



Original Article

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The Impact of Mothers' Smartphone Use, eHealth Literacy, Maternal Role Performance Confidence, and Online Social Support on Health Promotion Behavior for Infants and Toddlers

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Abstract

Background: This study aimed to identify the factors influencing health promotion behaviors for infants and toddler, focusing on the time spent by mothers using smartphone, eHealth literacy, maternal role performance confidence, and online social support.

Methods: This study surveyed 136 women who gave birth to a child in 2023. For this study, recruitment announcements were made on popular parenting websites. Multiple regression analysis was performed to identify the factors affecting health promotion behaviors.

Results: The mean age of the participants was 33.8 years, and the mean age of the children was 13.3 months old. Mothers spent 20.2 hours weekly on smartphone to access health information. A total of 86.7% of the respondents indicated that they primarily used the Internet to make health decisions. Factors that influenced health promotion behaviors were role performance confidence ($\beta=0.54$, $P<0.001$), eHealth literacy ($\beta=0.18$, $P=0.015$), online social support ($\beta=0.16$, $P=0.022$), and time spent on smartphone ($\beta=-0.17$, $P=0.006$), with an explanatory power of 51.3% ($F=29.43$, $P<0.001$).

Conclusions: To improve the health promotion behaviors of mothers for their infants and young children, it is believed that interventions that increase confidence in their roles, online social support, and eHealth literacy are required, and that smartphone screen time should be limited. These baseline data can guide the development of effective intervention programs to improve healthcare for infants and toddlers.

Keywords: Infant, Health promotion, Health literacy, Self concept, Mothers

INTRODUCTION

Infancy is the period of fastest growth and development, and changes related to survival instincts appear. Toddlerhood is a period of marked physical, motor, and cognitive function de-

velopment [1]. Young children are less able to look after their health and are more likely to be exposed to illnesses and threats to their safety, requiring active parental care [2]. The role of caring for children is mainly assumed by mothers, and health promotion behaviors for mothers serve as a foundation for the

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growth and development of their children, playing a critical role in improving their health [3,4]. Therefore, health promotion activities performed by parents are essential for promoting the health of their children [4].

Parents actively seek information related to caregiving behaviors to ensure the well-being of their children [5]. In addition to seeking information, online spaces were found to be helpful when making decisions related to parenting [6]. Mothers expressed high levels of concern related to their children regarding health, growth, development, immunization, feeding, weaning food, sleep problems, and illnesses [5,7].

Even among the various types of information, mothers recognize that the information is insufficient [3], and it has been reported that they are constantly exploring for better quality information [8]. The amount of online data is vast and often unverified; therefore, the ability to obtain and use high-quality information is required [9,10]. If health literacy is high, the necessary information can be obtained and applied to healthcare, but if not, the time to search for relevant information is longer. According to a survey by the Ministry of Science and ICT [11], the proportion of over-dependent risk groups has increased each year for the previous five years, particularly for those in their 30s. There are also studies that say that excessive use of smartphones threatens health [12,13]. When examining the results of various studies, it is necessary to examine the relationship between the health promotion behaviors of mothers and the health of their children from various perspectives.

Mothers are responsible for childbirth and parenting from pregnancy, but they face various difficulties when experiencing this for the first time. The belief of the mother in her ability to play a role in practicing health promotion behaviors for her child is very important [14]. Role performance confidence is the self-efficacy of the self-perceived developmental and task coping ability of the mother and the higher the confidence [15], the more positive the parenting behavior, which leads to young children health promotion behavior [16]. Recognition and encouragement of health-promotion behaviors that mothers perform and empathy for their difficulties assists in providing emotional security [17]. Social networks between mothers facing similar situations are known to assist them in practicing appropriate parenting behaviors [18]. It recognizes that access to the Internet can provide various types of online assistance and social support is received through this medium [7].

In Korea, studies on health promotion behaviors for children have identified factors influencing health promotion program

development [19], stress [20], parenting efficacy [21,22], and social support [23]. No studies have been conducted on health promotion behaviors during the critical developmental period of infancy (1 month to 3 years). In this study, we aimed to identify the factors influencing health-promotion behaviors using variables that consider the characteristics of mothers who search for and easily access information through the Internet.

This study specifically aimed to evaluate the effects of smartphone usage, eHealth literacy, maternal confidence, and online social support on health-promotion behaviors for children.

METHODS

Research design

This cross-sectional descriptive study was conducted to identify the factors related to the health promotion behaviors of mothers of infants and young children.

Participants

The participants in this study were mothers of children under 3 years of age who did not have congenital diseases and lived in B city or G province. Those who understood the purpose of the study through the recruitment notice agreed to participate voluntarily. The sample size of the participants was calculated using the G-power program, and the sample size required for multiple regression analysis was 118 with an effect size (d)=0.15, power ($1-\beta$)=0.08, significance level (α)=0.05, and 10 predictor variables. Considering that this study was an online survey, a total of 140 were distributed, with a dropout rate of 20%, and there were 136 completed surveys.

Measurements

The general characteristics assessed include the mother's age, the ages of the children, items pertaining to parenting support, and the perceived health status of both the children and the mother. Furthermore, a question was formulated to prompt mothers to report the time dedicated within a week to seeking information specifically aimed at enhancing the health of their children.

eHealth literacy

eHealth literacy was assessed using a tool developed by Chang et al. [24]. Two questions ("How useful is the Internet when making decisions about your mother's health?" and "How important is it to you to have access to health resources via

the Internet?”) related to Internet use in health-related decision-making were not included in the score, and knowledge, ability, evaluation, and use of health information on the Internet comprised eight questions. Higher scores indicated higher eHealth literacy. Cronbach's α for reliability in the development study was 0.88 [24], and in this study, it was 0.89.

Maternal role performance confidence

Confidence in performing the maternal role was measured using the Maternal Confidence Questionnaire developed by Parker and Zahr [25] and translated into Korean [26]. It consists of 12 positive and two negative items, with a higher score indicating higher confidence in performing the maternal role. Cronbach's α for reliability in the development study was 0.89 [26], and in this study, it was 0.81.

Online Social Support

The Korean version of the Online Social Support Scale, developed by Nick et al. [27] and modified by Shin [28], after validity measurement, was used. It consists of 26 items including esteem/emotional, informational, instrumental, and social companionship, with a higher score indicating a higher level of social support. The reliability for the development study was 0.94–0.95 based on the scale developed by Nick et al. [27] and 0.85–0.90 based on the scale modified by Shin [28]. In this study, it was 0.88–0.97.

Health promotion behavior

Health promotion behaviors were measured using a tool developed by Kim et al. [4]. It consists of 35 items in seven areas: safety, emotional support/endeavor, activity/rest, disease prevention, appropriate clothing, nutrition, and cleanliness/hygiene. A higher score indicates better health promotion behaviors by the mother for infants and toddlers. Cronbach's α for reliability in the development study was 0.88 [4], and in this study, it was 0.90.

Data collection and ethical considerations

Before data collection, the principal investigator obtained approval from the institutional review board (2-1040709-AB-N-01-202403-HR-014-02). Data were collected between April 2 and 30, 2024. A recruitment notice describing the purpose and significance of the study, its characteristics, and the expected effects was posted on parenting websites mainly used by mothers, including P and M. Using the contact information in the

recruitment notice, the researcher directly explained the purpose of the study and distributed the survey link. To participate in the study, respondents accessed the survey link and selected, agree or not agree. Only those selected agree were enrolled in the survey.

Data analysis

The data were analyzed using SPSS for Windows (version 27.0; IBM Corp.). The general characteristics of the participants, eHealth literacy, maternal role performance confidence, online social support, and health promotion behavior for infants and toddlers were calculated as real numbers, percentages, means, and standard deviations. The differences in health promotion behavior according to general characteristics, eHealth literacy, maternal role performance confidence, and online social support were t-test and analysis of variance. The relationships between variables were determined using Pearson's correlation coefficient, and the factors affecting health promotion behavior were analyzed using multiple regression analysis.

RESULTS

Differences in health promotion behaviors by participants' characteristics

The mean age $\pm$ standard deviation of the mothers was 33.8 $\pm$ 3.48 years, and the mean age of the children was 13.3 $\pm$ 4.15 months. A total of 91.2% of the mothers responded that their husbands assisted them with child-rearing, and the mean time they received assistance was 4.2 $\pm$ 3.44 hours. 55.9% of the mothers perceived themselves as healthy and 89.7% perceived their children as healthy. The average weekly smartphone usage time was 20.2 $\pm$ 12.53 hours. Among the general characteristics, age ($t=2.32$, $P=0.022$) and smartphone usage time ($F=4.42$, $P=0.037$) showed significant differences in infants and toddlers health promotion behaviors (Table 1).

Level of eHealth literacy, maternal confidence, online social support, health promotion behavior

The eHealth literacy mean score was 30.3 $\pm$ 5.79 points, maternal role performance confidence mean score was 57.0 $\pm$ 5.85 points, online social support mean score was 83.2 $\pm$ 30.37 points, and infant/toddler health promotion behavior score was mean 116.9 $\pm$ 11.11 points (Table 2).

Table 1. Differences in health promotion behaviors by participants' characteristics (n=136)

Variable	Category	Mean±SD	Number (%)	Comparison of health promotion behaviors		
				Mean±SD	t or F	P-value
Age (yr)		33.8±3.48				
	≤33		49 (36.0)	119.8±11.85	2.32	0.022
	>34		87 (64.0)	115.0±10.38		
Children age (mo)		13.3±4.15				
	≤12		61 (44.9)	117.0±10.00	0.12	0.080
	>12		75 (55.1)	116.8±11.90		
Perceived health status of mother	Healthy		76 (55.9)	117.0±11.09	0.116	0.090
	Unhealthy		60 (44.1)	116.8±11.19		
Perceived health status of child	Healthy		122 (89.7)	116.9±11.28	-0.361	0.719
	Unhealthy		14 (10.3)	115.9±9.72		
Children care support	Husband		124 (91.2)	116.4±11.04	0.47	0.634
	Parents of subjects or parents in law		12 (8.8)	117.7±12.71		
Time receiving caregiving support (hr)		4.2±3.44				
	≤4		51 (37.5)	119.1±12.13	1.86	0.066
	>4		85 (62.5)	115.5±10.28		
Mobile usage time (hr/wk)		20.2±12.53				
	<14		45 (33.1)	118.8±12.03	4.42	0.037
	14-27		76 (55.9)	116.8±10.23		
	>27		15 (11.0)	111.4±11.35		
How useful is the Internet when making decisions about your mother's health?		4.0±0.61				
How important is it to you to have access to health resources via the Internet?		4.3±0.51				

SD, standard deviation.

Table 2. Level of eHealth literacy, maternal confidence, online social support, health promotion behavior (n=136)

Variable	Possible range	Mean±SD	Min	Max
e-Health literacy	8-40	30.3±5.79	16.00	40.00
Maternal role performance confidence	14-70	57.0±5.85	38.00	68.00
Online social support scale	26-130	83.2±20.37	29.00	126.00
Esteem/emotional	10-50	33.1±8.88	10.00	50.00
Informational	7-35	25.1±5.10	9.00	35.00
Instrumental	5-25	13.0±4.41	5.00	21.00
Social companionship	4-20	11.8±3.59	4.00	20.00
Health promotion behavior	35-175	116.9±11.11	88.00	134.00
Safety	6-30	21.4±2.35	15.00	24.00
Emotional support/endeavor	7-35	23.6±2.76	17.00	28.00
Activity/exercise	4-20	13.9±1.54	10.00	16.00
Disease prevention	5-25	16.9±1.70	11.00	20.00
Appropriate clothing	3-15	10.3±1.28	7.00	12.00
Nutrition	5-25	14.7±2.47	9.00	20.00
Cleanliness/hygiene	5-25	16.1±2.07	11.00	20.00

Max, maximum; Min, minimum; SD, standard deviation.

Correlations among eHealth literacy, maternal role performance confidence, online social support, and health promotion behaviors

Infants and toddlers health promotion behaviors were positively correlated with eHealth literacy ($r=0.50$, $P<0.001$), maternal role performance confidence ($r=0.67$, $P<0.001$), and online social support ($r=0.28$, $P<0.001$). Maternal role performance confidence was positively correlated with eHealth literacy ($r=0.46$, $P<0.001$) and online social support ($r=0.21$, $P<0.001$), while online social support was positively correlated with eHealth literacy ($r=0.30$, $P<0.001$) (Table 3).

Factors affecting infant health promotion behaviors for infants and toddlers

First, to test the assumptions of the regression analysis, the conditions of multicollinearity, normality of residuals, independence, and homoscedasticity were confirmed. The variance inflation factor was 1.12–2.38, which did not exceed 10, and the tolerance limit was 0.41–0.89, which was 0.1 or higher. The Dubin-Waston statistic was 1.97, which is close to 2, thus there was no autocorrelation. The results of the multiple regression analysis showed that the regression model was statistically significant ($F=29.43$, $P<0.001$) and explained 51.3% of the total variance in infants and toddlers health promotion behaviors. The factors influencing infants and toddlers health promotion behaviors were maternal role performance confidence ($\beta=0.54$,

$P<0.001$), eHealth literacy ($\beta=0.18$, $P=0.015$), smartphone usage time ($\beta=-0.17$, $P=0.006$), and online social support ($\beta=0.16$, $P=0.022$) (Table 4).

DISCUSSION

The results showed that higher role performance confidence of the mother was associated with higher eHealth literacy and lower smartphone usage time. Also, a higher level of online social support was associated with a higher health promotion behavior score. These factors are discussed in the order of their influence on health promotion behavior for infants and toddlers.

The role performance confidence of the mother positively affects health promotion behavior, which is consistent with the findings of previous studies [20,21]. The confidence level of the mother is important in forming maternal identity [29]. Becoming a parent is a difficult social role; however, when women gain confidence in the process of becoming a mother, they expect to successfully and actively participate in parenting, thereby improving the health outcomes and quality of life of their children [15]. In this study, the average age of the children was 13 months, indicating that younger children were included compared to those in previous studies [20,21]; therefore, health promotion behaviors of the mothers were likely to be more frequent [20]. Repeated engagement in health-promoting behaviors has been shown to increase self-confidence [29], which

Table 3. Correlations among eHealth literacy, maternal role performance confidence, online social support and health promotion behaviors for infants and toddlers (n=136)

	<i>r</i> (<i>P</i>)		
	Health promotion behaviors	eHealth literacy	Maternal role performance confidence
eHealth literacy	0.50 (<0.001)		
Maternal role performance confidence	0.67 (<0.001)	0.46 (<0.001)	
Online social support	0.28 (<0.001)	0.30 (<0.001)	0.21 (0.007)

Table 4. Factors affecting infant health promotion behaviors for infants and toddlers

Variable	B	SE	β	t	P-value
(Constant)	48.39	10.80		4.48	<0.001
Maternal role performance confidence	1.02	0.13	0.54	7.76	<0.001
eHealth literacy	0.34	0.14	0.18	2.48	0.015
Smartphone usage time	-0.15	0.06	-0.17	-2.78	0.006
Online social support	0.08	0.04	0.16	2.31	0.022
Age	-0.19	0.21	-0.51	0.85	0.409
$R=0.729$, Adj $R^2=0.513$, $F=29.43$, $P<0.001$					

Adj, adjusted; SE, standard error.

aligns with the findings of this study. In a study by Kristensen et al. [30], the confidence level of mothers increased at 6 months postpartum compared to 2 months postpartum, and this was reported to be related to a decrease in parenting stress. Since parenting stress hinders parenting behavior, increased confidence may have led to an increase in health promotion behaviors for children. To improve future health promotion, interventions to increase the role performance confidence of mothers should be implemented.

Higher eHealth literacy was associated with more health promotion behaviors, which is consistent with the findings of previous studies [20,31]. Many people prefer online information because of accessibility, availability, and interactivity [32]. More than 70% of those who search for health information online obtain information on the health of their family [33]. As reported by You et al. [23], children under the age of five are in a period where health management is provided entirely by their primary caregivers, and mothers with high demands for health information are more interested in information related to child health promotion and perform health promotion behaviors using the information they acquire. In a study on Health Information Seeking and Health Literacy, Reifegerste et al. [34] reported that mothers who do not receive sufficient benefits from the information resources available online, engage in more frequent information seeking. Parents of infants and toddlers with high health literacy are more likely to search for information about the health of their children, formulate strategies, and practice health promotion, and they effectively search for information [35].

Shorter smartphone usage time was associated with performing more health promotion behaviors. In a study by Nomkin and Gordon [36], it was found that when there was a mobile phone during breastfeeding, the mother focused on the mobile phone, and the time focused on the child was reduced, which prevented her from receiving sensitive information. In particular, face-to-face interactions stimulate brain and cognitive development in infants [37]. The results in this study suggests that when mothers spend more time searching for information to promote the health of their children, they focus more on their mobile devices than on their children and failed to engage in appropriate health promotion behaviors. Although there have been studies on the importance of searching for health promotion information, there is a lack of studies on mobile device usage time; thus, further studies are required to address this.

In this study, higher online social support was associated with

more health promotion behaviors, which is consistent with the results of You et al. [23]. Social support has long been recognized to provide emotional and practical assistance to individuals with difficulties. Owing to changes in the characteristics of modern society compared to the the past, there are time constraints in using social support systems, making it difficult to receive appropriate support for the role of a mother [38]. Baker and Yang [38] stated that online social support is a new resource for women. Similar to the role of existing social support, it can improve confidence in maternal roles, provide information about health promotion behaviors for children, facilitate honest discussions, provide information about new roles and behaviors, and expected results [39]. Yoon and You [19] found that participants in a health promotion behavior reinforcement program engaged in more health promotion behaviors through online social support. This study confirmed that the Internet can be utilized as a support source for sharing information and experiences regarding health management of children. Further studies are required into how to select and utilize communities that mothers can use, and how to provide online social support that is necessary to promote the health of children. In the community, it is necessary to develop programs that use online environments to provide resources for mothers to utilize.

The limitations of this study are as follows. First, for mothers of children who are second-born or later, the information they seek regarding parenting may differ from that sought for first-born children. This was not accounted for in the current study, and future research should address this limitation. Second, this study recruited participants through a parenting website, mainly used by mothers living in specific areas, caution is required when extending the results. However, the results are meaningful because there is a lack of studies on the factors influencing health promotion behavior, and the study targeted mothers of children under 3 years of age, a critical developmental period. To increase the practice of health promotion behavior in the future, education of mothers is required to increase role performance confidence and eHealth literacy. In addition, it is necessary to build and utilize a verified online community in which mothers can share their difficulties and obtain health information. Since smartphone usage time of mothers is related to interactions with their children, it is suggested that a program be developed to strengthen health promotion behavior for infants and toddlers and evaluate its effectiveness.

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AUTHOR CONTRIBUTIONS

Dr. So Yeon PARK had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. All authors reviewed this manuscript and agreed to individual contributions.

Conceptualization: all authors. Data curation: SYJ. Formal analysis: all authors. Funding acquisition: SYP. Investigation: all authors. Methodology: all authors. Supervision: SYP. Writing—original draft: all authors. Writing—review & editing: SYP.

CONFLICTS OF INTEREST

No existing or potential conflict of interest relevant to this article was reported.

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DATA AVAILABILITY

The data presented in this study are available upon reasonable request from the corresponding author.

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