

The Moderating Effect of Self-Efficacy on Pregnancy Stress and Smartphone Addiction of Pregnant Women in Late Pregnancy: A Longitudinal Study

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Purpose: We aimed to understand the current situation of smartphone addiction in pregnant women, and explored the moderating effect of self-efficacy between pregnancy stress and smartphone addiction.

Patients and Methods: This study adopted a longitudinal design to collect pregnant women from the obstetrics and gynecology department of a tertiary hospital in Shenyang in 2020 from early pregnancy (T1) to their late pregnancy (T2). A total of 342 questionnaires were collected, including the Smartphone Addiction Scale-Short Version (SAS-SV), the Pregnancy Pressure Scale (PPS), and the Chinese version of the General Self-Efficacy Scale (GSES). Multiple hierarchical regression and simple slope test were used to test the moderating effect of self-efficacy.

Results: Smartphone addiction in T2 (44.74) was more severe than in T1 (33.11). The interaction item of T1 pregnancy stress and T2 self-efficacy was positively correlated with smartphone addiction ($\beta=0.205$, $P<0.01$) and explained an additional 3.2% variance ($\Delta R^2=0.032$, $P<0.01$). The influence of pregnancy stress on smartphone addiction was gradually decreased in the low, mean, and high groups of self-efficacy.

Conclusion: Smartphone addiction in late pregnancy was more severe than that in early pregnancy, possibly due to increased pregnancy stress. The self-efficacy of pregnant women could reduce the impact of pregnancy stress on smartphone addiction. Medical staff can alleviate the bad behavior by improving their self-efficacy.

Keywords: late pregnancy, pregnancy stress, smartphone addiction, self-efficacy, moderating effect

Introduction

In recent years, with the popularity of smartphones, the focus of researchers has gradually shifted to the study of smartphone addiction behavior which is a common phenomenon in the social environment.^{1,2} Smartphone addiction refers to the negative impact on individuals or society caused by long-term excessive use of smartphones, such as impulsive use of phones, ignoring the surrounding environment, or affecting interpersonal communication.³ The unique accessibility and convenience of smartphones, as well as the ease and usefulness of application push messages, make addiction more likely to occur and affect more people.⁴ Previous studies have shown that women were more prone to smartphone addiction than men, so the mobile phone addiction behavior of pregnant women cannot be ignored.⁵ Firstly, pregnant women rely on smartphones to obtain parenting information. Secondly, changes in the emotions and personal experiences of pregnant women, as well as their ability to cope with persistent emotional distress, greatly enhance addiction and develop sustained coping strategies, namely, escaping reality through smartphones.⁶ Smartphone addiction can lead to various psychological problems and affect an individual's physical health.^{7,8} In addition, the high comorbidity of smartphone addiction and psychiatric disorders can also affect major social functions and daily life.⁹ For pregnant women, smartphone addiction not only leads to the aforementioned hazards, but is also highly likely to lead to adverse pregnancy outcomes.¹⁰

Pregnancy stress referred to the psychological threat caused by various stress events during pregnancy, mainly manifested as concerns about the health of mother and baby, difficulty adapting to multiple roles (mother, wife, patient, etc.), and family economic burden.¹¹ A study on pregnant women in northwest China showed that Among 750 respondents, 709 (94.53%) had mild or above pregnancy stress.¹² The ACE (Anonymity, Convenience, and Escape) theoretical model proposed by Young¹³ illustrated that the network had the characteristic of avoidance, and individuals used the network to escape the pressure generated in life. The cognitive-behavioral model of PIU (pathological internet use) proposed by Davis¹⁴ believed that the occurrence of internet addiction behavior was closely related to negative psychological factors. Therefore, people with higher levels of stress were more inclined to use their phones as a way to alleviate negative emotions, thus forming addiction behavior.^{15,16}

The perception of stressors factors depended on the personal capacity to elaborate. In the presence of stressors, individuals might or might not have obvious stress symptoms.¹⁷ Self efficacy was an individual's subjective judgment and level of confidence in whether they could successfully complete a certain behavioral goal or activity task when facing a specific situation.¹⁸ Many studies have shown that individuals with high self-efficacy can better control internet addiction.^{19,20} When faced with the same source of stress, individuals with high self-efficacy adopted different corresponding strategies, which in turn affected healthy behavior.^{21,22} Studies on college students have shown that self-efficacy played a positive role in the relationship between physical activity and internet addiction.²³ However, there was no research to confirm that self-efficacy can moderate the impact of pregnancy stress on smartphone addiction.

Transition refers to the transition from one life stage or state to another, during which individuals may face changes in their physical health, role relationships, expectations, and abilities, making them vulnerable to the impact of risk.²⁴ The pregnancy in this study belongs to a transitional developmental transition period, which might have an impact on the health and behavior of pregnant women. The self-efficacy theory emphasizes the exploration of internal psychological processes and the regulatory role of self factors on behavior, which can help pregnant women better adapt to their own changes.²⁵ Based on the above theory, this article proposed the following hypothesis: self-efficacy can moderate the relationship between pregnancy stress and smartphone addiction.

Materials and Methods

Study Design and Sample

This study adopted a longitudinal design to collect pregnant women in early pregnancy (T1) who underwent examinations in the obstetrics and gynecology department of a tertiary hospital in Shenyang in 2020, and conducted follow-up surveys in their late pregnancy (T2). All pregnant women signed a written informed consent form. According to Kendall's²⁶ sample size standard, the sample size was 10–20 times the number of variables. This study contained 17 variables, and considering a 20% dropout rate, the sample size was 306–408. Finally, a total of 400 Chinese questionnaires were sent out in this survey, 26 invalid questionnaires (incomplete content and a large number of duplicates) were eliminated in T1 stage, and 374 valid questionnaires remained. During T2 stage, 374 respondents were followed up, and a total of 356 completed the follow-up (18 were lost). After removing 14 invalid questionnaires, 342 (85.5%) valid questionnaires were finally recovered. Inclusion criteria: gestational age before 14 weeks (T1); no complications or endocrine system diseases; no mental illness.

Measurements

Demographic Variables

A self-filled questionnaire was used, which included age, occupation (business/ service industry, civil servants/public institutions, unemployed, and others), personal monthly income (RMB) (<2000 yuan, 2001–4000 yuan,>4001yuan), whether the husband smoked, daily exercise time (<2h, 2–4h, 4–8h), daily exposure to noise (no,<15min, 15min–1h,>1h).

Measurement of Smartphone Addiction

The Smartphone Addiction Scale-Short Version (SAS-SV) was used.²⁷ The scale included 10 items and used a 1–6 level scoring system from “strongly disagree” to “strongly agree”. Add the scores of all items to get the total score. The total score range was 10–60, and high scores represented a high level of smartphone addiction. Cronbach's alpha coefficient was 0.89 in this study.

Measurement of Pregnancy Stress

The Pregnancy Pressure Scale (PPS) was used.²⁸ The scale included 30 items and used a 1–4 level scoring system from “not at all” to “always”. Add the scores of all items to get the total score. The total score range was 30–120, and high scores represented a high level of pregnancy stress. Cronbach’s alpha coefficient was 0.91 in this study.

Measurement of General Self-Efficacy

The Chinese version of the General Self-Efficacy Scale (GSES) was used.²⁹ The scale included 10 items and used a 1–4 level scoring system from “completely incorrect” to “completely correct.” Add the scores of all items to get the total score. The total score range was 10–40, and high scores represented a high level of self-efficacy. Cronbach’s alpha coefficient was 0.94 in this study.

Statistic Analysis

This study was analyzed by IBM SPSS 26.0 software. Descriptive statistics, t-tests, and analysis of variance were used for one-way analysis. Partial correlations analysis was used to describe the correlation between variables. The multiple stratified regression analysis was used to preliminarily test the moderating effect of self-efficacy on the impact of pregnancy stress on smartphone addiction. If the standardized regression coefficient of the interaction term was meaningful, it could indicate the existence of a moderating effect, and centralized variables before regression analysis.³⁰ The simple slope test was used to visualize the moderating effect of self-efficacy. Using a two-tailed test, the significance level was set to $\alpha = 0.05$.

Results

The Impact of Demographic Characteristics on Smartphone Addiction

The results showed that there was a statistically significant difference in smartphone addiction of pregnant women among different professions and daily exercise hours ($P < 0.05$), as shown in [Table 1](#).

Psychological Health Status in Early and Late Pregnancy

Compared to early pregnancy, the pregnancy stress and smartphone addiction in late pregnancy were more severe, as shown in [Table 2](#).

Correlation Analysis of Pregnancy Stress, Self-Efficacy, and Smartphone Addiction

From [Table 3](#), it could be seen that pregnancy stress was negatively correlated with self-efficacy ($P < 0.01$), and positively correlated with smartphone addiction tendency ($P < 0.01$). There was a negative correlation between self-efficacy and smartphone addiction tendency ($P < 0.01$).

The Moderating Effect of Self-Efficacy on Pregnancy Stress and Smartphone Addiction

In the first step, age, occupation, and daily exercise time were added to the regression model as control variables. In the second step, pregnancy stress and self-efficacy were added to the regression model, with regression coefficients of 0.436 and -0.148 , respectively, jointly explaining the 24.8% variation in the smartphone addiction of pregnant women. Add the pregnancy stress * self-efficacy after centralized treatment to the regression model in Step 3, and its interaction term ($\Delta R^2 = 0.032$, $\beta = 0.205$, $P < 0.01$) had a significant impact on smartphone addiction, explaining a 3.2% variation in smartphone addiction. Self-efficacy played a moderating role between pregnancy stress and smartphone addiction, as shown in [Table 4](#).

Divide the subjects into high self-efficacy group (Mean \pm SD), medium self-efficacy group (Mean), and low self-efficacy group (Mean \pm SD) based on the mean of self-efficacy and its next standard deviation, and draw a moderating effect map. The results in [Figure 1](#) showed that as self-efficacy increased from low to high, the impact of pregnancy stress on smartphone addiction gradually decreased. Self-efficacy played a moderating role in the relationship between pregnancy stress and smartphone addiction.

Table 1 Demographic Variables of Participants in Relation to Smartphone Addiction

Variables	N(%)	SAS-SV Score	F/t	P-value
Age (Years)			1.678	0.094
≤30	96 (28.1%)	44.17±9.92		
>30	246 (71.9%)	42.17±9.91		
Occupation			3.043	0.029
Business/Service Industry	148 (43.3%)	43.21±9.73 ^a		
Civil servants/public institutions	76 (22.2%)	39.80±10.96 ^{ab}		
Unemployed	98 (28.7%)	44.01±8.57 ^b		
Others	20 (5.8%)	44.15±12.01		
Average monthly income			0.131	0.878
<2000CNY	87 (25.4%)	42.35±8.91		
2001–4000CNY	135 (39.5%)	43.04±10.02		
>4001CNY	120 (35.1%)	42.66±10.61		
Husband smoking situation			−0.900	0.369
Yes	114 (33.3%)	42.05±9.81		
No	228 (66.7%)	43.07±10.00		
Daily exercise time			20.262	<0.001
<2h	235 (68.7%)	44.42±8.85 ^a		
2–4h	83 (24.3%)	41.01±10.53 ^a		
4–8h	24 (7.0%)	32.17±10.79 ^a		
Daily exposure time to noise			1.994	0.115
No	137 (40.1%)	41.16±10.63		
<15min	105 (30.7%)	44.08±9.69		
15min–1h	75 (21.9%)	43.44±8.77		
>1h	25 (7.3%)	43.64±9.72		

Notes: ^{a,b}The difference in variables was statistically significant after pairwise comparison with Least-Significant Difference. partial η^2 : occupation=0.026, daily exercise time=0.052.

Table 2 Psychological Health Status in Early and Late Pregnancy

Variables	T1	T2	t	P-value
PPS Score	39.07±8.85	43.31±15.20	−4.467	<0.001
GSES Score	28.72±6.82	28.04±7.57	1.236	0.217
SAS-SV Score	33.11±9.83	44.74±9.94	−12.717	<0.001

Notes: T1, Early pregnancy (less than 14 weeks); T2, Late pregnancy (greater than 28 weeks); PPS Score, score of pregnancy stress; GSES Score, score of general self-efficacy; SAS-SV Score, score of smartphone addiction.

Table 3 Correlation Analysis of Pregnancy Stress, Self-Efficacy, and Smartphone Addiction

Variables	T1 PPS Score	T1 GSES Score	T1 SAS-SV Score	T2 PPS Score	T2 GSES Score	T2 SAS-SV Score
T1PPS Score	1					
T1GSES Score	−0.262**	1				
T1SAS-SV Score	0.276**	−0.142**	1			
T2PPS Score	0.961**	−0.231**	0.266**	1		
T2GSES Score	−0.335**	0.135*	−0.047	−0.321**	1	
T2SAS-SV Score	0.589**	−0.163**	0.123*	0.560**	−0.340**	1

Notes: T1, Early pregnancy (less than 14 weeks); T2, Late pregnancy (greater than 28 weeks); PPS Score, score of pregnancy stress; GSES Score, score of general self-efficacy; SAS-SV Score, score of smartphone addiction.* $P<0.05$, ** $P<0.01$.

Table 4 Multiple Regression Analysis of Pregnancy Stress, Self-Efficacy, and Smartphone Addiction

Variables	T2 SAS-SV Score		
	Step1 (β)	Step2(β)	Step3(β)
Age	-0.093	-0.050	-0.068
Occupation 1	-0.117*	-0.115*	-0.122**
Occupation 2	0.062	0.045	0.036
Occupation 3	0.025	0.026	0.024
Daily exercise time	-0.309**	-0.230**	-0.207**
T1 PPS Score		0.436**	0.533**
T2 GSES Score		-0.148**	-0.158**
T1 PPS Score*T2 GSES Score			0.205**
F	9.974**	28.948**	28.825**
R ²	0.129	0.378	0.409
ΔR^2	0.129	0.248	0.032

Notes: T1, Early pregnancy (less than 14 weeks); T2, Late pregnancy (greater than 28 weeks); PPS Score, score of pregnancy stress; GSES Score, score of general self-efficacy; SAS-SV Score, score of smartphone addiction.; Occupation 1: Civil servants/Public institutions vs Business/Service Industry; Occupation 2: Unemployed vs Business/Service Industry; Occupation 3: Others vs Business/Service Industry; *P < 0.05, **P < 0.01.

Discussion

The smartphone addiction among women in the third trimester of pregnancy in this study was above average. Compared to early pregnant women, late pregnant women have a higher smartphone addiction. Pregnant women showed more concern for fertility as their gestational age increased, and they needed to search online for information related to fertility. At the same time, as the workload decreased, they spent more time on smartphones, increasing the smartphone addiction. Excessive use of smartphone could have adverse effects on the main social functions and daily life of pregnant women.³¹ In addition, smartphone addiction could lead to physiological problems such as headaches, ear pain, enlarged median nerve, decreased grip and hand function, arm or shoulder soreness, poor immune system, and psychological problems

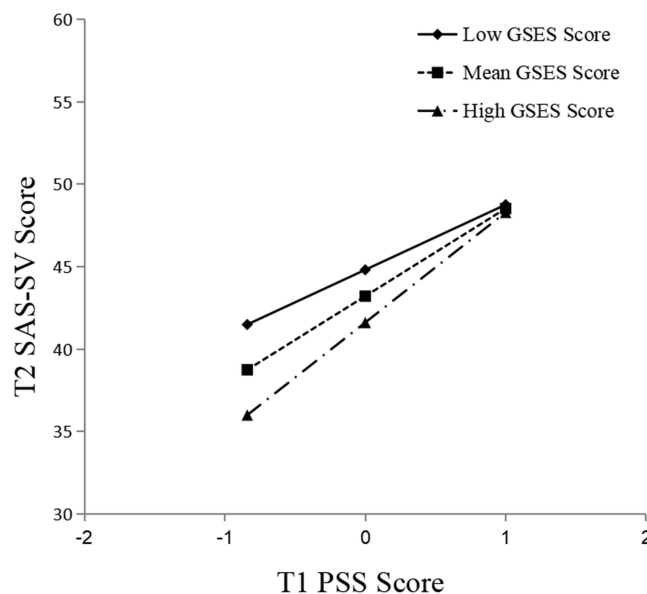


Figure 1 Simple slope test chart of self-efficacy regulation effect.

such as irritability, sleep disorders, and depression.^{5,32} Medical staff should remind pregnant women to control their smartphone addiction, thus avoiding adverse risks during pregnancy.

The overall level of pregnancy stress in this article was higher than similar studies.³³ This might be because our research was carried out in 2020, when the whole country was suffering from COVID-19, which had a certain impact on their admission and also increased their psychological burden.³⁴ Our study showed that compared to early pregnant women, late pregnant women had higher pregnancy stress. Pregnant women, as a special group, not only bear the pressure of ordinary people, but also face the pregnancy related pressure brought about by the pregnancy itself, role changes, and changes in surrounding social relationships. As the gestational age continued to increase, the psychological sensitivity and vulnerability of pregnant women also changed, and the pressure of pregnancy also increased.³⁵ Previous study had shown that there was a stronger correlation between psychological stress in pregnant women in the late stages of pregnancy and neurological development in children.³⁶ Therefore, medical staff should pay attention to the stress situation during pregnancy, especially during the late pregnancy period, to avoid adverse pregnancy outcomes. The results also showed a positive correlation between pregnancy stress and smartphone addiction, indicating that the greater pregnancy stress, the more likely pregnant women were to develop smartphone addiction behavior, consistent with previous studies.¹⁶ Previous studies showed that individuals could alleviate psychological stress in various ways in situations of psychological conflict or stress, such as excessive consumption, excessive drinking, smoking, or excessive use of certain drugs, which had become a response to stress behavior, thereby achieving the goal of transferring psychological stress or temporarily paralyzing oneself.¹³ Pregnant women in the later stages of pregnancy, when facing increasing pressure, chose to use smartphones to temporarily escape. This immediate psychological avoidance, combined with the illusory online environment, became the main reinforcement factor for forced online behavior among pregnant women.

Our research has shown that self-efficacy moderated the impact of pregnancy stress on smartphone addiction in pregnant women. As self-efficacy increased, the impact of pregnancy stress on smartphone addiction gradually decreased. Pregnant women with a high sense of self-efficacy could effectively manage their negative emotions, divert attention through healthier ways, and reduce the occurrence of bad behavior.^{37,38} On the contrary, pregnant women with low self-efficacy were more likely to adopt negative coping styles such as withdrawal and avoidance, and may use mobile internet to escape life and work pressure, ultimately forming smartphone addiction. Self-efficacy could predict an individual's overall confidence in coping with stress and regulate or alter the correlation between stress and behavior.^{39,40} In summary, if the self-efficacy of women in late pregnancy was high, they would adopt a positive attitude to face pregnancy stress, thereby reducing their tendency to become addicted to smartphones.

This study provided a new perspective for reducing adverse behaviors in pregnant women in clinical practice, that was, nursing staff could develop intervention methods aimed at improving self-efficacy to improve adverse behaviors. It was recommended that nursing staff can use peer education to improve self-efficacy.⁴¹ For example, they could invite mothers who have successfully given birth naturally to share their firsthand experiences, act as role models to encourage expectant mothers, enhance their confidence in childbirth, and enhance their self-efficacy. They can use mobile intervention platforms to explain childbirth knowledge to pregnant women, conduct prenatal training, and reduce pregnancy pressure, further enhancing confidence.⁴² Pregnant women's family members also need to provide full companionship, encourage, stabilize their emotions, and improve their self-efficacy.

Conclusion

The pregnancy stress and smartphone addiction in late pregnancy were higher than that in early pregnancy. At the same time, pregnancy stress could also exacerbate smartphone addiction behavior, which might bring adverse pregnancy outcomes to pregnant women. The self-efficacy of pregnant women could effectively moderate the impact of pregnancy stress on smartphone addiction, that was, pregnant women with higher self-efficacy had less impact on smartphone addiction due to pregnancy stress. Therefore, it was suggested that obstetric medical staff should pay attention to the pregnancy stress and smartphone addiction behavior in the late pregnancy, and took intervention measures to improve the self-efficacy of pregnant women and reduced the occurrence of adverse behavior.

Data Sharing Statement

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethical Approval

This study was reviewed and approved by the Ethics Committee of General Hospital of the Northern Theater Command. The study followed the principles of the Declaration of Helsinki. All participants were requested to read and sign the informed consent form before starting this study.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors reported no conflicts of interest in this work.

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