J Clin Periodontol 2005; 32: 815–821 doi: 10.1111/j.1600-051X.2005.00739.x

Journal of Clinical Periodontology

Factors related to utilization of dental services during pregnancy

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Habashneh R, Guthmiller JM, Levy S, Johnson GK, Squier C, Dawson DV, Fang Q. Factors related to utilization of dental services during pregnancy. J Clin Periodontol 2005; 32: 815–821. doi: 10.1111/j.1600-051X.2005.00739.x. © Blackwell Munksgaard 2005.

Abstract

Objectives: The purposes of this study were to investigate factors related to utilization of dental services during pregnancy and to assess the extent of mothers' knowledge regarding oral health during pregnancy and its effect on pregnancy outcomes.

Materials and Methods: Cross-sectional data were collected from 625 women using a structured questionnaire mailed to mothers who had given birth in Johnson County, Iowa from August 2001 to March 2002. The survey assessed knowledge, behaviours, attitudes toward dental care during pregnancy, and personal, demographic and pregnancy-related factors. Variables which showed associations in bivariate analysis ($p \leqslant 0.1$) were considered as candidates for building logistic regression models separately by domain (demographics, dental health care behaviours, lifestyle, financial variables, pregnancy-related variables, and knowledge of the possible association between oral health and pregnancy). Significant domain-specific regression results ($p \leqslant 0.05$) were used to develop a final model using forward stepwise logistic regression analyses.

Results: The overall response rate was 69%. Dental visits during pregnancy were reported by 49% of respondents. Forty-three percent were aware of the possible connection between oral health and pregnancy outcomes. In the final logistic regression analysis, factors significantly associated with reporting dental visits during pregnancy were: (1) personal factors (being married, greater frequency of visiting the dentist when not pregnant and use of inter-proximal cleaning aids); (2) financial factors (dental insurance); and (3) knowledge of the possible connection between oral health and pregnancy outcomes.

Conclusions: There was limited knowledge of the possible relationships between oral health and pregnancy outcomes in a fairly homogeneous population of women who were of relatively high socioeconomic standing. This study suggests that better education of the importance of dental care before and during pregnancy is needed.

Key words: dental visits; oral health knowledge; oral hygiene; periodontitis; pregnancy

Accepted for publication 17 November 2004

The interaction between oral and systemic health has long been of interest. It has been shown that pregnant women have a higher incidence of gingival inflammation compared to non-pregnant women (Loe & Silness 1963, Jensen et al. 1981, Nuamah & Annan 1998). The incidence of gingival inflammation in pregnant women has been reported to range from 36% to 100% (Jensen et al. 1981, Ferris 1993). Hormonal and vascular changes associated with pregnancy can exaggerate the response of the gingiva to bacterial plaque (Zachariasen 1993, Raber-Durlacher et al. 1994). Good oral hygiene practices, however, can minimize gingival disease during pregnancy (Raber-Durlacher et al. 1994, Silness & Loe 1966).

Recently, evidence has shown an association between periodontal disease and pre-term low birthweight babies. Two case–control studies (Offenbacher et al. 1996, Dasanayake 1998) and cohort studies (Jeffcoat et al. 2001, Offenbacher et al. 2001, Lopez et al. 2002) showed that periodontal disease could be an independent risk factor for pre-term birth and low birthweight after adjusting for several known risk factors. In fact, treatment of periodontal disease has been shown to reduce pre-term birth (Lopez et al. 2002, Jeffcoat et al. 2003). Other studies have shown additional associations between periodontal disease and pregnancy such as increased risk for development of preeclampsia during pregnancy (Boggess et al. 2003) and periodontal diseases and significant

positive correlations between periodontal status and serum IL-8 and IL-1β levels (Hasegawa et al. 2003). Interestingly, results of another case–control study questioned the associations between periodontal disease and preterm birth (Davenport et al. 2002).

Several studies of dental care-seeking behaviours during pregnancy have been conducted. Most studies have shown that at most half (35–50%) of women visit the dentist during their pregnancy (Murtomaa et al. 1991, Rogers et al. 1991, Mangskau & Arrindell 1996, Gaffield et al. 2001, Lydon-Rochelle et al. 2004). The association between use of dental services during pregnancy and demographic characteristics, however, is less clear. There are conflicting results regarding the associations of age, race, education, and household income with the likelihood of dental visits during pregnancy (Murtomaa et al. 1991, Mangskau & Arrindell 1996, Watson et al. 1998, Gaffield et al. 2001, Lyndon-Rochelle et al. 2004). Pre-natal care (PNC) and early entry into PNC were significantly associated with seeking dental care in the Pregnancy Risk Assessment Monitoring System (PRAMS) study in Illinois, Louisiana, and New Mexico (Gaffield et al. 2001) but not in Washington State (Lyndon-Rochelle et al. 2004). Other factors demonstrating a significant association with utilization of dental services during pregnancy include frequency of previous utilization of dental services (when not pregnant) and having private health insurance (Mangskau & Arrindell 1996, Watson et al. 1998, Gaffield et al. 2001). Recently, a Danish study reported on self-assessment of gingival health conditions of pregnant women, oral hygiene habits and dental visits during pregnancy (Christensen et al. 2003). Telephone interviews were conducted with 1935 pregnant women. Results indicated that only 27% of the women perceived signs of gingival inflammation, felt the need for seeking dental care or had intensified their oral hygiene habits during pregnancy. Thus, the investigators recommended that pregnant women need education regarding the possible impact of periodontal diseases on pregnancy outcomes and periodontal prevention and treatment options (Christensen et al. 2003).

Although there is interest in general health education of women during pregnancy, to our knowledge no US study has been published that has addressed the extent of mothers' knowledge regarding the associations between oral health and pregnancy. Therefore, the purposes of this study were to assess the extent of mothers' knowledge regarding the association between oral health and pregnancy, and to investigate additional factors related to utilization of dental services during pregnancy.

Materials and Methods

Study population

The target population was mothers who gave birth from August 2001 to March 2002 in Johnson County, Iowa. The study protocol was approved by the Institutional Review Board for the use of human subjects in research at the University of Iowa. Names and addresses were collected from state birth certificates in Johnson County, Iowa. Questionnaires were sent to mothers to gather information on knowledge, behaviours, and attitudes toward dental care during pregnancy, and personal, demographic, and pregnancy-related factors.

Data collection

Between January and June, self-administered questionnaires were mailed to 889 mothers. Return of the questionnaire was considered consent. Questionnaires were coded to allow a second mailing. After 3 weeks, non-respondents were sent a reminder notice and another survey. The subject matter of the questionnaire was designed to assess: (1) mothers' personal characteristics, including financial, psychological, and pregnancy-related factors; (2) frequency of utilization of dental services during pregnancy; and (3) mothers' knowledge of the potential associations between oral health and pregnancy outcomes.

The main dependent variable was utilization of dental services during pregnancy, dichotomized as whether or not the women had a dental visit during pregnancy. To study the factors related to the likelihood of a woman visiting a dental office during her pregnancy, a model describing six broad domains (demographics, dental health care behaviours, lifestyle, financial variables, pregnancy-related variables, and knowledge of the possible association between oral health and pregnancy) was developed (Fig. 1).

Statistical analysis

Data from the completed questionnaires were analysed and descriptive frequency tables were generated. Bivariate analyses were performed, and variables showing association with the primary outcome ($p \leqslant 0.1$) in bivariate analysis were considered as candidates for logistic regression models for each domain separately. Multiple logistic regression models were developed to identify fac-

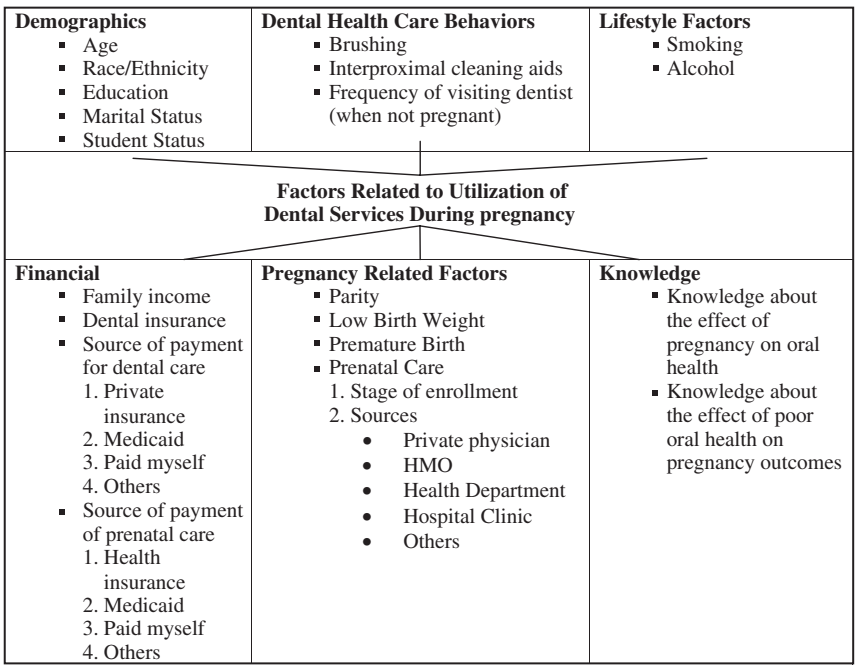

Fig. 1. Conceptual model of factors influencing utilization of dental services during pregnancy including main categories and subcategories.

tors associated with the utilization of dental services during pregnancy, and potential interactions were explored, initially within each of the six domains. Variables that showed significant results ($p \leqslant 0.05$) in domain-specific regression models were used to develop a final model using forward stepwise logistic regression analysis, and verified using backward elimination. All possible two-way interactions were considered for all variables in the final model as well as for any variables in the candidate list obtained from the initial bivariate screen.

Results

Completed questionnaires were received from 625 mothers for an overall response rate of 69%.

Descriptive analyses

Sociodemographic characteristics

The majority of mothers were younger than 35 years of age (87%), Caucasian (84%), married (87%) and of relatively high socioeconomic status as judged by household income and education (Table 1).

Pregnancy-related characteristics

The majority started PNC during the first trimester (81%). A private physician was the most frequently reported source of PNC (Table 1).

Behaviours

Ninety-two percent of the respondents reported brushing their teeth at least once a day, while two-thirds of the women reported use of inter-proximal cleaning aids. Five percent smoked and 0.4% drank alcohol during pregnancy (Table 1).

Dental visits during pregnancy

Of the 625 respondents, half (49%) reported a visit to the dentist during their most recent pregnancy (Table 2), whereas prior to pregnancy almost three-quarters (71%) reportedly visited the dentist every 6–12 months. Among mothers who reported having a dental visit during pregnancy, the main types of treatment received were examination and routine cleaning (96% and 95%, respectively). For those who did not report a dental visit during pregnancy,

Table 1. Characteristics of the mothers

Characteristic	Number of subjects ($n = 625$)	Percentage
Age group		
$\leqslant 20$	71	11
21–25	116	19
26–30	197	31
31–35	162	26
$\geqslant 36$	79	13
Race/Ethnicity		
White	520	84
Non-white	101	16
Marital status		
Married	539	87
Not married	86	13
Education		
Less than high school	29	5
Graduated high school	134	21
Some college or 2-year degree	166	27
4-year college graduate	172	28
Some graduate or professional study	120	19
Annual household income		
$<$\$20,000	77	13
\$20,000–39,999	176	29
\$40,000–59,999	139	23
\$60,000–79,999	118	19
$\geqslant$\$80,000	101	16
Employment status		
No	210	34
Yes-full time	197	32
Yes-part time	208	34
Dental insurance		
Yes	433	69
No	188	31
Source of payment for dental care		
Private insurance	333	60
Medicaid	128	21
Paid myself	68	13
Other	33	6
Source of payment for pre-natal care		
Health insurance	485	78
Medicaid	83	13
Paid myself	44	7
Other	10	2
Parity		
First	271	43
Second	230	37
Third or more	124	20
Pre-natal care		
No pre-natal care	3	0.1
Began pre-natal care during 1st trimester	509	81
Began pre-natal care after 1st trimester	113	18
Source of pre-natal care		
Private physician	277	45
Health maintenance organization	63	10
Health department	56	10
Hospital clinic	205	32
Other	21	3
Infant's birthweight		
Less than 5.5 pounds	44	0.8
5.5 pounds or more	575	92
Gestational age		
Less than 37 weeks	39	0.6
37 weeks or more	577	94
Toothbrushing		
Yes	611	98
No	12	2
Number of toothbrushings per day		
Not every day	53	8

Table 1. (Contd.)

Characteristic	Number of subjects ($n = 625$)	Percentage
Once	209	35
Twice or more	352	57
Inter-proximal cleaning		
Yes	408	66
No	211	34
Number of inter-proximal cleanings per day		
Not every day	298	71
Once	99	23
Twice or more	20	6
Mouthwash use		
Yes	141	23
No	482	77
Smoking		
Before pregnancy	87	14
During pregnancy	31	5
Currently	62	10
Never	445	71
Alcohol drinking		
Before pregnancy	298	42
During pregnancy	27	0.4
Currently	229	37
Never	71	17

Table 2. Utilization of dental services during pregnancy

Visiting the dentist during pregnancy	Number	Percentage
Yes	309	49
No	316	51

the most common reasons for not going to the dentist were, ''I was not having a problem'' (89%), and ''I chose to delay until after pregnancy'' (68%). Of the 34% who cited ''other'' as the reason for not having a visit, nearly two-thirds indicated that they did not think they should go to the dentist while pregnant, or had not been informed that they should visit the dentist. Approximately one-third (39%) indicated that they did not consider a dental visit a priority.

Mothers' health knowledge

Table 3 presents results concerning mothers' knowledge of the possible association between pregnancy outcomes and oral health. Forty-three percent reported having heard about the possible connection between pregnancy and oral health and 39% thought that tooth and gum problems could affect outcomes of pregnancy.

The greatest proportion of the respondents (85%) stated that books and magazines were the most useful in learning about oral health and pregnancy, followed by ''my dentist told me about it'' (54%).

Factors related to utilization of dental services during pregnancy

Bivariate logistic regression results for all statistically significant variables in the domain-specific logistic modeling

Table 4 displays the bivariate (unadjusted) results for those variables which remained in the domain-specific models and were entertained as candidates for the final model. Mothers who had reported a dental visit during pregnancy were more likely to be older and married, and have 4 or more years of college (68%), while the lowest prevalence (16%) was for mothers with a high school education or less.

Healthier lifestyle behaviours were associated with greater likelihood of having had a dental visit during pregnancy. Mothers who reported brushing their teeth more frequently and using inter-proximal aids were each more likely with visit the dentist compared to those who did not ($p < 0.0001$). Mothers who reported smoking before ($p = 0.0001$) and after ($p < 0.0007$) pregnancy were less likely to report a dental visit during pregnancy. Women who consumed alcohol during pregnancy were significantly less likely to report a dental visit during pregnancy ($p = 0.0166$). Interestingly, women who consumed alcohol before pregnancy were more likely to report dental visits ($p = 0.0009$).

Greater income and having dental insurance were significantly associated with a greater likelihood of reporting a dental visit during pregnancy ($p < 0.0001$).

Mothers who initiated their PNC care during the first trimester and had a private source of prenatal were more likely to have a dental visit compared with those who initiated their PNC later ($p < 0.0001$).

There were significant correlations between knowledge of the potential association between pregnancy outcomes and oral health and a dental visit (Table 3). For each of the three questions in this area, the more knowledgeable the women were, the more likely they were to visit the dentist ($p < 0.0001$).

Multivariable logistic regression analyses (final model)

Table 5 displays results from the final model exploring the association of variables across the domains on the mothers' use of dental services during pregnancy using forward stepwise logistic regression analyses. The results indicate that those married ($p = 0.0046$), using inter-proximal cleaning aids ($p < 0.0001$), reporting dental visits every 6–12 months when not pregnant ($p < 0.0001$), having dental insurance ($p < 0.0001$), and aware of the possible connection between oral health and pregnancy ($p = 0.0015$, $p = 0.0214$, $p < 0.0001$ respectively, for the three listed items) were significantly more likely to report dental visits compared with their counterparts. The odds of reporting a dental visit of married mothers were 3.55 times that of unmarried mothers. There were approximately 10-fold as high odds of dental care utilization during pregnancy for mothers who reported regular (every 6–12 months) dental attendance when not pregnant compared with mothers who reported a visit every 2 years. Given that the variable 'previous dental visit' was such a strong predictor that might obscure other variables being considered for the final model, additional analysis was performed excluding the variable 'previous dental visit'. This revealed that educational level and level of income were significant predictors for utilization of dental services during pregnancy in this

Table 3. Mothers' responses to knowledge statements

Knowledge statement	(%)	
	Yes	No
Have you heard about the possible connection between oral health and pregnancy?	43	56
Do you think tooth and gum problems could affect out- comes of pregnancy?	39	61
Do you believe in the statement ''a tooth for a baby''?	19	81
Do you believe calcium will be drawn out of your teeth by the developing baby?	47	53
Source of learning*		
I read it in a book, magazine, or pamphlet	85	15
My medical doctor told me about it	32	68
It was mentioned during pre-natal care	46	54
My dentist told me about it	54	46
Previous experiences with pregnancy	40	60
Other	4	96

*Participants who responded to source of learning are the 43% that responded yes to ''Have you heard about the possible connection between oral health and pregnancy?''

modified model excluding 'previous dental visit'.

Respondents who reported having dental insurance were 4.86 times as likely to report a dental visit compared with those with no insurance. Among those who responded positively to the knowledge statements, the odds of a dental visit during pregnancy were two to five times as likely as for those who did not agree with the statements.

Discussion

To our knowledge, this is the first published study conducted in the US assessing the level of mothers' awareness regarding the potential association between oral health and pregnancy out-

Table 4. Bivariate (unadjusted) results of variables that remained in the domain-specific models and were candidates for inclusion in the final modeling across all domains

Parameters	Odds ratio	*p*-value
Age group		**(<0.0001)***
⩾30 *versus* <20 (68% *versus* 14%)†	12.35	<0.0001
26–30 *versus* <20 (50% *versus* 14%)	5.74	0.0042
21–25 *versus* <20 (32% *versus* 14%)	2.75	0.0877
Marital status		
Married *versus* not married (55% *versus* 12%)	8.94	0.0001
Education		**(<0.0001)**
4 years of college or more *versus* high school or less (68% *versus* 16%)	11.27	<0.0001
2 years of college *versus* high school or less (51% *versus* 16%)	5.40	0.0169
Inter-proximal cleaning aids		
Yes *versus* no (61% *versus* 27%)	4.60	<0.0001
Number of toothbrushings per day		
Once or more *versus* less than Once (54% *versus* 9%)	11.26	<0.0001
Previous dental attendance		**(<0.0001)**
Every 6–12 months *versus* Every 2 years (64% *versus* 9%)	16.88	<0.0001
Others *versus* every 2 years (19% *versus* 9%)	2.20	0.1056
Smoking before pregnancy		
No *versus* yes (52% *versus* 32%)	3.43	<0.0001
Smoking currently (after pregnancy)		
No *versus* yes (52% *versus* 24%)	2.30	0.0007
Alcohol consumption during pregnancy		
No *versus* yes (50% *versus* 26%)	2.92	0.0166
Alcohol consumption before pregnancy		
No *versus* yes (43% *versus* 56%)	0.59	0.0009
Annual household income		**(<0.0001)**
$60,000–⩾$79,999 *versus* ⩽$20,000–$39,999 (71% *versus* 24%)	7.58	<0.0001
$40,000–$59,999 *versus* ⩽$20,000–$39,999 (61% *versus* 24%)	4.85	0.0053
Dental Insurance		
Yes *versus* no (63% *versus* 19%)	6.92	<0.0001
Pre-natal care		
Began pre-natal care during 1st trimester *versus* Began pre-natal care after 1st trimester (57% *versus* 15%)	7.57	<0.0001
Source of pre-natal care		**(<0.0001)**
Private physician *versus* hospital clinic (63% *versus* 49%)	1.74	<0.0001
Other *versus* hospital clinic (23% *versus* 49%)	0.32	<0.0001
''Do you think tooth and gum problems could affect outcomes of pregnancy?''		
Yes *versus* no (65% *versus* 21%)	3.77	<0.0001
''Do you think pregnancy increases the tendency for your gums to bleed, swell, or be red?''	6.98	<0.0001
Yes *versus* no (69% *versus* 38%)		
''Have you heard about the possible connection between oral health and pregnancy?''		
Yes *versus* no (75% *versus* 29%)	7.27	<0.0001

*The bolded numbers represent the overall *p*-values for the specific categories.

†Percentages in parentheses represent the percentage of women who reported a dental visit for each group.

Table 5. Multivariable logistic regression for dental visits during pregnancy (final model, giving odds ratio adjusted for other variables in the model)

Variable	Dental visit (%)	No visit (%)	Odds ratio 95%CI	*p*-value
Marital status				
Married	55	45	3.55 (1.48, 8.54)	0.0046
Not married	12	87	1.00	
Inter-proximal cleaning				
Yes	61	39	2.82 (1.73, 4.59)	<0.0001
No	27	73	1.00	
Previous dental attendance				
Every 6–12 months	64	36	10.48 (4.98, 22.07)	<0.0001
Every 2 years	10	90	1.00	
Other	20	80	2.16 (0.73, 6.40)	0.3819
Dental insurance				
Yes	63	37	4.86 (2.84, 8.32)	<0.0001
No	19	81	1.00	
''Do you think tooth and gum problems could affect outcomes of pregnancy?''				
Yes	65	35	2.35 (1.39, 3.98)	0.0015
No	21	79	1.00	
''Do you think pregnancy increases the tendency for your gums to bleed, swell, or be red?''				
Yes	69	31	1.76 (1.09, 2.84)	0.0214
No	38	62	1.00	
''Have you heard about the possible connection between oral health and pregnancy?''				
Yes	75	25	4.87 (2.68, 8.82)	<0.0001
No	29	70	1.00	

comes. Moreover, the study investigated the possible association between dental visits and a number of variables that have not been previously studied.

The present study reflects the self-reported use of dental services during pregnancy among a predominantly Caucasian population of relatively high socieoeconomic status (as judged by reported income and education). Therefore, generalizations must be made carefully as this is a rather unique population which is not reflective of either the general Iowa or US populations.

The prevalence of reported dental visits during pregnancy (49%) exceeded that reported for the four states (Arkansas, Illinois, Louisiana, and New Mexico) in the PRAMS study (22.7–34.7%) (Gaffield et al. 2001) and the North Dakota study (42.6%) (Mangskau & Arrindell 1996), but was similar to the level reported in Washington State (48%) (Lyndon-Rochelle et al. 2004). However, there was a lower proportion of reported dental visits during pregnancy in the present study in comparison with the proportions reported in the Behavioural Risk Factor Surveillance System (BRFSS) among Iowa adults (70.3%) and Iowa women (73.3%) in 1999 (http://apps.nccd.cdc.cov).

Factors related to dental visits not reported in previous studies included oral health awareness and use of inter-proximal cleaning aids. Forty-three percent of the subjects responded ''positively'' to the question ''Have you heard about the possible connection between oral health and pregnancy?''. Notably, respondents who agreed with this statement were significantly more likely to report a dental visit during pregnancy. These findings suggest that better knowledge and awareness play an important role in understanding the benefit of utilizing dental services during pregnancy.

Increased frequency of visits to the dentist when not pregnant was strongly related to increased utilization of dental services during pregnancy. Mothers reporting dental visits every 6–12 months when not pregnant were more likely to report a dental visit during pregnancy compared with those who reported visits every 2 years when not pregnant. Only one previous study concluded that having regular dental visits when not pregnant was associated with greater utilization of dental services during pregnancy ($p<0.0001$) (Rogers 1991).

The present study found that neither age nor educational level were significant factors in the final logistic regression model after adjustment for other variables. However, they did have significant bivariate relationships. Thus, it was assumed that age and education were associated with other variables, such as knowledge of oral health, that were more closely related to dental visits. Another explanation is that the very strong association (Odds ratio 10.48) with previous dental attendance masked other significant variables. As stated previously, additional analysis excluding the previous dental visit variable revealed that level of education was a significant predictor for dental visits in the final modified model. Similar results have been presented in previous studies (Mangskau & Arrindell 1996, Watson et al. 1998, Gaffield et al. 2001, Lyndon-Rochelle et al. 2004).

Pregnancy-related factors, including early entry into PNC and a private source of PNC have previously been reported to be important predictors of dental utilization during pregnancy (Gaffield et al. 2001). Despite the fact that the majority of respondents in the present study reported initiation of PNC during the first trimester and reported a private source of PNC, these factors were not significant predictors of having a dental visit during pregnancy, when adjusted for other variables. One previous study in Washington also showed no significant association between initiation of PNC and reported dental visits (Lyndon-Rochelle et al. 2004).

In the present study, having dental insurance was strongly associated with a dental visit during pregnancy. This is similar to several previous reports (Mangskau & Arrindell 1996, Watson et al. 1998, Gaffield et al. 2001, Lyndon-Rochelle et al. 2004).

A potential limitation of this investigation was reliance on self-reported data by the study participants where inaccuracies can be introduced. Although informal pilot testing was carried out to make sure that women understood the questions, one cannot rule out the possibility that some women misunderstood the questions. Moreover, no data were collected from non-respondents to allow for comparison of characteristics of respondents and non-respondents.

In summary, approximately one half of the mothers in this study reported visiting the dentist during their recent pregnancy. Significant explanatory variables for having a dental visit during pregnancy included being married, use of inter-proximal cleaning aids, visiting the dentist every 6–12 months when not pregnant, having dental insurance and being aware of the possible connection between oral health and pregnancy outcomes.

Interestingly, many of the respondents had not received information about oral health and the importance of

dental care prior to and during pregnancy, or if they had, they may not have comprehended or endorsed it. To increase utilization of dental services during pregnancy, we propose that dental health education be integrated into pre-natal health care programs. Prenatal care providers including nurses and physicians should be educated regarding the reported relationships between dental health and pregnancy outcomes and should be encouraged to discuss with their patients the importance of dental care and refer patients for dental care. In addition, dentists also need to be aware of the importance of dental care during pregnancy and should be encouraged to be a part of the pre-natal team. Finally, barriers preventing pregnant women from obtaining dental care should be identified and eliminated. One such limitation may be financial whereby future goals may be to include seeking medical insurance coverage of dental procedures during pregnancy. In addition, future studies should assess: (1) utilization of dental services during pregnancy in other population groups, including ethnically diverse and heterogeneous socioeconomic populations; (2) the role of the dental team in the PNC system; and (3) dental educational interventions and their effects on utilization of dental services during pregnancy.

Acknowledgements

This study was supported in part by funding from the Dows Institute for Dental Research and the Department of Periodontology, the University of Iowa, College of Dentistry.

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