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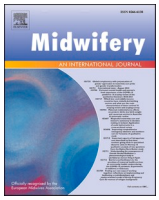
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Browsing throughout pregnancy: The longitudinal course of social media use during pregnancy

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ABSTRACT

Background: The number of people using social media has substantially increased over the past years. Previous studies have shown associations between social media overuse and mental health problems during pregnancy. The current study evaluates changes in social media use during pregnancy.
Methods: Pregnant women were recruited at their first antenatal appointment between January 2020 and July 2022 (N = 1135). The time spent on social media, frequency of social media use and problematic social media use, using the Bergen Social Media Addiction Scale (BSMAS), were assessed at 12, 20 and 28 weeks of pregnancy. Pearson r correlations and repeated measures ANOVAs were performed to assess possible changes in social media use over the course of pregnancy. Lastly, we stratified social media use throughout pregnancy for parity.
Results: There was a significant change in social media use over time, for the time spent on social media, frequency of social media use and problematic social media use. Mean social media scores were the lowest at 12 weeks of pregnancy and increased significantly at 20 weeks of pregnancy, after which they remained stable at 28 weeks. Compared to multiparous women, primiparous women spent more time on social media at 20 weeks of pregnancy, but not at 12 or 28 weeks.
Conclusion: Because overuse of social media has been associated with poor mental health, healthcare professionals should be aware of the intensity of social media use throughout pregnancy.

Introduction

Statement of Significance

Problem or Issue:
The number of people using social media has substantially increased over the past years.
What is already known:
Previous studies have shown associations between social media overuse and mental health problems during pregnancy.
What this Paper Adds:
The aim of this study is to assess the possible variability of intensity and problematic social media use over the course of pregnancy. There was a significant change in social media use over time. Mean social media scores were the lowest at 12 weeks of pregnancy and increased significantly at 20 weeks, after which they remained stable at 28 weeks.

Over the past years, the percentage of people using social media has increased. In 2012, 61.5 % of individuals aged 12 years and older used social media in the Netherlands (Statistics the Netherlands, 2012). In 2019, this rate was 87.4 % (Statistics the Netherlands, 2019) and even 96 % for people between the ages of 25 and 45 years (Statistics the Netherlands, 2019). Given these high percentages, it is important to understand the potential risk of excessive or even problematic social media use, as this could eventually lead to social media addiction. Problematic social media use refers to being less able to regulate social media use impulses, feeling discomfort when not able to use social media and thinking of the use of social media constantly (Griffiths et al., 2014). Previous studies have shown associations between excessive social media use and depressive symptoms in non-pregnant populations (Boer et al., 2021, 2020; Hussain and Griffiths, 2018; Lin et al., 2016; Shensa et al., 2017, 2018).

Pregnancy is a period in which many emotional, social, and physiological changes take place (Emmanuel and St John, 2010; Ridner, 2004). Pregnant women may therefore be especially vulnerable to problematic social media use and its negative consequences for mental

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health, such as more symptoms of depression, anxiety, and stress. Additionally, many social media platforms and influencers are specifically targeting pregnant women, for example through sharing pregnancy and child related products and advice (Chee et al., 2023). Pregnant women and mothers also target other (expectant) mothers with pregnancy-related posts, for example by sharing information and emotional support (Oviatt and Reich, 2019). Previous studies have indeed demonstrated associations between social media use during pregnancy and more negative affect, self-criticism, lower quality of life, and even higher levels of depressive symptoms (Muskens et al., 2023; Smith et al., 2020). A possible explanation for these associations is that pregnant women might have specific motivations to use social media. According to earlier research, the main reasons for women to use social media during the perinatal period are the need of social support, emotional support and information (Archer and Kao, 2018; Baker and Yang, 2018; Lupton, 2017; Smith et al., 2020). However, when seeking support online, women can be confronted with misinformation (Chee et al., 2023), judgment (Abetz and Moore, 2018), and unrealistic representations (Liechty et al., 2018).

Because problematic social media use may have negative consequences for the mental health of pregnant women, such as more symptoms of depression, anxiety and stress (Muskens et al., 2023; Smith et al., 2020), it is important to assess the use of social media over the course of pregnancy. During the three trimesters of pregnancy, women may have different motivations to use social media. For example, because of a higher risk of miscarriage, many women do not yet disclose their pregnancy in the first trimester (Lou et al., 2017). These women often search online for support and information to answer their questions (Lou et al., 2017; Sayakhot and Carolan-Olah, 2016), possibly resulting in increased use. In the third trimester, there may be different reasons pregnant women (over)use social media. Due to reduced mobility and changes in social and work-related activities, for instance, women may have reduced live social contacts, which could make them feel lonely. These women might use social media to compensate for not having many live contacts (O'Day and Heimberg, 2021). Taken together, problematic use of social media might not be stable during pregnancy, with variations from the first to the third trimester.

Furthermore, there might also be a difference in social media use during pregnancy for primiparous and multiparous women. Previous studies found that primiparous women experience more pregnancy-related worries and anxiety than multiparous women (Blackmore et al., 2016; Boekhorst et al., 2020; Huizink et al., 2016). As a consequence, primiparous women might search online for support and information more often than multiparous women who have already experienced a normal evolving pregnancy.

Optimal physical and mental health of pregnant women is of the utmost importance for both the mother and the fetus (Van den Bergh et al., 2017). Since social media use may increase pregnant women's mental health issues, including more symptoms of depression, anxiety and stress, increase self-criticism, and lower their quality of life (Muskens et al., 2023; Smith et al., 2020), it is important to understand during which trimesters pregnant women are most vulnerable to possible negative influences of social media and potentially problematic social media use. This might also be helpful for health care professionals, to know what the most optimal timing and frequency is in asking about social media use during pregnancy.

The primary aim of this study is to assess the possible variability of intensity and problematic social media use over the course of pregnancy from the first to the third trimester. The secondary aim was to assess whether primiparous and multiparous women differed in their social media use over the course of pregnancy. Based on existing literature, we expect to find a U-shaped pattern of social media use during pregnancy, with an increase of social media use in the first and third trimesters. Furthermore, we expect to find higher social media scores during pregnancy in primiparous women in comparison to multiparous women.

Materials and methods

Participants and procedure

Participants were recruited as part of a large longitudinal prospective cohort study in the Netherlands, the Brabant Study, of which details have been described elsewhere (Meems et al., 2020). Dutch-speaking women (18+ years old) were recruited by community midwives or obstetricians during their first antenatal appointment. Women with high-risk pregnancies were excluded from participation in the Brabant Study, to ensure that the study outcomes were not affected by pregnancies that are often characterized by (highly) invasive interventions, such as primary cesarean sections. Exclusion criteria were a multiple pregnancy, known endocrine disorder before pregnancy (other than thyroid function problems), type I diabetes mellitus, rheumatoid arthritis, severe psychiatric disorders (schizophrenia, borderline personality disorder, or bipolar disorder), HIV, drug or alcohol addiction problems or any other disease resulting in treatment with drugs that are potentially harmful for the fetus and need careful follow-up during pregnancy. At 12, 20 and 28 weeks of pregnancy, participants of the Brabant Study filled out questionnaires. Between May 2018 and July 2022, 2204 women agreed to participate in the study; however, five women did not provide written informed consent ($N = 2199$) and were subsequently excluded. Further, 516 women were included prior to January 2020, and subsequently did not receive the social media questionnaires, which were not administered prior to January 2020. Of the 1683 women that did receive the social media questionnaires, 1150 (68.3 %) women completed all social media use questions at 12, 20 and 28 weeks of pregnancy within a timeframe of four weeks (12 +/- 4 weeks, 20 +/- 4 weeks and 28 +/- 4 weeks). Furthermore, fifteen women participated during multiple pregnancies in the Brabant Study, for which all responses except their first complete participation were excluded from this study. This resulted in a total sample of 1135 women in the current study. See Fig. 1 for the flowchart.

The included sample ($N = 1135$) was compared to the excluded sample ($N = 460$) regarding demographic and obstetric variables. Only differences in educational level and employment were found between the women who completed all social media questionnaires and the women who did not. Women in the included sample were more often highly educated ($\chi^2(1)=3.97$, $p=.046$, phi coefficient=0.05, small effect size) and more often had a paid job ($\chi^2(1)=5.11$, $p=.024$, phi coefficient=0.06, small effect size).

The study was approved by the Medical Ethics Committee at the Máxima Medical Centre Veldhoven (NL64091.015.17).

Measures

Social media use

Both *intensity* of social media use and *problematic* social media use were measured at 12, 20 and 28 weeks of pregnancy. Social media were defined as: "Facebook, Instagram, LinkedIn, Pinterest, Twitter, YouTube, etc.".

Intensity of social media use

Both the time spent on social media (**SMU Time**) and the frequency of social media use (**SMU Frequency**) were measured. To measure SMU Time participants were asked how many hours per day they used social media ("How many hours a day do you use social media platforms?"). Participants could choose between nine options ranging from "*1 = I don't use social media*" to "*9=seven or more hours a day*". The scores were converted into actual hours that ranged between 0 and 7 h a day. More specifically, "I don't use social media" was recoded to 0 h, "less than half an hour a day" to 0.5 h, "3 hours a day" to 3 h, and "7 or more hours a day" was recoded to 7 h.

To measure SMU frequency, participants were asked how frequently

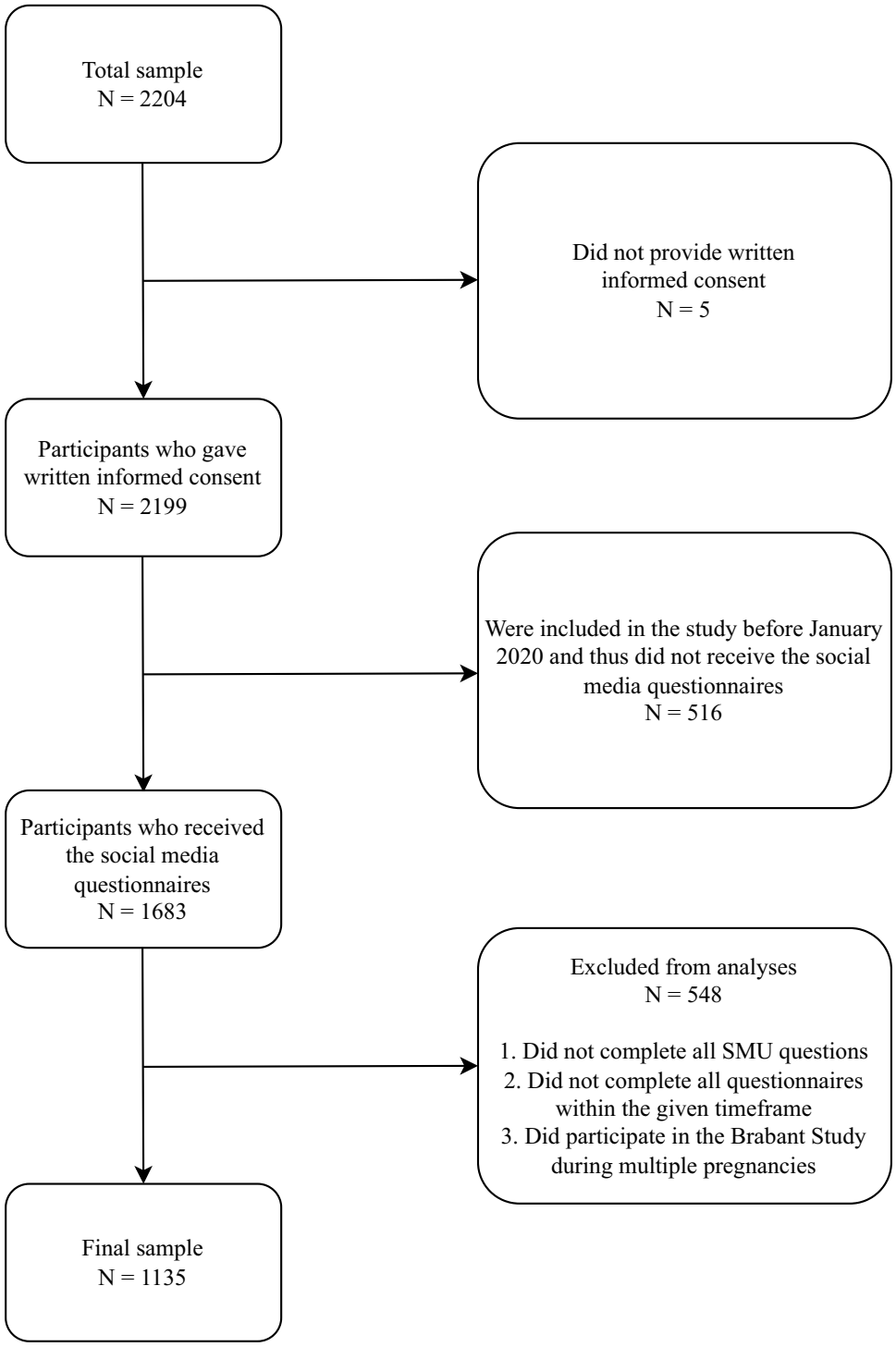


Fig. 1. Flowchart for the participating women in the current study (N = 1135).
Note: SMU, Social Media Use.

they visited social media platforms ("How frequently do you visit social media platforms?"). Participants could select one of the seven options, ranging between *1 = I don't use social media* and *7=five or more times a day*. These scores were converted into mean social media visits per week that ranged between 0 and 35 visits (Shensa et al., 2017, 2018). For example, I don't use social media was recoded to 0 visits, less than once a week was recoded to 0.5 visits, 3–6 days a week to 4.5 visits and 5 or more times a day was recoded to 35 visits.

Problematic social media use

The Bergen Social Media Addiction Scale (BSMAS) was used to assess problematic social media use during pregnancy (Andreassen et al., 2016). This questionnaire is adapted from the validated Bergen Facebook Addiction Scale (Andreassen et al., 2012). Each item represents one of six core elements of addiction: salience, mood modification, tolerance, withdrawal, conflict, and relapse (Griffiths, 2005). For example, women were asked to what extent they tried to cut down on the use of social media without success. Participants were asked to rate

six items on a five-point Likert Scale (*1=Very rarely to 5=Very often*). Total scores range from 6 to 30 and higher scores indicate more problematic social media use. In the current study, the Cronbach's alpha of the BSMAS ranged between 0.76 and 0.79. Furthermore, in this study a cut-off score of 3 or above on at least four of the six items, indicates *potential social media addiction* (Andreassen et al., 2012).

Descriptive characteristics

At 12 weeks of pregnancy demographic, obstetric and psychological features were assessed such as age, level of education, employment, having a partner, parity, unplanned pregnancy, previous miscarriage or abortion and depression earlier in life using self-report.

Statistical analyses

To assess whether the three social media variables were stable over time, the rank-order stability of the variables was checked by performing Pearson *r* correlations between all three time points for each social media variable separately. Furthermore, to assess possible change in social media use scores over time (12, 20 and 28 weeks of pregnancy), three repeated measures ANOVAs were performed to evaluate the mean-level stability for the three social media variables. Using three mixed between-within-subjects ANOVAs, the possible change of social media use over time (SMU Time, SMU Frequency and BSMAS) in both primiparous and multiparous women were assessed. Lastly, independent sample *t*-tests were used to show possible differences in mean social media use scores between the primiparous and multiparous women. Analyses were performed in SPSS (version 27.0).

Results

Table 1 shows the participant characteristics and mean variable scores. Women in the current study had a mean age of 31.3 (SD=3.6).

Table 1
Characteristics of the participating women ($N = 1135$).

	No. (%)	Mean (SD)	Range
Demographics			
Age (years)		31.33 (3.58)	19–43
High level of education[a]	838 (73.8)		
Employment	1102 (97.1)		
Having a partner	1118 (98.5)		
History of depression	134 (11.8)		
Pregnancy related			
Multiparity	536 (47.2)		
Unplanned pregnancy	76 (6.7)		
Previous miscarriage / abortion	324 (28.5)		
Social media use			
SMU Time[b]			
12 weeks		1.60 (1.05)	0–7
20 weeks		1.78 (1.12)	0–7
28 weeks		1.80 (1.17)	0–7
SMU Frequency[c]			
12 weeks		19.79 (11.1)	0–35
20 weeks		20.42 (11.1)	0–35
28 weeks		20.56 (11.1)	0–35
BSMAS			
12 weeks		9.40 (3.22)	6–24
20 weeks		9.76 (3.57)	6–30
28 weeks		9.84 (3.42)	6–26
Cut-off BSMAS			
Above cut-off BSMAS ≥1[d]	119 (10.5)		
12 weeks	59 (5.2)		
20 weeks	80 (7.0)		
28 weeks	65 (5.7)		

Note: SD, standard deviation; SMU, Social Media Use
[a] Bachelor's degree or higher; [b] Assessed in hours per day; [c] Measuring site visits per week; [d] women who scored above the BSMAS cut-off at least once during their pregnancy.

Most women were employed (97.1 %) and had a partner (98.5 %). Almost half of the women were multiparous (47.2 %). Fig. 2(a–c) shows the mean social media scores for SMU Time, SMU Frequency and the BSMAS, respectively. Throughout pregnancy, women spent between 1.6 and 1.8 h a day on social media and reported to visit social media platforms between 19.8 and 20.6 times per week. The mean BSMAS scores were 9.40, 9.76 and 9.84 at 12, 20 and 28 weeks, respectively. Of the 1135 women, 119 (10.5 %) scored above the cut-off of the BSMAS at least once. At 12, 20 and 28 weeks of pregnancy, 59 (5.2 %), 80 (7.0 %) and 65 (5.7 %) of women scored above the BSMAS cut-off, respectively.

Demographic and obstetric variables were compared between women who scored above the BSMAS cut-off and the group of women who did not. Women who scored above the cut-off, less often had a paid job ($\chi^2(1)=6.86$, $p=.009$, phi coefficient=-0.08, small effect size) and more often had a history of depression ($\chi^2(1)=15.12$, $p < .001$, phi coefficient=0.12, small effect size). The two groups did not differ regarding age, level of education, having a partner, parity, unplanned pregnancy and previous miscarriage or abortion.

Stability of social media use during pregnancy

The data on the three timepoints, 12, 20 and 28 weeks of pregnancy, were significantly correlated within each social media variable, which means the social media variables were stable over time, all $p < .001$ (see Table 2).

Next, repeated measures ANOVAs were used to assess the possible change in social media use scores from 12 to 28 weeks of pregnancy. A significant change in SMU Time was demonstrated across the three different time points, Wilks' Lambda=0.94, $F(2, 1133)=36.39$, $p<.001$, multivariate partial eta squared=0.06. Post-hoc pairwise comparisons showed significant differences in SMU Time between 12 ($M = 1.60$, SD=1.05) and 20 ($M = 1.78$, SD=1.12) weeks of pregnancy ($p < .001$) and 12 and 28 ($M = 1.79$, SD=1.17) weeks of pregnancy ($p<.001$). No differences were found between 20 and 28 weeks of pregnancy.

Furthermore, there was also a significant change in SMU Frequency over time, Wilks' Lambda=0.99, $F(2, 1133)=5.14$, $p=.006$, multivariate partial eta squared=0.01. Post-hoc pairwise comparisons showed significant differences in SMU Frequency between 12 ($M = 19.79$, SD=11.1) and 20 ($M = 20.42$, SD=11.1) weeks of pregnancy ($p=.038$) and 12 and 28 ($M = 20.56$, SD=11.1) weeks of pregnancy ($p=.007$). No differences were found between 20 and 28 weeks of pregnancy.

Lastly, a significant change in BSMAS scores was also demonstrated, Wilks' Lambda=0.97, $F(2, 1133)=17.39$, $p < .001$, multivariate partial eta squared=0.030. Significant differences were found between 12 ($M = 9.40$, SD=3.22) and 20 ($M = 9.76$, SD=3.57) weeks of pregnancy ($p < .001$) and 12 and 28 ($M = 9.84$, SD=3.42) weeks of pregnancy ($p < .001$). No differences were found between 20 and 28 weeks of pregnancy.

Differences in social media use according to parity

Results of the mixed between-within subjects ANOVA showed that there was a significant interaction between parity and time for SMU Time, Wilks' Lambda=0.99, $F(2, 1132)=3.61$, $p=.027$, multivariate partial eta squared=0.006. T-tests showed that SMU time was significantly higher in primiparous ($M = 1.87$, SD=1.16) compared to multiparous ($M = 1.67$, SD=1.07) women, at 20 weeks of pregnancy only, $t(1133)=3.10$; $p=.002$, Cohen's $d = 0.184$. See Fig. 3a.

Furthermore, there was no significant difference in the course of SMU Frequency between primiparous and multiparous women, Wilks' Lambda=0.999, $F(2, 1132)=0.32$, $p = .726$, multivariate partial eta squared=0.001. T-tests also did not show significant differences. See Fig. 3b.

The last analysis showed a significant interaction between parity and time for the BSMAS, Wilks' Lambda=0.99, $F(2, 1132)=4.08$, $p = .017$, multivariate partial eta squared=0.007. T-tests did not show any

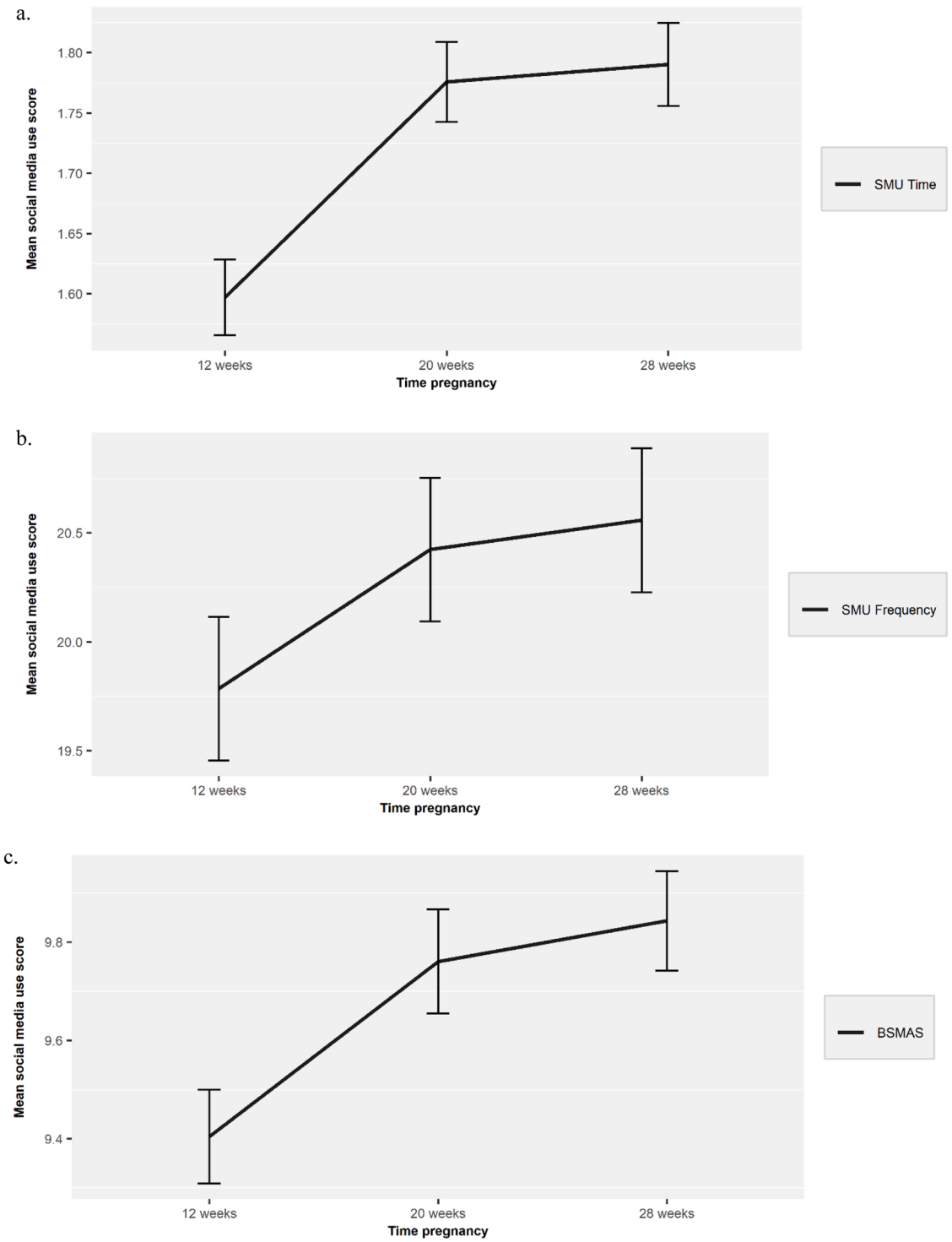


Fig. 2. Mean social media use scores at 12, 20 and 28 weeks of pregnancy for SMU Time (panel a), SMU Frequency (panel b) and the BSMAS (panel c).
Note: SMU, Social Media Use; BSMAS, Bergen Social Media Addiction Scale. Error bars are standard error of the mean.

significant differences between the two groups. See Fig. 3c.

Discussion

This longitudinal study is among the first showing a linear increase throughout pregnancy of three types of social media use (SMU Time, SMU Frequency and the BSMAS). In the current study, 10.5 % of pregnant women were possibly addicted to social media. Primiparous women spent more time on social media than multiparous women, but only in the second trimester. Primiparous and multiparous women did not differ in frequency or problematic use of social media.

The current study showed that social media use was the lowest in the first trimester of pregnancy, which is not completely in line with our expectations. Based on previous literature, we expected to find a U-shape patterns of social media use during pregnancy. More specifically, we expected to find higher social media use in the beginning of pregnancy. Many women keep their pregnancy a secret in the first trimester because of a higher risk for miscarriage. These women often search

Table 2
Pearson correlations between the different timepoints (12, 20 and 28 weeks of pregnancy) for the three social media variables.

	1.	2.	3.
1. SMU Time 12			
2. SMU Time 20	.715***		
3. SMU Time 28	.712***	.757***	
	4.	5.	6.
4. SMU Frequency 12			
5. SMU Frequency 20	.700***		
6. SMU Frequency 28	.701***	.721***	
	7.	8.	9.
7. BSMAS 12			
8. BSMAS 20	.717***		
9. BSMAS 28	.674***	.726***	

Note: BSMAS, Bergen Social Media Addiction Scale; SMU, Social Media Use; ***$p < .001$.

online for information and to share their experiences (Lou et al., 2017; Sayakhot and Carolan-Olah, 2016), possibly resulting in increased use. In addition, we expected higher social media use in the third trimester, because of reduced mobility and changes in social and work-related activities. Women in their third trimester might use social media to compensate for not having many live contacts (O'Day and Heimberg, 2021). Our results were not in line with our first expectation as we did not find higher scores in the first trimester. This might be because pregnant women use other sources to find information regarding their pregnancy instead of using social media. A recent narrative literature review stated that although social media is a common source to look up pregnancy related-information, the exact percentages vary greatly across different studies (Conrad, 2022). This review also notes that many studies found women using search engines on the internet most frequently to find answers to their pregnancy related-questions (Conrad, 2022). For the current study, this could imply that women might still use the internet often at the beginning of their pregnancy, but not necessarily social media platforms.

Furthermore, the results of the current study showed that social media use did not differ according to parity, but that primiparous women did spend more time on social media in the second trimester. Primiparous women often experience more pregnancy-related worries and anxiety in comparison to multiparous women, who already have experience with being pregnant as well as childbirth (Blackmore et al., 2016; Boekhorst et al., 2020; Huizink et al., 2016). This might explain why primiparous women spent more time on social media, in order to search online for pregnancy-related support and information. Why we only found a difference between primiparous and multiparous women at 20 weeks of pregnancy, and not at 12 and 28 weeks, needs to be addressed in future research. This is important, as this increase in social media use could have negative effects on the mental health of pregnant women, for example it could lead to more symptoms of depression, anxiety and stress (Muskens et al., 2023; Smith et al., 2020). The use of social media has increased over the past years (Statistics the Netherlands, 2012; Statistics the Netherlands, 2019). Almost everyone in the Netherlands aged between 25 and 45 years uses social media nowadays (Statistics the Netherlands, 2012). Moreover, in the current study, the percentage of women scoring above the cut-off of potential social media addiction was 10.5 %, making this group of pregnant women extra vulnerable. These women might need to be carefully monitored by healthcare professionals, as associations between excessive social media use with poor mental health and poor sleep outcomes have been found (Alonzo et al., 2021). Both optimal mental health and good sleep quality of pregnant women is of the utmost importance for both the mother and the fetus (Lu et al., 2021; Van den Bergh et al., 2017).

The current study has strengths and limitations. Important strengths of this study are the relatively large sample size ($N = 1135$) and the longitudinal design with assessments of social media use at each trimester. Furthermore, regarding obstetric parameters, such as parity, age, and number of previous miscarriages, the current sample is similar to the National Dutch birth figures (Perined, 2021). A limitation of this study is that social media use was measured by self-report, which may have caused retrospective bias (Seabrook et al., 2016). Future research could use the experience sampling method, which could serve as a more direct method to register social media use (Seabrook et al., 2016; van den Heuvel et al., 2021). Smartphone data can also be used to assess patterns of social media use (Mahalingham et al., 2023). Also, we did not specify the type of social media used. For example, the use of pregnancy support apps (with discussion forum) may be seen as social media by some, but not by others. Moreover, we did not ask what kind of content the women consumed on social media. Future research could focus on the motivations of women to use social media during pregnancy, for example for reassurance, social support, relaxation, or to learn about pregnancy, and the possible association with positive and negative feelings, such as feeling more content, happy, anxious, or worried. Furthermore, social media use during pregnancy was assessed at 12, 20 and 28 weeks of pregnancy. It would have been interesting to have an additional assessment around 36 weeks of pregnancy, when all women in the Netherlands are on pregnancy leave. At that time, pregnant women might use more social media, due to increased spare time and (potential) reduced mobility. Another limitation is that our sample included predominantly white, Dutch women who were more often highly educated, compared to the national figures (Statistics the Netherlands, 2021). This may limit the generalizability of the results.

For future research it might be relevant to gain a comprehensive understanding of the motives of women for utilizing social media during pregnancy as well as the adverse and beneficial effects they may encounter. This can be researched by a qualitative study to gain more insight in women's thought processes and experiences. Besides that, it might be beneficial to conduct a quantitative study to further investigate the associations between specific motivations to use social media during pregnancy and negative outcomes. For example, it would be interesting to know whether spending time catching up with friends and family members on social media would have the same impact on the mental health of pregnant women as compared to seeking parenting advice and support from strangers who may express opposing opinions to one's personal opinions and beliefs. In the current study, social media was assessed as one construct, rather than splitting it into different social media types (Facebook, Instagram, pregnancy-apps, etc.) and/or aspects (posting photos/videos, browsing content, interacting/responding, etc.). It could be, however, that specific types and/or aspects of social media use show a different pattern over time during pregnancy and might be uniquely associated with specific mental health outcomes. Therefore, future research should focus on differentiating these potential effects.

In conclusion, our findings indicate that pregnant women use more social media as pregnancy progresses and that primiparous women spent more time on social media in the second trimester compared to multiparous women. One out of ten pregnant women were potentially addicted to social media, which is of importance for healthcare professionals, because of its association with negative mental health outcomes, such as more symptoms of depression, anxiety and stress (Muskens et al., 2023; Smith et al., 2020). Additionally, more research should focus on investigating the underlying mechanisms of the association between problematic social media use and mental health issues, specifically in pregnant women.

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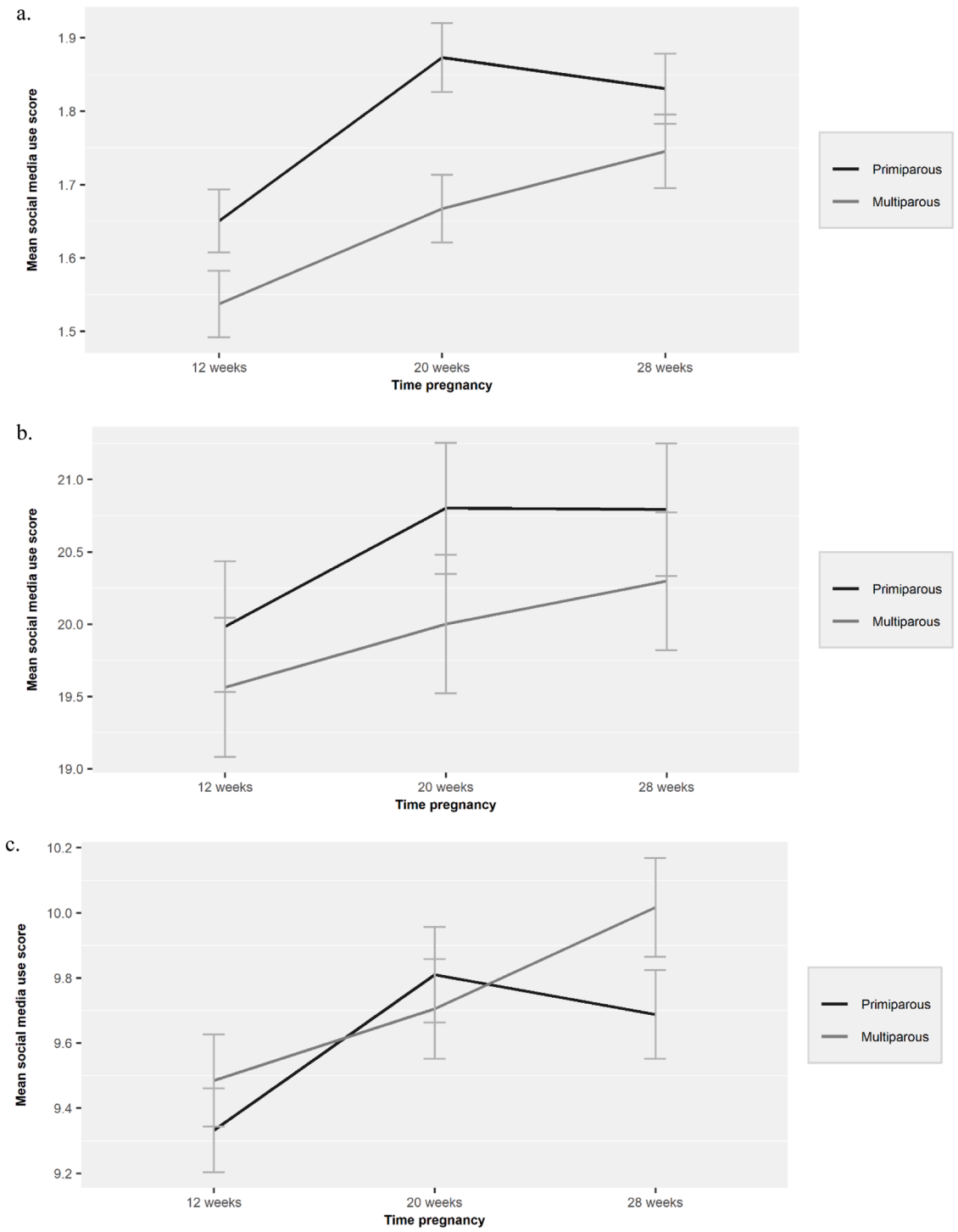


Fig. 3. Mean social media use scores at 12, 20 and 28 weeks of pregnancy for SMU Time (panel a), SMU Frequency (panel b) and the BSMAS (panel c) for primiparous and multiparous women.
Note: Error bars are standard error of the mean.

CRediT authorship contribution statement

Lotte Muskens: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Visualization. **Myrthe G.B.M. Boekhorst:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Victor J.M. Pop:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration. **Marion I. van den Heuvel:** Conceptualization, Methodology, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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