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S Acharya
KC Pentapati
PV Bhat

Authors' affiliations:
S Acharya, KC Pentapati, Department of Community Dentistry, Manipal College of Dental Sciences, Manipal University, Manipal, India
PV Bhat, Department of Obstetrics and Gynecology, Melaka Manipal Medical College, Manipal University, Manipal, India

Correspondence to:
Shashidhar Acharya
Department of Community Dentistry
Manipal College of Dental Sciences
Manipal University
Manipal 576104
India
Tel.: +91 94481 27031
Fax: +91 82025 71966
E-mail: shashidhar_acharya@yahoo.com

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Dental neglect and adverse birth outcomes: a validation and observational study

Abstract: *Objectives:* The objectives of this study were to validate the Indian translation of the Dental Neglect Scale (DNS) among a sample of parturient Indian women and to investigate dental neglect as a possible risk indicator in adverse birth outcomes. *Subjects and methods:* Three hundred and sixteen parturient women were administered the DNS and the Modified Dental Beliefs Scale (MDBS) and were also clinically examined for oral health status. Information regarding socio-economic status, weeks of gestation and birth weight was also collected. A gestation period of less than 37 weeks was considered as preterm and a birth weight of less than 2500 gm as 'low birth weight'. *Results:* The Indian version of the DNS was found to be reliable (Cronbach's Alpha = 0.72) and valid for assessing dental neglect among the women. Factor analysis of the DNS revealed a two-factor structure accounting for 56% variance. Dental neglect was higher among those with poorer oral health status, lower socio-economic and educational status. Multinomial logistic regression showed high dental neglect and negative dental beliefs and not poor oral health, as significant risk indicators for occurrence of adverse birth outcomes. *Conclusion:* The finding of an association of adverse birth outcomes with dental neglect and beliefs, but not with poor oral health could be due to the influence of other more important general factors which had a direct bearing on birth outcomes. There is a need for further research to assess the role of behavioural factors like dental neglect as risk indicators for adverse birth outcomes.

Key words: dental neglect; India; low birth weight; oral health; preterm

Introduction

Behavioural factors can influence health outcomes by facilitating or acting as barriers to accessing healthcare services (1). Factors like poor dental attitudes, beliefs, knowledge and practices have been known to be associated with poor oral health (2). One of the most important behavioural factors that can impact oral health is dental neglect. Thomson *et al.* (3) suggested that behaviours and attitudes related to dental neglect may be useful in determining poor oral health outcomes. They defined dental neglect as being 'the failure to take precautions to maintain oral health, failure to obtain needed dental care and physical neglect of the oral cavity' (3).

In recent years, dental care in India has come within the reach of a large section of the population owing to high economic growth. In spite of this, utilization of dental care by this population is not assured as

strong barriers remain. These barriers may arise from negative attitudes and beliefs towards dental health care (2). The reasons for this could be the ignorance about the importance of oral health, social restrictions, taboos and poverty (2). A complex interplay of all these factors may manifest as dental neglect.

As in any developing country, it is the women who are among the most vulnerable sections of the population when it comes to hindered access to healthcare facilities. Gender discrimination makes women more vulnerable to various diseases and associated morbidity and mortality. Women are largely excluded from making decisions, have limited access to and control over resources and are restricted in their mobility (4). In general, an Indian woman is less likely to seek appropriate and early care for disease, irrespective of her the socio-economic status (5). Maternal mortality and morbidity is higher in developing countries compared with developed countries (6, 7).

Oral and dental problems associated with pregnancy include dental caries (8), erosion (9), pregnancy gingivitis and periodontal infection, pregnancy epulis, increased tooth mobility and dental problems related to labour and delivery (8–15).

One of the most common birth complications related to labour and delivery is preterm and low birth weight (LBW). The World Health Organization (WHO) defines preterm birth (PTB) as gestation period less than 37 weeks (16) and LBW as a birth weight of less than 2500 gm (17). Some of the risk factors for PTB include very low or high maternal age, low socio-economic status, inadequate prenatal care, use of alcohol and tobacco, malnutrition, and multi-parity and previous spontaneous preterm delivery (18, 19). Low birth weight is a well-documented risk factor for neonatal and infant morbidity, as well as mortality and can be caused by a short gestational period, or a retarded intrauterine growth or a combination of both (17).

In recent years, the role of oral health in these complications has received increasing attention. Offenbacher *et al.* (19) first suggested that poor oral health may cause pregnancy complications. Previous epidemiologic studies have reported positive associations between periodontal disease and adverse pregnancy outcomes including preterm low birth weight (PTLBW) (20, 21) LBW (21, 22), PTB (23), foetal growth restriction (24) and pre-eclampsia (25). On the other hand, some recent studies (26, 27) found no such association between periodontitis and pregnancy outcome. Such contrary findings could be due to inherent differences between the populations studied or due to the presence of other factors that may influence the association between periodontitis and PTLBW (28).

Neglect of dental treatment during pregnancy has been reported by various authors (29–31). The most common reason for not accessing dental care during pregnancy was the belief that dental examination and treatment might result in adverse birth outcomes (29, 30). In a developing country like India, there is a need to quantify the levels of dental neglect in this vulnerable population so as to plan appropriate oral health interventions.

The objectives of this study were to validate the Indian translation of the Dental Neglect Scale (DNS) among a sample of parturient Indian women and to investigate dental neglect as a possible risk indicator in adverse birth outcomes.

Study population and methods

The cross-sectional study was conducted among a group of 316 'parturient' women admitted to two hospitals in Udupi district, Karnataka, India. One of the two hospitals was the district government hospital, and the other was a university-run teaching hospital. Clearance was obtained from the ethics committee of university prior to the study. Women with diabetes mellitus, genitourinary infection, history of smoking or antibiotic usage, systemic infection, dental treatment history during current pregnancy and women with less than 20 teeth remaining were excluded. For a period of 3 months from March to May 2009, a total of 350 women who were admitted to the labour wards after delivery and satisfied the inclusion criteria were invited to participate in the study. Of these, 316 gave their consent.

Data collection

Those who gave their consent where administered a questionnaire consisting of the Indian translation of the DNS and the Modified Dental Beliefs Scale (MDBS) (32). Responses to these questionnaires were obtained through interview method. Information about socio-economic status, number of previous pregnancies, birth weight and weeks of gestation was also collected. Socio-economic status was assessed by using the revised Kuppuswamy Scale (33), the most widely used Indian scale, which divided the population into five groups ranging from 1, the highest socio-economic status group, to 5, the lowest, based on their educational level, occupation and income. A gestation period of less than 37 weeks was considered as preterm and a birth weight of less than 2.5 kg was considered as LBW. Gestational age assessment was done based on the 'Last Menstrual Period'. When these data were missing, the Capurro score (34) to estimate gestational age was used. Those babies that were both preterm and low birth weight at the time of delivery were classified separately, as PTLBW. The birth weight was recorded immediately after birth using calibrated weighing scales. The examiners were blinded to the adverse birth outcomes. This was achieved by first collecting the questionnaire, oral health and demographic data from the patient. The gestational age and birth weight data were later collected from the babies' hospital records.

Clinical examination

The women were subjected to an oral examination 1 day after delivery, where caries experience (35), gingivitis severity (36), probing depth (PD) and loss of attachment (LOA) for all teeth except third molars and oral hygiene status (37) were assessed in that order. Probing depth and LOA were assessed at six

sites (mesial, middle and distal surfaces on both palatal/lingual and buccal sides) on each tooth present (excluding the wisdom teeth). Probing pocket depth was measured in millimetres from the free gingival margin to the base of the gingival sulcus or periodontal pocket (38). Loss of attachment was determined using the cemento–enamel junction as a reference point. Probing depth and LOA were recorded in millimetres (mm) using the North Carolina periodontal probe, 15 mm in length and 0.35 mm in diameter (Hu-Friedy, Chicago, IL, USA).

All the examinations were conducted in the dental clinics of the respective hospitals by the author (SA) and a local dentist on a dental chair. Both were trained and calibrated prior to the study by an expert who was familiar with the indices and examination protocols. A total of 20 women were re-examined by the two examiners after a week to test to test intra and inter examiner variability.

Questionnaires

The six-item DNS used was the amended version reported by Thomson and Locker (39). Scores for the DNS (a Likert scale) was computed by adding the individual scores obtained for each item. Each item had responses ranging from 1 (definitely no) to 5 (definitely yes). The total scores for the DNS ranged from 6 to 30, with higher scores signifying greater dental neglect. Translation of the DNS was done in the local language by a linguistic expert who was proficient in English as well as the local language. However, as translation alone did not ensure that the Indian 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 DNS. The questionnaire was re-administered to the women after a week for assessing test–retest reliability. A seventeen-item MDBS (32), which has been previously validated in an Indian population, was also administered to the women.

Statistical analysis

Principal component analysis (PCA) with varimax rotation was used to determine the factor structure of the DNS. Cronbach's Alpha was used to measure the internal consistency of the questionnaires. Chi-square test was used to compare the oral health status against DNS categories and ANOVA with Tukey's *post hoc* was used to compare DNS scores against socio-economic status. To identify the relationship between independent variables and adverse birth outcomes, multinomial regression model was employed with the outcome variables being preterm, LBW and PTLBW. The multinomial regression was done under the assumption that the three outcomes were separate and could not be ordered. An analysis of variance inflation factor was undertaken to detect and, if necessary, avoid multi colinearity between independent variables. All the statistical analysis was done using SPSS version 16 (SPSS Inc., Chicago, IL, USA) statistical software package. A P value of ≤ 0.05 was considered statistically significant.

Results

Descriptive analysis

A total of 316 women participated in the study, of whom 165 were from the government hospital and the remaining 151 were from the university teaching hospital. The mean age of the study population was 25.88 ± 3.77 (Range: 18–42). A total of 234 (74.1%) women had babies with normal or above normal birth weight and term. Fifty (15.8%) women had either preterm or LBW babies. Thirty-two (10.1%) women had PTLBW babies. Half of the women had finished high school, and most of the respondents were from the lower socio-economic strata. No history of smoking was reported from the study population. All the women had dental caries experience, but the proportion of those with moderate-to-high caries levels was low. For the purpose of statistical comparison, the sample population was divided into three groups based on their DNS scores as 'Low' (6–10), 'Moderate' (11–14) and 'High' (15–30).The proportion of the sample population in these three groups was 28.5% (n = 90), 40.8% (n = 129) and 30.7% (n = 97), respectively (Table 1). Factor analysis of the DNS was done by PCA with varimax rotation. The analysis revealed the presence of a two-factor solution accounting for 56% of variance (Table 2).

Bivariate and multivariate analysis

The respondents' DNS scores ranged from 6 to 22 with the highest mean score reported for 'putting off dental care' (2.45 ± 1.22) and 'home dental care' (2.18 ± 0.84). The overall mean DNS score for the sample population was found to be 12.51 ± 3.4 (Table 3). On comparing the oral health status against the 'High', 'Moderate' and 'Low' DNS groups, we found that the proportion of women with higher LOA, PD, decayed, missing and filled teeth (DMFT), Oral Health Information Suite and gingival index scores was more in the high DNS group as compared to the other two groups. All these differences were statistically significant (Table 4).

The DNS scores were also compared against educational and socio-economic status. We found that mean DNS scores increased with decreasing levels of educational attainment, with the highest mean DNS scores (13.81 ± 3.88) reported by the least educated women. A similar relationship was observed with socio-economic status where the lowest socio-economic status groups reported the highest mean DNS scores (Table 5).

Intraclass coefficients were calculated to test the intra- and interexaminer variability for the clinical indices. The correlation coefficients for probing pocket depth and LOA ranged from 0.93 to 0.98. The Indian translations of the DNS and the MDBS were shown to be reliable with the Cronbach's' alpha for internal consistency found to be 0.72 for the DNS and 0.78 for the MDBS, respectively. The test–retest correlation analysis showed that the coefficients were ranging from 0.70 to 0.98 for the individual items and item total correlation coefficient being 0.97, respectively.

Table 1. **Descriptive data of the study population**

	Variables	Particulars	Number	Percentage
Socio demographic data	Educational status	Primary	107	33.9
		High school	158	50.0
		Graduate	51	16.1
	Socio-economic status	Upper	12	3.8
		Upper Middle	22	7.0
		Lower Middle	58	18.4
		Upper Lower	100	31.6
		Lower	124	39.2
Psychometric questionnaire data	Modified dental beliefs scores	Low (17–24)	93	29.4
		Mod (25–33)	129	40.8
		High (34–55)	94	29.7
	Dental neglect	Low (6–10)	90	28.5
		Moderate (11–14)	129	40.8
		High (15–30)	97	30.7
Oral health status	Probing pocket depth	<4 mm (1)	202	63.9
		≥4 mm (2)	114	36.1
	Loss of attachment	1. Mild (≤2 mm)	71	22.5
		2. Slight (3–4 mm)	206	65.2
		3. Severe (>4 mm)	39	12.3
	Gingival index scores	Mild	65	20.6
		Moderate	168	53.2
		Severe	83	26.3
	Oral Hygiene Index (Simplified)	Good	64	20.3
		Fair	198	62.7
		Poor	54	17.1
	Dental caries (DMFT scores)	Very Low (<5)	168	53.2
		Low (5–8.9)	104	32.9
		Moderate (9–13.9)	38	12.0
		High (>13.9)	6	1.9

DMFT, decayed, missing and filled teeth.

Table 2. **Factor structure of the Indian version of the Dental Neglect Scale**

		Components	
	Items	1	2
1	I keep up my home dental care	0.488	0.757
2	I receive the dental care I should	0.691	−0.167
3	I need dental care, but I put it off	0.448	−0.217
4	I brush as well as I should	0.774	0.273
5	I control snacking between meals as well as I should	0.694	−0.084
6	I consider my dental health to be important	0.573	−0.54
	Eigen value	2.32	1.02
	Variance explained	31.6	24.1

We found that although all the oral health indicators, dental neglect and beliefs were poorer among those with adverse birth outcomes, the differences were statistically significant only for dental neglect and beliefs. Multinomial logistic regression was done to further test the relationship between independent variables and adverse birth outcomes after adjusting for educational status, socio-economic status and age (Table 6). The independent variables included were PD, LOA, DMFT, oral hygiene status, gingivitis severity, dental neglect and dental beliefs and the outcome variables were preterm, LBW and PTLBW occurrence. The analysis revealed that high dental neglect and negative dental beliefs were significant risk indicators for the occurrence of adverse birth outcomes after adjusting for other variables. Those with high levels of dental neglect were more likely to have had PTBs (OR: 5.4; $P = 0.002$), low birth weight babies (OR: 6.5; $P = 0.002$) and PTLBW babies (OR: 6.9; $P = 0.01$). Similarly, those with more negative dental beliefs were more likely to have had preterm (OR: 4.7; $P = 0.01$), LBW (OR: 3.1; $P = 0.05$) and PTLBW babies (OR: 5.4; $P = 0.03$). Also, increasing severity of gingivitis was a significant predictor for LBW occurrence (OR: 0.8, $P = 0.04$).

Discussion

This study was done to validate the Indian translation of the DNS to assess the dental neglect among a sample of parturient Indian women, to know the difference in oral health status and levels of dental neglect between those with and without adverse birth outcomes and to study the role of dental neglect as a risk indicator in adverse birth outcomes. We found a strong relationship between poor oral health and dental neglect but not between poor oral health and adverse birth outcomes. It was also observed that dental neglect and negative dental beliefs were higher among those with adverse birth outcomes as compared to those with normal births.

The Indian version of the six-item DNS was found to be reliable and valid for assessing dental neglect among 'post par-

Table 3. **Frequency distributions of Dental Neglect Scale item responses**

		Responses					
	Items	1 *n* (%)	2 *n* (%)	3 *n* (%)	4 *n* (%)	5 *n* (%)	Mean ± SD
1	I keep up my home dental care	59 (18.7)	168 (53.2)	66 (20.9)	19 (6)	4 (1.3)	2.18 ± 0.84
2	I receive the dental care I should	68 (21.5)	184 (58.2)	38 (12)	25 (7.9)	1 (0.3)	2.07 ± 0.82
3	I need dental care, but I put it off	83 (26.3)	111 (35.1)	28 (8.9)	84 (26.6)	10 (3.2)	2.45 ± 1.22
4	I brush as well as I should	81 (25.6)	157 (49.7)	59 (18.7)	19 (6)	0 (0)	2.05 ± 0.82
5	I control snacking between meals as well as I should	61 (19.3)	187 (59.2)	53 (16.8)	13 (4.1)	2 (0.6)	2.07 ± 0.74
6	I consider my dental health to be important	116 (36.7)	187 (59.2)	11 (3.5)	1 (0.3)	1 (0.3)	1.68 ± 0.58

Table 4. **Oral health status in relation to Dental Neglect Scale response categories**

Oral variables	Specifics	DNS low *n* (%)	DNS moderate *n* (%)	DNS high *n* (%)	*P* value
Loss of attachment	Mild ($\leq$2 mm)	23 (31.9)	34 (47.2)	15 (20.8)	$\chi^2 = 21.37$
	Slight (3–4 mm)	61 (29.8)	86 (42.0)	58 (28.3)	$P < 0.001$
	Severe (>4 mm)	6 (15.4)	9 (23.1)	24 (61.5)	
Probing depth	<4 mm	67 (33)	89 (43.8)	47 (23.2)	$\chi^2 = 15.87$
	$\geq$4 mm	23 (20.4)	40 (35.4)	50 (44.2)	$P < 0.001$
DMFT	Low and very low (< 9.0)	88 (32.4)	117 (43.0)	67 (24.6)	$\chi^2 = 35.98$
	High and very high (>9.0)	2 (4.5)	12 (27.3)	30 (68.2)	$P < 0.001$
OHIS	Good	26 (40.6)	23 (35.9)	15 (23.4)	$\chi^2 = 10.5$
	Fair	55 (27.6)	85 (42.7)	59 (29.6)	$P = 0.033$
	Poor	9 (17.3)	20 (38.5)	23 (44.2)	
GI	Mild	17 (41.5)	19 (29.2)	19 (29.2)	$\chi^2 = 13.07$
	Moderate	50 (29.8)	69 (41.1)	49 (29.2)	$P = 0.01$
	Severe	13 (15.7)	41 (49.4)	29 (34.9)	

$P \leq 0.05$: statistically significant.
DMFT, decayed, missing and filled teeth; DNS, Dental Neglect Scale; GI, gingival index; OHIS, Oral Health Information Suite.

Table 5. **Mean Dental Neglect Scale scores in relation to educational and socio-economic status categories**

		n	Percentage	DNS score Mean ± SD
Educational status	Primary (1)	107	33.9	13.81 ± 3.88
	High school (2)	157	50.0	12.14 ± 2.98
	Graduate (3)	52	16.1	10.92 ± 2.91
P value, *post hoc*	$F = 15.2$	$P < 0.001$		1 > 2, 1 > 3
Socioeconomic status	Upper (1)	12	3.8	11.25 ± 2.83
	Upper middle (2)	22	7.0	11.14 ± 2.86
	Lower middle (3)	58	18.4	11.14 ± 3.06
	Upper lower (4)	100	31.6	13.10 ± 3.13
	Lower (5)	124	39.2	13.02 ± 3.77
P value, *post hoc*	$F = 5.21$	$P < 0.001$		4 > 3, 5 > 3

$P \leq 0.05$: statistically significant.
DNS, Dental Neglect Scale.

tum' women, as shown by its high internal consistency and test–retest reliability. Construct validity was shown by the association between dental neglect and the oral health status, as well as with the dental beliefs.

Factor analysis of the DNS revealed a two-factor solution where the first item related to 'home care' loaded on one factor and the remaining five items loaded on the second factor which concerned attitudes towards dental health and home dental care. However, item 1 of the DNS was found to load on the second factor too, although to a lesser degree. Other authors too have reported two-factor structures for the DNS, but with different factor distribution (3, 39–41).

The oral health status of the study population was quite poor with a vast majority the women suffering from gingivitis and dental caries. However, the proportion of women with high caries experience was low. The high prevalence of gingi-

Table 6. **Multinomial logistic regression to test the relation between oral health, behavioural factors and adverse birth outcomes**

		Preterm *n* (%) *n* = 57	Adjusted odds ratio	LBW *n* (%) *n* = 57	Adjusted odds ratio	PTLBW *n* (%) *n* = 82	Adjusted odds ratio
Probing depth	≥4 mm	25 (21.9)	1.8 (0.9–3.5)	24 (21.1)	1.5 (0.7–2.9)	35 (30.7)	1.7 (0.7–4.3)
	<4 mm	32 (15.8)	Ref	33 (16.3)	Ref	47 (23.3)	Ref
	P value		0.12		0.34		0.24
Loss of attachment	Severe	10 (25.6)	1.8 (0.7–4.6)	10 (25.6)	1.3 (0.5–3.5)	15 (38.5)	1.1 (0.4–3.56)
	Non-severe	47 (20.0)	Ref	47 (20.0)	Ref	67 (24.2)	Ref
	P value		0.22		0.58		0.55
Oral hygiene	Good	7 (13)	Ref	11 (20.4)	Ref	13 (24.1)	Ref
	Fair	36 (18.2)	1.4 (0.6–3.8)	34 (17.2)	1.4 (0.5–3.5)	50 (25.3)	1.0 (0.4–2.9)
	Poor	14 (21.9	1.9 (0.7–5.3)	12 (18.8)	1.3 (0.4–4.1)	19 (29.7)	1.1 (0.3–5.1)
	P value		0.42		0.53		0.87
Gingivitis	Severe	16 (19.3)	0.6 (0.2–1.6)	15 (18.1)	0.8 (0.2–1.4)	23 (27.7)	0.3 (0.1–1.1)
	Moderate	25 (14.7)	1.3 (0.6–2.9)	26 (15.5)	0.8 (0.3–1.8)	37 (22.0)	0.8 (0.3–2.3)
	Mild	16 (24.6)	Ref	16 (24.6)	Ref	22 (33.8)	Ref
	P value		0.3		0.04		0.3
DMFT	High and Very high	10 (22.7)	1.1 (0.4–2.2)	13 (29.5)	1.4 (0.6–3.4)	15 (34.1)	1.6 (0.6–4.3)
	Low and Very low	47 (17.3)	Ref	44 (16.2)	Ref	67 (24.6)	Ref
	P value		0.83		0.48		0.41
Dental beliefs (MDBS scores)	High	15 (16.0)	4.7 (1.5–15.5)	21 (22.3)	3.1 (1.0–10.0)	26 (27.7)	5.4 (1.2–24.0)
	Moderate	27 (20.9)	1.3 (0.6–2.9)	24 (18.6)	1.2 (0.5–2.8)	37 (28.7)	1.6 (0.5–4.8)
	Low	15 (16.1)	Ref	12 (12.9)	Ref	19 (20.4)	Ref
	P value		0.01		0.05		0.03
Dental neglect (DNS)	High	25 (25.8)	5.4 (1.8–16.0)	28 (28.9)	6.5 (2.0–20.7)	37 (38.1)	6.9 (1.6–30.0)
	Moderate	22 (17.1)	2.3 (1.0–5.5)	22 (17.1)	1.8 (0.8–4.3)	32 (24.8)	2.1 (0.7–5.8)
	Low	10 (11.1)	Ref	7 (7.8)	Ref	13 (14.4)	Ref
	P value		0.002		0.002		0.009

$P \leq 0.05$: statistically significant.
DMFT, decayed, missing and filled teeth; DNS, Dental Neglect Scale; LBW, low birth weight; MDBS, Modified Dental Beliefs Scale; PTLBW, preterm low birth weight.

val bleeding was in agreement with results obtained by other investigators (21, 22, 24) where almost all of the pregnant women presented bleeding after probing. The low proportion of women who presented with severe LOA was in agreement with other studies carried out among adults and pregnant women (21, 24, 42, 43). We found higher dental neglect scores to be associated with poorer oral health, which was in agreement with previous reports (3, 39, 44, 45).

Numerous studies have found a relationship between poor oral health and occurrence of adverse birth outcomes (20–26). Although we observed a higher prevalence of periodontal disease among those with adverse birth outcomes, the differences observed were not statistically significant. A lack of association between poor oral health and adverse birth outcomes have been reported by other investigators as well (26–28, 43). Furthermore, systematic reviews have failed to find a definite association between poor oral health and adverse birth outcomes. Common criticisms outlined in these reviews were the heterogeneity of the study populations, varying periodontal disease criteria and inadequate controlling of confounding factors (46–49).

Dental care is usually low on the list of priorities among pregnant women and post-partum mothers. In our study, 'putting of needed dental care' and 'home dental care' had the greatest impact on dental neglect which reflected this attitude. We also observed that the levels of dental neglect and negative dental beliefs were significantly and consistently higher among the PT, LBW and PTLBW groups than the controls. The finding of an association of adverse birth outcomes with dental neglect and beliefs but not with poor oral health could be due to the influence of other more important general factors which had a direct bearing on birth outcomes.

A cross-sectional study design was used in this study. A cohort study design, which would have been ideal in this scenario, was not used owing to time and resource constraints. In the present study, half the respondents had finished high school and yet remained in the lower socio-economic strata. As the assessment of socio-economic status involved asking about monthly income, a sensitive topic, response bias among the respondents reporting lesser than actual income, may have distorted the socio-economic status data to some extent.

Although the presumed association between dental neglect and adverse birth outcomes lacks biological plausibility, it is possible that dental neglect may be a proxy indicator for basic health attitudes and practices that may have a direct association with adverse birth outcomes. These could be the women's educational, socio-economic status, as well as their attitudes towards health in general. Those with high dental neglect and negative dental beliefs could have poorer attitudes to health, as well as inferior health knowledge and

practices that could put them at risk of adverse birth outcomes.

The present study was an observational one and the behavioural variables found to be associated with adverse birth outcomes in our study can at best be termed as risk indicators rather than risk factors. This study showed that there was a high level of dental neglect and negative dental beliefs in addition to poor oral health status among the women who have implications for dental practice. There is need for the dental profession to educate not only the women, but also the obstetrics community regarding the importance of maintaining good oral health during pregnancy. Further research is needed to know whether these dental behavioural indicators are independent risk factors predisposing to adverse birth outcomes.

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