

## Application of Perceived Maternal Parenting Self-Efficacy (PMP S-E) Questionnaire in a Mid-West Community Medical Center NICU in the United States

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### Abstract

Preterm birth and infants' admission to neonatal intensive care units (NICU) are associated with significant emotional and psychological stresses on mothers that interfere with normal mother-infant relationship. Maternal self-efficacy in parenting ability may predict long-term outcome of mother-infant relationship as well as neurodevelopmental and behavioral development of preterm infants. The Perceived Maternal Parenting Self-Efficacy (PMP S-E) tool was developed to measure self-efficacy in mothers of premature infants in the United Kingdom. The present study determined if maternal and neonatal characteristics could predict PMP S-E scores of mothers who were administered to in a mid-west community medical center NICU. Mothers whose infants were born less than 37 weeks gestational age and admitted to a level III neonatal intensive care unit participated. Participants completed the PMP S-E and demographic survey prior to discharge. A logistic regression analysis was conducted from PMP S-E scores involving 103 dyads using maternal education, race, breast feeding, maternal age, infant's gestational age, Apgar 5-minute score, birth weight, mode of delivery and time from birth to completion of PMP S-E questionnaire. Time to completion of survey and gestational age were the significant predictors of PMP S-E scores. The finding of this study concerning the utilization of the PMP S-E in a United States mid-west tertiary neonatal center suggest that interpretation of the score requires careful consideration of these two variables.

**Keywords** Pre-mature neonates; Maternal self-efficacy; The perceived maternal parenting self-efficacy tool

### Introduction

Preterm birth rate in the United States rose 20 percent between 1990 and 2006 and accounted for nearly 12.8 percent in 2006 [1]. Since then the rate has decrease but still accounts for 11.4 percent of births in 2013 [2]. With the improved survival of preterm infants, there is an increasing concern for their long term neurodevelopmental and behavioral outcome. An abnormal mother-infant relationship has been identified as one of the major factors that can negatively impact these preterm infants [3-6]. Preterm birth and admission to neonatal intensive care units (NICU) interfere with normal mother infant attachment, physically and psychologically. Mothers experience diminishing competence with increased institutional authority over their babies' care [7-9]. The uncertainty of their infants' health and survival, risk of disability and family disruption added additional sources of maternal stress [10-13]. Various aspects of NICU environment, as well as infant's physical appearance and behavior of the infant, alterations in parental role and staff-parent interaction, provided further barriers to assumption of normal caretaking and parenting responsibilities [14,15].

Maternal self-perceived incapacities and incompetence in parenting responsibilities is one of the greatest sources of psychological stress [14-16]. Mother's belief in her effectiveness in performing and managing a variety of tasks in the parenting role is the key to self-efficacy theory by Bandura [17]. Maternal self-efficacy in her parenting ability can predict long-term outcome of mother-infant relationship

and neurodevelopmental and behavioral development of at-risk infants [18-20]. NICU interventions targeted at restoring maternal confidence, including improved modified interaction between mother and infant, have claimed variable positive results [21].

Emergence of institutional interest in the family-centered care, points to an increasing need for a tool to objectively assess maternal self-efficacy that can be used during hospitalization and is useful in assessing results of various interventions. Current available measures have been designed largely for utilization in outpatient settings or for term infants. The Perceived Maternal Parenting Self-Efficacy (PMP S-E) tool developed by Barnes and Adamson-Macedo is the tool developed specifically to assess maternal self-efficacy of at-risk infants while the baby is hospitalized [22]. PMP S-E has shown to be reliable and valid to assess general self-efficacy level in mothers of hospitalized preterm neonates in the United Kingdom (UK). This study's purpose was to evaluate the application of PMP S-E in a mid-west community medical center NICU and to determine if selected maternal and infant variables can predict survey scores.

### Methods and Materials

#### Participants

A convenience sample of healthy hospitalized mothers who had given birth to a premature neonate (< 37 weeks gestational age) was recruited from the NICU and Special Care Nursery in a midwestern hospital. Dyads were selected according to the following criteria as established by Barnes and Adamson-Macedo [22]: the premature

neonates were without comorbidities such as genetic anomalies, congenital malformations, active infection or fever, hemodynamic instability, painful or contagious skin disorders, gastroschisis or omphalocele, hemophilia, and necrotizing enterocolitis. In addition, neonates did not have  $\geq$  than 3 clinically significant cardiopulmonary events in the preceding 24 hrs, nor where they receiving parenteral nutrition only or receiving oxygen therapy. Exclusion criteria were a lack of informed consent and mother's inability to understand verbal and written English. The Institutional Review Board approved this study.

## Instruments

This study used descriptive cross sectional survey, the Perceived Maternal Parenting Self-Efficacy (PMP S-E), which has been shown to be a reliable and valid measure of parenting self-efficacy in mothers of relatively healthy hospitalized preterm neonates [22].

<b>Factor 1: Care taking procedures (4-16 points)</b>
I am good at keeping my baby occupied
I am good at feeding my baby
I am good at bathing my baby
I am good at changing my baby
<b>Factor 2: Evoking behavior (6-24 points)</b>
I can make my baby happy
I can make my baby calm when he/ she has been crying
I am good at soothing my baby when he/she becomes upset
I am good at soothing my baby when he/she becomes fussy
I am good at soothing my baby when he/she continually cries
I am good at getting my babies attention
<b>Factor 3: Reading behavior or Signaling (7-28 points)</b>
I believe that I can tell when my baby is tired and needs to sleep
I believe that I have control over my baby
I can tell when my baby is sick
I can read my baby's cues
I am good at understanding what my baby wants
I am good at knowing what activities my baby does not enjoy
I believe that my baby responds well to me
<b>Factor 4: Situational beliefs (3-12 points)</b>
I believe that my baby responds well to me
I believe that my baby and I have a good interaction with each other
I can show affection to my baby

**Table 1:** The perceived parenting self-efficacy (PMP S-E) questionnaire.

The PMP S-E measures mothers' perceptions of their self-efficacy in providing infant care (Table 1). This scale consists of 20 items divided

into four subscales: caretaking procedures, evoking behaviors, reading behaviors and signaling and situational beliefs. Responses to each item use a four-point Likert scale from: 1, strongly disagree to 4, strongly agree. Total scores can range from 20 to 80; a higher score indicates a higher level of maternal self-efficacy.

## Procedure

Mothers of eligible infants were approached by a NICU Child Development Team clinical therapist for enrollment within a 24-48 hour period following delivery. Potential participants were informed that upon agreement to participate: (1) medical records of their premature infant would be reviewed for pertinent perinatal and neonatal data, including demographics, anthropometrics, gestational age, sex, mode of delivery, pregnancy and delivery complication (s), Apgar scores, enteral feeding pattern, time to discharge; (2) the mothers' medical records would be reviewed concerning gravida and para; (3) mothers' would be asked to complete a demographic survey concerning marital status, education level completed, ethnicity, and drug and tobacco use history; and (4) complete the PMP S-E questionnaire. Mothers could leave blank answers to any question that made them feel uncomfortable.

During the time from birth to completion of the PMP S-E, parents participated in the medical center's family center developmental supportive care program that is provided to all neonatal parents. A neonatal nurse worked with the mother and infant daily until discharge. The nurse adjusted the pace and emphasis of the interaction to each parents' needs through various modalities, including modeling, demonstration, verbal instruction, and hands-on experience. Parents were supported in implementing an individualized program specific to their infant's needs which included: breast feeding, practice flexion, swaddling, kangaroo care, cycle lighting, sensitization to the appropriate stimulation for their infants, and infant massage therapy. The infant message therapy was coordinated with physical and occupational therapists.

## Data Analysis

Frequency distributions depicted respondents and their answers to PMP S-E and demographic questions. Data from participants not answering all the items on the PMP S-E were not utilized for analyzes for total PMP S-E scores or for total scores within the factor in which the item was not answered. Logistic regression was used to determine if demographic and infant variables could predict scores on PMP S-E. For analysis, education, race, mode of delivery and breastfeeding were considered categorical data. Mothers' age, gestational age of infant, time from birth to completion of PMP S-E questionnaire, Apgar 5, and birth weight were considered as non-categorical data.

Unpaired t-test assuming equal variance were conducted using means, standard deviations, and sample size between the present study and the study by Barnes and Adamson-Macedo [22] to identify differences for birth weight, gestational age, maternal age, time from birth to completion of PMP S-E, and total scores for PMP S-E.

SPSS V. 19 was used to analyze the data and the alpha level for all evaluations was set at 0.05.

## Results

Characteristics of the study sample are summarized in Tables 2 and 3. Four (4) mothers declined to participate (mean age 24 yrs; all white,

non-Hispanic; infants' mean birth weight 2.11 kg; apgar score at 1 minute = 7.5; and gestational age = 31.8 wks). Of the 103 maternal participants, most were white, non-Hispanic (78%), 11 per cent Hispanic, 6 percent African-American, and the remainder were Asian. (Table 2)

Factors	Mean (SD)
Birth Weight (kg)	1.83 ± 0.74
Gestation Age (weeks)	31.7 ± 3.2
Time from birth (days)*	14.2 ± 12.0
Apgar 1	6.0 ± 2.1
Apgar 5	7.9 ± 1.2
*Time from birth to completion of PMP S-E questionnaire, range 1-40 days.	

**Table 2:** Neonatal characteristics.

These ethnicity characteristics are representative of the ethnicity distribution from the state from which these data were collected [23]. Time from birth to completion of PMP S-E and gestational age were significant predictor of survey score (Table 4).

Variable	Trait	N	%
Age (years)	< 20	6	6
	20-24	25	24
	25-29	38	37
	30-34	22	21
	≥ 35	12	12
Means (SD)	27.9 ± 6.3		
Marital Status	Married Other	50	49
	Common-law	1	1
	Single	42	41
	Did not answer	10	10
Education	High School	19	48
	Vocational	2	2
	College	45	44
	Graduate degree	1	1
	Did not answer	6	5
Mode of Delivery	Vaginal	26	25
	Cesarean	87	75
Breast Feeding	Yes	80	79
	No	23	21
Para	2.7 ± 1.8	103	100
Gravida	1.2 ± 1.4		

**Table 3:** Maternal characteristics.

Significantly higher birth weights, time from birth to completion of PMP S-E, and total PMP S-E scores were seen in this study when compared to the study by Barnes and Adamson-Macedo [22] (Table 6). No differences between studies were found for gestational age and maternal age (Table 6).

Total scores and scores for each factor are found in Table 5. Table 5 also contains means for these scores reported by Barnes and Adamson-Macedo [22].

Variables in the equation	Beta	Wald X <sup>2</sup>	p	Odds Ratio	CI
Maternal education	-0.046	0.006	0.939	0.955	0.297-3.072
Ethnicity	0.653	0.687	0.407	1.921	0.410-8.990
Breastfeeding infant	0.008	0	0.993	1.008	0.202-5.017
Maternal age	0.006	0.011	0.916	1.006	0.903-1.120
Gestational age	-0.428	4.348	0.037	0.652	0.436-.975
Apgar 5 minute	-0.154	0.239	0.625	0.857	0.463-1.589
Birth weight	0.029	0.001	0.971	1.03	0.214-4.953
Time to test	-0.153	11.288	0.001	0.858	0.785-.938
Mode of delivery	0.377	0.312	0.576	1.457	0.389-5.459

**Table 4:** Variables of significance in predicting score on PMP S-E.

## Discussion

The purpose of this study was to determine the application of the PMP S-E questionnaire in the United States and to determine if selected maternal and infant variables could predict scores. The results of the present study indicated that the variables maternal education, ethnicity, and age along with infant birth weight, Apgar 5 minute score, mode of delivery and breast feeding did not predict PMP S-E score. The only two variables that did predict PMP S-E score were time from birth to PMP S-E completion and infant gestational age.

The PMP S-E was developed in the UK by Barnes and Adamson-Macedo [22] and it was suggested by the authors that the survey's use outside the UK would require further cross-cultural study. Whether or not PMP S-E scores by American mothers of premature neonates are indicative of those reported in the UK was not known. In an attempt to control for differences between studies, mother-preterm dyads were selected according to the criteria established by Barnes and Adamson-Macedo [22]. Similarities between studies existed in mothers who declined to participate (<4%), first time mothers (58% and 56%), gestational age, and maternal age. Differences between studies included significantly higher infant birth weights, a longer time interval from birth to completion of PMP S-E and higher total PMP S-E scores and individual factor scores.

The finding that a significant positive relationship was identified between gestational age and higher PMP S-E scores is contrary to results of a recent publication. Pennell et al. [24], using the Preterm Parenting and Self-Efficacy Checklist (PP S-EC), found that parents of very preterm infants (< 32 weeks) did not report significantly lower levels of parental self-efficacy or higher levels of psychological stress when compared to parents of preterm (32-37 weeks) or term infants.

Measurement	N	Present Study Means $\pm$ SD	Barnes and Adamson-Macedo <sup>22</sup> Means
Factor I: Care taking procedures (4-16 pts)	88	12.8 $\pm$ 3.2	11.6
Factor II: Evoking behaviors (6-24 pts)	94	22.5 $\pm$ 5.1	21.2
Factor III: Reading behavior signaling (7-28 pts)	97	18.1 $\pm$ 4.5	17.1
Factor IV: Situational beliefs (3-12 pts)	102	10.6 $\pm$ 1.8	10.1
Total score (20-80 pts)	85	63.6 $\pm$ 14.7	59 $\pm$ 11.4

**Table 5:** Comparison of perceived maternal parenting self-efficacy (PMP S-E) scores of present study to Barnes and Adamson-Macedo [22].

However, participants in this Australian based study were mothers and fathers and completion of (PP S-EC) occurred following discharge

from the hospital. In addition, the survey was conducted online via the internet potentiating selection effect for computer competent, higher socioeconomic strata participants with possible access to better support systems (Table 5 and 6).

The Apgar score provides convenient shorthand for reporting the status of the newborn infant and the response to resuscitation. Neonatal resuscitation among preterm infants improves with experience and education of provider institution [25-27]. Normal 5-minutes Apgar [28] ( $7.9 \pm 1.2$ , Table 2) in the present study indicated overall success of neonatal resuscitative effort provided to study infants after birth. Mothers' tend to experience more severe psychological stress when an infant appears more critically ill [29,30]. Successful initial resuscitation and transition after birth can serve to alleviate the level of maternal stress related to preterm birth and admission to NICU. The combination of successful initial resuscitation and high birth weight could have resulted in overall lower baseline parental distress related to their infant's health and translated to higher overall PMP S-E scores.

	Present study	Barnes and Adamson-Macedo <sup>22</sup>	t value	95% CI	p	SE
Birth Weight (kg)	1.83 $\pm$ 0.74	1.6 $\pm$ 0.47	3.0838	-0.3769 to -0.0831	0.0023	0.075
Gestational age (wks)	31.7 $\pm$ 3.2	31.9 $\pm$ 2.6	0.5556	-0.509 to 0.909	0.5790	0.36
Time from birth to Completion of PMP S-E (days)	14.2 $\pm$ 12.0	10.0 $\pm$ 6.4	3.6889	-6.442 to -1.958	0.0003	1.139
Maternal age (years)	27.9 $\pm$ 6.3	28 $\pm$ 5.9	0.1306	-1.407 to 1.607	0.8962	0.765
Total PMP S-E scores	63.6 $\pm$ 14.2	59 $\pm$ 11.4	2.7812	7.858 to -1.342	0.0058	1.654

**Table 6:** Comparison of maternal and neonate characteristic of present study to Barnes and Adamson-Macedo [22].

The completion of PMP S-E may be a time dependent process in that time from birth to completion of PMP S-E corresponded to significantly higher score (Table 4). With successful aggressive and early individualized family centered developmental care, mothers can become increasingly familiar with engaging and communicating with their infants. Previous studies have established that parental adjustments to preterm infants is a time-dependent process through familiarity with infants' signals and behaviors correlating to increased confidence in attending to infant needs [31-33]. The results of the present study suggest that the association of time to completion of PMP S-E needs to be considered carefully when attempting to assimilate it into an institutional quality improvement process.

The PMP S-E was previously studied among healthy, full term infants [34,35]. Leahy-Warren et al. [35] examined the relationship between functional and informal social support, postnatal depression and maternal self-efficacy. In this study [34], mean PMP S-E scores of  $65.0 \pm 8.2$  were reported for 447 first-time mother of term infant from Ireland when evaluated at 1-6 weeks post-delivery. Gharibeth and Hamlan [35] sought to identify the maternal characteristics, including maternal self-efficacy, which influenced maternal attachment of first-time Jordanian mothers. Gharibeth and Hamlan [35] reported PMP S-E scores of  $56.4 \pm 8.4$  for 220 mother-term infant dyads within 2 months post-delivery. Both studies [34,35] involved first time mothers

of uncomplicated full term deliveries that completed PMP S-E at times comparable to the current study. If gestational age and time to completion was of primary concern in influencing PMP S-E scores, these two studies [34,35] should provide comparable or higher scores than the present study. However, the mean PMP S-E scores for Gharibeth and Hamlan [35] were lower than the present study and that of Leahy-Warrant et al. [34] and Barnes and Adamson-Macedo [22]. The differences in PMP S-E scores among studies suggest that other confounding factors besides prematurity and time to completion of PMP S-E, including socio-economic environment, maternal affected state and medical support system, could affect participant responses.

Breastfeeding is the optimal source of infant feeding and nutrition with numerous nutritional and neurodevelopmental advantages. As part of national strategies to increase breastfeeding, the US Healthy People 2020 includes goals of increasing the percentage of infants who are breastfed from current 74% to at least 81.9% and those exclusively breastfed in the first 3 months from current 33.6% to 46.2% [36]. The American Academy of Pediatrics also reaffirms its recommendation for exclusive breastfeeding for both term and preterm infants in the first 8 months [37]. Despite the recommendations, the rates of breastfeeding at hospital discharge remain low in premature infants due to the numerous unique challenges of NICU, including stress and physical barrier of NICU. The data collected in this study was from a

NICU that had undergone extensive training and policy update to remove potential barriers to breastfeeding. The success of breastfeeding initiatives was evident in higher than expected breastfeeding dyads of 79% in the present study. Such family centered breast-feeding interventions have been shown to reduce maternal stress and increase positive maternal infant interactions [38]. Barnes and Adamson-Macedo [39] had previously predicted a lower PMP S-E score associated with higher percentage of breastfeeding mother-preterm dyads. The possibility exists that the updated breastfeeding policy of the NICU that participated in this study allowed for positive maternal-infant interaction that was reflected in higher PMP S-E scores.

## Conclusion

The finding of this study concerning the utilization of the PMP S-E in a United States mid-west tertiary neonatal center suggest that interpretation of the score requires careful consideration of various intervening variables. Those intervening variables include time from birth to completion of PMP S-E and gestational age of the neonate. Future studies should determine the effect that level of medical and supportive service provided on admission and during course of hospitalization has on PMP S-E scores.

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