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Lifetime Prevalence and Correlates of Migraine among Women in a Pacific Northwest Pregnancy Cohort Study

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Abstract

Background—Migraine is a common neurological disorder, ranked among the world's leading causes of years lived with disability by the World Health Organization. The burden of migraine is highest in women of reproductive age.

Methods—We characterized the prevalence, symptoms and correlates of migraine and other headaches among 500 women enrolled in a pregnancy cohort study. Migraine diagnoses (e.g., definitive migraine and probable migraine) were based on the International Classification of Headache Disorders-II criteria. Headache-related disability, before and during early pregnancy was determined using the Migraine Disability Assessment questionnaire. Logistic regression models were used to estimate adjusted odds ratios and 95% confidence intervals.

Results—The lifetime prevalence of definitive migraine was 20.0% (95% confidence interval 16.6-23.8%). When probable migraine was included, the lifetime prevalence of any migraine (definitive migraine plus probable migraine) increased to 29.8% (95% confidence interval 25.9-34.0%). An additional 16.6% (95% confidence interval 13.5-20.2%) of women in the cohort were classified as having non-migraine headaches. Over 26% of migraineurs experienced moderate or severe headache-related disability during early pregnancy. Migraine headaches were associated with a family history of headache or migraine (odds ratio=3.47; 95% confidence interval 2.14-5.63), childhood car sickness (odds ratio=8.02; 95% confidence interval 4.49-14.35), pre-pregnancy obesity status (odds ratio=3.83, 95% confidence interval 1.77-8.26), and a high frequency of fatigue (odds ratio=2.01; 95% confidence interval 1.09-3.70).

Conclusion—Migraine and headache-related disability are prevalent conditions among pregnant women. Diagnosing and treating migraine and headaches during pregnancy is essential.

Keywords

Migraine; headache; prevalence; correlates; pregnancy

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Introduction

Migraine is a common neurological disorder, ranked among the world's leading causes of years lived with disability by the World Health Organization ¹. Population-based studies have reported the lifetime prevalence of migraine in women to be between 16% and 32% ²⁻⁸. In a meta-analysis of studies using the International Classification of Headache Disorders (ICHD) diagnostic criteria, the estimated model-based prevalence was 17% for females and 7.6% for males ².

The prevalence of migraine in women rises after the average age of menarche, and peaks before the average age of menopause, affecting most women during their childbearing years ⁹⁻¹¹. Further, accumulating evidence suggests associations of migraine with increased risks of adverse perinatal outcomes including preeclampsia, fetal growth restriction and placental abruption ¹²⁻¹⁵.

Previous studies have shown that pre-existing migraine diminishes or disappears in the majority of pregnant women, while for some the disorder may remain unchanged or worsen ¹⁶⁻²⁶. For others, migraine may appear for the first time during pregnancy ²⁷. Some investigators have reported that spontaneous improvement in migraine symptoms tends to occur in the first trimester of pregnancy, when dramatic changes in estradiol levels occur and pain thresholds increase ²⁸. Given previous reports of adverse pregnancy complications of migraine and critical role of the early pregnancy period in the evolution of adverse pregnancy complications, it is important to understand the prevalence and related risk factors of migraine in early pregnancy. To the best of our knowledge there are few studies that specifically assess change of migraine symptoms in early pregnancy.

We conducted cross-sectional analyses of data from an on-going cohort study of pregnant women in Seattle, Washington, with the principal aim of assessing lifetime prevalence, symptoms and correlates of migraine in this population;

Materials and Methods

Study Population and Data Collection

The population for the present report was drawn from participants of the ongoing Migraine and Pregnancy Study which is a cohort study designed to investigate the relationship between migraine, headache symptoms before and during pregnancy and the risk of preeclampsia. Participants were recruited from pregnant women attending prenatal care at clinics affiliated with Swedish Medical Center in Seattle, Washington. Women who initiated prenatal care prior to 20 weeks gestation were eligible for the study. Women were ineligible if they initiated prenatal care after 20 weeks gestation, were younger than 18 years of age, did not speak and read English, did not plan to carry the pregnancy to term, or did not plan to deliver at Swedish Medical Center. Participants were invited to provide blood and urine samples and to participate in an in-person interview. The study population for this report is from the first 500 participants who were enrolled and were interviewed during the period of April 2009 and December 2010.

Participants completed a questionnaire administered by trained interviewers at enrollment around 20 weeks gestation. The interview included a structured migraine assessment questionnaire (adapted from the deCODE Genetics migraine questionnaire) ²⁹. The interview also included questions regarding medical history, pre-pregnancy weight and general health, pregnancy-related symptoms, and headache characteristics, as well as an assessment of the disability associated with headaches experienced before and during early pregnancy (adapted from the Migraine Disability Assessment Score (MIDAS))

questionnaire). All participants were asked if they had ever experienced headache episodes. Headache classification was determined using the International Classification of Headache Disorders II (ICHD-II) criteria established by the International Headache Society (IHS) ³⁰. “Definitive Migraine (DM)” was defined by at least five lifetime headache attacks lasting 4-72 hours, with (1) at least two of the qualifying pain characteristics (unilateral location, pulsating quality, moderate or severe pain intensity, aggravation by routine physical exertion), (2) at least one of the associated symptoms (nausea and/or vomiting, photo/phonophobia), and (3) not readily attributable to another central nervous system disorder or head trauma (according to subject self-report). “Probable Migraine (PM)” was defined as those fulfilling all but one of the DM criteria. Finally, any migraine was defined as the group with either DM or PM combined.

Participants were asked to report days of work, school, housework and social activities missed due to headaches during the three months before the index pregnancy, and during the first three months of the index pregnancy. Grading of pre-pregnancy responses was performed according to the MIDAS scoring guideline, which categorizes the number of days disrupted by headaches during a three-month period into groups of minimal, mild, moderate, and severe disability. Participants were also asked to report number of days they experienced headache and to rate the severity of their headache pain on a scale of 0-10 (where 0 is no pain, and 10 is the most severe pain) before and during pregnancy ³¹.

The procedures used in the study were in agreement with the protocol approved by the Institutional Review Board of Swedish Medical Center, Seattle, WA. All participants provided written informed consent.

Statistical Analysis

Prevalence estimates and 95% CI for the prevalence estimates of migraine and other headache were determined using previously described methods ³². Frequency distributions of sociodemographic, reproductive, medical and behavioral factors among groups defined by ICHD-II (definitive migraine, probable migraine, and no migraine) and the cohort were compared. Characteristics associated with definitive and probable migraine headaches were determined using Chi-square or Fisher's exact tests. We also compared headache-related characteristics, as assessed using the MIDAS instrument according to migraine and non-migraine headache status.

Using logistic regression procedures, we calculated odds ratios (ORs) and 95% confidence intervals (95% CIs) relating risk of migraine with putative correlates. In multivariable analyses, confounding was assessed by entering covariates into a logistic regression model, one at a time, and by comparing adjusted and unadjusted ORs. Final logistic regression models included those covariates that altered unadjusted ORs by at least 10%. Backward logistic regression modeling procedures combined with the change-in-estimate approach were used to select the final models reported in this manuscript. Covariates in the final models included pre-pregnancy body mass index (BMI), family history of headache or migraine, childhood carsickness and frequency of fatigue. All analyses were performed using Stata 9.0 (Stata, College Station, TX) statistical analysis software. All reported confidence intervals were calculated at the 95% level, and all reported p-values are two-tailed.

Results

Of the 500 pregnant women in the present analysis, a total of 232 reported experiencing headache episodes in their lifetime. The lifetime prevalence of DM was 20.0% (N=100) (95% CI 16.6-23.8%). When probable migraine was included, the lifetime prevalence of any

migraine (i.e., DM plus PM) in this population increased to 29.8% (N=149) (95% CI 25.9-34.0%). An additional 16.6% (N=83) (95% CI 13.5-20.2%) of the cohort were classified as having non-migraine headaches. There was no significant difference in migraine prevalence with regards to parity in this population. Characteristics of the study population, women with DM, those with PM and those with no migraine headache are summarized in Table 1.

A comparison of headache characteristics used for the classification of migraine among study participants reporting headache episodes is presented in Table 2. The most influential criteria that distinguished DM and PM were the typical length of episodes, aggravation by physical exertion, association with nausea and/or vomiting, and complaints of photo- and phonophobia. All criteria in Table 2 distinguished DM/PM from other types of headache.

Women with any migraine, as compared with those with other non-migraine headache, were more likely to report that their symptoms were associated with neck and shoulder pain and menstruation. Women with any migraine were also more likely to have had clinical testing (e.g., MRI, x-ray, blood testing), have received a physician diagnosis of migraine, and were more likely to use medications for headache relief than women with non-migrainous headaches. Women with any migraine were also more likely to report a higher prevalence of aura-like symptoms (any focal, sensory, or speech alterations preceding the onset of headache) (p-value =0.08) than women with non-migrainous headaches (data not shown).

Table 3 summarizes migraine-related disability experienced during the 3-month period prior to the study pregnancy. Approximately 52.4% of women with any migraine and 18.1% of women with non-migraine headaches reported having any headache attack during the 3-month period prior to pregnancy. Of note, 8.0% of those with any migraine and 2.4% of women with non-migrainous headaches were categorized as having moderate or severe headache-related disability (p=0.03). Women with any migraine reported a higher frequency of headache days and a higher severity of pain in the 3 months prior to pregnancy as compared with women who had non-migraine headaches (both p-values <0.001).

Assessments of headache-related disability during the first 3 months of pregnancy were also evaluated for women with any migraine and those with non-migrainous headaches (Table 4). A total of 79.9% of women with any migraine and 71.1% of women with non-migrainous headaches reported having any headache attack during the first trimester of the index pregnancy. Approximately 26.% of women with any migraine and 13.2% of women with non-migrainous headaches reported having moderate or severe headache-related disability during early pregnancy (p=0.21). Again, subjects with any migraine reported a higher severity of pain during early pregnancy compared to subjects with non-migrainous headache (p=0.02). It appeared that migrainous patients experienced headache deterioration during early pregnancy. Comparing intra-patient qualitative changes in self-scored pain before and during early pregnancy, 42% got worse while only 14% improved. Patients with any migraine had higher MIDAS scores during early pregnancy compared to their MIDAS scores prior to pregnancy, regardless of pre-pregnancy overweight or obese status (Figure 1).

Stepwise logistic regression analysis was performed to identify correlates and comorbidities of migrainous headaches (Figure 2). Correlates associated with migraine headaches were a positive family history of headache or migraine (adjusted OR=3.47; 95% CI 2.14-5.63), a personal history of car sickness in childhood (adjusted OR=8.02; 95% CI 4.49-14.35), pre-pregnancy obesity status (adjusted OR=3.83, 95% CI 1.77-8.26), and a high frequency of fatigue (exhaustion) (adjusted OR=2.01; 95% CI 1.09-3.70).

Discussion

The results of this study confirm and expand the literature on the lifetime prevalence and correlates of migraine in women of childbearing age. First, our study findings of a high prevalence (29.8%) of lifetime migraine in this cohort of pregnant women is consistent with prior literature, especially with results of studies among US populations ⁴⁻⁷. For example, 27.6% female adults reported severe headache or migraine in the previous 3 months from data collected in 1999 to 2004 in the National Health and Nutrition Examination Survey (NHANES) ⁶. The National Health Interview Survey (NHIS) age-adjusted prevalence of severe headache or migraine in the last 3 months among female adults was 22.3% and the highest prevalence of 26.1% was reported among females aged 18-44 ⁷. Furthermore, the American Migraine Prevalence and Prevention (AMPP) Study found that the highest 1-year period prevalence was observed among those ages 18-59. In that study, 17.1% of women met diagnostic criteria for definitive migraine and an additional 5.1% met diagnostic criteria for probable migraine ⁴.

Migraine is a disabling disorder among adults and is more prevalent among women than men. This is, at least partly, due to the influence of female sex hormones ^{9, 26}. Several studies have shown that about one-half to three-fourths of female migraineurs experience a reduction in the frequency or total cessation of migraine attacks during pregnancy ¹⁶⁻²⁶, mainly in the second and third trimesters ^{21, 26}. However, we observed that about 40% of patients with any migraine experienced headache deterioration in early pregnancy as indicated by their MIDAS ranking. This finding may have several possible explanations. During the first trimester, women experience increased physiological and psychological changes including hormonal fluctuation, morning sickness, and sleep deprivation. In addition, there is a heightened cautiousness among women with regards to using medication during early pregnancy to prevent or treat their headaches. Maggioni et al reported that use of medication during pregnancy was reduced and restricted to a limited number of compounds ²¹.

It is well established that migraine aggregates within families. Our findings are generally consistent with studies documenting positive associations between family history of headache /migraine and migraine risk ³³⁻³⁴. Stewart and his colleagues observed that the relative risk (RR) of migraine in first-degree relatives of migraine probands was elevated compared with family members of controls (RR = 1.88; 95% CI: 1.30 - 2.72). They also noted that early onset of migraine in the proband, as well as the severity of migraine are associated with higher levels of family history of migraine ³³.

Notably, positive associations of obesity and migraine have been more consistently observed in reproductive aged women ³⁵⁻³⁷. In a cohort of 3,733 women interviewed during early pregnancy, Vo and her colleague observed that relative to normal weight women, obese women had a 1.48-fold increased odds of experiencing migraine (OR = 1.48; 95% CI 1.12-1.96). Severely obese (OR = 2.07; 95% CI 1.27-3.39) and morbidly obese (OR = 2.75; 95% CI 1.60-4.70) women had the highest odds of migraine ³⁷. The observed association between migraine and obesity is biologically plausible because obesity, comorbid with pain disorders including migraine, shares common pathophysiological characteristics including systemic inflammation ³⁸, and derangements in adipose-tissue derived cytokines ³⁹⁻⁴⁰.

Our finding concerning the association between childhood car sickness and migraine risk is in agreement with previous reports ^{34, 41}. Barabas et al compared the incidence of motion sickness among 222 children in four diagnostic categories--migraine, non-migraine headaches, seizure disorders, and learning disabilities. Motion sickness was found to be an associated feature in 45% of the cases of childhood migraine in contrast to a 5% to 7%

incidence in the other groups⁴¹. Motion sickness occurs in approximately 50% of migraine sufferers. The authors speculated important relationships between the trigeminal system and vestibular nuclei that may have implications for both motion sickness and migraine⁴².

Fatigue is a feeling of tiredness, exhaustion, or lack of energy. Fatigue ranks high among early symptoms of pregnancy. During early pregnancy, increased levels of the hormone progesterone, lower blood sugar levels, lower blood pressure and increased blood production might team up to sap women's energy. In a group of 1,334 women was interviewed during early pregnancy, migraineurs had an increased risk of fatigue (exhaustion) (OR = 2.04; 95% CI 1.52-2.76)⁴³.

Some important limitations must be considered when interpreting the results of our study. First, the cross-sectional study design precludes delineation of the temporal relation between correlates and migraine. Second, misclassification of headache type is possible, as indicated by the presence of 'aura-like' symptoms and "physician diagnosis" of migraine among non-migrainous participants. The questionnaire also did not ask women to describe multiple headache types, and it is presumed that subjects described the headache episodes most burdensome to them. Underreporting of less severe forms of headache is possible, and must be considered when interpreting the comparison of any migraine with non-migrainous headaches. Additionally, our results are limited by the ability of women to accurately recall headaches occurring before the index pregnancy, which may also be influenced by the severity of the headache. Therefore, possible errors in recall of self-reported information cannot be excluded. Finally, study findings may not be generalized to the broader population since our study was limited to largely well-educated, Non-Hispanic white women living in the Pacific Northwest of the US.

Results from our study and prior literature indicate high prevalence of migraine among pregnant women. Our finding that 40% of women with any migraine experienced headache deterioration in early pregnancy also further reflects the economic and physical impacts of migraine on pregnant women. We expect that present findings may contribute to the design and interpretation of analyses that evaluate perinatal outcomes in relation to maternal migraine status before and during pregnancy. In accordance with 'Lifting the Burden'⁴⁴, the global campaign against headache, large studies spanning the pregnancy period are warranted to identify the change in course of migraine in pregnancy and opportunities for targeted education and treatment.

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Abbreviation list

ICHD	the International Classification of Headache Disorders
MIDAS	Migraine Disability Assessment
ICHD-II	the International Classification of Headache Disorders-II
IHS	International Headache Society
DM	definitive migraine
PM	probable migraine
OR	odds ratios

CI	confidence intervals
BMI	body mass index
RR	relative risk
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
AMPP	American Migraine Prevalence and Prevention
SD	standard deviation
IQR	inter-quartile range

Figure 1.
The boxplots of Migraine Disability Assessment Score (MIDAS) before or during early pregnancy according to categories of pre-pregnancy body mass index (kg/m^2).

Figure 2.

the adjusted odds ratios (OR) and 95% confidence intervals (CI) of risk of any migraine according to maternal pre-pregnancy body mass index, family history of headache/migraine, history of childhood car sickness, asthma, and frequency of fatigue (exhaustion) prior to pregnancy. Odds ratios are adjusted for all the variables included in the figure. Y-axis is on logarithmic scale.

Table 1
Characteristics of study participants according to migraine classification by International Classification of Headache Disorders, 2nd edition (ICHD-II), Seattle, Washington, USA, April 2009 - December 2010

Characteristic	All Women N = 500	Definitive Migraine N = 100	Probable Migraine N = 49	No Migraine N = 351
Maternal Age (years)	33.4 ± 4.2	33.1 ± 4.4	32.7 ± 4.6	33.6 ± 4.1
Maternal Age Group				
22-24	4 (0.8)	1 (1.0)	2 (4.1)	1 (0.3)
25-29	90 (18.0)	17 (17.0)	8 (16.3)	65 (18.5)
30-34	222 (44.4)	51 (51.0)	23 (46.9)	148 (42.2)
35-39	145 (29.0)	22 (22.0)	12 (24.5)	111 (31.6)
40	39 (7.8)	0 (0.0)	4 (8.2)	26 (7.4)
Race/Ethnicity				
Non-Hispanic White	430 (86.0)	86 (86.0)	40 (81.6)	304 (86.6)
Non-Hispanic Black	8 (1.6)	2 (2.0)	2 (4.1)	4 (1.1)
Asian	39 (7.8)	6 (6.0)	4 (8.2)	29 (8.3)
Other	18 (3.6)	5 (5.0)	3 (6.1)	10 (2.9)
Missing	5 (1.0)	1 (1.0)	0 (0.0)	4 (1.1)
Annual Household Income				
<50,000	20 (4.0)	3 (3.0)	3 (6.1)	14 (4.0)
50,000-69,999	33 (6.6)	6 (6.0)	7 (14.3)	20 (5.7)
70,000	428 (85.6)	90 (90.0)	39 (79.6)	299 (85.2)
Missing	19 (3.8)	1 (1.0)	0 (0.0)	18 (5.1)
Post-Secondary Education	493 (98.6)	97 (97.0)	46 (93.9)	350 (99.7)
Married or Living with Partner	452 (90.4)	89 (89.0)	41 (83.7)	322 (91.7)
Pre-pregnancy BMI (kg/m²)	23.5 ± 4.7	24.3 ± 5.6	25.3 ± 4.9	23.0 ± 4.3
Pre-pregnancy BMI (kg/m²)				
<18.5	24 (4.8)	4 (4.0)	1 (2.0)	19 (5.4)
18.5-24.9	340 (68.0)	64 (64.0)	25 (51.0)	251 (71.5)
25.0-29.9	92 (18.4)	19 (19.0)	15 (30.6)	58 (16.5)
30.0	42 (8.4)	12 (12.0)	8 (16.3)	22 (6.3)
Missing	2 (0.4)	1 (1.0)	0 (0.0)	1 (0.3)
History of spontaneous abortion	150 (30.0)	30 (30.0)	19 (38.8)	101 (28.8)
Multiparous	239 (47.8)	42 (42.0)	26 (53.1)	171 (48.7)
Cigarette Smoker	95 (19.0)	23 (23.0)	7 (14.3)	65 (18.5)
Alcohol Use in Pregnancy	23 (4.6)	5 (5.0)	1 (2.0)	17 (4.8)
Pre-Pregnancy Medical Diagnosis				
Hypertension	11 (2.2)	3 (3.0)	4 (8.2)	4 (1.1)
Asthma	82 (16.4)	21 (21.0)	14 (28.6)	47 (13.4)
Sense of Exhaustion Prior to Preg.				
Never	359 (71.8)	57 (57.0)	23 (46.9)	279 (79.5)
Rare/Infrequently (<=1/month)	60 (12.0)	22 (22.0)	8 (16.3)	30 (8.5)

Characteristic	All Women N = 500	Definitive Migraine N = 100	Probable Migraine N = 49	No Migraine N = 351
Frequently/above (2-3/month)	79 (15.8)	21 (21.0)	16 (32.6)	42 (12.0)
Missing	2 (0.4)	0 (0.0)	2 (4.1)	0 (0.0)
Disease in Childhood				
Car sickness	93 (40.1)	48 (48.0)	17 (34.7)	28 (8.0)
Unexplained Fevers	7 (3.0)	4 (4.0)	2 (4.1)	1 (0.3)
Frequent Stomach aches	37 (16.0)	19 (19.0)	8 (16.3)	10 (2.9)
Unexplained Vomiting	7 (3.0)	3 (3.0)	3 (6.1)	1 (0.3)
Dizzy Spells	25 (10.8)	11 (11.0)	7 (14.3)	7 (2.0)
Headache	74 (31.9)	42 (42.0)	16 (32.7)	16 (4.6)
Any Family History Headache/Migraine	220 (44.0)	69 (69.0)	28 (57.1)	123 (35.0)

N (%) unless otherwise noted; SD = standard deviation; BMI=body mass index

Table 2
Distribution of headache characteristics used to classify migraine status among participants who reported headache episodes, Seattle, Washington, USA, April 2009-December 2010

Characteristics	Definitive Migraine (N=100) n (%)	Probable Migraine (N=49) n (%)	Other Headache N=83) n (%)
Lifetime number of episodes [*]			
1	0 (0.0)	0 (0.0)	17 (20.5)
2-4	0 (0.0)	0 (0.0)	23 (27.7)
5+	100 (100.0)	49 (100.0)	42 (50.6)
Typical length of episodes ^{†*}			
< 4 hours	0 (0.0)	29 (59.2)	42 (50.6)
4 – 72 hours	100 (100.0)	14 (28.6)	39 (47.0)
> 72 hours	0 (0.0)	6 (12.2)	2 (2.4)
Unilateral location [*]	59 (59.0)	25 (51.0)	19 (22.9)
Moderate/severe pain [*]	94 (94.0)	43 (87.8)	60 (72.3)
Pulsating quality [*]	68 (68.0)	26 (53.1)	28 (33.7)
Aggravated by physical exertion ^{†*}	82 (82.0)	29 (59.2)	31 (37.4)
Associated nausea/vomiting ^{†*}	85 (85.0)	30 (61.2)	30 (36.1)
Photo-and phonophobia ^{†*}	85 (85.0)	31 (63.3)	32 (38.6)
Central nerve system cause [*]	0 (0.0)	0 (0.0)	13 (15.7)

[†] p < 0.05, comparing definitive and probable migraine

^{*} p < 0.05, comparing probable migraine and other headache

Table 3
Headache-related disability in the 3 months before pregnancy among participants reporting lifetime headache episodes, Seattle, Washington, USA, April 2009- December 2010

Headache-Related Disability	Any Migraine [*] (N=149) n (%)	Other Headache (N=83) n (%)
Any Headache Attack during the 3 months prior to this pregnancy [†]		
No	57 (38.2)	56 (67.5)
Yes	77 (51.7)	15 (18.1)
Unknown	15 (10.1)	12 (14.5)
Pre-Pregnancy MIDAS Grade (mean $\pm$ SD) [†]	3.9 $\pm$ 9.1	1.0 $\pm$ 3.8
Pre-Pregnancy MIDAS Grade (median [IQR]) [†]	0 [0-4]	0 [0-0]
Pre-Pregnancy MIDAS Grade [†]		
I (minimal disability)	105 (70.5)	67 (80.7)
II (mild disability)	17 (11.4)	2 (2.4)
III (moderate disability)	9 (6.0)	1 (1.2)
IV (severe disability)	3 (2.0)	1 (1.2)
Unknown	15 (10.1)	12 (14.5)
Pre-Pregnancy Pain Scale (mean $\pm$ SD) [†]	3.3 $\pm$ 3.2	1.0 $\pm$ 2.3
Pre-Pregnancy Pain Scale (median [IQR]) [†]	4 [0-6]	0 [0-0]
Pre-Pregnancy Pain Scale [†]		
0 (none)	57 (38.2)	56 (67.5)
1-3	8 (5.4)	5 (6.0)
4-6	43 (28.9)	7 (8.4)
7-9	24 (16.1)	3 (3.6)
10 (highest)	2 (1.3)	0 (0.0)
Unknown	15 (10.1)	12 (14.5)
Pre-Pregnancy Headache Frequency (mean $\pm$ SD) [†]	3.8 $\pm$ 7.0	1.3 $\pm$ 3.7
Pre-Pregnancy Headache Frequency (median [IQR]) [†]	1 [0-4]	0 [0-0]
Pre-Pregnancy Headache Frequency [†]		
0 (no headache) in 3 month interval	57 (38.2)	56 (67.5)
<10 days in 3 month interval	58 (38.9)	12 (14.5)
10 days in 3 month interval	19 (12.8)	3 (3.6)
Unknown	15 (10.1)	12 (14.5)

N (%) unless otherwise noted; SD = standard deviation; IQR = inter-quartile range; MIDAS= Migraine Disability Assessment Score

^{*} Definitive plus probable migraines.

[†] p<0.05

Table 4
Headache-related disability* during the first 3 months of pregnancy among participants reporting lifetime headache episodes, Seattle, Washington, USA, April 2009- December 2010

Headache-Related Disability	Any Migraine* (N=149) n (%)	Other Headache (N=83) n (%)
Any Headache Attack in the first 3 months during pregnancy		
No	25 (16.8)	21 (25.3)
Yes	119 (79.9)	59 (71.1)
Unknown	5 (3.4)	3 (3.6)
Early Pregnancy MIDAS Grade (mean $\pm$ SD)	10.7 $\pm$ 19.9	6.4 $\pm$ 18.0
Early Pregnancy MIDAS Grade (median [IQR]) [†]	4 [0-12]	0 [0-6]
Pregnancy MIDAS Grade		
I (minimal disability)	85 (57.1)	59 (71.1)
II (mild disability)	20 (13.4)	10 (12.1)
III (moderate disability)	17 (11.4)	5 (6.0)
IV (severe disability)	22 (14.8)	6 (7.2)
Unknown	5 (3.4)	3 (3.6)
Early Pregnancy Pain Scale (mean $\pm$ SD)	4.9 $\pm$ 2.8	3.8 $\pm$ 2.8
Early Pregnancy Pain Scale (median [IQR]) [†]	6 [4-7]	4 [0-6]
Early Pregnancy Pain Scale		
0 (none)	25 (16.8)	21 (25.3)
1-3	10 (6.7)	13 (15.7)
4-6	57 (38.3)	30 (36.1)
7-9	49 (32.9)	16 (19.3)
10 (highest)	2 (1.3)	0 (0.0)
Unknown	6 (4.0)	3 (3.6)
Qualitative Pain Change since Pregnancy		
Same	49 (32.9)	22 (26.5)
Improved	21 (14.1)	6 (7.2)
Worsened	62 (41.6)	43 (51.8)
Unknown	17 (11.4)	12 (14.5)

N(%) unless otherwise noted; SD = standard deviation; IQR = inter-quartile range. MIDAS= Migraine Disability Assessment Score

* Definitive plus probable migraines

[†] p<0.05 for Mann-Whitney U test