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# Hyperemesis Gravidarum and the Oral Cavity

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**HYPEREMESIS GRAVIDARUM AND THE ORAL CAVITY**

by

**JAMIE PEÑA**

B.S., Dental Hygiene, University of New Mexico, 2010

THESIS

Submitted in Partial Fulfillment of the  
Requirements for the Degree of

**Master of Science  
Dental Hygiene**

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## **Dedication**

The extensive journey that has brought this work into form is dedicated in loving memory to my beautiful friend and colleague, Jiraporn Blanchfield. Thank you for your friendship and for making the world a better place!

This research and thesis is for all women who have endured and/or who will endure the condition Hyperemesis gravidarum (HG). My sincere hope is that it will bring greater awareness, education and understanding of the numerous effects of HG on the oral cavity and positively benefit those who suffer from them.

## Acknowledgements

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Last and most essentially, thank you to all of the amazing HG survivors that participated in this study. May your stories and voices be heard!

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## **ABSTRACT**

Hyperemesis gravidarum (HG), a condition of extreme nausea and vomiting during pregnancy, can significantly impact the oral cavity in numerous ways both during and after HG pregnancy. The purpose of this study was to determine the prevalence of oral and dental related issues pertaining to Hyperemesis gravidarum as well as to uncover common oral and dental complications associated with the condition. This effort was made to provide dental hygienists and professionals with a thorough understanding of HG and its various effects on the oral cavity in order that patients of this population may be sufficiently recognized and served. Matters were examined through survey and data was collected from 251 women who have endured Hyperemesis gravidarum. Results of the study highlighted the difficulty that women who have suffered from HG had with routine oral hygiene during HG pregnancy and the various affects that Hyperemesis gravidarum has on the oral cavity during and after pregnancy. Dental hygienists and professionals must be aware and educated on Hyperemesis gravidarum and how it impacts the oral cavity in order that patients of this population may be optimally served.

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## Chapter I

### Introduction

#### Hyperemesis Gravidarum and the Oral Cavity

**Background:** Hyperemesis gravidarum (HG)<sup>1</sup> is a severe form of persistent nausea and vomiting during pregnancy which directly affects the oral cavity of the patient in numerous ways. Though nearly all women experience some nausea and vomiting during pregnancy (also known as morning sickness) an estimated 0.5-3.0%<sup>1</sup> of pregnant women suffer from an extreme form, often termed “all day sickness”, Hyperemesis gravidarum. Due to excessive vomiting and an inability to keep any food or liquids in, HG patients often become severely dehydrated. Dehydration is a loss of adequate fluids in the body and can be fatal when not treated. Patients who suffer from Hyperemesis gravidarum frequently require hospitalization and IV fluids in order to stay alive. For these patients, oral and dental problems may arise during this time of continuous vomiting and stress. In addition to constant nausea and vomiting, dehydration, and anxiety over their health and the health of their baby/babies, patients are typically unable to adequately perform ideal oral habits while suffering from HG. It is proposed that most if not all patients who suffer from Hyperemesis gravidarum also experience some form of dental issue or oral related complication during and/or after having HG. Dental hygienists should be aware and educated on this condition, its effects on the oral cavity, and how to best serve their patients who are suffering or have suffered from Hyperemesis gravidarum.

**Statement of the Problem:** What is the prevalence of oral and dental related issues pertaining to Hyperemesis gravidarum? What are the most common oral and dental

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<sup>1</sup> Per editors: For the consistency of this paper, HG has been stated as accounting for 0.5-3% of all pregnancies throughout. All sources vary within these percentages.

complications relating to Hyperemesis gravidarum? How can dental hygienists best serve their patients who are suffering or have suffered from this condition?

**Significance of the Problem:** Dental hygienists play a significant role in the health and overall well-being of their patients. In order to best serve their patients and communities, dental hygienists must be aware and educated on a variety of disorders, diseases, and conditions that may affect their patients-- particularly those that specifically concern the oral cavity. For this reason, it is essential that dental hygienists have access to the most recent and accurate knowledge on various disorders or conditions that affect the general and oral health of their patients. Though it is seemingly apparent that Hyperemesis gravidarum has a direct impact on the oral cavity due to the nature of the condition, little research has been found within the scope of dentistry regarding the condition. The purpose of this study is to provide dental professionals with statistically analyzable data concerning patients who have experienced oral complications and/or dental issues due to having Hyperemesis gravidarum during pregnancy so that this population (and those with similar experiences) may be optimally served.

Hyperemesis gravidarum is the term used to describe the condition of those suffering from prolonged, persistent nausea and vomiting during pregnancy. For some women this may last for several weeks or for their entire pregnancy. It is a well-known and accepted fact among dental professionals that for favorable health of both mother and baby, superb oral hygiene is essential during pregnancy. Unfortunately for pregnant patients dealing with Hyperemesis gravidarum however, appropriate dental hygiene habits are typically unattainable. Many HG patients are unable to use a toothbrush, tongue cleaner, floss or any other oral hygiene device without inducing nausea, gagging, and/or vomiting. After days of

dealing with HG, the patient can quickly become severely dehydrated and ultimately require hospitalization and IV fluids in order to sustain her life and the life of her baby/babies. This proves to be an extremely emotional and difficult time as the patient loses the ability to maintain her normal daily activities, including routine oral hygiene care. Depending on the severity of dehydration due to the condition, the patient may experience mild to extreme xerostomia (dry mouth). From a combination of xerostomia and continuous acid exposure (due to vomiting), dental caries and/or dental erosion can easily occur. Ironically, a dehydrated patient with HG may also suffer from ptyalism, or hypersalivation which can be extremely uncomfortable or irritating for the patient and may also induce further vomiting. With the inability to brush/floss properly, HG patients may also deal with halitosis (bad breath), an altered sense of taste, and inflamed, erythemic, and bleeding gingiva (gingivitis). Due to the stress of the condition, a patient may also experience bruxism (in which she may not have experienced previously) among other ailments, oral complications or dental issues.

As with most diseases, disorders, or conditions, the effects of Hyperemesis gravidarum on the oral cavity most likely vary from patient to patient. It is conceivable however, that most, if not all HG patients experience some type of oral complication or dental issue in relation to the condition, though they may not. By conducting research through surveying patients who have had Hyperemesis gravidarum (those who were pregnant and experiencing HG at the time of study were not included due to potential sensitivity harm) a greater understanding of the most common dental issues and/or oral complications due to HG were obtained. Through the collection of analyzable data, dental hygienists will have access to a fuller understanding of the effects of Hyperemesis gravidarum specifically on the

oral cavity and will be able to apply that knowledge so that they may better serve their patients.

### **Operation Definitions**

**Hyperemesis**- severe or prolonged vomiting.

"The clinical practicability is limited by a higher degree of side effects, especially hyperemesis"

Persistent severe vomiting leading to weight loss and dehydration, as a condition occurring during pregnancy.

**Dehydration**- Dehydration means a body does not have as much water and fluids as it should. Dehydration can be mild, moderate, or severe based on how much of the body's fluid is lost or not replenished. When it is severe, dehydration is a life-threatening emergency.

**Xerostomia**- Xerostomia is the subjective feeling of oral dryness, which is often (but not always) associated with hypofunction of the salivary glands. The term is derived from the Greek words ξηρός (xeros) meaning "dry" and στόμα (stoma) meaning "mouth".

**Ptyalism**- hypersalivation, extra or excessive saliva

**Gravidarum**- "Of pregnancy"

**Ketonuria**- ketone bodies present in the urine

**Halitosis** – Bad breath

**Bruxism**- The grinding of teeth

## Chapter II

### Literature Review

#### Introduction

The purpose of this literature review is to expand the understanding of the condition Hyperemesis gravidarum and its potential effects on the oral cavity. Though nausea and vomiting presents itself in 70%-80% of all pregnancies with 0.5%-3% occurring as extreme cases (HG), the exact cause of Hyperemesis gravidarum is not yet fully understood.<sup>1</sup>

“Hyperemesis gravidarum is a complex condition with a multifactorial etiology characterized by severe intractable nausea and vomiting. Despite a high prevalence, studies exploring underlying etiology and treatments are limited.”<sup>2</sup>

The University of New Mexico PubMed/MeSH search engines were utilized to access the Medline database for review of medical and dental literature regarding Hyperemesis gravidarum and the dental implications of consistent, prolonged nausea and vomiting. Text words and phrases such as “Hyperemesis gravidarum”, “nausea AND vomiting”, “pregnancy”, “vomiting and dental caries”, “dental care AND pregnancy” among many others were searched. No professional literature or research studies pertaining specifically to Hyperemesis gravidarum and the resulting oral health of the mother were found.

The overall current information and understanding of the condition Hyperemesis gravidarum will be discussed. Potential dental and oral repercussions from Hyperemesis gravidarum will be explored and data regarding dental issues and oral complications as a result of excessive vomiting for extended periods of time will also be examined.

## **Hyperemesis Gravidarum Definition, Diagnosis and Symptoms**

Hyperemesis gravidarum is a serious condition which is generally characterized by persistent vomiting during pregnancy and typically a 5% or greater loss of pre-pregnancy body weight. As a result of excessive vomiting for days to several weeks or months (HG may last for weeks up through the entire pregnancy), dehydration, metabolic and electrolyte imbalances, and malnutrition often result.<sup>1,3</sup> Nausea and vomiting during pregnancy (NVP), also referred to as “morning sickness”, affects the majority of pregnancies (70-80%) and is generally considered to be on a spectrum from mild to severe. For this reason, it may sometimes be challenging to diagnose a patient with Hyperemesis gravidarum thus some physicians (though not always) may only consider a patient to have Hyperemesis gravidarum once she has lost 5% or more of her pre-pregnancy body weight. Extreme cases of HG are not usually problematic to diagnose, “however there are no unequivocal diagnostic criteria for HG.”<sup>7</sup> Because there are no -across the board- specific guidelines for diagnosing HG, less extreme cases may be underdiagnosed. “A modified Pregnancy-Unique Quantification of Emesis and Nausea (PUQE) scoring index may be beneficial to assess the severity and therefore guide the management (Lacasse et al., 2008)”<sup>8</sup>. It is also important to rule out other disorders, diseases, or conditions that may be confused with or mistaken for HG. Some differential diagnosis include: Gastroenteritis, hepatitis, peptic ulcer, and pancreatitis to name a few.<sup>8</sup> Symptoms of HG include but are not limited to: Nausea that does not subside, vomiting more than 4 times a day, constipation, dehydration, feeling light headed or dizzy, losing 10 pounds or more, xerostomia (including dry or furry tongue), confusion, ptyalism, ketonuria, loss of skin elasticity, an altered sense of taste, jaundice, low blood pressure, headaches, and extreme fatigue among others.<sup>1,3,4,5</sup>

## **Epidemiology and Risk Factors**

Hyperemesis gravidarum is considered to be a multifactorial condition which may manifest for one or several different reasons. Various beliefs exist as to the definite cause/causes of HG which appears to be a controversial topic among many. “The etiology of Hyperemesis gravidarum is poorly understood.”<sup>3</sup> “There are many theories about the causes of HG, but none have been confirmed. HG is a complex disease that is likely caused by many factors.”<sup>4,7</sup> Statistically HG tends to be more common among non-Caucasian women and non-smokers. General risk factors may include: first time pregnancy, women who have previously had HG, obesity, young maternal age, a molar pregnancy (abnormal growth of cells where no fetus is present), women carrying a female fetus, mother or sister having had HG, a history of diabetes, hyperthyroidism, and/or a multiple pregnancy (carrying more than one baby) among others.<sup>2,3,4,6,9</sup>

## **Hormones**

The most widely accepted cause of nausea and vomiting during pregnancy and possibly Hyperemesis gravidarum is a change in hormones, including steroid hormones, and perhaps most importantly the pregnancy human chorionic gonadotropin (hCG) hormone which quickly rises during the first trimester of pregnancy. A spike in hCG may explain why the highest incidence of HG occurs during early pregnancy when hCG is at its peak levels.<sup>8</sup> This alone does not account as the cause of Hyperemesis gravidarum due to the fact that all pregnancies involve an increase in hCG levels however not all women experience HG or even nausea. Additional hormones may play an important role in contributing to HG including estrogen and thyroid related hormones. An article comprised of 3 studies discussed the role of hormones in HG, “HCG was increased in women with HG who were hospitalized

for >4 days compared with women who were hospitalized for <4 days.<sup>19</sup> Thyroid-stimulating hormone and FT4 were not associated with a higher readmission rate.<sup>18</sup> Estradiol of women who were hospitalized for >4 days were similar to levels of women hospitalized for <4 days.<sup>19</sup> WBC level was not associated with severity.”<sup>17,18,19</sup> While studies have proved that some of these hormones (primarily hCG) play a significant role in nausea and vomiting, none have been pinpointed as the underlying and/or definitive cause of Hyperemesis gravidarum.<sup>8,9</sup>

### **Nutritional Deficiencies**

Nutritional and vitamin deficiencies are another generally accepted theory that may widely contribute to nausea and vomiting during pregnancy. Pyridoxine or Vitamin B6 has long been used or prescribed to patients who are suffering from nausea and vomiting while pregnant. For patients with HG however, Vitamin B6 supplements have not been a cure all. “Although it was useful for alleviating nausea, it was not effective in HG (Vutyavanich et al., 1995).”<sup>8</sup> When a patient has been suffering from persistent vomiting, she may quickly become deficient in a number of critical vitamins and minerals. Another crucial vitamin, Thiamine, or Vitamin B1 may become depleted in patients suffering from HG and must be supplemented in these patients to prevent further complications such as Wernicke-Korsakoff syndrome, beriberi, and optic neuropathy.<sup>8, 10</sup>

### **Bacterial Theory**

Within only the last decade, the gram-negative bacterium *Helicobacter pylori* (*H. pylori*) has been receiving much attention and may be to blame for many conditions and extra-gastric diseases including Hyperemesis gravidarum. Some studies have revealed a correlation between *H. pylori* and HG, “Significant positive association between HG and *H.*

*pylori* infection has been demonstrated by several case-control studies<sup>[37-42]</sup>, and in a systematic review of 14 case-control studies, Golberg et al<sup>[32]</sup> (2007) found higher prevalence of HG in *H. pylori*-infected pregnant women than uninfected ones (pooled OR = 4.45; 95% CI: 2.31-8.54).C” Nevertheless, other studies have demonstrated otherwise, “Several studies found no relationship between HG and *H. pylori*<sup>[24,53-55]</sup>.”<sup>11</sup> Due to these controversial findings, it is still unclear whether or not *Helicobacter pylori* is a key culprit for causing HG in some patients, however it seems to be a contributing factor and is listed as such.

### **Psychological Aspects**

With much lack of a single definitive root cause for Hyperemesis gravidarum, it can be easy for some to assume that it is as a psychological problem rather than a true medical condition. Though it has been demonstrated that stress and anxiety can certainly increase nausea and vomiting, there is no substantial evidence that Hyperemesis gravidarum is caused by an underlying psychological issue. “The links between psychological characteristics and HG appear to be wildly exaggerated in medical research. The evidence to substantiate any claims of psychological "risk factors" for HG is extremely weak at best, and in the case of many traits virtually nonexistent. Nevertheless, some authors claim that "unquestionably" there is a link to psychological factors...<sup>6, 11</sup> Often studies that purport such relationships admit there is a severe lack of data to support these findings.<sup>3, 11, 19</sup> Studies on psychological components of HG "have been scarce, uncontrolled, or, when controlled, have covered series that are too small to provide valid tests."<sup>1</sup> Although psychological factors are not the primary cause for Hyperemesis gravidarum, mental status (including stress and anxiety) should always be considered and taken into account as part of the “multifactorial” definition. Once

a pregnant woman has been experiencing NVP or HG (which may include constant nausea and vomiting, dehydration, malnutrition, extreme fatigue, an inability to perform her daily activities, concern for her family, job, future, etc.) she may easily become overwhelmed and/or depressed. In many cases Hyperemesis gravidarum patients have miscarried or have had to make the difficult decision to abort their baby/babies and resume their previous health and life due to the devastation and difficulty of HG. The effects of Hyperemesis gravidarum can include numerous heartaches, losses, conditions and physical ailments. Therefore, psychological issues may arise as a result of HG or in conjunction with it.

### **Genetic Components**

Last and possibly most significantly, more recent studies have revealed that genetics could play a major role in determining who is affected by Hyperemesis gravidarum. A study released within the past year found that a gene, RYR2, may contribute to the condition. Excitingly, greater understanding of potential causes and/or contributors to Hyperemesis gravidarum is continuing to unfold. Still, further research is needed, “Additional studies are required, such as functional analysis of the deleterious RYR2 variant L3277R, complete deletion analysis of RYR2, and a larger GWAS. However, this novel discovery may provide the first step in understanding the etiology of HG. The identification of genes linking HG to RYR2 provides an intriguing new avenue for diagnosis, research, and therapy.”<sup>17</sup>

### **Hospitalization**

Although there is no simple definite origin of Hyperemesis gravidarum at this time, “No single theory seems to provide an adequate explanation for HG”<sup>11</sup>, one thing is certain; HG bleakly affects pregnancies and is cause for many hospitalizations. “HG occurs in approximately 0.5-3% of pregnancies and is the single most frequent reason for hospital

admission in the first half of pregnancy.”<sup>3,7</sup> Once any person becomes dehydrated from non-stop nausea and vomiting (whether pregnant or not) and is unable to keep any liquids in, the only option for the patient is to receive life-sustaining intravenous fluids. This frequently requires hospitalization-- HG accounts for a large percentage of hospitalizations, which during pregnancy is “only second to pre-term labor for hospitalization.”<sup>9</sup> Such a demand for hospitalizations understandably results in economic burden for the patient, and society at large which ought to also serve as motivation for further research and understanding of HG.<sup>13</sup>

### **Potential Dental and Oral Repercussions of HG**

Due to the nature of Hyperemesis gravidarum, the oral cavity is directly affected by this condition. Several oral complications or dental issues may arise either during or after a patient has lived with HG. When a patient is suffering from Hyperemesis gravidarum, it is often a struggle for her to perform routine adequate oral hygiene care, if any. Many HG patients are unable to use a toothbrush, tongue cleaner, floss or any other oral hygiene device without inducing nausea, gagging, and/or vomiting. In combination with lack of oral hygiene, and a constant acidic environment due to continuous vomiting, dental caries and erosion may quickly arise. Additionally, when a patient with HG becomes dehydrated from excessive vomiting, xerostomia may result. Hyperemesis gravidarum patients may also experience ptyalism, or an excessive amount of saliva production which can induce further vomiting. Halitosis and bruxism are also potential problems that can arise as a result of HG amidst several other dental issues or oral complications that may present themselves.

## **Data Regarding Dental Issues and Oral Complications as a Result of Excessive Vomiting**

It has long been recognized that excessive vomiting can quickly contribute to dental erosion and dental caries. Many studies have shown a high incidence of dental issues and oral complications among patients who experience chronic vomiting within disorders such as bulimia. “From these studies it is apparent that bulimic women present with a variety of oral and pharyngeal signs and symptoms, including dental caries and tooth erosion, dental pain, increased levels of cariogenic bacteria, orthodontic abnormalities, xerostomia (the subjective complaint of a dry-mouth) and decreased saliva secretion (the objective measure), decreased salivary pH, decreased periodontal disease, parotid enlargement, and swallowing impairments. Dental erosion is the major finding associated with bulimia.”<sup>14</sup> While these studies give great insight into how long-term vomiting can affect the oral cavity within the scope of bulimia, they cannot account for an accurate understanding of how Hyperemesis gravidarum impacts the oral cavity. Research specific to HG and its effects on the oral cavity is necessary so that patients that have been impacted by this condition may be optimally served.

### **Complaints/Discussions: About Dental Issues among HG Survivors**

Though not in a professional context, numerous discussions between women through “blogs” who have dealt with Hyperemesis gravidarum during pregnancy and have suffered from dental complications as a result can be simply found throughout the internet. On a Forum called, “DC Urban Moms and Dads”, several women shared their experiences. One anonymous blogger wrote, “I had serious dental issues including major bone loss from the disorder, chronic low Vitamin D, anemia after giving birth--lots of HG survivors do as well.”

Another wrote, “Dental problems, for sure, damage to the esophagus, nutritional deficiencies. I think part of the reason many doctors don't take it seriously is that it's the women who suffer the most, not their babies. And so they say, well, the babies are born healthy, what's the big deal, as if women's health doesn't matter. It's lousy.”<sup>15</sup> A blogger on another site said, “I also know that MANY of us, able to brush or not, have to deal with follow up dental issues. I've already dropped \$5K on my mouth and we're not done yet.” Another shared, “Teeth brushing - I had a severe gag reflex and constant vomiting last time and couldn't even manage to rinse with plain water. As a result I needed several thousand dollars’ worth of post-pregnancy dental work.”<sup>16</sup> These examples are merely a few of the complaints and discussions among women who have suffered from dental issues as a result of Hyperemesis gravidarum. By reviewing these dialogs, it is apparent that the oral cavity of this population is highly affected by the condition.

### **Summary**

Hyperemesis gravidarum is a complicated, difficult and challenging condition that affects at least 0.5-3% of all pregnancies. HG is characterized by persistent nausea and vomiting that can lead to dehydration among several other complications and is a primary cause of hospitalization for pregnant women. Due to the nature of the condition, HG has a direct impact on the oral cavity. Many women who have endured pregnancies with Hyperemesis gravidarum have conversed and complained about dental and oral complications as a definite result of the condition. Research within the scope of dental hygiene pertaining specifically to Hyperemesis gravidarum and its effects on the oral cavity is tremendously necessary and required so that this population may be better served in the future.

## **Chapter III**

### **Methods and Materials**

#### **Background**

This descriptive research concentrated on studying women who have endured Hyperemesis gravidarum (HG) during pregnancy and the prevalence of oral and dental related issues resulting from and/or pertaining to the condition. The study also focused on uncovering common oral and dental complications relating to Hyperemesis gravidarum. Previous studies regarding Hyperemesis gravidarum and its relation to the dental health of the mother are limited. Women who have withstood Hyperemesis gravidarum were surveyed using an online self-reporting questionnaire regarding their experiences. The results of the questionnaires were analyzed for a fuller comprehension of how HG affects the oral cavity of the mother both during and after pregnancy.

Dentists and dental hygienists must be knowledgeable of diseases and conditions that affect the body and overall well-being of their patients, particularly those that impact the oral cavity. Hyperemesis gravidarum is a severe form of persistent nausea and vomiting during pregnancy which directly affects the oral cavity of the patient in numerous ways. A comprehensive study of women who have endured Hyperemesis gravidarum provides dental professionals with an improved understanding of the condition and how it impacts the oral cavity of the patient.

Although Hyperemesis gravidarum affects a substantial amount of women during pregnancy (0.5-3% of pregnancies) and merits attention and study, significant populations of women who have lived the condition are not easily available for questioning in any particular physical location. Fortunately, there are readily available online support groups and forums

devoted to helping women who are currently experiencing or who have endured the condition. Through this medium, women who have withstood Hyperemesis gravidarum, and are no longer pregnant, were questioned regarding their experiences.

The Hyperemesis Education and Research (HER) Foundation is an organization devoted to helping women who are suffering from and/or who have survived Hyperemesis gravidarum. Their online forums and social media are a magnificent resource and place where women who are experiencing or have experienced the condition are able to find support and hope from others. The HER Foundation Facebook page is currently followed by over 12,000 followers; most of which are women who have either had HG or are going through it now.

Kimber MacGibbon, Registered Nurse and Director of Education & Research of the HER Foundation was contacted for permission to present the research survey on the HER Foundation Facebook page for maximum participation. Due to the high volume of advertisements that occur on the main HER Foundation Facebook page, MacGibbon allowed for the survey to be posted onto a smaller component of the HER Foundation webpage which consists of nearly 2,000 women who have either had or are currently experiencing Hyperemesis gravidarum.

### **Study Approval**

The study was reviewed and approved by the University of New Mexico Institutional Review Board (IRB).

### **Research Design**

The survey which was created through the online survey program, Google Forms, asked HG survivors questions about their experience with Hyperemesis gravidarum and their

oral health. The participants were asked questions particularly regarding HG—which trimesters the condition was experienced and for how long it lasted. The remainder of the survey focused on the oral health of the women. The women were asked about their oral health care and habits prior to pregnancy as well as during their HG pregnancy. Participants were also asked specifically about any oral complications that they may have experienced during and/or after their HG pregnancy. The questionnaire was comprised of 29 multiple choice questions with the addition of an open-ended space for individual comments at the finish of the survey. The study was made available for participation on the HER Foundation webpage, along with the approved Cover Letter of Informed Consent, on March 4, 2017 at 9 pm and remained accessible for two weeks when it was closed on March 18, 2017 at 9 pm Mountain standard time.

### **Limitations**

The research study was limited to only women who have had Hyperemesis gravidarum in the past and are no longer pregnant. This limited any women that follow the HER Foundation webpage and were pregnant at the time of the study from participation.

## Chapter IV

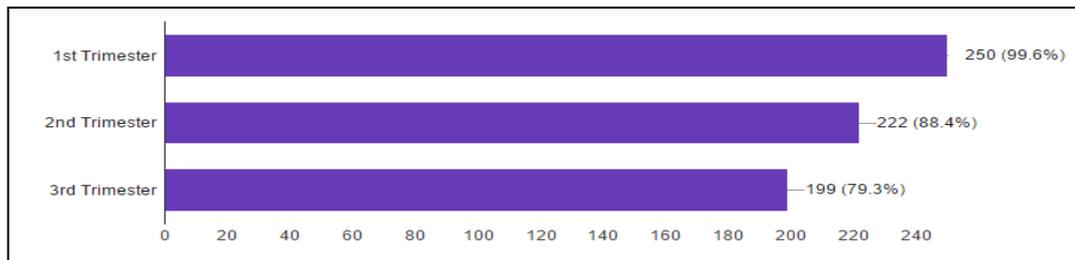
### Results

There were a total of 251 responses to the survey. Most questions were answered by all 251 respondents, however five of the questions were answered by 250 of the participants, two questions were answered by 249, and 1 question was answered by 248 respondents.

There were a total of 84 typed responses for the last open-ended question (See Table 1).

Descriptive statistics were used to analyze and summarize the data.

Participants were asked to determine in which trimesters they had experienced HG and for how long. Of the 251 responses, 250 women had experienced HG during the 1<sup>st</sup> trimester, 222 women reported having HG in the 2<sup>nd</sup> trimester and 199 women reported having endured HG in the 3<sup>rd</sup> trimester. Over 91% of participants reported having suffered the condition Hyperemesis gravidarum for 20 weeks or more during their pregnancies.



*Figure 1: Reported HG Trimesters*

Upon the question, “How often did brushing and/or flossing your teeth induce nausea and/or vomiting during your HG pregnancy?”, 134 of the 251 respondents reported that brushing and/or flossing always induced nausea and/or vomiting during their HG pregnancy, 79 reported often, 24 reported that brushing and/or flossing sometimes induced nausea and/or vomiting, 10 replied rarely and 4 answered never. Thus, 84.9% of all participants reported

that brushing/flossing either always or often induced nausea and/or vomiting during their HG pregnancy.

In the same way, 154 women reported always having difficulty with brushing or flossing their teeth during HG pregnancy, 63 answered that they often experienced difficulty with brushing or flossing, 25 answered sometimes, 5 said rarely and 4 of the 251 respondents reported never having difficulty brushing or flossing. Therefore, 96.5% of respondents reported having difficulty brushing or flossing at least sometimes during their HG pregnancy and 86.5% reported often or always having difficulty.

Similarly, of 251 responses, 107 participants answered that they rarely were able to brush their teeth as normal during HG pregnancy, 62 reported sometimes being able to brush as normal, 56 answered that they were never able to brush their teeth as normal during their HG pregnancy, 17 replied that they often could brush as normal, and 9 reported always being able to brush their teeth as normal during HG pregnancy. Of the total responses, 64.9% of the women surveyed were either never or rarely able to brush their teeth as normal during their HG pregnancies. However, when asked specifically, “During your HG pregnancy, did you brush/floss your teeth as normal or did you alter your oral hygiene routine in some way?”, a staggering 92.8% of participants reported having altered their oral hygiene routine in some way while the remaining 7.2% of women reported maintaining their previous oral hygiene routine during HG pregnancy.

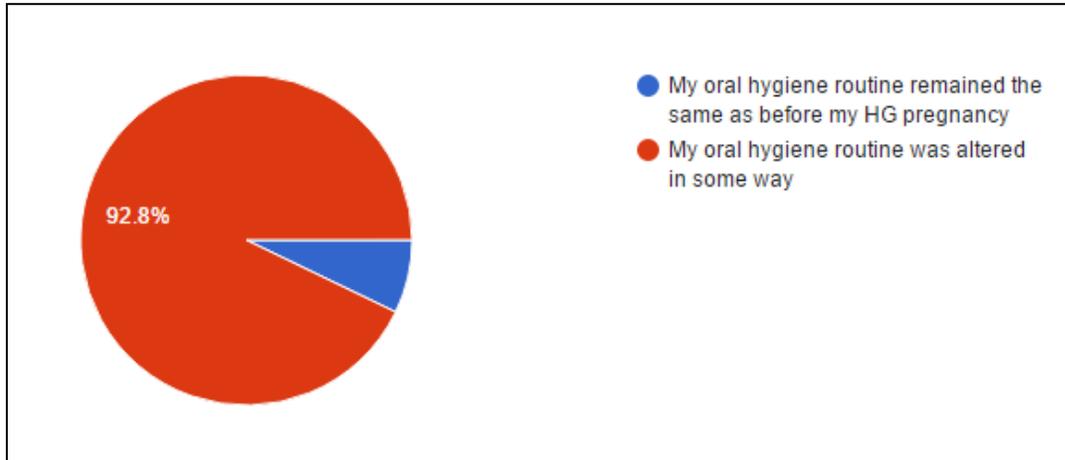


Figure 2: The Alteration of Oral Hygiene Routine During HG Pregnancy

Next, the women who had experienced HG were asked how often they brushed their teeth *before* HG pregnancy, and subsequently asked the same question again in the following question pertaining to their daily brushing *during* their HG pregnancy. Of the 251 responses, 189 women reported brushing 2 times a day before pregnancy, 42 said they brushed 1 time a day, 16 said 3 or more times a day and 4 said that they brushed less than 1 time a day before HG pregnancy. However, of the 251 responses regarding daily brushing *during* HG pregnancy, 167 reported brushing less than 1 time a day, 51 answered 1 time a day, 18 said 3 or more times a day and 15 replied that they brushed 2 times a day during HG pregnancy. This exhibited a significant decrease in daily brushing during HG pregnancy.

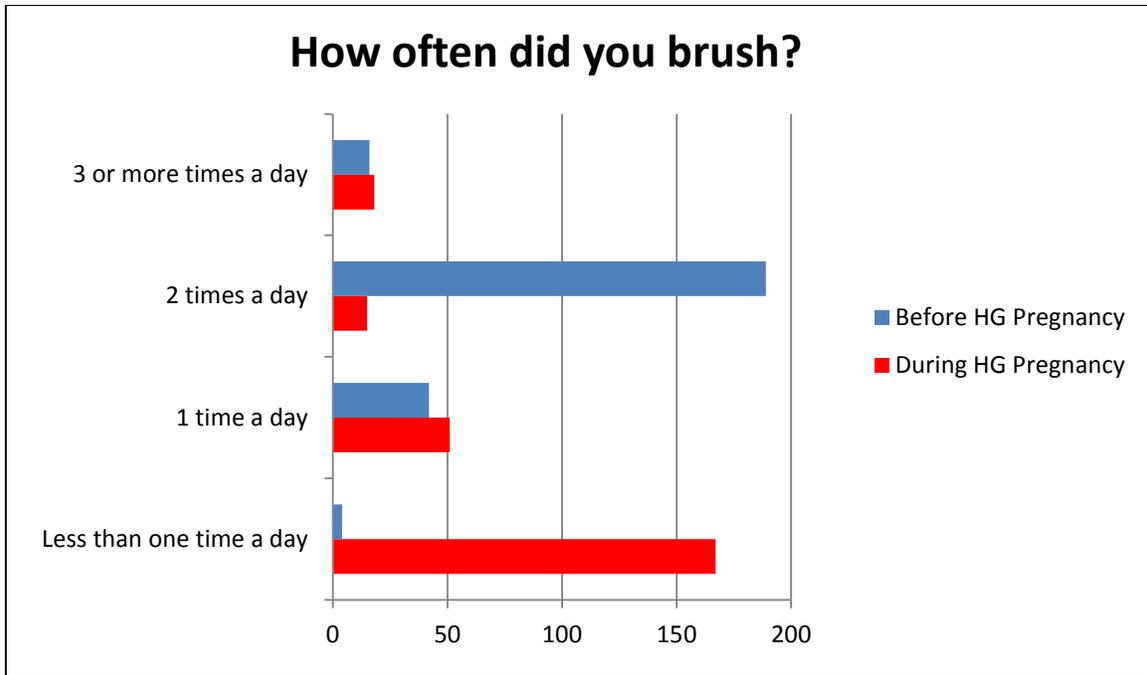


Figure 3: Comparison of dental brushing routine before and during HG pregnancy

Correspondingly, a significant decrease was also seen among dental flossing routines during HG pregnancy. Of the 250 responses regarding flossing habits *prior* to pregnancy, 8 reported never flossing, 57 said that they rarely flossed, 44 reported occasionally flossing, 32 responded to having flossed 3-4 times a week, 61 answered 1-2 times per week, and 48 said that they flossed 1 or more times a day *before* HG pregnancy. In respect to flossing routines *during* HG pregnancy of the 251 responses, 142 reported never flossing during their HG pregnancy, 65 said rarely, 23 reported occasionally flossing, 3 participants replied that they flossed 3-4 times per week, 10 said 1-2 times per week and 8 reported flossing 1 or more times a day during HG pregnancy.

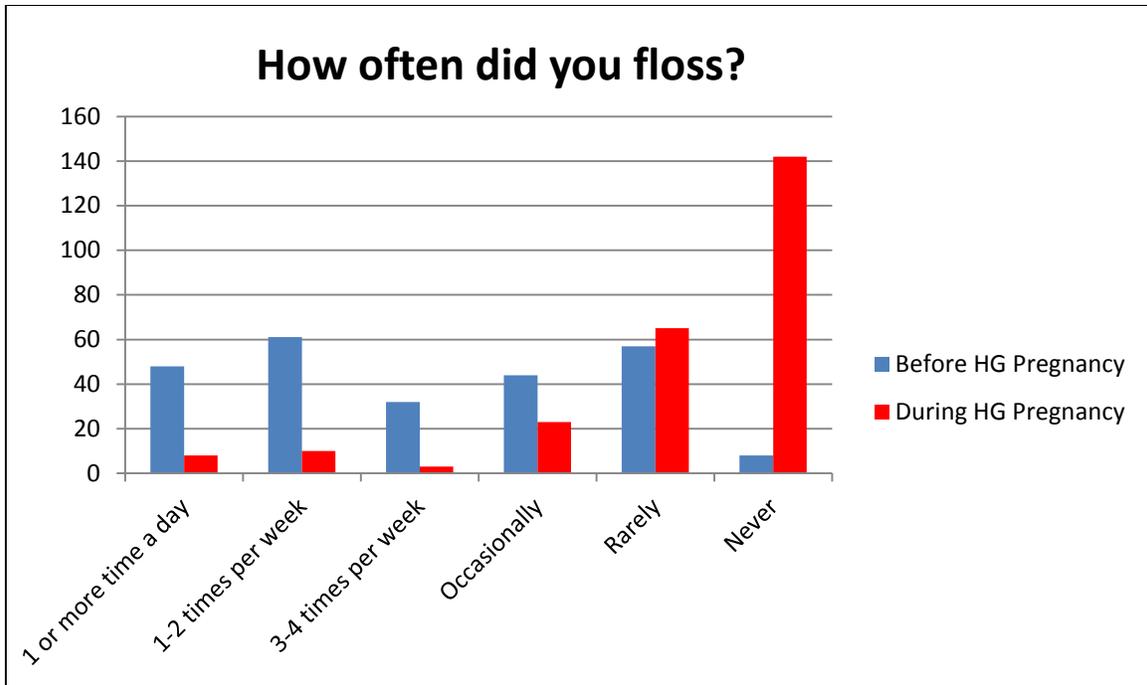


Figure 4: Comparison of flossing routine before and during HG pregnancy

The use of mouthwash before and during HG pregnancy was also compared. Of the 250 responses regarding the use of mouthwash *before* HG pregnancy, 105 women reported sometimes using mouthwash, 92 said that they used mouthwash regularly before pregnancy, and 53 answered never. In regard to the use of mouthwash *during* HG pregnancy, 161 reported never using mouthwash during their HG pregnancy, 46 reported sometimes using mouthwash, and 43 reported using mouthwash regularly. As with brushing and flossing, there was an apparent decrease in the use of mouthwash during HG pregnancy, however not as drastic. This is significant in that mouthwash may be easier for some patients to use than brushing or flossing during HG pregnancy. Thus, dental hygienists and professionals may be able to recommend a fluoridated mouthwash to some HG patients who may have otherwise used nothing.

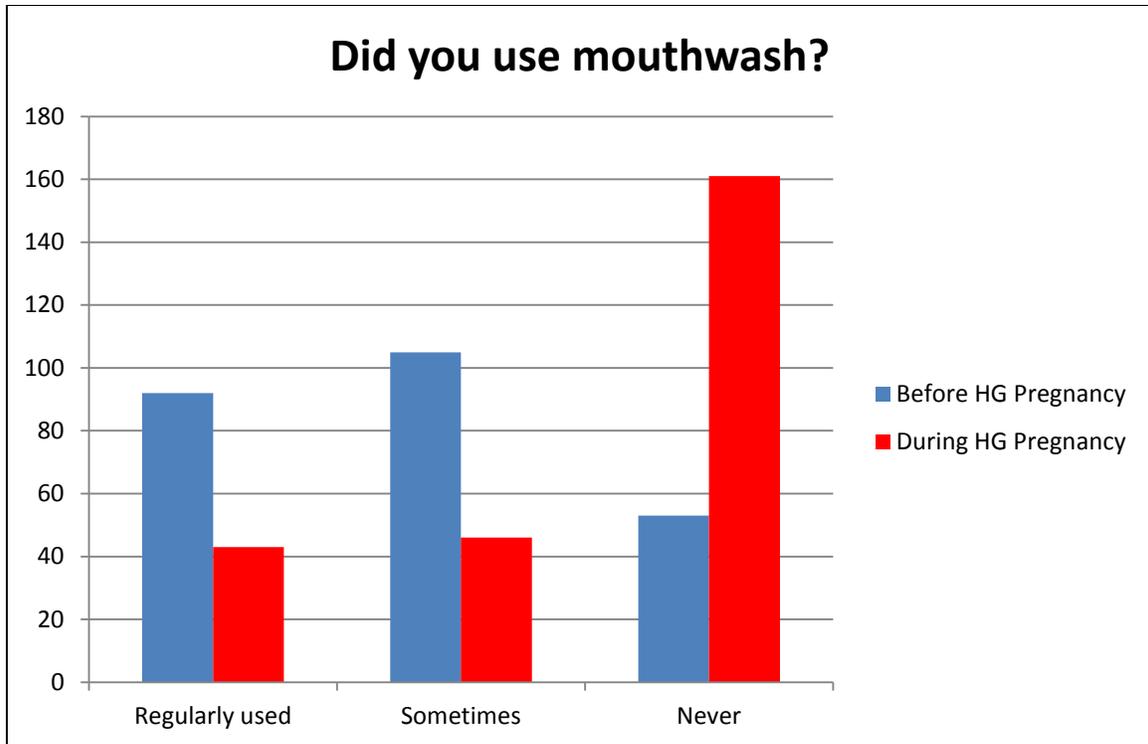
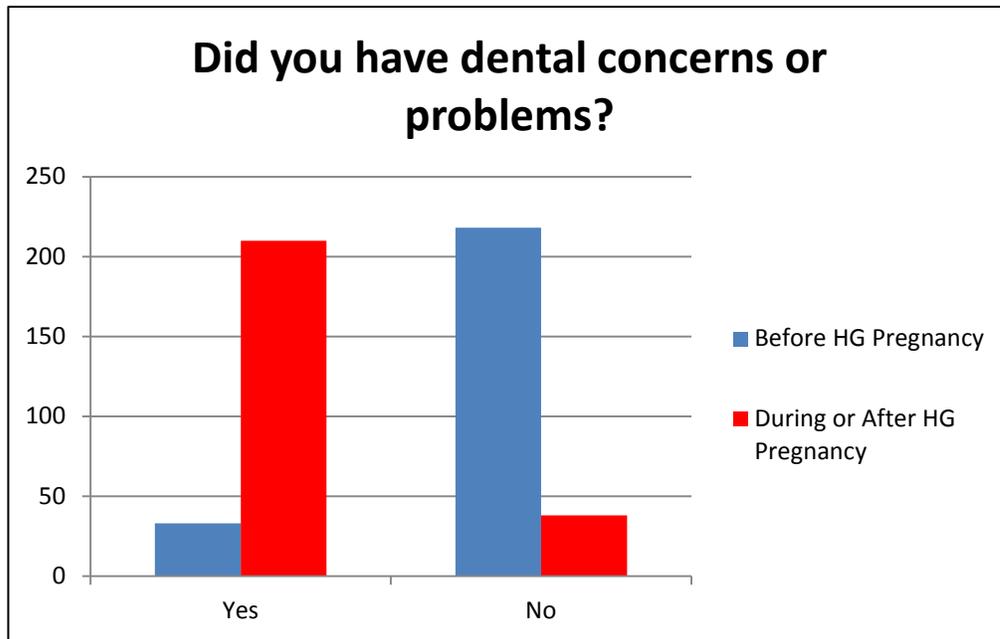


Figure 5: Comparison of use of mouthwash before and during HG pregnancy

Next, participants were asked if they received regular dental cleanings and exams before their HG pregnancies. Of the 250 responses, 198 reported “yes” to receiving regular cleanings and check-ups while 53 answered “no” to having received regular cleanings and check-ups before HG pregnancy. Though this question does not give any specific oral health background information, it allows the reader to have a generalized idea of how many participants (78.9%) in the study were seen regularly by a dental team *before* their HG pregnancies.

Among the most noteworthy findings of the study, participants were asked if they had any dental concerns or problems prior to (before) HG pregnancy, and subsequently asked if they had dental concerns or problems during or after HG pregnancy. Of the 251 responses relating to dental concerns *before* HG pregnancy, 218 women reported having no concerns or

problems while the remaining 33 reported having had concerns or problems before HG pregnancy. Significantly, of the 248 responses regarding having had dental concerns or problems *during or after* HG pregnancy, 210 reported having dental concerns or problems and the remaining 38 answered no. The observable difference between having dental concerns or problems before and during or after HG pregnancy is clear.

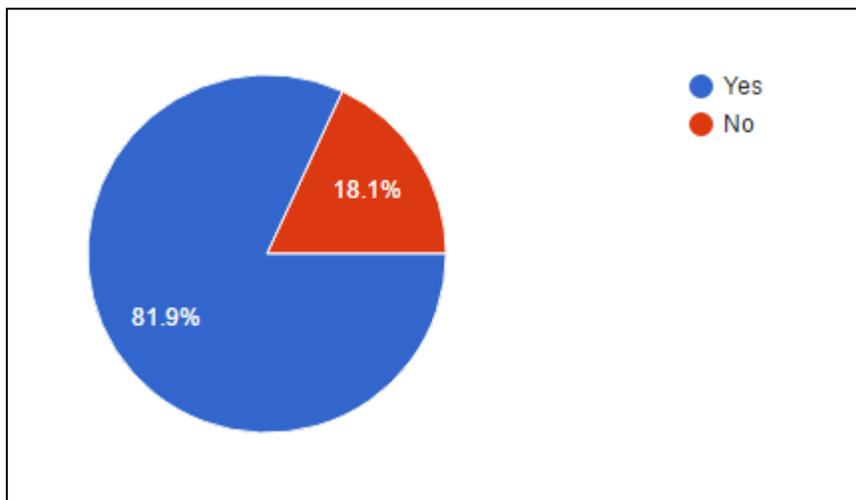


*Figure 6:* Comparison of dental concerns or problems before and during and/or after HG pregnancy

Next, the women who had endured HG pregnancy were asked if they experienced dry mouth that they had not experienced previously (before pregnancy) during their pregnancy. Of the 251 responses, 136 answered no and 115 reported having experienced dry mouth during HG pregnancy. It is well known throughout the dental community that dry mouth can have a considerable impact on the oral cavity. Thus, it is important for dental professionals

to be aware that experiencing dehydration in relation to HG pregnancy may contribute to dry mouth during HG pregnancy.

Participants were also asked if they experienced hyper salivation (ptyalism) during their HG pregnancy in which they had not experienced before. Of the 249 responses, 204 reported experiencing hyper salivation during their HG pregnancies while the remaining 45 answered no. Ptyalism is significant during HG pregnancy. For many women experiencing the condition, the extra saliva can be extremely uncomfortable and also induce further nausea and vomiting. It is essential that dental professionals be aware of ptyalism and how it affects women suffering from HG. This may allow dental professionals to consider possible ways to alleviate the discomfort associated with ptyalism so they may best serve their patients.



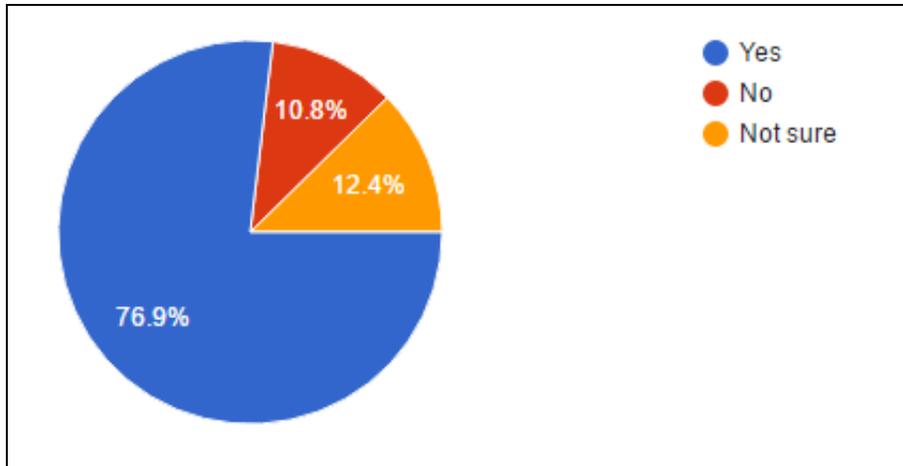
*Figure 7:* Reported percentage of women who experienced ptyalism during HG pregnancy

Furthermore, participants were asked if they experienced any oral or dental pain during or after their HG pregnancies which had not been experienced prior to pregnancy. Of the 251 responses, 155 answered “yes” to having oral or dental pain during HG pregnancy that was not experienced prior to pregnancy while 96 answered “no”. Participants were also asked, “To your knowledge, did you develop dental cavities during your HG pregnancy?” Of

the 251 responses, 138 answered “yes” to having developed dental caries, 69 answered “not sure”, and 44 said “no”.

Participants were then asked whether they had lost any teeth during or after their HG pregnancy. Of the 250 responses, 175 responded “no”, 63 said “yes”, and 12 answered “unsure”. Ideally, this type of question would be asked and answered with a thorough background knowledge base and in a clinical setting; however it is worth noting that 25.2% of women reported having lost a tooth during or after HG pregnancy. Additionally, participants of this study reported having lost their teeth due to HG pregnancy in the open-ended question of the survey (See Table 1).

When asked, “Did your gums bleed more during or after your HG pregnancy than before pregnancy?” 193 of the 251 respondents said “yes”, 31 answered “not sure” and 27 said “no” to an increase in gingival bleeding.” Additionally, when asked, “To your awareness, did you develop gum disease (gingivitis or periodontal) during or after your HG pregnancy?” 100 participants answered “yes”, 66 said “no”, and 85 answered “not sure”. Again, it would be ideal to observe these types of findings in a clinical study; however, 39.8% of women reported being aware of developing some form of gum disease. Participants also described an increase in gingival sensitivity and gum diseases during and after HG pregnancy in the last open-ended question of the survey (See Table 1).

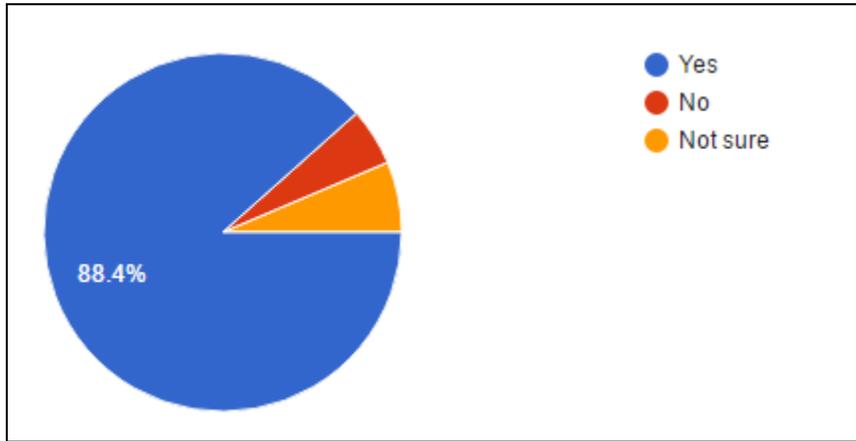


*Figure 8: Reported increase in gingival bleeding during HG pregnancy*

Respondents were also asked if they experienced bruxism during or after their HG pregnancy that had not been experienced before pregnancy. Of the 251 responses, 124 said “no”, 82 answered “yes”, and 45 reported that they were “not sure” if they had experienced bruxism. Dental professionals are well versed in the effects of bruxism and how to help treat and prevent the numerous issues associated with it. It is important for dental hygienists and professionals to be aware that bruxism may be experienced during or after HG pregnancy though it may not have been an issue for the patient prior to pregnancy.

Although it may often occur in any pregnancy regardless of whether Hyperemesis gravidarum is present or not, the women were also asked if they had experienced an alteration in taste during their HG pregnancies. Of the 250 responses, 222 participants said “yes”, 16 answered “not sure” and 13 said “no”. An alteration in the sense of taste may be significant for any woman during pregnancy. This information is beneficial for dental professionals to be aware that a woman with HG may be experiencing a drastic change within the oral cavity including a tremendous alteration in taste among many other changes.

This may affect what she (tries to) eats, and or the types of toothpastes and dentifrices or mouthwashes that may be used.



*Figure 9:* Reported percentage of women who experienced an alteration of taste in HG pregnancy

Participants were asked, “Did you alter your normal oral daily habits during your HG pregnancy? For example did you chew more gum than usual or suck on candies, cough drops, or lozenges (which you had not done before pregnancy) during your HG pregnancy?” Of the 251 responses, 176 answered “yes” to having altered their normal oral/daily habits during HG pregnancy while the remaining 75 answered “no”. Thus, 70.1% reported having changed their oral habits during HG pregnancy. This is significant for dental professionals to consider when discussing diet and/or daily habits with patients. A women suffering from HG may find her only relief from sucking on candy. A dental professional must know to ask any patient what their habits include and counsel and educate them accordingly.

When asked, “Do you feel that HG pregnancy had an impact on your oral health in any way?” a resounding 90.4% or 226 answered “yes” HG had impacted their oral health in a negative way, 5 answered “yes” that HG had impacted their oral health in a positive way

(may or may not have read entire response choice as it was the first listed), and 19 answered “no”, HG pregnancy had not impacted their oral health in any way.

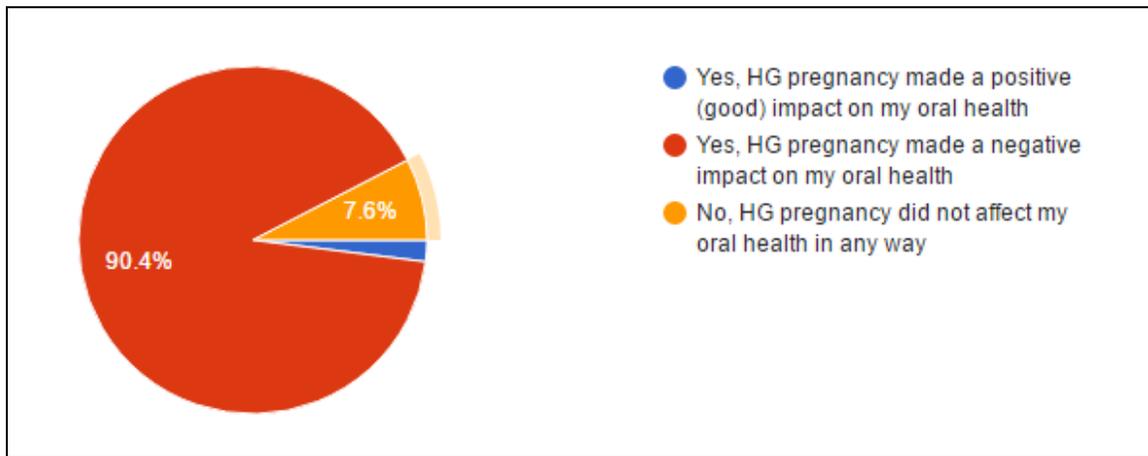


Figure 10: Report of impact that HG pregnancy had on the oral health

Last, participants were asked, “Did you experience any other oral or dental related issues or complications not mentioned (in previous questions) during or after your HG pregnancy?” Of the 249 responses, 159 answered “no”, no other issues were experienced that were not mentioned in the previous questions, and 90 answered “yes”. Of the 90 that answered yes, 84 typed their experiences in the “Please Explain” area below the final question. The typed responses were significant (see Table 1) and uncovered other ways that Hyperemesis gravidarum may affect the oral cavity which were not comprised within the study. These included: Ulcers, hypersensitivity (of teeth and gums), continued oral “triggers”, lock jaw, bone growth, and teeth shifting.

Table 1: *Typed Responses*

<ul style="list-style-type: none"> <li>• “Mouth ulcers. I had two teeth extracted during HG pregnancies.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My bottom front teeth turned slightly black and teeth became far more sensitive.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth were weakened, dentist thought maybe the baby was stealing my calcium since my nutrients were so low. My teeth cracked and chipped, almost as if they were crumbling. I didn't lose teeth or have cavities but I did have to have cracks filled.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Missing lateral incisors. Only have baby teeth. Those baby teeth are now loose. I now have braces again and then will get implants.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Beginning stage gum disease requiring deep cleaning of entire mouth. I also developed 8 cavities during pregnancy.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Cracking teeth degrading quickly now. 6 root canal and crowns. 4 extractions. Before 3 HG pregnancies I only had two fillings done when I was a child.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I am super sensitive to anything being in my mouth even now. It makes me gag e.g. brushing my teeth now every. single. time makes me gag, blowing up inflatable toys or swimming armbands that kind of thing.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Teeth had holes in them.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Enamel damage on the back of lower teeth”</li> </ul>
<ul style="list-style-type: none"> <li>• “Had a filling.. which was good all things considered and a crack sealed”</li> </ul>
<ul style="list-style-type: none"> <li>• “I brushed away all the enamel off the sides of my teeth.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I had trouble using certain toothpastes. It would make me gag more. I had to use something with less fluoride. Ordered by the dentist.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Due to the vomiting, my crowns and bridge broke. I also had more cavities. I brushed my teeth often and then was told that brushing after vomiting can cause additional erosion.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Extreme loss of enamel from my last HG pregnancy. Now I have tooth sensitivity and several cavities.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Teeth started chipping. I was so sick I couldn't stand up most of the pregnancy and spent a good deal of time in the hospital so brushing my teeth was much lower on the priority list than usual.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My front teeth slightly chipped from becoming so weak from puking so much bile.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth have begun to rot since my HG pregnancies. Many are loose but haven't fallen out yet.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I have periodontal issue, I require gum grafting due to a receding gum.”</li> </ul>
<ul style="list-style-type: none"> <li>• “The enamel of my teeth has almost entirely worn away.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I am 6 months postpartum and I haven't been "brave" enough to go to the dentist even though I know I need to because my teeth are VERY VERY sensitive to any thing that is a little bit cold or hot...I hurt really bad. For example, I can't have ice cream at all...it sounds like a nightmare right now.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I experienced lock jaw in each one of my HG pregnancies from about 20 weeks onward.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Broken teeth, expedited bone growth on my inner lower jaw”</li> </ul>

Table 1 continued

<ul style="list-style-type: none"> <li>• “I had to have a protective covering put on my back teeth to try and help with cavities. I think it's the same thing they tend to do to small children. I have had two HG pregnancies, and I have had this done both times to try to help protect my teeth.”</li> </ul>
<ul style="list-style-type: none"> <li>• “More cavities, deeper cavities and no enamel on teeth left.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I had to have three cavities filled after my HG pregnancy.”</li> </ul>
<ul style="list-style-type: none"> <li>• “14 cavities”</li> </ul>
<ul style="list-style-type: none"> <li>• “Tooth extraction and lost half of my molar. Huge hole. Teeth shifted. And to go back to question number 27 - I couldn't do any of those couldn't chew gum or suck on candy because it produced too much saliva and could NOT swallow if not I'd throw up. Please bring more awareness to this horrible condition.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Root planing and scaling on one quadrant of teeth, enamel erosion, hyper-sensitivity, four cavities.”</li> </ul>
<ul style="list-style-type: none"> <li>• “All of my teeth are extremely sensitive to hot and cold. They were not sensitive at all before hg but I have been through 3 hg pregnancies now. My back teeth are all breaking and falling out of my mouth. All of my teeth feel like they are deteriorating. My first pregnancy I brushed my teeth immediately after getting sick each time. I learnt that made it worse (for enamel and sensitivity) so I stopped and just started swishing water to rinse them instead. I was getting sick over 50 times a day though for my full pregnancies.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I have a cavity so bad it formed a pocket or abscess currently awaiting surgery to remove 5 teeth.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Pregnancy induced gingivitis”</li> </ul>
<ul style="list-style-type: none"> <li>• “Severe Ulcers on my tongue and cheeks”</li> </ul>
<ul style="list-style-type: none"> <li>• “I know for a fact HG ruined my teeth both pregnancies. I have cavities now!! Vomiting a million times a day and rinsing with water was the only thing I could do any toothpaste or mouth wash would make me throw up immediately.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Build up of plaque”</li> </ul>
<ul style="list-style-type: none"> <li>• “Several teeth chipped from regular use (was told it was because the acid eroded them), and two root canals with suspected oral surgery in future. Am followed by an Endodontist and still trying to fix problems from HG pregnancy in 2013.”</li> </ul>
<ul style="list-style-type: none"> <li>• “After HG I had gum disease and enamel erosion. I was also in need of a deep cleaning. It took a year of dental cleanings and sealants to get my teeth healthy.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I lost 2 back teeth and had 2 root canals. After the pregnancy my enamel was severely damaged.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Had to have a root canal and crown during pregnancy.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My gums weakened....due to vomiting non stop it effected my teeth ....I had beautiful healthy teeth and gums prior.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Pain in my gums during HG”</li> </ul>
<ul style="list-style-type: none"> <li>• “Crippling anxiety to visit the dentist. Will need to have teeth removed or root canals as my gums severely receded during each pregnancy. Both daughters with teeth issues present on their teeth coming through their gums etc”</li> </ul>
<ul style="list-style-type: none"> <li>• “Cavities galore! And a filling came out as well.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Multiple cavities and crowns”</li> </ul>

Table 1 continued

<ul style="list-style-type: none"> <li>• “Yellow, weakened teeth”</li> </ul>
<ul style="list-style-type: none"> <li>• “Teeth sensitivity”</li> </ul>
<ul style="list-style-type: none"> <li>• “All my teeth rotted due to Hyperemesis Gravidarum and I have full set of dentures because of Hyperemesis Gravidarum.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My cap actually came off because the tooth that it was covering broke down due to decay.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Cracked molars and sensitive teeth”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth became loose, formed cavities and are now very painful. The dentist informed me that I will need to get them all pulled in the next two years. I can't eat most normal foods and hot and cold are very painful.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth are so chipped and weak and little breaks on the bottom of my teeth, my teeth are sensitive and gums too.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth shifted.”</li> </ul>
<ul style="list-style-type: none"> <li>• “TMJ, my grinding of my teeth and vomiting and overbite has severe impact on my teeth I will lose 4 of my teeth.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I recall a specific "taste" that would trigger nausea.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My gums are more recessed, and I may need a gum graft on one tooth. One tooth became sensitive after my Hg pregnancy. Even post Hg, I had to wait a long time to go in to see the dentist (about 6 mos. post-partum) because I had a back injury (weak bones &amp; weak muscles from the Hg + a fall) plus I had so many oral aversions from the Hg &amp; was dealing w/ so many nausea/gagging issues. After Hg, going to the dentist is a very aversive and difficult situation to face. When you have vomited so much, it is hard to have someone poke around in your mouth and put odd textures/tastes &amp; fingers in there. I had to fight a lot of nausea, panic, &amp; anxiety just to go to my dental cleaning, and during it, I felt as though I was suffering a great deal, struggling w/ the nausea &amp; anxiety. I think it was a sort of emotional &amp; physical trigger for PTSD in regards to the Hg for me. Talking w/ other Hg moms, they seem to have the same sorts of issues w/ going to the dentist. Thank you for researching this. Many OBs and ER doctors brush off Hg as being nothing more than "a little morning sickness", when in reality, for those of us who have severe Hg, there are many lasting consequences to our health - consequences of malnutrition and PTSD being two of those.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I have had multiple problems since my HG.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My gums are torn in a few places and won't heal.”</li> </ul>
<ul style="list-style-type: none"> <li>• “The backs of my teeth feel pitted and my molars are way more sensitive.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I had two teeth pulled after.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Teeth feel sore and loose all my bones hurt. I assume that they were depleted.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth are very sensitive”</li> </ul>
<ul style="list-style-type: none"> <li>• “Mouth Ulcers”</li> </ul>

## **Discussion**

Hyperemesis gravidarum is a difficult condition during pregnancy that significantly and directly impacts the oral cavity in several ways. Dental hygienists and professionals must be aware and educated on the condition, how it can and does affect the oral cavity, and how to best serve patients suffering from or who have endured Hyperemesis gravidarum. It is crucial that dental hygienists and professionals be considerate of the multi-faceted effects of HG and how it may shape the future of not only the oral cavity, but every aspect of a patient's life- physically, emotionally, financially, etc. during and after HG pregnancy.

## **Conclusion**

The findings of this study demonstrate that Hyperemesis gravidarum has a tremendous impact on the oral cavity of the women who suffer from the condition. It is clear that women suffering from HG have extreme difficulty performing adequate daily oral hygiene which can quickly lead to a variety of well-understood oral disorders and diseases that occur from insufficient oral maintenance. Additionally, many other oral ailments may arise in conjunction with or as a result of Hyperemesis gravidarum. Women who have endured HG may experience dry mouth, ptyalism, bruxism, periodontal diseases, dental pain and/or decay, tooth loss, an alteration in the sense of taste, dental erosion, shifting teeth, ulcers, and/or hypersensitivity among other oral conditions during or after HG pregnancy. Ultimately, dental hygienists and professionals must be aware and understand Hyperemesis gravidarum and the profound impact that it can have on the oral cavity. With this knowledge, dental hygienists can be fully prepared to best serve their patients with understanding and compassion. Intended for inclusive education, this study was particularly broad and covered a vast variety of issues that may occur relating to the oral cavity and

Hyperemesis gravidarum. Further, more detailed research of most topics within this study and within a clinical setting is recommended.

## **Chapter V**

### **Article for Submission**

Hyperemesis Gravidarum and the Oral Cavity

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Key Words: Hyperemesis Gravidarum, oral cavity, nausea, vomiting

## **Abstract**

**Purpose:** The purpose of this study was to determine the prevalence of oral and dental related issues pertaining to Hyperemesis gravidarum (HG) as well as to uncover common oral and dental complications associated with the condition. This effort was made to provide dental hygienists and professionals with a thorough understanding of HG and its various effects on the oral cavity in order that patients of this population may be sufficiently recognized and served.

**Methods:** An online self-reporting questionnaire was used to question women who had endured Hyperemesis gravidarum regarding their oral hygiene habits before and during HG pregnancy. The survey also asked questions concerning the women's oral health and conditions that may have been experienced during or after HG pregnancy.

**Results:** A total of 251 women who had endured HG during pregnancy responded to the survey. The majority of the women reported having had difficulty with maintaining routine dental hygiene (which can induce further nausea and vomiting) during HG pregnancy. A significant decrease in daily brushing and flossing during HG pregnancy was found. Many subsequent oral conditions and ailments were experienced during and after HG pregnancy.

**Conclusion:** Hyperemesis gravidarum has a tremendous impact on the oral cavity of the women who suffer from the condition both during and after pregnancy. It is essential that dental hygienists are aware and educated on HG and how it affects the oral cavity so that they may best serve their patients.

## **Introduction**

### **Hyperemesis Gravidarum and the Oral Cavity**

**Background:** Hyperemesis gravidarum (HG) is a severe form of persistent nausea and vomiting during pregnancy which directly affects the oral cavity of the patient in numerous ways. Though nearly all women experience some nausea and vomiting during pregnancy also known as “morning sickness”, an estimated 0.5-3.0%<sup>1</sup> of pregnant women suffer from an extreme form, often termed “all day sickness”, Hyperemesis gravidarum. Due to excessive vomiting and an inability to keep any food or liquids (including water) in, HG patients often become severely dehydrated. Dehydration is a loss of adequate fluids in the body and can be fatal when not treated. Patients who suffer from Hyperemesis gravidarum often require hospitalization and IV fluids in order to stay alive. For these patients, oral and dental problems may arise during this time of continuous vomiting and stress. In addition to constant nausea and vomiting, dehydration, and anxiety over their health and the health of their baby/babies, patients are typically unable to adequately perform ideal oral habits while suffering from HG. It is proposed that most if not all patients who suffer from Hyperemesis gravidarum also experience some form of dental issue or oral related complication during and/or after having HG. Dental hygienists should be aware and educated on this condition, its effects on the oral cavity, and how to best serve their patients who are suffering or have suffered from Hyperemesis gravidarum.

**Significance of the Problem:** Dental hygienists play a significant role in the health and overall well-being of their patients. In order to best serve their patients and communities, dental hygienists must be aware and educated on a variety of disorders, diseases, and conditions that may affect their patients-- particularly those that specifically

concern the oral cavity. For this reason, it is essential that dental hygienists have access to the most recent and accurate knowledge on various disorders or conditions that affect the general and oral health of their patients. Though it is seemingly apparent that Hyperemesis gravidarum has a direct impact on the oral cavity due to the nature of the condition, little research has been found within the scope of dentistry regarding the condition and the variety of effects that it may have on the oral cavity of the mother. The purpose of this study was to provide dental professionals with data concerning patients who have experienced oral complications and/or dental issues due to having Hyperemesis gravidarum during pregnancy so that this population may be optimally understood and served.

Hyperemesis gravidarum is the term used to describe the condition of those suffering from prolonged, persistent nausea and vomiting during pregnancy. For some women this may last for several weeks or for their entire pregnancy. It is a well-known and accepted fact among dental professionals that for favorable health of both mother and baby, superb oral hygiene is essential during pregnancy. Unfortunately for pregnant patients dealing with Hyperemesis gravidarum however, appropriate dental hygiene habits are typically unattainable. Many HG patients are unable to use a toothbrush, tongue cleaner, floss or any other oral hygiene device without inducing nausea, gagging, and/or vomiting. After days of dealing with HG, the patient can quickly become severely dehydrated and ultimately require hospitalization and IV fluids in order to sustain her life and the life of her baby/babies. This proves to be an extremely emotional and difficult time as the patient loses the ability to maintain her normal daily activities, including routine oral hygiene care. Depending on the severity of dehydration due to the condition, the patient may experience mild to extreme xerostomia. From a combination of xerostomia and continuous acid exposure (due to

vomiting) dental caries and/or dental erosion can easily occur. A patient with HG may also suffer from ptyalism, or hypersalivation which can be extremely uncomfortable or irritating for the patient and may also induce further vomiting. With the inability to brush/floss properly, HG patients may also deal with halitosis, an altered sense of taste, and/or periodontal diseases. Due to the stress of the condition, a patient may also experience bruxism among other ailments, oral complications or dental issues.

As with most diseases, disorders, or conditions, the effects of Hyperemesis gravidarum on the oral cavity most likely vary from patient to patient. It is conceivable however, that most, if not all HG patients experience some type of oral complication or dental issue in relation to the condition. By conducting research through surveying patients who have had Hyperemesis gravidarum (those who were pregnant and experiencing HG at the time of study were not included due to potential sensitivity harm) a greater understanding of the most common dental issues and/or oral complications due to HG were obtained. Through the collection of analyzable data, dental hygienists will have access to a fuller understanding of the effects of Hyperemesis gravidarum specifically on the oral cavity and will be able to apply that knowledge so that they may better serve their patients.

### **Epidemiology and Risk Factors**

Hyperemesis gravidarum is considered to be a multifactorial condition which may manifest for one or several different reasons. Various beliefs exist as to the definite cause/causes of HG which appears to be a controversial topic among many. Theories as to the cause of HG include but are not limited to: A change in hormones, nutritional deficiencies, possible bacterial origins, and genetics. Statistically HG tends to be more common among non-Caucasian women and non-smokers. General risk factors may include:

first time pregnancy, women who have previously had HG, obesity, young maternal age, women carrying a female fetus, mother or sister having had HG, a history of diabetes, hyperthyroidism, and/or a multiple pregnancy (carrying more than one baby) among others.<sup>2,3,4,6,9,17</sup>

### **Hospitalization**

Although there is no simple definite origin of Hyperemesis gravidarum at this time, one thing is certain; HG bleakly affects pregnancies and is cause for many hospitalizations. Once any person becomes dehydrated from non-stop nausea and vomiting (whether pregnant or not) and is unable to keep any liquids in, the only option for the patient is to receive life-sustaining intravenous fluids. This frequently requires hospitalization-- HG accounts for a large percentage of hospitalizations, which during pregnancy is “only second to pre-term labor for hospitalization.”<sup>9</sup> Such a demand for hospitalizations understandably results in economic burden for the patient, and society at large which ought to also serve as motivation for further research and understanding of HG.<sup>3,7,13</sup>

### **Summary**

Hyperemesis gravidarum is a complicated, difficult and challenging condition that affects at least 0.5-3% of all pregnancies. HG is characterized by persistent nausea and vomiting that can lead to dehydration among several other complications and is a primary cause of hospitalization for pregnant women. Due to the nature of the condition, HG has a direct impact on the oral cavity. Research within the scope of dental hygiene pertaining specifically to Hyperemesis gravidarum and its effects on the oral cavity is tremendously necessary and required so that this population may be better served in the future.

**Statement of the Problem:** What is the prevalence of oral and dental related issues pertaining to Hyperemesis gravidarum? What are the most common oral and dental complications relating to Hyperemesis gravidarum? How can dental hygienists best serve their patients who are suffering or have suffered from this condition?

### **Methods and Materials**

**Background.** This descriptive research concentrated on studying women who have endured Hyperemesis gravidarum (HG) during pregnancy and the prevalence of oral and dental related issues resulting from and/or pertaining to the condition. The study also focused on uncovering common oral and dental complications relating to Hyperemesis gravidarum. Previous studies regarding Hyperemesis gravidarum and its relation to the dental health of the mother are limited. Women who have withstood Hyperemesis gravidarum were surveyed using an online self-reporting questionnaire regarding their experiences. The results of the questionnaires were analyzed for a fuller comprehension of how HG affects the oral cavity of the mother both during and after pregnancy.

Dentists and dental hygienists must be knowledgeable of diseases and conditions that affect the body and overall well-being of their patients, particularly those that impact the oral cavity. Hyperemesis gravidarum is a severe form of persistent nausea and vomiting during pregnancy which directly affects the oral cavity of the patient in numerous ways. A comprehensive study of women who have endured Hyperemesis gravidarum provides dental professionals with an improved understanding of the condition and how it impacts the oral cavity of the patient.

Although Hyperemesis gravidarum affects a substantial amount of women during pregnancy and merits attention and study, significant populations of women who have lived

the condition are not easily available for questioning in any particular physical location. Fortunately, there are readily available online support groups and forums devoted to helping women who are currently experiencing or who have endured the condition. Through this medium, women who have withstood Hyperemesis gravidarum, and are no longer pregnant, were questioned regarding their experiences.

The Hyperemesis Education and Research (HER) Foundation is an organization devoted to helping women who are suffering from and/or who have survived Hyperemesis gravidarum. Their online forums and social media are a magnificent resource and place where women who are experiencing or have experienced the condition are able to find support and hope from others. The HER Foundation Facebook page is currently followed by over 12,000 followers; most of which are women who have either had HG or are going through it now.

Kimber MacGibbon, Registered Nurse and Director of Education & Research of the HER Foundation was contacted for permission to present the research survey on the HER Foundation Facebook page for maximum participation. Due to the high volume of advertisements that occur on the main HER Foundation Facebook page, MacGibbon allowed for the survey to be posted onto a smaller component of the HER Foundation webpage which consists of nearly 2,000 women who have either had or are currently experiencing Hyperemesis gravidarum.

**Study approval.** The study was reviewed and approved by the University of New Mexico Institutional Review Board (IRB).

**Research design.** The survey which was created through the online survey program, Google Forms, asked HG survivors questions about their experience with Hyperemesis

gravidarum and their oral health. The participants were asked questions particularly regarding HG—which trimesters the condition was experienced and for how long it lasted. The remainder of the survey focused on the oral health of the women. The women were asked about their oral health care and habits prior to pregnancy as well as during their HG pregnancy. Participants were also asked specifically about any oral complications that they may have experienced during and/or after their HG pregnancy. The questionnaire was comprised of 29 multiple choice questions with the addition of an open-ended space for individual comments at the finish of the survey. The study was made available for participation on the HER Foundation webpage, along with the approved Cover Letter of Informed Consent, on March 4, 2017 at 9 pm and remained accessible for two weeks when it was closed on March 18, 2017 at 9 pm Mountain standard time.

### **Limitations**

The research study was limited to only women who have had Hyperemesis gravidarum in the past and are no longer pregnant. This limited any women that follow the HER Foundation webpage and were pregnant at the time of the study from participation.

### **Results**

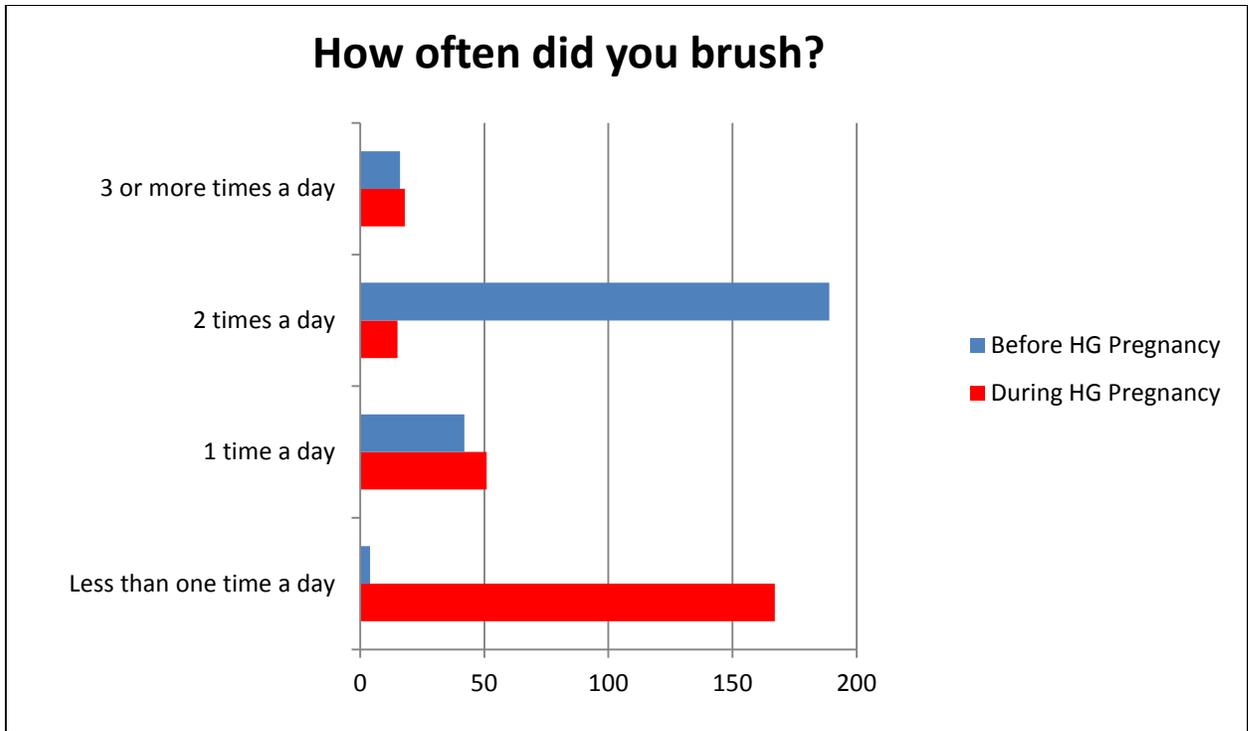
There were a total of 251 responses to the survey. Most questions were answered by all 251 respondents, however five of the questions were answered by 250 of the participants, two questions were answered by 249, and 1 question was answered by 248 respondents. There were a total of 84 typed responses for the last open-ended question (See Table 1). Descriptive statistics were used to analyze and summarize the data.

Participants were asked to determine in which trimesters they had experienced HG and for how long. Of the 251 responses, 99.6% of the women experienced HG during their

first trimester, 88.4% in the second trimester, and 79.3% of participants reported having it the third trimester. Over 91% of participants reported having suffered the condition for 20 weeks or more during their pregnancies.

Regarding routine oral hygiene care, 84.9% of all participants reported that brushing/flossing either always or often induced vomiting during their HG pregnancy. Furthermore, 96.5% of respondents reported having difficulty brushing and/or flossing at least sometimes during their HG pregnancy and 86.5% reported often or always having difficulty with oral hygiene. An overwhelming 92.8% of all participants reported having altered their oral hygiene in some way during their HG pregnancy.

When comparing the oral hygiene routines of the women before and during HG pregnancy, the significant and unfortunate alterations were clear. The women were asked how often they brushed before and during HG pregnancy. Of the 251 responses, 189 women reported brushing 2 times a day before pregnancy, 42 said they brushed 1 time a day, 16 said 3 or more times a day and 4 said that they brushed less than 1 time a day before HG pregnancy. However when asked the same question regarding brushing routines during HG pregnancy, the outcome was considerable different. Of the 251 responses, 167 reported brushing less than 1 time a day, 51 answered 1 time a day, 18 said 3 or more times a day and 15 said 2 times a day.



*Figure 1: Comparison of brushing routine before and during HG pregnancy*

Correspondingly, a significant decrease was also seen among dental flossing routines during HG pregnancy. Of the 250 responses regarding flossing habits *prior* to pregnancy, 8 reported never flossing, 57 said that they rarely flossed, 44 reported occasionally flossing, 32 responded to having flossed 3-4 times a week, 61 answered 1-2 times per week, and 48 said that they flossed 1 or more times a day *before* HG pregnancy. In respect to flossing routines *during* HG pregnancy of the 251 responses, 142 reported never flossing during their HG pregnancy, 65 said rarely, 23 reported occasionally flossing, 3 participants replied that they flossed 3-4 times per week, 10 said 1-2 times per week and 8 reported flossing 1 or more times a day during HG pregnancy.

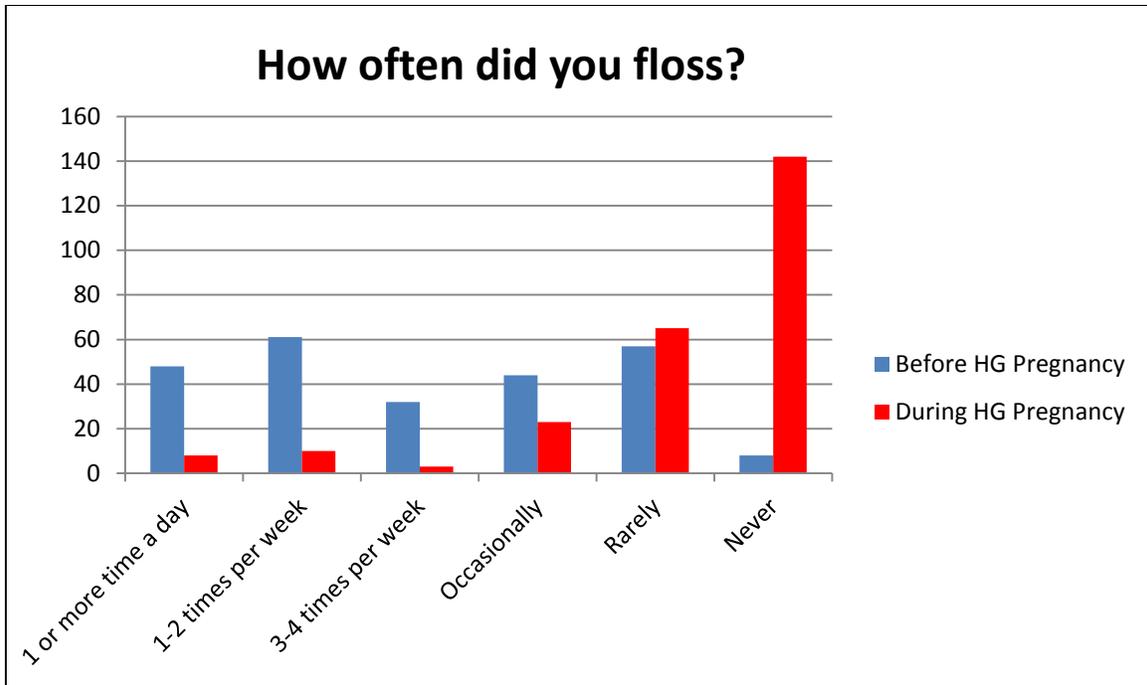


Figure 2: Comparison of flossing routine before and during HG pregnancy

The use of mouthwash before and during HG pregnancy was also compared. Of the 250 responses regarding the use of mouthwash *before* HG pregnancy, 105 women reported sometimes using mouthwash, 92 said that they used mouthwash regularly before pregnancy, and 53 answered never. In regard to the use of mouthwash *during* HG pregnancy, 161 reported never using mouthwash during their HG pregnancy, 46 reported sometimes using mouthwash, and 43 reported using mouthwash regularly. As with brushing and flossing, there was an apparent decrease in the use of mouthwash during HG pregnancy, however not as drastic. This is significant in that mouthwash may be easier for some patients to use than brushing or flossing during HG pregnancy. Thus, dental hygienists and professionals may be able to recommend a fluoridated mouthwash to some HG patients who may have otherwise used nothing.

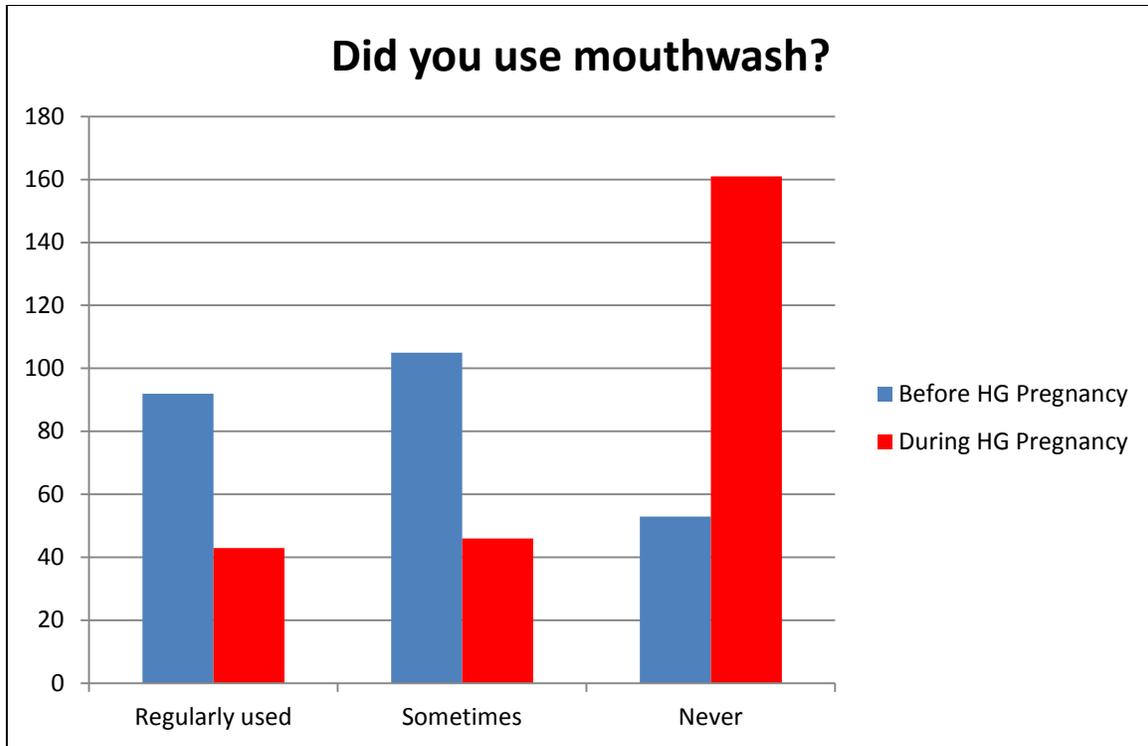
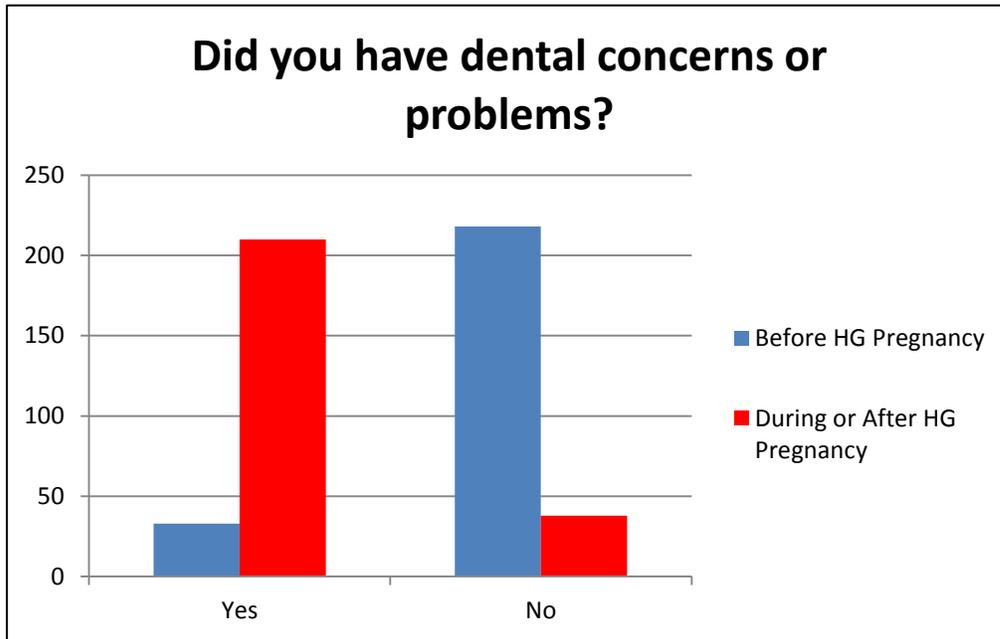


Figure 3: Comparison of use of mouthwash before and during HG pregnancy

Next, participants were asked if they received regular dental cleanings and exams before their HG pregnancies. Of the 250 responses, 198 reported “yes” to receiving regular cleanings and check-ups while 53 answered “no” to having received regular cleanings and check-ups before HG pregnancy. Though this question does not give any specific oral health background information, it allows the reader to have a generalized idea of how many participants (78.9%) in the study were seen regularly by a dental team *before* their HG pregnancies.

Among the most noteworthy findings of the study, participants were asked if they had any dental concerns or problems prior to (before) HG pregnancy, and subsequently asked if they had dental concerns or problems during or after HG pregnancy. Of the 251 responses relating to dental concerns *before* HG pregnancy, 218 women reported having no concerns or

problems while the remaining 33 reported having had concerns or problems before HG pregnancy. Significantly, of the 248 responses regarding having had dental concerns or problems *during or after* HG pregnancy, 210 reported having dental concerns or problems and the remaining 38 answered no. The observable difference between having dental concerns or problems before and during or after HG pregnancy is clear.



*Figure 4:* Comparison of dental concerns or problems before and during and/or after HG pregnancy

Next, the women who had endured HG pregnancy were asked if they experienced dry mouth that they had not experienced previously (before pregnancy) during their pregnancy. Of the 251 responses, 136 answered no and 115 reported having experienced dry mouth during HG pregnancy. It is well known throughout the dental community that dry mouth can have a considerable impact on the oral cavity. Thus, it is important for dental professionals

to be aware that experiencing dehydration in relation to HG pregnancy may contribute to dry mouth during HG pregnancy.

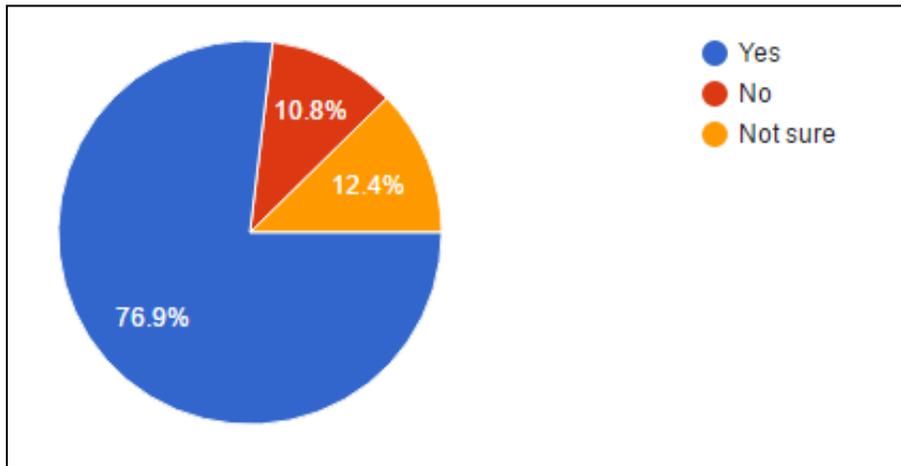
Participants were also asked if they experienced hyper salivation (ptyalism) during their HG pregnancy in which they had not experienced before. Of the 249 responses, 81.9% of the women reported experiencing hyper salivation during their HG pregnancies while the remaining 18.1% did not. Ptyalism is significant during HG pregnancy. For many women experiencing the condition, the extra saliva can be extremely uncomfortable and also induce further nausea and vomiting. It is essential that dental professionals be aware of ptyalism and how it affects women suffering from HG. This may allow dental professionals to consider possible ways to alleviate the discomfort associated with ptyalism so they may best serve their patients.

Furthermore, participants were asked if they experienced any oral or dental pain during or after their HG pregnancies which had not been experienced prior to pregnancy. Of the 251 responses, 155 answered “yes” to having oral or dental pain during HG pregnancy that was not experienced prior to pregnancy while 96 answered “no”. Participants were also asked, “To your knowledge, did you develop dental cavities during your HG pregnancy?” Of the 251 responses, 138 answered “yes” to having developed dental caries, 69 answered “not sure”, and 44 said “no”.

Participants were then asked whether they had lost any teeth during or after their HG pregnancy. Of the 250 responses, 175 responded “no”, 63 said “yes”, and 12 answered “unsure”. Ideally, this type of question would be asked and answered with a thorough background knowledge base and in a clinical setting; however it is worth noting that 25.2% of women reported having lost a tooth during or after HG pregnancy. Additionally,

participants of this study reported having lost their teeth due to HG pregnancy in the open-ended question of the survey (see Table 1).

When asked, “Did your gums bleed more during or after your HG pregnancy than before pregnancy?” 193 of the 251 respondents said “yes”, 31 answered “not sure” and 27 said “no” to an increase in gingival bleeding.” Additionally, when asked, “To your awareness, did you develop gum disease (gingivitis or periodontal) during or after your HG pregnancy?” 100 participants answered “yes”, 66 said “no”, and 85 answered “not sure”. Again, it would be ideal to observe these types of findings in a clinical study; however, 39.8% of women reported being aware of developing some form of gum disease. Participants also described an increase in gingival sensitivity and gum diseases during and after HG pregnancy in the last open-ended question of the survey (see Table 1).

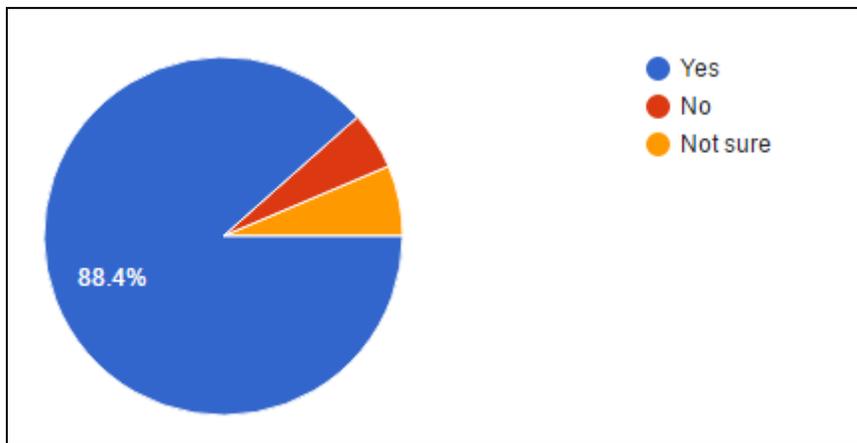


*Figure 5: Reported increase in gingival bleeding during HG pregnancy*

Respondents were also asked if they experienced bruxism during or after their HG pregnancy that had not been experienced before pregnancy. Of the 251 responses, 124 said “no”, 82 answered “yes”, and 45 reported that they were “not sure” if they had experienced bruxism. Dental professionals are well versed in the effects of bruxism and how to help treat

and prevent the numerous issues associated with it. It is important for dental hygienists and professionals to be aware that bruxism may be experienced during or after HG pregnancy though it may not have been an issue for the patient prior to pregnancy.

Although it may often occur in any pregnancy regardless of whether Hyperemesis gravidarum is present or not, the women were also asked if they had experienced an alteration in taste during their HG pregnancies. Of the 250 responses, 222 participants said “yes”, 16 answered “not sure” and 13 said “no”. An alteration in the sense of taste may be significant for any woman during pregnancy. This information is beneficial for dental professionals to be aware that a woman with HG may be experiencing a drastic change within the oral cavity including a tremendous alteration in taste among many other changes. This may affect what she (tries to) eats, and or the types of toothpastes and dentifrices or mouthwashes that may be used.



*Figure 6:* Reported percentage of women who experienced an alteration of taste in HG pregnancy

Participants were asked, “Did you alter your normal oral daily habits during your HG pregnancy? For example did you chew more gum than usual or suck on candies, cough

drops, or lozenges (which you had not done before pregnancy) during your HG pregnancy?” Of the 251 responses, 176 answered “yes” to having altered their normal oral/daily habits during HG pregnancy while the remaining 75 answered “no”. Thus, 70.1% reported having changed their oral habits during HG pregnancy. This is significant for dental professionals to consider when discussing diet and/or daily habits with patients. A women suffering from HG may find her only relief from sucking on candy. A dental professional must know to ask any patient what their habits include and counsel and educate them accordingly.

When asked, “Do you feel that HG pregnancy had an impact on your oral health in any way?” a resounding 90.4% or 226 answered “yes” HG had impacted their oral health in a negative way, 5 answered “yes” that HG had impacted their oral health in a positive way (may or may not have read entire response choice as it was the first listed), and 19 answered “no”, HG pregnancy had not impacted their oral health in any way.

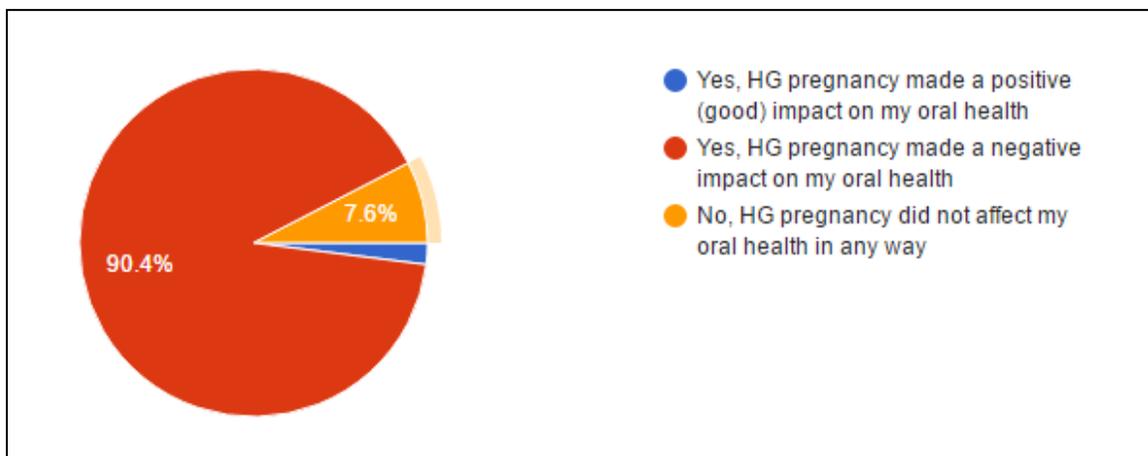


Figure 7: Report of impact that HG pregnancy had on the oral health

Last, participants were asked, “Did you experience any other oral or dental related issues or complications not mentioned (in previous questions) during or after your HG pregnancy?” Of the 249 responses, 159 answered “no”, no other issues were experienced

that were not mentioned in the previous questions, and 90 answered “yes”. Of the 90 that answered yes, 84 typed their experiences in the “Please Explain” area below the final question. The typed responses were significant (see Table 1) and uncovered other ways that Hyperemesis gravidarum may affect the oral cavity which were not comprised within the study. These included: Ulcers, hypersensitivity (of teeth and gums), continued oral “triggers”, lock jaw, bone growth, and teeth shifting.

Table 1: *Typed Responses*

• “Mouth ulcers. I had two teeth extracted during HG pregnancies.”
• “My bottom front teeth turned slightly black and teeth became far more sensitive.”
• “My teeth were weakened, dentist thought maybe the baby was stealing my calcium since my nutrients were so low. My teeth cracked and chipped, almost as if they were crumbling. I didn’t lose teeth or have cavities but I did have to have cracks filled.”
• “Missing lateral incisors. Only have baby teeth. Those baby teeth are now loose. I now have braces again and then will get implants.”
• “Beginning stage gum disease requiring deep cleaning of entire mouth. I also developed 8 cavities during pregnancy.”
• “Cracking teeth degrading quickly now. 6 root canal and crowns. 4 extractions. Before 3 HG pregnancies I only had two fillings done when I was a child.”
• “I am super sensitive to anything being in my mouth even now. It makes me gag e.g. brushing my teeth now every. single. time makes me gag, blowing up inflatable toys or swimming armbands that kind of thing.”
• “Teeth had holes in them.”
• “Enamel damage on the back of lower teeth”
• “Had a filling.. which was good all things considered and a crack sealed”
• “I brushed away all the enamel off the sides of my teeth.”
• “I had trouble using certain toothpastes. It would make me gag more. I had to use something with less fluoride. Ordered by the dentist.”
• “Due to the vomiting, my crowns and bridge broke. I also had more cavities. I brushed my teeth often and then was told that brushing after vomiting can cause additional erosion.”
• “Extreme loss of enamel from my last HG pregnancy. Now I have tooth sensitivity and several cavities.”

Table 1 continued

<ul style="list-style-type: none"> <li>• “Teeth started chipping. I was so sick I couldn’t stand up most of the pregnancy and spent a good deal of time in the hospital so brushing my teeth was much lower on the priority list than usual.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My front teeth slightly chipped from becoming so weak from puking so much bile.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth have begun to rot since my HG pregnancies. Many are loose but haven’t fallen out yet.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I have periodontal issue, I require gum grafting due to a receding gum.”</li> </ul>
<ul style="list-style-type: none"> <li>• “The enamel of my teeth has almost entirely worn away.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I am 6 months postpartum and I haven’t been "brave" enough to go to the dentist even though I know I need to because my teeth are VERY VERY sensitive to any thing that is a little bit cold or hot...I hurt really bad. For example, I can’t have ice cream at all...it sounds like a nightmare right now.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I experienced lock jaw in each one of my HG pregnancies from about 20 weeks onward.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Broken teeth, expedited bone growth on my inner lower jaw”</li> </ul>
<ul style="list-style-type: none"> <li>• “I had to have a protective covering put on my back teeth to try and help with cavities. I think it's the same thing they tend to do to small children. I have had two HG pregnancies, and I have had this done both times to try to help protect my teeth.”</li> </ul>
<ul style="list-style-type: none"> <li>• “More cavities, deeper cavities and no enamel on teeth left.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I had to have three cavities filled after my HG pregnancy.”</li> </ul>
<ul style="list-style-type: none"> <li>• “14 cavities”</li> </ul>
<ul style="list-style-type: none"> <li>• “Tooth extraction and lost half of my molar. Huge hole. Teeth shifted. And to go back to question number 27 - I couldn't do any of those couldn't chew gum or suck on candy because it produced too much saliva and could NOT swallow if not I'd throw up. Please bring more awareness to this horrible condition.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Root planing and scaling on one quadrant of teeth, enamel erosion, hyper-sensitivity, four cavities.”</li> </ul>
<ul style="list-style-type: none"> <li>• “All of my teeth are extremely sensitive to hot and cold. They were not sensitive at all before hg but I have been through 3 hg pregnancies now. My back teeth are all breaking and falling out of my mouth. All of my teeth feel like they are deteriorating. My first pregnancy I brushed my teeth immediately after getting sick each time. I learnt that made it worse (for enamel and sensitivity) so I stopped and just started swishing water to rinse them instead. I was getting sick over 50 times a day though for my full pregnancies.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I have a cavity so bad it formed a pocket or abscess currently awaiting surgery to remove 5 teeth.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Pregnancy induced gingivitis”</li> </ul>
<ul style="list-style-type: none"> <li>• “Severe Ulcers on my tongue and cheeks”</li> </ul>
<ul style="list-style-type: none"> <li>• “I know for a fact HG ruined my teeth both pregnancies. I have cavities now!! Vomiting a million times a day and rinsing with water was the only thing I could do any toothpaste or mouth wash would make me throw up immediately.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Build up of plaque”</li> </ul>

Table 1 continued

<ul style="list-style-type: none"> <li>• “Several teeth chipped from regular use (was told it was because the acid eroded them), and two root canals with suspected oral surgery in future. Am followed by an Endodontist and still trying to fix problems from HG pregnancy in 2013.”</li> </ul>
<ul style="list-style-type: none"> <li>• “After HG I had gum disease and enamel erosion. I was also in need of a deep cleaning. It took a year of dental cleanings and sealants to get my teeth healthy.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I lost 2 back teeth and had 2 root canals. After the pregnancy my enamel was severely damaged.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Had to have a root canal and crown during pregnancy.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My gums weakened....due to vomiting non stop it effected my teeth ....I had beautiful healthy teeth and gums prior.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Pain in my gums during HG”</li> </ul>
<ul style="list-style-type: none"> <li>• “Crippling anxiety to visit the dentist. Will need to have teeth removed or root canals as my gums severely receded during each pregnancy. Both daughters with teeth issues present on their teeth coming through their gums etc”</li> </ul>
<ul style="list-style-type: none"> <li>• “Cavities galore! And a filling came out as well.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Multiple cavities and crowns”</li> </ul>
<ul style="list-style-type: none"> <li>• “Yellow, weakened teeth”</li> </ul>
<ul style="list-style-type: none"> <li>• “Teeth sensitivity”</li> </ul>
<ul style="list-style-type: none"> <li>• “All my teeth rotted due to Hyperemesis Gravidarum and I have full set of dentures because of Hyperemesis Gravidarum.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My cap actually came off because the tooth that it was covering broke down due to decay.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Cracked molars and sensitive teeth”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth became loose, formed cavities and are now very painful. The dentist informed me that I will need to get them all pulled in the next two years. I can't eat most normal foods and hot and cold are very painful.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth are so chipped and weak and little breaks on the bottom of my teeth, my teeth are sensitive and gums too.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth shifted.”</li> </ul>
<ul style="list-style-type: none"> <li>• “TMJ, my grinding of my teeth and vomiting and overbite has severe impact on my teeth I will lose 4 of my teeth.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I recall a specific "taste" that would trigger nausea.”</li> </ul>

Table 1 continued

<ul style="list-style-type: none"> <li>• “My gums are more recessed, and I may need a gum graft on one tooth. One tooth became sensitive after my Hg pregnancy. Even post Hg, I had to wait a long time to go in to see the dentist (about 6 mos. post-partum) because I had a back injury (weak bones &amp; weak muscles from the Hg + a fall) plus I had so many oral aversions from the Hg &amp; was dealing w/ so many nausea/gagging issues. After Hg, going to the dentist is a very aversive and difficult situation to face. When you have vomited so much, it is hard to have someone poke around in your mouth and put odd textures/tastes &amp; fingers in there. I had to fight a lot of nausea, panic, &amp; anxiety just to go to my dental cleaning, and during it, I felt as though I was suffering a great deal, struggling w/ the nausea &amp; anxiety. I think it was a sort of emotional &amp; physical trigger for PTSD in regards to the Hg for me. Talking w/ other Hg moms, they seem to have the same sorts of issues w/ going to the dentist. Thank you for researching this. Many OBs and ER doctors brush off Hg as being nothing more than "a little morning sickness", when in reality, for those of us who have severe Hg, there are many lasting consequences to our health - consequences of malnutrition and PTSD being two of those.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I have had multiple problems since my HG.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My gums are torn in a few places and won't heal.”</li> </ul>
<ul style="list-style-type: none"> <li>• “The backs of my teeth feel pitted and my molars are way more sensitive.”</li> </ul>
<ul style="list-style-type: none"> <li>• “I had two teeth pulled after.”</li> </ul>
<ul style="list-style-type: none"> <li>• “Teeth feel sore and loose all my bones hurt. I assume that they were depleted.”</li> </ul>
<ul style="list-style-type: none"> <li>• “My teeth are very sensitive”</li> </ul>
<ul style="list-style-type: none"> <li>• “Mouth Ulcers”</li> </ul>

## Discussion

Hyperemesis gravidarum is a difficult condition during pregnancy that significantly and directly impacts the oral cavity in several ways. Dental hygienists and professionals must be aware and educated on the condition, how it can and does affect the oral cavity, and how to best serve patients suffering from or who have endured Hyperemesis gravidarum. It is crucial that dental hygienists and professionals be considerate of the multi-faceted effects of HG and how it may shape the future of not only the oral cavity, but every aspect of a patient’s life- physically, emotionally, financially, etc. during and after HG pregnancy.

## **Conclusion**

The findings of this study demonstrate that Hyperemesis gravidarum has a tremendous impact on the oral cavity of the women who suffer from the condition. It is clear that women suffering from HG have extreme difficulty performing adequate daily oral hygiene which can quickly lead to a variety of well-understood oral disorders and diseases that occur from insufficient oral maintenance. Additionally, many other oral ailments may arise in conjunction with or as a result of Hyperemesis gravidarum. Women who have endured HG may experience dry mouth, ptyalism, bruxism, periodontal diseases, dental pain and/or decay, tooth loss, an alteration in the sense of taste, dental erosion, shifting teeth, ulcers, and/or hypersensitivity among other oral conditions during or after HG pregnancy. Ultimately, dental hygienists and professionals must be aware and understand Hyperemesis gravidarum and the profound impact that it can have on the oral cavity. With this knowledge, dental hygienists can be fully prepared to best serve their patients with understanding and compassion. Intended for inclusive education, this study was particularly broad and covered a vast variety of issues that may occur relating to the oral cavity and Hyperemesis gravidarum. Further, more detailed research of most topics within this study and within a clinical setting is recommended.

### **How dental hygienists can help their patients that are affected by HG**

As with all patients, dental hygienists can have a profound impact on a patient who is experiencing Hyperemesis gravidarum or has already endured the condition. First and foremost, dental hygienists must be aware and educated on the condition, what it is and how it affects the patient's overall well-being and oral health.

For patients who are experiencing HG:

- Be compassionate-Understand that the patient may not be able to perform adequate oral hygiene without inducing nausea or vomiting or allow for a complete prophylaxis if at all
- Discuss what works for the patient- suggest alternative ways that a patient may be able to perform oral hygiene care. For example: Suggest that the patient try using a water pick if she simply cannot brush or floss
- Advise patients not to brush immediately after vomiting due to acid exposure
- If the patient finds some relief in sucking on candies or chewing gum, advise patient to use sugarless candy and gum
- Discuss possible mouthwashes and dentifrices that the patient may not have considered prior to pregnancy
- Brainstorm with the patient ways that she can reduce acid exposure to teeth and plaque even if she cannot brush or floss at all- be creative
- Be enduring with the patient and willing to suggest everything and anything!
- Refer HG patients to the HER Foundation for unconditional support and resources

For patients who are post-partum and have experienced HG:

- Consider that the patient most likely had extreme difficulty brushing/flossing during pregnancy and does not need to be shamed regarding their OH during pregnancy
- If the patient presents with many oral conditions post HG pregnancy, be considerate in your words and approach in discussing treatment needs and plans
- Again, be compassionate- Be aware that many HG patients often have guilt or negative feelings regarding their pregnancies and may suffer from post-partum depression, PTSD or many other additional circumstances that may correlate with HG

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## Appendices

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## Appendix A

### HRRC Approval Letter



Human Research Review Committee  
Human Research Protections Office

March 1, 2017

Christine Nathe  
University of New Mexico  
MSC09 5020  
Albuquerque, NM 87131  
(505) 272-8147  
Fax: (505) 272-5584  
CNathe@salud.unm.edu

Dear Christine Nathe:

On 3/1/2017, the HRRC reviewed the following submission:

Type of Review: Initial Study  
Title of Study: Hyperemesis Gravidarum and the Oral Cavity- A Survey  
Investigator: Christine Nathe  
Study ID: 17-083  
Submission ID: 17-083  
IND, IDE, or HDE: None

Submission Summary: Initial Study  
Documents Approved: 

- Appendix Survey
- HG Protocol in Word
- HG Cover Letter.pdf

Review Category: EXEMPTION: Categories (2) Tests, surveys, interviews, or observation.

Determinations/Waivers: Provisions for Consent are adequate.  
HIPAA Authorization Addendum Not Applicable.

Submission Approval Date: 3/1/2017  
Approval End Date: None  
Effective Date: 3/1/2017

The HRRC approved the study from 3/1/2017 to inclusive. If modifications were required to secure approval, the effective date will be later than the approval date. The "Effective Date" 3/1/2017 is the date the HRRC approved your modifications and, in all cases, represents the date study activities may begin.

Because it has been granted exemption, this research is not subject to continuing review.

Please use the consent documents that were approved and stamped by the HRRC. The stamped and approved consents are available for your retrieval in the "Documents" tab of the parent study.

This determination applies only to the activities described in this submission and does not apply should you make any changes to these documents. If changes are being considered and there are questions about whether HRRC review is needed, please submit a study modification to the HRRC for a determination. A change in the research may disqualify this research from the current review category. You can create a modification by clicking Create Modification / CR within the study.

In conducting this study, you are required to follow the Investigator Manual dated April 1, 2015 (HRP-103), which can be found by navigating to the IRB Library.

Sincerely,

A handwritten signature in black ink, appearing to read "Thomas F. Byrd". The signature is written in a cursive style with a large initial 'T'.

Thomas F. Byrd, MD  
*HRRC Chair*

## Appendix B

### Informed Consent Cover Letter

University of New Mexico Health Sciences Center

Informed Consent Cover Letter for Anonymous Surveys

#### STUDY TITLE

Hyperemesis Gravidarum and the Oral Cavity

Professor Christine Nathe from the Department of Dental Medicine, is conducting a research study. The purpose of the study is to understand how Hyperemesis Gravidarum affects the oral cavity. You are being asked to participate in this study because you have experienced Hyperemesis Gravidarum.

Your participation will involve answering survey questions. The survey should take no more than 5-10 minutes to complete. Your involvement in the study is voluntary, and you may choose not to participate. There are no names or identifying information associated with this survey. The survey includes questions such as "How many times per day did you brush your teeth during your pregnancy with Hyperemesis Gravidarum?" You can refuse to answer any of the questions at any time. There are no known risks in this study, but some individuals may experience discomfort when answering questions. All data will be kept for up to 6 months electronically and then deleted.

The findings from this project will provide information on Hyperemesis Gravidarum and the Oral Cavity. If published, results will be presented in summary form only.

If you have any questions about this research project, please feel free to call Professor Nathe at (505)272-8147. If you have questions regarding your legal rights as a research subject, you may call the UNMHSC Office of Human Research Protections at (505) 272-1129.

By clicking on the survey link, you will be agreeing to participate in the above described research study.

Thank you for your consideration.

Sincerely,

Christine Nathe, RDH, MS  
Professor and Director  
Jamie Pena, RDH, MS©  
Graduate Candidate  
Division of Dental Hygiene  
Department of Dental Medicine

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Version Date

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## Appendix C

### Hyperemesis Gravidarum and the Oral Cavity Survey

**For the purpose of this survey HG is used throughout as the abbreviation for Hyperemesis Gravidarum**

#### **Hyperemesis Gravidarum (HG)**

1. Are you currently pregnant? This survey is intended only for women who experienced the condition Hyperemesis Gravidarum during pregnancy and are no longer pregnant. If the answer is “yes”, and you are currently pregnant please do not continue with this survey. By continuing with the survey I confirm that I have read the consent letter provided in the attachment and agree to consent.

Yes – I am currently pregnant and will not continue with the survey

No – I am not currently pregnant and I have read and confirm consent

2. During which stage of pregnancy did you experience the condition Hyperemesis Gravidarum?.

1<sup>st</sup> Trimester

2<sup>nd</sup> Trimester

3<sup>rd</sup> Trimester

3. For how long did you experience HG?

Less than 4 weeks

4-8 weeks

9-20 weeks

20 or more weeks

4. How often did brushing and/or flossing your teeth induce nausea and/or vomiting during your HG pregnancy?

Brushing/flossing always induced nausea and/or vomiting during my HG pregnancy

Brushing/flossing often induced nausea and/or vomiting during my HG pregnancy

Brushing/flossing sometimes induced nausea and/or vomiting during my HG pregnancy

Brushing/flossing rarely induced nausea and/or vomiting during my HG pregnancy

Brushing/flossing never induced nausea and/or vomiting during my HG pregnancy

5. How often did you experience difficulty with brushing or flossing your teeth during your HG pregnancy due to the pregnancy?

I always had difficulty brushing/flossing my teeth during my HG pregnancy

I often had difficulty brushing/flossing my teeth during my HG pregnancy

I sometimes had difficulty brushing/flossing my teeth during my HG pregnancy

I rarely had difficulty brushing/flossing my teeth during my HG pregnancy

I never had difficulty brushing/flossing my teeth during my HG pregnancy

6. Were you able to brush your teeth as normal during your HG pregnancy?

I was always able to brush my teeth as normal during my HG pregnancy

I was often able to brush my teeth as normal during my HG pregnancy

I was sometimes able to brush my teeth as normal during my HG pregnancy

I was rarely able to brush my teeth as normal during my HG pregnancy

I was never able to brush my teeth as normal during my HG pregnancy

7. During your HG pregnancy, did you brush/floss your teeth as normal or did you alter your oral hygiene routine in some way?

My oral hygiene routine remained the same as before my HG pregnancy

My oral hygiene routine was altered in some way

8. How often did you brush your teeth BEFORE your HG pregnancy?

Less than 1 time a day

1 time a day

2 times a day

3 or more times a day

9. How often did you brush your teeth DURING your HG pregnancy?

Less than 1 time a day

1 time a day

2 times a day

3 or more times a day

10. How often did you floss your teeth BEFORE your HG Pregnancy?

1 or more times a day

1-2 times per week

3-4 times per week

Occasionally- a few times per month

Rarely- Only when something felt stuck between my teeth

Never

11. How often did you floss your teeth DURING your HG pregnancy?

1 or more times a day

1-2 times a week

3-4 times a week

Occasionally- a few times per month

Rarely- Only when something felt stuck between my teeth

Never

12. Did you use mouthwash BEFORE your HG pregnancy?  
I used mouthwash regularly before my HG pregnancy  
I sometimes used mouthwash before my HG pregnancy  
I never used mouthwash before my HG pregnancy
13. Did you use mouthwash DURING your HG pregnancy?  
I used mouthwash regularly during my HG pregnancy  
I sometimes used mouthwash during my HG pregnancy  
I never used mouthwash during my HG pregnancy
14. Did you receive regular dental cleanings/check-ups BEFORE your HG pregnancy?  
Yes  
No
15. Did you visit the dentist office **during** your HG pregnancy?  
Yes  
No
16. Did you have dental concerns or problems PRIOR to your HG pregnancy?  
Yes  
No
17. Did you have dental concerns or problems DURING or AFTER your HG pregnancy?  
Yes  
No

18. Did you experience dry mouth during your HG pregnancy that you had not experienced before pregnancy?

Yes

No

19. Did you experience hyper salivation (extra saliva) during your HG pregnancy that you had not experienced before pregnancy?

Yes

No

20. Did you experience oral or dental pain during or after your HG pregnancy that you had not experienced before pregnancy?

Yes

No

21. To your knowledge, did you develop dental cavities during your HG pregnancy?

Yes

No

Not sure

22. Did you lose any teeth during or after your HG pregnancy?

Yes

No

Not sure

23. Did your gums bleed more during or after your HG pregnancy than before pregnancy?
- Yes
  - No
  - Not sure
24. To your awareness, did you develop gum disease (gingivitis or periodontal) during or after your HG pregnancy?
- Yes
  - No
  - Not sure
25. Did you experience bruxism (grinding your teeth) during or after your HG pregnancy that you had not experienced before pregnancy?
- Yes
  - No
  - Not sure
26. Did you experience an alteration in your sense of taste during your HG pregnancy?
- Yes
  - No
  - Not sure
27. Did you alter your normal oral/daily habits during your HG pregnancy? For example, did you chew more gum than usual or suck on candies, cough drops, or lozenges (which you had not done before pregnancy) during your HG pregnancy?
- Yes
  - No

28. Do you feel that HG pregnancy had an impact on your oral health in any way?

Yes, HG pregnancy made a positive (good) impact on my oral health

Yes, HG pregnancy made a negative impact on my oral health

No, HG pregnancy did not affect my oral health in any way

29. Did you experience any other oral or dental related issues or complications not mentioned above during or after your HG pregnancy?

Yes

No

Please explain:

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