Maternal Oral Health: An Examination Survey Conducted in Three Referral Hospitals in Bhutan

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ABSTRACT

Introduction: Good oral health is important for women during pregnancy and throughout their lives. Mothers with good oral health are less likely to transmit cariogenic bacteria to their infants and toddlers. Thus, maternal oral health is directly related to family health. **Objective:** To determine the prevalence of dental caries, periodontal diseases and modifiable risk factors among pregnant women seeking antenatal care in three referral hospitals in Bhutan. **Methods:** A descriptive cross-sectional survey of pregnant women was conducted in April-May 2017. We used a non-probability sampling method to recruit pregnant women (*n*=443). Oral examinations were done according to methods recommended by the WHO. Participants completed a questionnaire for modifiable risk factors. **Results:** Overall, caries prevalence was 40% among pregnant women, ranging from 54% in those under 25 to 81% in women 35 and older. The mean decayed, missing and filled permanent teeth (DMFT) was 1.93 (SD=2.66). Nearly 72% of women had calculus on their teeth. Just over 2% had periodontitis. Most women rated their oral health as good to excellent (89%) versus poor (11%). Just 11% reported having had dental care during pregnancy. **Conclusions:** There is an urgent need for professional dental care during pregnancy, especially among older and multiparous women. Increasing awareness on the importance of oral health during pregnancy will improve maternal health and the health of their young children.

Key words: Dental caries; DMFT; Oral health; Oral hygiene; Periodontal disease; Pregnancy.

INTRODUCTION

The World Health Organization (WHO) stresses that oral health is an "integral and essential" component of overall health[1]. The WHO recommends integration of oral health into national and community-level initiatives to improve health overall for optimal social and economic development.

Oral health is an important, albeit often overlooked, component of overall health and a significant public health issue. In fact, oral diseases (dental caries, periodontitis) are the two most common diseases among adults and children of all ages around the world[2]. These conditions are largely preventable and treatable in their acute phases, but can become chronic, life-long health problems. In pregnancy, normal physical changes in pregnancy increase the risk of dental caries, pregnancy gingivitis, periodontitis, and other oral health conditions[3]. Increased parity is associated with tooth loss, perhaps due to exacerbation of pre-existing periodontitis[4]. Despite early reports, treating periodontal disease during pregnancy is unlikely to affect birth outcomes[5,6]. Untreated mothers whose mouths are colonized with cariogenic bacteria (*Streptococcus mutans* and others) are more likely than healthy mothers to infect their infants and toddlers, setting up conditions for decay in primary teeth (early childhood caries)[7]. To ensure optimal oral health for women and their very young children, dental and maternity care providers recommend a balanced diet, daily oral hygiene practices, and dental visits during pregnancy, with professional teeth cleaning and treatments as needed[8].

Little is known about women's oral health in Bhutan, especially during pregnancy and childbearing years. Since 2012, all dental units in regional and districts hospitals have been headed by a dental surgeon and assisted by dental hygienists and, in the more populous towns, by dental laboratory technicians, thus improving dental care for patients at the hospital settings[9]. However, when asked about oral health care for the 2012 Bhutan National Health Survey, most respondents age 10 to 75 (66%) reported that they had never had dental care[10].

The purpose of this study was to determine the prevalence of oral disease and modifiable risk factors for oral disease among pregnant women seen for prenatal care in Bhutan's three referral hospitals. The study yielded information about maternal oral health, oral hygiene practices and oral health care in Bhutan. Because dental caries is a vertically transmitted infectious disease, knowing more about maternal oral health is critically important for improving the health of Bhutan's youngest children as well.

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METHODS

For a pilot study aimed at estimating the prevalence of oral disease among pregnant women, we conducted a cross-sectional descriptive survey (clinical examinations, face-to-face interviews) of oral health, using methods recommended by the WHO, in prenatal clinics in Bhutan's three regional referral hospitals in 2017. Approval for the research protocol and informed consent procedures was obtained from the Ministry of Health's Research Ethics Board of Health (REBH/Approval/2016/065 dated 15th November, 2016) and the Yale University Human Investigations Committee (#200020426, 2/27/26). We obtained local administrative approvals from each of the three study sites as well.

Sample

To recruit study participants, we used what the WHO guidelines call the "pathfinder method," a non-probability stratified sampling technique that is a practical and economical approach to determining the overall prevalence and severity of disease and variations among subgroups that are likely to have different disease prevalence[11]. The WHO describes the method as suitable for determining the overall prevalence of major oral diseases, identifying differences in disease prevalence and severity in population subgroups and obtaining data with which to determine the need for intervention. A pilot survey such as this study includes important population subgroups and aims to generate data that can be used for planning more comprehensive, systematic, nationwide assessment and monitoring of oral health.

For this exploratory study and relative ease of access to study subjects, we included pregnant women who were seen for prenatal care in Bhutan's three referral hospitals [Jigme Dorji Wangchuck National Referral Hospital (JDWNRH), the Eastern Regional Referral Hospital (ERRH) in Mongar, and the Central Regional Referral Hospital (CRRH) in Gelephu] during the study period. This approach was designed to draw a consecutive sample from among all primiparous or multiparous women who presented for prenatal care in the weeks that examiners were on site for data collection. The sampling approach was intended to describe maternal oral health overall and was not intended for comparison of findings by hospital or administrative division of the country. Study participants were those who consented to having an oral examination and completing the questionnaire. Women were excluded from the study sample if they did not consent to the examination, did not know their parity or duration of pregnancy, or were unable to cooperate during the examination portion of the survey. No record was kept to determine the number who refused to participate or did not meet study criteria in each site.

In the pathfinder survey approach, the pre-determined number of study participants is based on estimated disease prevalence as well as aims of the survey and resources available for the study. The WHO recommends random sampling within subgroups with known disease prevalence; however, oral disease prevalence in Bhutan is totally unknown. So the pathfinder sampling approach for this study was based on US data showing that dental caries (decayed, filled and missing teeth) and periodontal disease (gingival bleeding, periodontal pocketing, and loss of attachment) are relatively common and readily detectable in females of childbearing age[12]. For this exploratory pilot study of a single age group (childbearing age), including both primiparous and multiparous women, we planned to survey 150 pregnant women in each of three hospitals where a majority of Bhutan's births occur (in 2016, 52% of all births attended by trained personnel in Bhutan occurred in Thimphu, Sarpang and Mongar Districts)[13]. Based on the total population size (about 6,000 births at the three regional hospitals in 2016), the estimated disease prevalence (estimated at 50 percent since actual prevalence is unknown), this survey of 450 pregnant women was designed to provide us with 95 percent confidence that the sample-derived estimate would have less than a 5 percent margin of error.

Data Collection Procedures

The examinations and questionnaire survey were conducted over the course of six days at JDWNRH and 12 days each at the two regional referral hospitals (CRRH, ERRH) in April-May 2017. Informed consent was obtained before the oral examinations and questionnaire surveys were completed.

A team of dental examiners trained in WHO criteria for oral surveys conducted the examinations[14]. The procedures were standardized for validity, reliability and reproducibility through classroom lectures and field calibrations at the respective health centers prior to the survey. Intra- and inter-examiner reliability were maintained through cross-examinations of the subjects with Cohen's kappa greater than 0.75 indicating substantial agreement. Trained dental assistants recorded the results of the examination and the interview directly into an Excel spreadsheet created expressly for simultaneous collection of these data.

Information on oral health practices and modifiable risk factors was obtained from each study participant using a modified version of the WHO's questionnaire for assessing adult oral health[15]. In order to minimize the effects of literacy or language, a structured questionnaire interview was administered to the study participants in English or each participant's preferred language or dialect. Age was categorized for data collection (less than or equal to 25, 26 to 34, 35 and over).

Following the mouth examination, the dental hygienist/examiner completed a brief simple written summary of the findings that was given to each subject (in English and Dzongkha), along with a brochure describing good oral hygiene in pregnancy and new motherhood, as well as ways to prevent early childhood caries. The dental examiner made general recommendations for seeking care from a dental professional, when necessary, upon completion of the mouth examination.

Using an interview schedule modified from the WHO oral health assessment form, study participants were interviewed by the dental hygienists/examiners and asked to answer questions about oral health knowledge and attitudes toward oral hygiene and risk factors. We also asked about practices aimed at reducing risk, including good self-care (daily brushing, flossing); obtaining dental care during pregnancy; avoiding consumption of sugar-sweetened foods and beverages; and not smoking, chewing tobacco or chewing doma (areca quid).

Outcome Measures

Oral health status: The results of the examinations were recorded in terms of the percent of mothers affected by oral diseases and tooth status. First, we recorded the percent of mothers with untreated decay and any presence of caries (count of decayed, missing and filled permanent teeth; DMFT). Next, we recorded the prevalence and severity of periodontal disease, using the WHO-recommended Community Periodontal Index for describing treatment needs in terms of the highest level of severity: healthy gingiva, gingival bleeding (a common, normal physiologic response to pregnancy), presence of calculus, or presence of gingival pockets (mild-moderate 3.5-5.5 mm depth; deep >5.5 mm depth).

Modifiable risk factors: Based on responses to the survey interview, we determined the prevalence of common modifiable risk factors for dental caries and periodontal disease among pregnant women.

Analytical Approach

The results of the examination and the interview were summarized in Excel as counts and simple unadjusted rates for tooth status and responses, in general and for groups of interest. Differences in oral health status (coded as dichotomous outcomes: sound teeth with no caries versus any caries-affected teeth; healthy or bleeding gums versus presence of calculus or gingival pockets) were investigated for their association with age group (less than or equal to age 25, 26 to 34, 35 and over), parity (primiparous or multiparous), and residence (urban/semi-urban or rural), using chi-square tests.

We investigated the bivariate association between maternal age and prevalence of dental caries, based on the literature showing that the prevalence of dental caries increases with age. Likewise, we investigated the association between parity and periodontal conditions, based on the literature showing higher prevalence of periodontal disease in multiparous women, perhaps due to repeated episodes of gingivitis and/or aggravation of preexisting periodontitis.

We then examined the relationship between dental caries and age, adjusted for parity and other factors (residence, trimester), and the relationship between periodontal conditions and parity, adjusted for age and other factors that have been shown to affect oral health status (residence, trimester). Logistic regression analyses were performed with "R", an open-source statistical software package, to determine the association between age or parity and the outcome variables, after adjusting for other factors that can affect oral health status (residence, trimester of pregnancy). Results were considered statistically significant if the probability was less than 0.05. The logistic regression models were assessed for goodness-of-fit by determining the difference between the model-generated null and residual deviances, then comparing that difference to a chi-square distribution with the appropriate degrees of freedom to determine if the p-value was less than .05.

RESULTS

During the time allotted on site for conduct of the survey, the research team examined and interviewed 443 pregnant women, just short of the planned sample size of 450. Nearly all the women were less than 35 years old (90.5%). Most lived in the district capitals where the hospitals were located or in the surrounding towns (75.9%); just one in four lived in rural areas. The majority of women had at least some formal education (primary or secondary; 72.3%). Most reported being housewives (60%) rather than employed outside the home. Just over half the mothers were multiparous (54.2%) and the majority of mothers were in the second or third trimester of pregnancy (84.2%).

The results of the oral examinations are shown in Table 1. Nearly 60 percent of mothers had caries-affected teeth, i.e., teeth with decay or teeth that had been treated for decay with fillings or extraction. Forty percent of mothers had untreated decay at the time of the examination. The mean DMFT was 1.93 ($\pm$ 2.66), meaning that on average, these pregnant woman had about two and between zero to five teeth affected by decay. The actual range for number of affected teeth was zero to 28 (all teeth missing due to decay). As expected for this measure of life-long caries experience, the likelihood of having dental caries (active or history) increased significantly with age, from 54 percent of women under age 26, to 81 percent of women 35 and older (X^2 =10.98; p=0.004).

About 12 percent of women had healthy gingiva (not in need of professional care). Another 13 to 14 percent of mothers had bleeding gums, a relatively normal finding during pregnancy when the gingiva is engorged; these women would no doubt benefit from professional evaluation and information about good self-care. The majority of women (71.8%) were in need of professional care for cleaning and removal of calculus. Additionally, a few had evidence of periodontal disease and needed professional care for cleaning, scaling, and oral hygiene instruction. As expected, age and parity were associated (X^2=87.27; p<.05). The percentage of multiparous women in need of professional care (80.4%) was significantly greater than the percent of primiparous women in need of care (66.5%) (X^2 =11.08, p=0.0039).

Table 1. Oral Health Status of Pregnant Women Seen for Prenatal Care in Bhutan's Three Regional Referral Hospitals, April - May, 2017

	ORAL HEALTH STATUS	
CARIES EXPERIENCE	**Number of mothers**	**Percent**
Mothers with sound teeth	172	38.8%
Mothers with 1 to 4 caries-affected teeth	206	46.5%
Mothers with 5 or more caries-affected teeth	56	12.6%
Mothers with teeth missing for other reasons [a]	9	2.0%
Total	443	100.0%
MOTHERS WITH ANY UNTREATED DECAY	177	40.0%
TOOTH STATUS	**Mean number of teeth**	**STD**
Decayed teeth (D)	0.72	1.18
Missing teeth due to decay (M)	0.86	1.98
Filled teeth (F)	0.35	0.95
DMFT	1.93	2.66
PERIODONTAL HEALTH [b]	**Number of mothers**	**Percent**
Healthy gingiva	55	12.4%
Gingival bleeding	60	13.5%
Calculus or stain	318	71.8%
Shallow gingival pockets (3.5-5.5 mm)	10	2.3%
Deep gingival pockets (>5.5 mm)	0	0.0%
Total	443	100.0%

[a] Nine mothers with 12 teeth missing due to reasons other than caries, e.g. injury, were not counted in calculation of DMFT

[b] Severity and degree of periodontal diseases (gingivitis, periodontitis) in an individual, according to the WHO-recommended Community Periodontal Index (CPI) for assessing potentially treatable conditions. Bleeding gums are a relatively normal finding during pregnancy when the gingiva is engorged

Multivariate analyses confirmed the association between age and dental caries as well as the association between parity and periodontal conditions (Table 2). After adjusting for trimester, parity and residence, women age 35 to 44 were almost four times more likely than younger women under age 26 to have had tooth decay. Multiparous women were nearly twice as likely as primiparous women to need professional care for periodontal conditions (calculus, periodontitis).

Modifiable Risk Factors

Mothers were asked about oral health knowledge, attitudes, oral hygiene practices and diet to determine the prevalence of modifiable risk factors for disease; results are shown in Tables 3 and 4 (following pages). Overall, 89 percent of women rated their oral health as good to excellent. Most mothers valued good oral health as a component of overall good health. They knew that "germs" (microorganisms) cause tooth decay and that sugar-sweetened foods and poor oral hygiene contribute to disease. They knew that poor oral hygiene and improper brushing can cause periodontal disease. Few mothers reported frequent consumption of sweets and two-thirds avoid smoking or chewing. However, over 30 percent of mothers reported using areca quid (doma). Self-care was less-than-optimal. Less than half of mothers reported that they brush at least twice a day and none reported flossing. Many of the mothers did not use (or did not know if they use) fluoridated toothpaste. Few had had dental care during pregnancy, roughly equivalent to the six months prior to the survey.

DISCUSSION

This study is the first to describe maternal oral health status in Bhutan. The results showed that many pregnant women needed professional care for treatment of decay (40.0%) and periodontal conditions (74.1%). The examination findings were wholly consistent with the research literature showing that oral

Table 2. Factors Affecting the Risk of Oral Disease for Pregnant Women Seen for Prenatal Care in Bhutan's Three Regional Referral Hospitals, April - May, 2017

		ORAL DISEASE	
		Estimate (Standard Error)	**Odds ratio (95% CI)**
FACTOR		**PRESENCE OF CARIES-AFFECTED TEETH**	
Intercept		-0.01684 (0.28616)	---
Age	<=25	reference level	---
	26 - 34	0.42713(0.22725)	NS
	35 - 44	1.37025 (0.45184)	3.93 (1.69 – 10.11)
Parity	Primiparous	reference level	---
	Multiparous	-0.02099 (0.22650)	NS
Residence	Urban/semi-urban	reference level	---
	Rural	0.37628 (0.24609)	NS
Trimester	First	reference level	---
	Second	0.25551 (0.29646)	NS
	Third	-0.08447 (0.29006)	NS
		PRESENCE OF CALCULUS OR PERIODONTITIS	
Intercept		0.7338 (0.3222)	---
Age	<=25	reference level	---
	26 - 34	0.1654 (0.2508)	NS
	35 - 44	0.4025 (0.4829)	NS
Parity	Primiparous	reference level	---
	Multiparous	0.5734 (0.2521)	1.77 (1.09 – 2.92)
Residence	Urban/semi-urban	reference level	---
	Rural	0.3718 (0.2848)	NS
Trimester	First	reference level	---
	Second	-0.2134 (0.3369)	NS
	Third	-0.1880 (0.3342)	NS

NS: Not statistically significant at P<.05.
Goodness-of-fit test for presence of caries-affected teeth: X2 = 33.12(df=6);; p=.02.
Goodness-of-fit test for presence of calculus or periodontitis: X2 = 27.42(df=6); p=.03.

Table 3. Risk Factors for Oral Disease in Pregnant Women: Knowledge and Attitudes

	Number(*n*=443)	Percentage (%)
KNOWLEDGE		
Primary cause for tooth decay is…		
Germs	373	84.2%
Demons	3	0.7%
Smoking or chewing tobacco	48	10.8%
Drinking alcohol	3	0.7%
Other	16	3.6%
Plaque is…		
Soft deposit on teeth	41	9.3%
Hard deposit on teeth	22	5.0%
White patches on teeth	14	3.2%
Black patches on teeth	37	8.4%
Other	329	74.3%
Factor that helps formation of dental decay…		
Sugar/sweet foods	251	56.7%
Poor oral hygiene	145	32.7%
Drinking alcohol	3	0.7%
Green vegetables	5	1.1%
Don't know	39	8.8%
Cause of gum or periodontal disease is…		
Sugar/sweet foods	56	12.6%
Poor oral hygiene	138	31.2%
Calculus/tartar	16	3.6%
Improper brushing	128	28.9%
Don't know	105	23.7%
Main benefit of using toothpaste along with brushing is…		
Make the mouth clean and fresh	121	27.3%
Prevents dental decay	214	48.3%
Prevents gum disease	51	11.5%
Prevents oral cancer	25	5.6%
Don't know	32	7.2%
ATTITUDES		
Good oral health is important for general health.		
Agree	419	94.6%
Disagree	8	1.8%
Don't know	16	3.6%
Presence of teeth is important for smiling.		
Agree	414	93.5%
Disagree	17	3.8%
Don't know	12	2.7%
Poor oral health may affect baby inside the womb.		
Agree	323	72.9%
Disagree	16	3.6%
Don't know	104	23.5%
My overall oral health is…		
Very Good to Excellent	106	24.0%
Good	285	64.6%
Poor	50	11.3%

Table 4. Risk Factors for Oral Disease in Pregnant Women: Practices

	Number(*n*=443)	Percentage (%)
PERSONAL HYGIENE AND DIET		
I consume sweets or candy…		
Once daily	35	7.9%
Two to three times a week	63	14.2%
Four or more times a week	13	2.9%
Less than once a week	31	7.0%
Sometimes only	301	67.9%
I presently use…		
Chewing tobacco (Khain)	12	2.7%
Areca quid	138	31.2%
Smoke cigarettes or bidis	6	1.4%
Any combination of the above three	5	1.1%
Never use any of the above three	282	63.7%
I clean my teeth…		
Once a day	221	49.9%
Twice a day	205	46.3%
More than twice a day	12	2.7%
Sometimes in a week	4	0.9%
Never	1	0.2%
I use [type of] toothpaste…		
Fluoridated	254	57.3%
Non-fluoridated	69	15.6%
Desensitizing	34	7.7%
Other	17	3.8%
Don’t know	69	15.6%
I use [tools] for cleaning…		
Toothbrush	440	99.3%
Chewing stick	0	0.0%
Threads (floss)	0	0.0%
Fingers	3	0.7%
Any combination of the tools above	0	0.0%
I had dental care at hospital or BHU since becoming pregnant…		
Never	392	88.5%
Once	35	7.9%
Two or three times	12	2.7%
Four or five times	3	0.7%
More than five times	1	0.2%

disease prevalence among pregnant women increases with age and parity[16]. In contrast to the high prevalence of disease found on examination, most mothers rated their oral health as good to excellent. Very few women sought dental care while pregnant.

The results of this study show that there is room for improving oral health practices. Self-care (brushing with fluoridated toothpaste, flossing) could be improved. Efforts to discourage chewing doma are needed. Rapidly changing access to sugar-sweetened snacks and beverages may further increase the risk for poor oral health. All women need a dental check-up during pregnancy to detect and treat diseases; however, few women received dental care during pregnancy, despite widespread need for professional care.

In follow-up discussions with clinical staff, administrators and policymakers, there was general agreement about the importance of ongoing surveillance and the need for improving oral health in pregnancy and for very young children. Health care providers advised integrating oral health promotion into reproductive health care, including preconception care. They also recommended study of oral health among rural populations.

In addition to the study findings, there is other evidence of the need for oral health care in Bhutan. Annual reports from the Ministry of Health show that the counts for dental caries in every age and gender combination exceed other chronic disease conditions and all but the most common acute conditions[17]. In 2016, the overall numbers of fillings (51,084) and extractions (77,624) performed all across the country provide additional information about the burden of poor oral health. The only other data on oral disease prevalence come from a 2014 study of school-aged children in Bhutan, showing that only 16 percent of children age 6 were caries-free, far below the FDI/WHO goal (≥50% caries-free)[18,19].

The presence of caries in pregnant women in Bhutan is low, compared with country-specific levels of disease severity reported by the WHO; in fact, few countries in the world have mean DMFT less than 5.0 [20]. Several studies from other countries in the region and elsewhere provide context for assessing the findings; however, differences in the study populations limit the usefulness for understanding maternal oral health in Bhutan. For example, in the densely populated large city of Udaipur, India, 86 percent of pregnant women had dental caries, with DMFT increasing during pregnancy to an average of 4.13 $\pm$ 2.75 by the third trimester[21]. In Sri Lanka, a study of pregnant women showed that untreated decay was more prevalent in rural areas; mean DMFT was also higher among rural resident women (5.38 $\pm$ 3.0), compared with urban residents (3.69 $\pm$ 3.62) [22]. In another study, most women seen in a hospital prenatal clinic in Indore, India, were reportedly unaware that dental care is important in pregnancy and nearly half had never seen a dentist[23].

The WHO has determined that universal access to fluoride is part of the right to good health[24]. However, a recent study of naturally-occurring fluoride showed that the levels in Bhutan's drinking water are too low for preventing dental caries[25]. In the absence of community-based strategies (water fluoridation) or professional application of fluoride (gels, rinses, varnish), Bhutanese need to use fluoride toothpaste; however, many of the brands available for sale in Bhutan are not fluoridated and provide no protection against decay[26].

These results should be interpreted with the following limitations in mind: This study provides a cross-sectional look at maternal oral health, based on pregnant women seen for prenatal care in Bhutan's three largest health care facilities. The findings may not be representative of maternal oral health in other parts of the country or among rural residents who were not included in great number due the purposive approach to data collection at the three regional hospitals. The number who refused to participate or was otherwise eliminated from inclusion in the study sample is unknown. This study focused on the most common tooth and gum conditions, not on other oral related conditions. We did not attempt to determine personal barriers to recommended oral hygiene practices nor the impact of oral diseases on psychosocial well-being. Pregnant women who were found to be in need of treatment were informed, as were their prenatal care providers; however, follow-up was beyond the scope of this study. We did not identify barriers to dental care for pregnant women nor did we determine whether prenatal care or dental care providers in these hospitals consider dental care an essential part of good prenatal care. Nevertheless, the results shed light on significant, highly prevalent acute and chronic oral health conditions that are almost entirely preventable and treatable in mothers and can be vertically transmitted to infants and very young children.

CONCLUSIONS AND RECOMMENDATIONS

- Oral diseases (dental caries, periodontal conditions) are highly prevalent among pregnant women seen in Bhutan's three regional referral hospitals, indicating the urgent and widespread need for prevention and treatment to improve maternal oral health and limit the spread of disease to very young children.
- Oral hygiene knowledge, attitudes and self-care practices need improvement to ensure good maternal oral health before, during, and after pregnancy.

Adoption of a national oral health strategy is essential for ensuring dedicated resources at all levels (central, district and local government; local health care providers, facilities, and public health workers; school administrators), working together to improve oral health and disease prevention for pregnant women and their families in Bhutan. With leadership from the Ministry of Health and input from key stakeholders, we recommend development of a national oral health strategy that includes:

- Integrating oral health promotion and dental care into maternity and pediatric care;
- Sponsoring a nationwide campaign to promote the importance of oral health and disease prevention for pregnant women and very young children;

- Reducing risk for conditions common to both oral disease and chronic non-communicable diseases;
- Improving oral health surveillance, including adoption of WHO-recommended methods and measures;
- Conducting additional studies of oral health in rural populations and oral health in early childhood.

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REFERENCES

1. Petersen PE. The world oral health report 2003: Continuous improvement of oral health in the 21st century. Community Dentist Oral Epidemiol 2003; 31: 3-23. [Full Text | DOI]
2. Frencken JE, Sharma P, Stenhouse L, Green D, Laverty D, Dietrich T. Global epidemiology of dental caries and severe periodontitis: A comprehensive review. J Clin Periodontology 2017; 44(S18): S94-S105. [Full Text | DOI]
3. Burgess KA, Edelstein BL. Oral health in women during preconception and pregnancy: Implications for birth outcomes and infant health. Matern Child Health J 2006; 10: S169-S74. [Full Text | DOI]
4. Russell SL, Ickovics JR, Yaffee RA. Exploring potential pathways between parity and tooth loss among American women. Am J Public Health 2008; 98(7): 1263-70. [Full Text]
5. Xiong X, Buekens P, Fraser WD, Beck J, Offenbacher S. Periodontal disease and adverse pregnancy outcomes: A systematic review. Brit J Ob Gyn 2006; 113: 135-43. [Full Text | DOI]
6. Polyzos NP, Polyzos LP, Zavos A, Valachis A, Mauri D, Papanikolaou EG, et al. Obstetric outcomes after treatment of periodontal disease during pregnancy: Systematic review and meta-analysis. Brit Med J 2010; 34. [Full Text | DOI]
7. Çolak H, Dulgergil CT, Dalli M, Hamidi MM. Early childhood caries update: A review of causes, diagnoses and treatments. J Nat Sci Biol Med 2013; 4(1): 29-38. [PubMed | Full Text | DOI]
8. Oral Health Care During Pregnancy Expert Workgroup. Oral health care during pregnancy: A national consensus statement. Washington, DC: National Maternal and Child Oral Health Resource Center, 2012. [Full Text]
9. Yangchen S, Tobgay T, Melgaard B. Bhutanese health and the health care system: Past, present, and future. The Druk Journal 2016; 2(1). [Full Text]
10. Royal Government of Bhutan, Ministry of Health. Bhutan National Health Survey, 2012. [Full Text]
11. World Health Organization. Oral health survey: Basic methods. Fifth Edition. Geneva, Switzerland: WHO, 2013; 27-29. [Full Text]
12. National Health and Nutrition Examination Survey of US adults, 2011-2012. [Full Text]
13. Ministry of Health. Annual Health Bulletin, 2017. [Full Text]
14. World Health Organization. Oral health survey: Basic methods. Fifth edition. Geneva, Switzerland: Who, 2013, 83-4. [Full Text]
15. World Health Organization. Oral health survey: Basic methods. Fifth edition. Geneva, Switzerland: WHO, 2013; 111-14. [Full Text]
16. Russell SL, Ickovics JR, Yaffee RA. Exploring potential pathways between parity and tooth loss among American women. Am J Public Health 2008; 98(7): 1263-70. [Full Text]
17. Ministry of Health. Royal Gov of Bhutan. Annual health bulletin, 2017.Tables 3.3, 3.5. [Full Text]
18. Ngedup S, Phurpa D. National oral health survey in 6- and 12-year-old Bhutanese school children. Bhutan Health Journal 2016, 2(1): 11-6. [Full Text | DOI]
19. Hobdell M, Petersen PE, Clarkson J, Johnson N. Global goals for oral health 2020. International Dental Journal 2003; 53: 285-88. [Full Text]
20. Petersen PE. World map on dental caries, 35-44 years, 2003. [Full Text]
21. Kumar S, Tadakaadla J, Tibdewal H, Duraiswamy P, Kulkarni S. Factors influencing caries status and treatment needs among pregnant women attending a maternity hospital in Udaipur city, India. J Clin Exp Dent 2013; 5(2): e72-6. [Full Text | DOI]
22. Karunachandra NN, Perera IR, Fernando G. Oral health status during pregnancy: Rural-urban comparisons of oral disease burden among antenatal women in Sri Lanka. J Rural and Remote Health. 2012; 12: 1902-14. [PubMed | Full Text]

23. Jain D, Agrawal N, Guatam A, Jain S. Dental health care in pregnancy: A survey and literature review. J Dental and Med Sciences 2016; 15(6): 91-5. [Full Text]
24. Mullane DM, Baez RJ, Jones S, Lennon MA, Petersen PE, Rugg-Gunn AJ, et al. Fluoride and oral health. Community Dental Health2016; 33**:** 69–99. [Full Text | DOI]
25. Ngedup S, Phurpa D, Wangchuck R. Drinking water fluoride mapping in Bhutan. A report for the Bhutan Ministry of Health, 2013. [Full Text]
26. Ngedup S. Toothpaste in Bhutanese markets by fluoride content. Data available from the author upon request.

AUTHORS CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

SN: Concept, study design, data collection and oversight, critical reviews, research dissemination

MAL: Concept, study design, data analysis, manuscript drafting, critical reviews, research dissemination

DP: Data collection management, critical reviews, research dissemination

NW: Reviews

Authors agree to be accountable for all respects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

None

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