professional/managerial/business-upper (325)	506.6		
	p<0.001**		
Father's education			
Up to 5 years (352)	692.7	1.79	1.28-2.50
6-12 years (649)	536.6		
Diploma/degree (155)	494.6	1.00	
	p<0.001**		
Mother's education			
Up to 5 years (386)	717.7		
6-12 years (746)	564.3		
Diploma/degree (89)	539.7		
	p<0.001**		
Household income (rupees)			
< 3565 (109)	750.3		
3565-6288 (216)	716.5	1.64	1.10-2.46
6289-9057 (216)	652.6	1.44	1.01-2.08
9058-13703 (224)	581.5		
>13703 (460)	528.6	1.00	
	p<0.001**		
Family affluence scale			
No items (312)	712.9	1.76	1.23-2.52
One item (355)	608.8		
Two items (380)	584.2		
All three items (178)	507.9	1.00	
	p<0.001**		
Asset index			
Poorest (23)	706.5		
Second (127)	732.7		
Third (228)	690.0		
Fourth (222)	629.6		
Least poor (625)	552.3		
	p<0.001**		
Crowding index			
>2 /bed room (380)	690.8	1.45	1.06-1.97
Up to 2 / bed room (845)	578.0	1.00	
	p<0.001*		
Sibling index			
>2 siblings (201)	665.4		
Up to 2 siblings (875)	597.1		
No siblings (149)	636.0		
	p=0.251**		

For logistic regression analysis the dependent variable-OIDP score dichotomised as 0 if score=0 and 1 if score>0

Pseudo R^2 =0.09

*p value Mann-Whitney test; ** p value Jonckheere-Terpstra test

Model adjusted for gender and ethnicity

It was mainly the indicators of family material affluence that emerged as significant predictors of perceived oral health outcomes in the multivariate logistic regression models. Similarly, von Rueden *et al.*, (2006) found that the Family Affluence scale was a stronger predictor of subjective health outcomes than parental level of education in adolescents. The study by Pikhart *et al.,* (2003) provides both material and psychosocial explanations for the association between household item ownership and self-rated health. It was evident from their study that material factors have a direct effect on self-rated health as well as they affect self-rated health indirectly through psychosocial mechanisms. As self-rated general health is a strong predictor of self-rated oral heath in adolescents (Pattusi *et al.,* 2007), both material and psychosocial explanations could be considered as valid explanations for the associations between family material affluence and perceived oral health outcomes.

In conclusion, the present study provides evidence for social inequality in perceived oral health outcomes in adolescents from a developing country. Of the different indicators that were used to assess socioeconomic status, indicators of family material affluence emerged as significant predictors of perceived oral health outcomes. As the existence of social inequality in perceived oral health outcomes among adolescents in Sri Lanka has now been established, it is recommended that future studies assess the causes for social gradients in perceived oral health related outcomes among adolescents.

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