



# Medical Provider Promotion of Oral Health and Women's Receipt of Dental Care During Pregnancy

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## Abstract

**Objectives** Dental care during pregnancy is important. We examined whether promotion of oral health by medical providers during pregnancy and pregnant women's receipt of dental care improved between 2009 and 2012 in California. **Methods** We used population-based postpartum survey data collected during 2009 (n = 3105) and 2012 (n = 6810) to compare the prevalence of women's reports that, during pregnancy, (a) their medical providers discussed oral health and/or suggested they see a dentist, and (b) they received dental care. **Results** Between 2009 and 2012, the proportion of women reporting that their medical providers talked about oral health or referred them to a dentist increased significantly overall (from 36 to 42%, and 21–26%, respectively,  $p < 0.001$ ). The proportion of women with a dental visit during pregnancy also increased, from 38% in 2009 to 42% in 2012 ( $p < 0.005$ ). The improvements were largely among women of lower income and education levels, those covered by Medi-Cal, and Latinas. Women whose medical providers promoted oral health care were approximately two times more likely to report having had a dental visit during pregnancy, even after adjusting for several potential confounders. **Conclusions for Practice** Characteristics of women reporting that their medical providers promoted, and that they received, dental care during pregnancy in 2012 suggests that the increases in promotion and use of oral health care were largely concentrated among Medi-Cal recipients. Further improvement is needed for all populations of pregnant women. Both public and private providers need to incorporate promotion of and referral for dental care into routine prenatal care protocols.

**Keywords** Oral health · Pregnancy · Provider practices

## Significance

This study of a racial/ethnically and socioeconomically diverse sample of postpartum women shows that medical provider practices are associated with patients' receipt of dental care; this is the first California study to do so. It suggests that medical providers play an important role in

improving receipt of dental care during pregnancy, including among disadvantaged groups.

## Introduction

Oral health during pregnancy can influence the overall health of women. Poor oral health has been linked to chronic diseases such as diabetes, pulmonary infections, cardiovascular disease, and stroke, with implications for health across the lifespan (Azarpazhooh and Leake 2006; Demmer et al. 2008; Humphrey et al. 2008; U.S. Department of Health and Human Services 2000). Pregnant women have higher rates of gingival inflammation than non-pregnant women, which can lead to chronic oral infection known as periodontitis with potential long-term effects on oral health, like tooth or gum recession (Figuro et al. 2013; Hartnett et al. 2016). Some studies have found

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associations between previous periodontal treatment or oral disease (chronic inflammation of the gums causing local tissue destruction and loss of ligament and bone) in pregnant women and poor birth outcomes such as preterm birth and pre-eclampsia (Boggess et al. 2013; Chambrone et al. 2011; Clothier et al. 2007); however, some intervention studies have not shown a reduction of preterm birth when periodontal disease is treated (Macones et al. 2010; Michalowicz et al. 2006; Offenbacher et al. 2009). Despite open questions about effects on birth outcomes, few argue against the importance of at least one visit for routine oral health care during pregnancy. In fact, dental care during pregnancy is recommended and generally considered safe, and the risk of providing dental care to pregnant women is outweighed by the risk of not treating poor oral health conditions (AAPD 2016; ACOG 2013; American Dental Association 2011; CDA Foundation 2010; “Oral health care during pregnancy and early childhood: Practice guidelines” 2006).

A mother’s oral health status also has been linked to the oral health status of her children (Boggess and Edelstein 2006; CDA Foundation 2010). Untreated dental caries in the mother during pregnancy have been associated with caries in offspring (Berkowitz 2003; Finlayson et al. 2017). Women are often receptive to health messages while pregnant; pregnancy offers a window of opportunity to ensure good oral health for the mother and establish a strong foundation for the oral health care of her children (Boggess and Edelstein 2006).

In many states, Medicaid coverage for prenatal care includes dental care, and some low-income women are only eligible for Medicaid during pregnancy. It may be particularly important for these low-income women with Medicaid coverage for prenatal care to receive dental care during pregnancy, as pregnancy may be the only time they are eligible for dental benefits (Russell and Mayberry 2008). During the years examined in this study, full preventive dental coverage for adults aged 21 years and older with Medi-Cal (California’s Medicaid program) in California had been eliminated. However, limited dental coverage was retained for pregnant women, such as prophylaxis, root planing and periodic examinations.

The percent of women receiving dental care during pregnancy appears to vary depending upon the data source and population examined. Earlier studies showed that, in some states, rates of receipt of oral health care during pregnancy ranged from 35 to 43% between 1995 and 2000 (Gaffield et al. 2001; Lydon-Rochelle et al. 2004). A population-based study of pooled data from women in 10 states during 2004–2006 reported 40% of women had their teeth cleaned during pregnancy; the sample consisted of predominantly White women with private health insurance and more than a high school education (Hwang et al.

2011). Our previous study of a racially, ethnically and socioeconomically diverse population in California during 2002–2007 found that only 35% of women received any dental care during pregnancy (Marchi et al. 2010). A more recent population-based study of women in Rhode Island found that 53% had a dental visit during pregnancy in 2009; although fewer than 45% of women who were adolescents, had low education or low income levels, or were WIC or Medicaid recipients received dental care during pregnancy (Oh et al. 2011). In general, women who are of color, younger, without private health insurance, with low incomes, or who have not completed high school are less likely to obtain dental care while pregnant (Hwang et al. 2011; Marchi et al. 2010; Oh et al. 2011).

Despite surveys reporting that obstetricians show general support for receipt of oral health care during pregnancy, few report promoting it among their patients or conducting oral health evaluations during visits (George et al. 2012; May et al. 2014; Morgan et al. 2009). In Rhode Island, Oh et al. (2011) reported that only 52% of prenatal care providers advised women on the health of their teeth and gums (Oh et al. 2011). In a study of child-bearing women in 10 states during 2004–2006, 41% of women stated that they received dental counseling from their providers (Hwang et al. 2011). In a recent national sample of patients and obstetric providers from 52 randomly selected medical centers, 44% of pregnant patients reported being told that good oral health was important, yet only 22% were encouraged to see a dentist by their provider (May et al. 2014). A survey of obstetric providers in Michigan in 2013 indicated that while 80% of providers recognized the importance of oral health, only 35% reported discussing it during prenatal care visits (Wilson et al. 2017).

Previous studies have shown that encouragement from prenatal providers to obtain dental care during pregnancy has a positive effect on women’s use of care (Lydon-Rochelle et al. 2004; May et al. 2014; Thompson et al. 2013). Based on increasing evidence of the importance of oral health care during pregnancy, the American College of Obstetrics and Gynecology, the American Academy of Pediatric Dentistry, and the American Dental Association, published guidelines and patient education materials supporting the provision of oral health care during pregnancy (ACOG 2013; American Academy of Pediatric Dentistry 2011; American Dental Association 2011). In addition, several states, including California, released perinatal practice guidelines emphasizing the safety and benefits of oral health care during pregnancy, and encouraging medical providers to educate and counsel their patients and refer women to dental care (CDA Foundation 2010; “Oral health care during pregnancy and early childhood: Practice guidelines” 2006).

Using a diverse, population-based sample of California women with a live birth, we examined whether medical providers' promotion of oral health and women's receipt of dental care during pregnancy has changed in recent years. We used data from a population-based survey of postpartum women in 2009 and 2012 in California to compare the prevalence of women's self-reports that, during pregnancy, (a) their medical providers discussed oral health and/or suggested they see a dentist, and (b) they received dental care during pregnancy. We also examined whether women's receipt of dental care during pregnancy was associated with whether their medical providers discussed oral health or suggested that they see a dentist.

## Methods

### Data Source

The Maternal and Infant Health Assessment (MIHA) is an annual population-based survey of postpartum women in California conducted in English and Spanish since 1999. The MIHA survey is mailed to a stratified random sample of women statewide, drawn from the California birth record files of residents ages 15 years and older who had a singleton, twin, or triplet live birth; telephone follow-up is conducted with non-respondents. Completed surveys are linked with birth certificate data, and the final sample is weighted to reflect the population of births statewide for that year. MIHA covers topics related to the time periods before, during, and after the index birth, including access to and content of care; some topics vary from year to year. At the time of this study, oral health questions had been included in the MIHA survey in 2009 and 2012 only, with annual sample sizes of 3105 and 6810, and response rates of 70.6% and 69.6%, respectively. One hundred and eight (1.1%) women with no prenatal care were excluded from the analyses, as they would not have had the opportunity to have a medical provider discuss oral health, leaving a final sample size of 3068 in 2009 and 6739 in 2012. The MIHA study is conducted in accordance with prevailing ethical principles and approved by two Institutional Review Boards, that of the California Health and Human Services Agency and that of the University of California, San Francisco.

### Variable Descriptions

The primary outcome variables were medical provider oral health promotion counseling and referral, and women's use of dental care. Women were asked in both the 2009 and 2012 MIHA surveys whether, during pregnancy, (a) their medical doctors, nurses or other health care providers

talked to them about the health of their teeth and gums, (b) their medical providers suggested that they see a dentist, and (c) they visited a dentist, dental clinic or received dental care at a health clinic. The reason for the visit was not specified.

We considered several maternal characteristics that might influence women's reports of provider practices or use of dental care services, and that were available in the MIHA survey data linked with birth certificate information:

Maternal characteristics measured in birth certificate data included: *race/ethnicity/nativity*—categorized into Non-Latina White (hereafter “Whites”); Latina (regardless of race); Non-Hispanic Asian/Pacific Islander, American Indian/Alaska Native, Other, and Non-Hispanic Black (hereafter “Blacks”); Latina women were further categorized by whether they were born in the United States; *maternal age at delivery*—categorized, based on Denti-Cal eligibility cut-offs as 15–20, 21–24, 25–29, 30–34, and 35 years or greater; and *number of live births* (including the index birth)—categorized as first live birth versus second live birth or more.

Maternal characteristics measured in the MIHA survey included: *maternal education*—grouped into four categories corresponding to completed levels of education: women with less than a high school education, women who had completed high school or received their GED, women with some college, and women who had a college degree or postgraduate degree; *marital status at delivery*—classified either as married or unmarried; *language spoken at home*—categorized as English, Spanish, English/Spanish equally or Asian language/other language; *family income*—total pre-tax income from all sources during the calendar year prior to the birth and categorized in relation to the respondent's family size (as  $\leq 100\%$ , 101–200%, 201–300%, 301–400%, or  $> 400\%$  of the federal poverty guidelines); *pre-pregnancy health insurance*—categorized as insured (including public or private coverage) or uninsured; *prenatal health insurance*—categorized as Medi-Cal (California's Medicaid, which provided limited dental coverage for pregnant women), private coverage, uninsured/self-pay, or other (e.g., CHAMPUS, Tri-Care, or other government programs); *prenatal care initiation*—categorized into first trimester or second/third trimester; and *smoking before pregnancy*—self-reported cigarette use during the 3 months before pregnancy.

### Analyses

We first compared the prevalence of the characteristics of women in the MIHA survey samples in 2009 and 2012. To determine whether the prevalence of each characteristic was different in 2012 compared to 2009, we calculated Rao Scott

Chi-Square statistics and examined the *p*-values. We then calculated the prevalence of provider practices and receipt of dental care overall and by maternal characteristics for each year. We also calculated Rao Scott Chi-Square tests for each level of a characteristic by year for both provider practices and for use of dental care.

To examine the association between year and provider practice/women's use of dental care we calculated adjusted prevalence ratios, controlling for maternal characteristics (race/ethnicity/nativity, age, number of live births, education, marital status, language, income, pre-pregnancy and prenatal health insurance, prenatal care initiation, and smoking before pregnancy). Adjusted prevalence ratios were obtained from the predicted marginals of a logistic regression model. We used prevalence ratios instead of odds ratios because the prevalence of the outcome was greater than 10%. We tested for interaction using cross product terms between each maternal characteristic and year (i.e. race\*year) to determine if the association between year and provider practice/women's use of dental care varied by maternal characteristics.

Finally, to ascertain whether provider practices increased the use of dental care among pregnant women, we examined the most recent year of data (2012) and calculated prevalence ratios to examine the association between each provider practice and use of dental care, adjusting for the maternal characteristics listed above. All descriptive analyses were conducted in SAS software version 9.4 ProcSurvey methods (SAS Institute, Cary, NC), and prevalence ratios were calculated using SAS callable SUDAAN 11.1 ("SUDAAN FAQ;").

## Results

As shown in Table 1, the distributions of race/ethnicity/nativity, income, and trimester of prenatal care initiation were significantly different between 2009 and 2012 (the change in "other" insurance during pregnancy likely resulted from a slight change in measurement in 2012). In 2012, fewer Latina women were born outside of the US, more women were poor, and fewer women had first trimester prenatal care than in 2009. Although, the general profile of childbearing women was similar each year: most childbearing women in California were either White or Latina, had at least some college education, were between the ages of 25 and 34 years, had more than one live birth including the index birth, and were married. Around 60% of childbearing women were either poor or near-poor ( $\leq 200\%$  of poverty), and approximately one-half received Medi-Cal coverage for prenatal care. Close to 90% of women in the sample began prenatal care during the first trimester and did not smoke before pregnancy.

Table 2 displays the prevalence of women's reports of medical providers' promotion of oral health care and women's receipt of dental care during pregnancy in 2009 and 2012. Between 2009 and 2012, the prevalence of medical providers discussing the health of a pregnant woman's teeth and gums with her increased significantly from 36% to 42% ( $p < 0.0001$ ), as did the proportion of women stating that their providers suggested they see a dentist (from 21% in 2009 to 26% in 2012,  $p < 0.0001$ ). Additionally, women reported significant increases in actual receipt of dental care during pregnancy between 2009 and 2012 (38% and 42%, respectively;  $p < 0.0001$ ). The improvements in medical provider practices or use of dental care during pregnancy between 2009 and 2012 were largely seen among certain subgroups of women. For example, the percentage of Latina foreign-born women who received dental care during pregnancy increased significantly from 25% in 2009 to 37% in 2012. In contrast, the percentage of White women who received dental care during pregnancy did not change from 2009 to 2012 (53% and 52%, respectively). Increases were also suggested among other groups such as women with lower ages and education, poor women, Spanish-speakers and Medi-Cal recipients.

After adjusting for all covariates, as shown by the adjusted prevalence ratios (aPR) in Table 3, the overall prevalence of women reporting their providers talked about the health of their teeth and gums remained significantly higher in 2012 (PR = 1.19; 95% CI 1.10, 1.29) compared to 2009, as did the prevalence of women reporting that their providers suggested they see a dentist (PR = 1.33; 95% CI 1.19, 1.48). The prevalence of having any type of dental visit also was higher in 2012 compared to 2009 (PR = 1.12; 95% CI 1.05, 1.21) after adjustment. Shown in Table 3, significant results for the interaction between maternal characteristics and year confirm the unadjusted observation that Latina women, women less than 30 years old, women with less than a college degree, Spanish speakers, and Medi-Cal recipients were more likely than their counterparts to show improvement between 2009 and 2012 in medical provider practices or use of dental care.

Provider practices appeared to be highly associated with actual receipt of dental care during pregnancy, even after controlling for a range of maternal characteristics (Table 4). After adjusting for the maternal characteristics listed in Methods and in the tables, women who reported that their providers discussed the health of their teeth and gums were twice as likely (aPR 2.02, 95% CI 1.82, 2.24) to have a dental visit than women who reported that their providers did not talk about oral health. Similarly, if their providers suggested they see a dentist, women were twice as likely to report having had a dental visit (aPR 2.09, 95% CI 1.92, 2.29), even after adjusting for maternal characteristics.

**Table 1** Characteristics of women in the study sample; Maternal Infant Health Assessment, 2009 and 2012 (n = 9807)

	2009				2012				p-value <sup>a</sup>
	N	%	95% CI		N	%	95% CI		
Total	3068	100.0			6739	100.0			
Race/ethnicity/nativity									< 0.0001
White	770	29.2	27.6	30.8	2084	28.7	26.9	30.5	
Latina foreign born	809	29.4	27.9	30.9	1520	23.9	22.2	25.6	
Latina US born	656	23.7	22.1	25.3	1562	26.2	24.2	28.3	
Asian/PI/AI/AN/other	326	12.4	11.2	13.6	873	15.3	13.6	16.9	
Black	458	5.4	5.3	5.6	550	5.8	5.1	6.5	
Maternal age at delivery									0.111
15–20 years	424	12.6	11.4	13.8	778	10.1	8.8	11.4	
21–24 years	513	16.1	14.7	17.4	1174	16.9	15.3	18.6	
25–29 years	789	26.1	24.5	27.8	1892	26.6	24.7	28.6	
30–34 years	778	26.2	24.6	27.9	1775	27.3	25.4	29.3	
35+ years	564	18.9	17.5	20.4	1120	19.0	17.5	10.4	
Number of live births									0.910
First live birth	1245	40.0	38.2	41.8	2650	39.8	37.6	42.0	
Second live birth or more	1823	60.0	58.2	61.8	4089	60.2	58.0	62.4	
Maternal education									0.395
Less than high school	631	19.7	18.6	20.9	1210	18.0	16.3	19.7	
HS/GED	695	22.1	20.5	23.5	1511	22.0	20.2	23.7	
Some college	874	27.9	26.3	29.5	2168	28.2	26.3	30.1	
College graduate	874	30.3	28.8	31.9	1818	31.8	30.0	33.6	
Marital status at delivery									0.102
Married	1743	60.6	58.9	62.3	3686	58.4	56.5	60.4	
Not married	1294	39.4	37.7	41.1	3006	41.6	39.6	43.5	
Language spoken at home									0.100
English	1831	56.6	54.9	58.3	4160	57.5	55.4	59.6	
Spanish	665	23.8	22.4	25.2	1333	21.2	19.5	22.8	
English/Spanish equally	319	11.5	10.3	12.7	638	11.8	10.2	13.4	
Asian language/other	228	8.1	7.1	9.1	496	9.6	8.1	11.1	
Family income									0.003
≤ 100% federal poverty level (FPL)	1100	38.2	36.5	39.9	2864	43.2	41.3	45.1	
101–200% FPL	583	20.8	19.2	22.3	1326	18.6	16.9	20.3	
201–300% FPL	249	9.0	7.9	10.1	598	9.8	8.4	11.3	
301–400% FPL	195	7.4	6.4	8.4	424	6.8	5.8	7.7	
> 400% FPL	646	24.7	23.1	26.2	1029	21.6	20.0	23.3	
Pre-pregnancy insurance									0.490
Insured	2336	76.2	74.6	77.7	4765	75.3	73.6	77.1	
Uninsured	701	23.8	22.3	25.4	1926	24.7	22.9	26.5	
Prenatal insurance									< 0.0001
Medi-Cal	1573	50.5	48.8	52.2	3921	49.9	48.2	51.6	
Private	1335	45.0	43.3	46.7	2355	43.6	41.9	45.3	
Uninsured	61	2.0	1.5	2.5	129	1.5	1.1	2.0	
Other	86	2.5	2.0	3.1	311	5.0	4.1	6.0	
Prenatal care initiation									0.002
First trimester	2763	91.6	90.5	92.6	5765	88.8	87.4	90.2	
Second or third trimester <sup>b</sup>	256	8.4	7.4	9.5	859	11.2	9.8	12.6	

**Table 1** (continued)

	2009			2012			p-value <sup>a</sup>	
	N	%	95% CI	N	%	95% CI		
Total	3068	100.0		6739	100.0			
Smoking 3 months before pregnancy							0.923	
> 0 cigarettes/day	389	11.9	10.7	13.1	985	11.8	10.4	13.2
None	2640	88.1	86.9	89.3	5700	88.2	86.8	89.6

AI American Indian, AN Alaskan Native, PI Pacific Islander

<sup>a</sup>p-value for Rao-Scott Chi square of difference between MIHA years

<sup>b</sup>Women with no prenatal care are not included in the analyses

## Conclusions for Practice

According to this population-based study of the diverse California maternity population, the prevalence of women reporting that their medical providers discussed the health of their teeth and gums or suggested they visit a dentist during pregnancy increased significantly between 2009 and 2012. These improvements were driven by increases in the more disadvantaged groups, specifically, Latina women, women who spoke Spanish at home, women with less than a college education, younger women and women with Medi-Cal coverage for prenatal care. Significant increases in receipt of any type of dental care during pregnancy also were observed among some of the same subgroups of women.

The results of this study show a strong relationship between oral health promotion by medical providers and women's use of dental care, even when controlling for a wide range of maternal socioeconomic and demographic characteristics. This observational study cannot establish that the improvement in receipt of dental care was caused by the increase in providers promoting the importance of dental care during pregnancy; however, given the extensive covariates used for adjustment, such a connection is highly plausible. Women who reported that their medical providers discussed oral health during pregnancy or suggested they see a dentist had a two-fold higher prevalence of receipt of care than women whose providers did not promote oral health. Other studies have shown that providers' discussion of oral health with women may be a better mechanism for conveying the importance of oral health than print materials (Buerlein et al. 2011; Milgrom et al. 2013). While women can experience other significant barriers to oral health care, such as lack of dental coverage, cost of treatment and lack of available providers, the results of this study suggest that encouragement from medical providers to seek care may result in more women visiting a dentist during pregnancy.

This study was limited by the fact that MIHA is a retrospective postpartum survey and women who received dental care during pregnancy may have been more likely to remember their discussions with medical providers than women who did not. These women also may have had a higher burden of oral health conditions that prompted their medical providers to discuss oral health, but we do not have information on dental problems among the women in the survey, and are not aware of their disease burdens. Additionally, we do not know what type of provider the woman was referencing nor what was said by that provider, and the oral health messaging could vary by practitioner, with different levels of effect. Respondents were asked to consider the actions of their medical doctors, nurses or other health care workers during pregnancy; the term "other health care worker" could have meant "dentist" to some respondents. The word "medical" in the question hopefully steered most women to think about their physicians or nurses. Finally, we have no information on the woman's prior experience with oral health education, which could have influenced her care-seeking activities.

These limitations notwithstanding, the results of this study indicate that more medical providers discussed oral health and suggested that their patients see a dentist during pregnancy in 2012 compared with 2009. This improvement could have been influenced by an evolution in practice resulting from a growing scientific evidence base for the safety and importance of oral health care during pregnancy, by the uptake of guidelines released by ACOG and the California Dental Association Foundation between 2009 and 2012, by educational efforts of the American Dental Association, or by changes in women's awareness of the importance of oral health during pregnancy. During this time period, the California Department of Public Health devoted funds to promote oral health among pregnant women by ensuring that state perinatal programs align with the above-mentioned guidelines and by providing technical assistance to state and local programs in linking women to oral health care during pregnancy. Notably, the improvements in provider practices were primarily seen among women

**Table 2** Medical provider practices and dental care utilization by maternal characteristics; Maternal Infant Health Assessment, 2009 and 2012 (n = 9807)

	2009					2012					2009				
	Provider talked about health of teeth and gums					Provider talked about health of teeth and gums					Provider suggested that woman see a dentist				
	N	%	95% CI	N	%	N	%	95% CI	N	%	N	%	95% CI		
Total	1105	36.0	34.2	37.8	2824	41.8	39.6	44.1	633	20.7	19.2	22.2			
Race/ethnicity															
White	290	37.7	34.3	41.2	790	39.2	35.4	43.0	129	17.0	14.3	19.7			
Latina foreign born	300	37.3	33.9	40.7	727	48.1	43.6	52.6	239	29.6	26.4	32.8			
Latina US born	207	31.9	28.2	35.5	658	42.7	38.0	47.4	106	17.0	14.0	20.0			
Asian/PI/AI/AK Native/other	113	35.2	30.0	40.5	343	35.0	29.4	40.6	48	14.9	11.0	18.8			
Black	173	36.9	32.2	41.7	245	44.2	34.3	54.2	99	20.0	16.1	23.8			
Maternal age at delivery															
15–20 years	173	40.4	35.4	45.5	367	48.8	41.8	55.9	104	25.5	20.9	30.0			
21–24 years	177	34.1	29.7	38.4	542	48.7	43.2	54.2	115	21.8	18.0	25.6			
25–29 years	286	36.0	32.5	39.5	780	41.6	37.6	45.6	145	18.0	15.2	20.8			
30–34 years	267	34.4	31.0	37.9	698	37.1	33.1	41.1	153	20.0	17.1	22.9			
35+ years	202	36.8	32.7	40.9	437	39.1	33.9	44.3	116	21.1	17.6	24.6			
Number of live births															
First live birth	487	39.4	36.6	42.3	1178	45.0	41.4	48.6	268	21.8	19.4	24.2			
Second live birth or more	618	33.7	31.5	36.0	1646	39.8	37.0	42.5	365	19.9	18.0	21.8			
Marital status at delivery															
Married	609	35.0	32.7	37.3	1503	39.2	36.5	41.9	326	19.0	17.1	20.9			
Not married	486	37.4	34.5	40.2	1304	45.5	41.8	49.2	300	23.1	20.7	25.6			
Maternal education															
Less than high school	241	38.5	34.5	42.5	576	48.7	43.1	54.4	181	29.3	25.6	33.1			
HS/GED	267	39.0	35.1	42.9	688	45.0	40.3	49.7	172	25.0	21.5	28.4			
Some college	272	31.0	27.7	34.2	838	41.3	37.5	45.1	146	17.0	14.3	19.6			
College graduate	314	36.7	33.4	40.0	706	36.2	32.4	40.1	125	15.1	12.6	17.6			
Language spoken at home															
English	660	35.5	33.2	37.9	1636	39.5	36.7	42.3	327	17.2	15.4	19.1			
Spanish	246	37.3	33.6	41.0	642	46.4	41.8	51.0	207	31.2	27.6	34.7			
English/Spanish equally	117	36.8	31.5	42.2	298	51.3	43.8	58.8	63	20.2	15.7	24.7			
Asian language/Other	77	34.7	28.3	41.1	196	33.7	26.3	41.1	33	14.7	9.9	19.4			
Family income															
<= 100% FPL	415	37.7	34.6	40.7	1270	45.7	42.1	49.4	274	25.2	22.5	27.9			



Table 2 (continued)

	2012					2009					2012						
	Provider suggested that woman see a dentist					Woman had dental visit (N=3049)					Woman had dental visit (N=6722)						
	N	%	95% CI	<i>p</i> <sup>a</sup>		N	%	95% CI		N	%	95% CI		N	%	95% CI	<i>p</i> <sup>a</sup>
21–24 years	358	33.6	28.2	39.0	****	145	27.2	23.2	31.3	350	31.2	25.8	36.6				
25–29 years	513	28.1	24.4	31.8	****	260	33.7	30.3	37.1	700	37.6	33.7	41.6				
30–34 years	417	21.1	17.6	24.5		349	45.5	41.9	49.1	820	48.9	44.6	53.1				
35+ years	277	21.1	17.1	25.2		281	50.0	45.7	54.2	539	54.1	48.7	59.4				
Number of live births																	
First live birth	770	26.3	23.2	29.4	*	500	40.4	37.5	43.2	1107	45.1	41.6	48.6	*			
Second live birth or more	1054	26.4	23.8	28.9	****	662	36.7	34.5	39.0	1551	40.1	37.3	42.9				
Marital status at delivery																	
Married	915	22.2	20.0	24.5	*	793	45.8	43.4	48.2	1712	49.0	46.2	51.8				
Not married	896	32.2	28.6	35.7	****	358	26.6	24.0	29.1	929	32.5	29.1	36.0	**			
Maternal education																	
Less than high school	463	38.9	33.3	44.5	**	159	25.4	21.8	29.0	394	32.9	27.5	38.3	*			
HS/GED	485	33.7	29.0	38.4	*	202	27.5	24.0	31.0	469	31.7	27.2	36.2				
Some college	496	22.8	19.7	26.0	**	284	33.5	30.2	36.9	743	37.0	33.2	40.7				
College graduate	367	17.2	14.3	20.1		505	58.5	55.1	61.8	1039	59.0	54.8	63.3				
Language spoken at home																	
English	883	19.7	17.5	21.9		823	46.1	43.7	48.5	1719	45.8	43.0	48.6				
Spanish	573	40.0	35.5	44.5	**	159	24.5	21.1	27.8	481	35.9	31.5	40.3	****			
English/Spanish equally	210	39.6	31.6	47.5	****	76	23.9	19.2	28.7	228	35.4	27.7	43.1	*			
Asian language/Other	131	21.4	15.1	27.7		98	44.2	37.6	50.9	194	43.2	34.7	51.7				
Family income																	
<= 100% FPL	926	34.4	30.8	37.9	****	301	26.1	23.4	28.9	882	31.0	27.6	34.4	*			
101–200% FPL	346	24.2	20.4	28.1		164	27.9	24.1	31.7	414	31.0	26.5	35.5				
201–300% FPL	130	20.5	14.8	26.2		108	44.1	37.6	50.6	242	42.3	34.6	50.1				
301–400% FPL	70	14.3	9.8	18.8		86	44.7	37.6	51.9	225	56.9	49.6	64.3	*			
> 400% FPL	196	17.1	13.2	20.9		406	63.6	59.8	67.4	722	69.9	65.0	74.8				
Pre-pregnancy insurance																	
Insured	1152	23.8	21.6	26.1	****	989	43.1	41.0	45.2	2083	46.2	43.6	48.8				
Uninsured	656	33.9	29.7	38.0	*	164	22.7	19.5	26.0	562	29.9	25.7	34.0	**			
Prenatal insurance																	
Medi-Cal	1300	35.3	32.2	38.4	****	421	25.9	23.6	28.2	1192	30.3	27.3	33.3	*			
Private	408	15.6	13.3	17.9		691	52.5	49.7	55.2	1315	56.5	53.1	59.9				
Uninsured	36	33.8	18.9	48.6	*	14	21.7	10.8	32.5	31	28.0	15.9	40.2				
Other	74	29.7	20.4	39.1		32	40.9	29.6	52.3	113	39.7	29.8	49.6				

Table 2 (continued)

	2012				2009				2012			
	Provider suggested that woman see a dentist				Woman had dental visit (N=3049)				Woman had dental visit (N=6722)			
	N	%	95% CI	<i>p</i> <sup>a</sup>	N	%	95% CI	N	%	95% CI	<i>p</i> <sup>a</sup>	
Prenatal care initiation												
First trimester	1574	26.8	24.7	28.9	1080	39.3	37.4	41.1	2388	44.0	41.7	46.4
Second or third trimester <sup>b</sup>	218	23.3	18.0	28.6	66	26.3	20.5	32.1	239	28.1	22.4	33.9
Smoking 3 months before pregnancy												
> 0 cigarettes/day	230	19.9	16.0	23.9	132	33.3	28.3	38.3	295	30.0	24.6	35.4
None	1580	26.9	24.8	29.0	1018	38.5	36.7	40.4	2348	43.4	41.1	45.7

AI American Indian, AV Alaskan Native, PI Pacific Islander

<sup>a</sup>*p*-value for Rao-Scott Chi square of difference between MIHA 2009 and 2012

<sup>b</sup>Women with no prenatal care are not included in the analyses

\**p* < 0.05

\*\**p* < 0.01

\*\*\**p* < 0.001

\*\*\*\**p* < 0.0001

who were poorer, on Medi-Cal during pregnancy, Spanish-speaking and Latina foreign born. A potential reason for the greater increase among disadvantaged groups could be that providers in public or community clinic settings, who often see these patients, are more likely to communicate public health recommendations (Kogan et al. 1994; Lahr et al. 2005).

While improvements were seen in medical provider practices and use of dental care during pregnancy, the overall prevalence of providers promoting oral health and women receiving a dental visit remained very low in 2012. Only 42% of women reported that their providers discussed the health of their teeth and gums, even fewer (26%) said that their providers suggested they see a dentist. The overall prevalence of women reporting receipt of a dental visit during pregnancy remained below 50% for all but the most advantaged groups. Medical provider promotion of oral health among their pregnant patients is only one avenue for increasing dental care among that population. Our previous research and the work of others show that women face a range of barriers to dental care, such as lack of perceived need for care and financial barriers (Boggess and Edelstein 2006; Marchi et al. 2010). The expansion of Medi-Cal dental benefits in 2014, including expanded coverage during pregnancy, and opportunities to purchase dental coverage through Covered California (California’s health care marketplace), may help reduce financial barriers to care for some women.

Additional outreach to prenatal care providers and pregnant women is needed to ensure women receive recommended oral health education and intervention during pregnancy, and are convinced of its importance for their overall health. Strategies to improve provider practices to promote oral health during pregnancy could include training, both in medical school and through continuing education of current physicians and other health professionals (Hartnett et al. 2016; Jackson et al. 2015; Johnson et al. 2015), and establishing partnerships between prenatal care providers and dental services, such as that done in New York State (Kerpen and Burakoff 2013), and providing adequate reimbursement for the time needed to discuss oral health during prenatal care. Continued dissemination and promotion of the California guidelines on oral health during pregnancy to prenatal care providers in California is also important to raise awareness and understanding of the relationship between oral health and overall health. The creation of the California statewide Office of Oral Health in 2014 should help make further improvements in the oral health of pregnant women in this state.

**Table 3** Adjusted prevalence ratios of changes in medical provider practices and dental care utilization by year; Maternal Infant Health Assessment 2009 and 2012 (N=9807)

	Provider talked about the health of teeth and gums			Provider suggested seeing a dentist			Saw a dentist during pregnancy		
	Adjusted PR of provider discussing health of teeth and gums in 2012 versus 2009			Adjusted PR of provider suggesting R see a dentist 2012 versus 2009			Adjusted PR of seeing a dentist during pregnancy 2012 versus 2009		
	aPR	95% CI	<i>p</i> <sup>a</sup>	aPR	95% CI	<i>p</i> <sup>a</sup>	aPR	95% CI	<i>p</i> <sup>a</sup>
Outcome									
2012 versus 2009	1.19	1.10	1.29	1.33	1.19	1.48	1.12	1.05	1.21
Race/ethnicity			0.021			0.098			0.041
White	1.06	0.93	1.21	1.10	0.90	1.35	1.05	0.93	1.18
Latina foreign born	1.35	1.17	1.55	1.51	1.26	1.81	1.34	1.16	1.54
Latina US born	1.38	1.15	1.64	1.54	1.19	2.01	1.14	0.98	1.33
Asian/PI/AI/AK Native/other	0.96	0.77	1.21	1.24	0.85	1.80	1.02	0.82	1.25
Black	1.20	0.91	1.58	1.02	0.65	1.59	0.93	0.72	1.21
Age			0.081			0.014			0.984
15–20 years	1.17	0.94	1.45	1.33	1.00	1.77	1.11	0.90	1.38
21–24 years	1.53	1.26	1.85	1.82	1.41	2.36	1.11	0.92	1.35
25–29 years	1.13	0.98	1.30	1.47	1.19	1.83	1.12	0.97	1.29
30–34 years	1.10	0.94	1.28	1.10	0.88	1.37	1.11	0.97	1.26
35+ years	1.18	0.98	1.41	1.07	0.82	1.40	1.17	1.00	1.37
Parity			0.850			0.758			0.742
Primiparous	1.17	1.05	1.32	1.29	1.09	1.53	1.13	1.02	1.26
2 or more	1.21	1.09	1.34	1.35	1.17	1.56	1.12	1.02	1.23
Marital status			0.458			0.046			0.688
Married	1.17	1.04	1.31	1.21	1.04	1.40	1.11	1.02	1.21
Not married	1.23	1.09	1.39	1.51	1.28	1.78	1.15	1.01	1.30
Maternal education			0.023			0.237			0.836
Less than high school	1.30	1.09	1.55	1.45	1.16	1.81	1.19	0.99	1.43
HS/GED	1.18	1.01	1.38	1.41	1.13	1.76	1.17	0.98	1.39
Some college	1.37	1.18	1.58	1.41	1.13	1.75	1.14	1.00	1.30
College graduate	1.02	0.88	1.17	1.10	0.87	1.39	1.07	0.95	1.21
Language spoken at home			0.098			0.018			0.011
English	1.13	1.02	1.24	1.14	0.98	1.33	1.04	0.95	1.13
Spanish	1.33	1.12	1.57	1.41	1.16	1.73	1.32	1.12	1.55
English/Spanish equally	1.48	1.17	1.87	2.14	1.52	3.03	1.56	1.20	2.04
Asian language/other	0.89	0.58	1.37	1.36	0.70	2.66	0.97	0.68	1.39
Income			0.593			0.425			0.306
<= 100% FPL	1.25	1.11	1.41	1.47	1.25	1.72	1.18	1.03	1.35
101–200% FPL	1.24	1.04	1.48	1.17	0.92	1.48	1.09	0.90	1.31
201–300% FPL	1.24	0.95	1.63	1.35	0.92	1.99	0.93	0.73	1.18
301–400% FPL	1.17	0.88	1.56	1.12	0.70	1.79	1.31	1.04	1.65
> 400% FPL	1.06	0.90	1.24	1.23	0.93	1.63	1.13	0.99	1.28
Prenatal insurance			0.034			0.013			0.820
Medi-Cal	1.33	1.19	1.48	1.53	1.33	1.77	1.12	1.01	1.23
Private	1.06	0.94	1.19	1.05	0.86	1.27	1.14	1.01	1.27
Uninsured	1.07	0.61	1.88	1.48	0.64	3.40	1.52	0.82	2.83
Other	1.21	0.82	1.77	1.33	0.80	2.21	1.06	0.73	1.54
PNC initiation			0.843			0.626			0.646
First trimester	1.19	1.10	1.29	1.34	1.19	1.50	1.13	1.05	1.21
2nd or 3rd trimester <sup>b</sup>	1.19	0.89	1.60	1.24	0.83	1.84	1.07	0.82	1.40
Smoking 3 months before pregnancy			0.584			0.628			0.262
> 0 cigarettes/day	1.12	0.88	1.42	1.15	0.85	1.56	0.98	0.78	1.23
None	1.20	1.11	1.30	1.35	1.20	1.52	1.14	1.06	1.23

**Table 3** (continued)

PR prevalence ratio, aPR adjusted prevalence ratio, AI American Indian, AN Alaskan Native, PI Pacific Islander

<sup>a</sup>p-value for interaction between maternal characteristic and year for each provider practice and for utilization

<sup>b</sup>Women with no prenatal care are not included in the analyses

**Table 4** Prevalence ratios of receipt of dental care during pregnancy by medical provider promotion of oral health; Maternal Infant Health Assessment, 2012 (N = 6739)

	Woman saw a dentist during pregnancy					
	PR	95% CI		aPR	95% CI	
Medical provider talked about the health of teeth and gums <sup>a</sup>	1.91	1.72	2.12	2.02	1.82	2.24
Medical provider suggested woman see a dentist <sup>a</sup>	1.84	1.67	2.02	2.09	1.92	2.29

PR prevalence ratio, aPR adjusted prevalence ratio

<sup>a</sup>Adjusting for race/ethnicity/nativity, age, parity, education, marital status, language, income, insurance before pregnancy, prenatal insurance, prenatal care initiation and smoking before pregnancy

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## Compliance with Ethical Standards

**Conflict of interest** The authors state that they have no conflicts of interest.

## References

- AAPD. (2016). Guideline on Perinatal and Infant Oral Health Care. *Pediatric Dentistry*, 38(5), 54–58.
- ACOG. (2013). Committee Opinion No. 569: Oral health care during pregnancy and through the lifespan. *Obstetrics & Gynecology*, 122(2 Pt 1), 417–422. <https://doi.org/10.1097/01.aog.0000433007.16843.10>.
- American Academy of Pediatric Dentistry. (2011). Guideline on perinatal oral health care. *Reference Manual*, 33(6), 118–123.
- American Dental Association. (2011). For the dental patient: Oral health during pregnancy. *The Journal of the American Dental Association*, 142(5), 574.
- Azarpazhooh, A., & Leake, J. L. (2006). Systematic review of the association between respiratory diseases and oral health. *Journal of Periodontology*, 77(9), 1465–1482. <https://doi.org/10.1902/jop.2006.060010>.
- Berkowitz, R. J. (2003). Causes, treatment and prevention of early childhood caries: A microbiologic perspective. *Journal of the Canadian Dental Association*, 69(5), 304–307.
- Boggess, K. A., Berggren, E. K., Koskenoja, V., Urlaub, D., & Lorenz, C. (2013). Severe preeclampsia and maternal self-report of oral health, hygiene, and dental care. *Journal of Periodontology*, 84(2), 143–151. <https://doi.org/10.1902/jop.2012.120079>.
- Boggess, K. A., & Edelstein, B. L. (2006). Oral health in women during preconception and pregnancy: Implications for birth outcomes and infant oral health. *Maternal and Child Health Journal*, 10(5 Suppl), 169–174. <https://doi.org/10.1007/s10995-006-0095-x>.
- Buerlein, J. K., Horowitz, A. M., & Child, W. L. (2011). Perspectives of Maryland women regarding oral health during pregnancy and early childhood. *Journal of Public Health Dentistry*, 71(2), 131–135.
- CDA Foundation. (2010). *Oral health during pregnancy & early childhood: Evidence-based guidelines for health professionals*. Retrieved from Sacramento, CA: [http://www.cdafoundation.org/Portals/0/pdfs/poh\\_guidelines.pdf](http://www.cdafoundation.org/Portals/0/pdfs/poh_guidelines.pdf).
- Chambrone, L., Guglielmetti, M. R., Pannuti, C. M., & Chambrone, L. A. (2011). Evidence grade associating periodontitis to preterm birth and/or low birth weight: I. A systematic review of prospective cohort studies. *Journal of Clinical Periodontology*, 38(9), 795–808. <https://doi.org/10.1111/j.1600-051X.2011.01755.x>.
- Clothier, B., Stringer, M., & Jeffcoat, M. K. (2007). Periodontal disease and pregnancy outcomes: Exposure, risk and intervention. *Clinical Obstetrics & Gynecology*, 21(3), 451–466. <https://doi.org/10.1016/j.bpobgyn.2007.01.005>.
- Demmer, R. T., Jacobs, D. R. Jr., & Desvarieux, M. (2008). Periodontal disease and incident type 2 diabetes: Results from the First National Health and Nutrition Examination Survey and its epidemiologic follow-up study. *Diabetes Care*, 31(7), 1373–1379. <https://doi.org/10.2337/dc08-0026>.
- Figuro, E., Carrillo-de-Albornoz, A., Martin, C., Tobias, A., & Herrera, D. (2013). Effect of pregnancy on gingival inflammation in systemically healthy women: A systematic review. *Journal of Clinical Periodontology*, 40(5), 457–473. <https://doi.org/10.1111/jcpe.12053>.
- Finlayson, T. L., Gupta, A., & Ramos-Gomez, F. J. (2017). Prenatal maternal factors, intergenerational transmission of disease, and child oral health outcomes. *Dental Clinics of North America*, 61(3), 483–518. <https://doi.org/10.1016/j.cden.2017.02.001>.
- Gaffield, M. L., Gilbert, B. J., Malvitz, D. M., & Romaguera, R. (2001). Oral health during pregnancy: An analysis of information collected by the pregnancy risk assessment monitoring system. *The Journal of the American Dental Association*, 132(7), 1009–1016.
- George, A., Shamim, S., Johnson, M., Dahlen, H., Ajwani, S., Bhole, S., & Yeo, A. E. (2012). How do dental and prenatal care practitioners perceive dental care during pregnancy? Current evidence and implications. *Birth-Issues in Perinatal Care*, 39(3), 238–247. <https://doi.org/10.1111/j.1523-536X.2012.00553.x>.
- Hartnett, E., Haber, J., Krainovich-Miller, B., Bella, A., Vasilyeva, A., & Kessler, J. L. (2016). Oral health in pregnancy. *JOGNN*, 45, 565–573.

- Humphrey, L. L., Fu, R. W., Buckley, D. I., Freeman, M., & Helfand, M. (2008). Periodontal disease and coronary heart disease incidence: A systematic review and meta-analysis. *Journal of General Internal Medicine*, 23(12), 2079–2086. <https://doi.org/10.1007/s11606-008-0787-6>.
- Hwang, S. S., Smith, V. C., McCormick, M. C., & Barfield, W. D. (2011). Racial/ethnic disparities in maternal oral health experiences in 10 states, pregnancy risk assessment monitoring system, 2004–2006. *Maternal and Child Health Journal*, 15(6), 722–729. <https://doi.org/10.1007/s10995-010-0643-2>.
- Jackson, J. T., Quinonez, R. B., Kerns, A. K., Chuang, A., Eidson, R. S., Boggess, K. A., & Weintraub, J. A. (2015). Implementing a prenatal oral health program through interprofessional collaboration. *Journal of Dental Education*, 79(3), 241–248.
- Johnson, M., George, A., Dahlen, H., Ajwani, S., Bhole, S., Blinkhorn, A.,... . Yeo, A. (2015). The midwifery initiated oral health-dental service protocol: an intervention to improve oral health outcomes for pregnant women. *BMC Oral Health*, 15(1), 2. <https://doi.org/10.1186/1472-6831-15-2>.
- Kerpen, S. J., & Burakoff, R. (2013). Providing oral health care to underserved population of pregnant women: retrospective review of 320 patients treated in private practice setting. *New York State Dental Journal*, 79(5), 45–47.
- Kogan, M. D., Alexander, G. R., Kotelchuck, M., Nagey, D. A., & Jack, B. W. (1994). Comparing mothers reports on the content of prenatal-care received with recommended national guidelines for care. *Public Health Reports*, 109(5), 637–646.
- Lahr, M. B., Rosenberg, K. D., & Lapidus, J. A. (2005). Health departments do it better: Prenatal care site and prone infant sleep position. *Maternal and Child Health Journal*, 9(2), 165–172. <https://doi.org/10.1007/s10995-005-4868-4>.
- Lydon-Rochelle, M. T., Krakowiak, P., Hujoel, P. P., & Peters, R. M. (2004). Dental care use and self-reported dental problems in relation to pregnancy. *American Journal of Public Health*, 94(5), 765–771. doi:<https://doi.org/10.2105/Ajph.94.5.765>.
- Macones, G. A., Parry, S., Nelson, D. B., Strauss, J. F., Ludmir, J., Cohen, A. W.,... . Jeffcoat, M. (2010). Treatment of localized periodontal disease in pregnancy does not reduce the occurrence of preterm birth: Results from the Periodontal Infections and Prematurity Study (PIPS). *American Journal of Obstetrics & Gynecology*, 202(2), 147 e141–148. <https://doi.org/10.1016/j.ajog.2009.10.892>.
- Marchi, K. S., Fisher-Owen, S. A., Weintraub, J. A., Yu, Z., & Brave-man, P. A. (2010). Most pregnant women in California do not receive dental care: Findings from a population-based study. *Public Health Reports*, 125(6), 831–842.
- May, L., Suminski, R. R., Yeung, A. Y., Linklater, E. R., Christensen, C., & Jahnke, S. (2014). Pregnant patient knowledge of and obstetric provider advice on oral health. *Journal of Dentistry, Oral Disorders & Therapy*, 2(1), 1–6.
- Michalowicz, B. S., Hodges, J. S., DiAngelis, A. J., Lupo, V. R., Novak, M. J., Ferguson, J. E.,... . Tschida, P. A. (2006). Treatment of periodontal disease and the risk of preterm birth. *The New England Journal of Medicine*, 355(18), 1885–1894. <https://doi.org/10.1056/NEJMoa062249>.
- Milgrom, P., Riedy, C. A., Weinstein, P., Mancl, L. A., Garson, G., Huebner, C. E.,... . Sutherland, M. (2013). Design of a community-based intergenerational oral health study: “Baby Smiles”. *BMC Oral Health*, 13(1), 38. <https://doi.org/10.1186/1472-6831-13-38>.
- Morgan, M. A., Crall, J., Goldenberg, R. L., & Schulkin, J. (2009). Oral health during pregnancy. *Journal of Maternal-Fetal & Neonatal Medicine*, 22(9), 733–739. <https://doi.org/10.1080/14767050902926954>.
- Offenbacher, S., Beck, J. D., Jared, H. L., Mauriello, S. M., Mendoza, L. C., Couper, D. J.,... . Hauth, J. C. (2009). Effects of periodontal therapy on rate of preterm delivery: A randomized controlled trial. *Obstetrics and Gynecology*, 114(3), 551–559.
- Oh, J., Leonard, L., Fuller, D., & Miller, K. (2011). *Less than optimal oral health care during pregnancy in Rhode Island women: Oral health care as a part of prenatal care*. Retrieved from Rhode Island.
- Oral health care during pregnancy and early childhood: Practice guidelines. (2006) [Press release].
- Russell, S. L., & Mayberry, L. J. (2008). Pregnancy and oral health - A review and recommendations to reduce gaps in practice and research. *MCN-The American Journal of Maternal-Child Nursing*, 33(1), 32–37.
- SUDAAN FAQ. *UCLA: Statistical Consulting Group*.
- Thompson, T. A., Cheng, D., & Strobino, D. (2013). Dental cleaning before and during pregnancy among Maryland mothers. *Maternal and Child Health Journal*, 17(1), 110–118. <https://doi.org/10.1007/s10995-012-0954-6>.
- U.S. Department of Health and Human Services. (2000). *Oral health in America: A report of the surgeon general*. Retrieved from Rockville, MD.
- Wilson, E. H., Farrell, C., Zielinski, R. E., & Gonik, B. (2017). Obstetric provider approach to perinatal oral health. *The Journal of Maternal-Fetal & Neonatal Medicine*, 30(9), 1089–1091. <https://doi.org/10.1080/14767058.2016.1204291>.

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