

Predictors of Infant Care Competence Among Mothers With Postpartum Depression

Clinical Medicine Insights: Reproductive Health
Volume 13: 1–10
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DOI: 10.1177/1179558119834910



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ABSTRACT

BACKGROUND/OBJECTIVE: Postpartum depression is linked to decreased quality mother-infant interactions and long-term negative impacts on children's behavior and health. Infant care competence may be reduced by postpartum depression and other maternal or environmental variables. Thus, the objective of this study was to explain factors that contribute to perceived infant care competence among mothers with postpartum depression.

METHODS: Multiple regression analysis and correlational analysis were conducted to study associations between the predictors (depression severity, social support, child development, family functioning) and the outcome of perceived infant care competence among a peer support intervention study for mothers with postpartum depression (n = 55).

RESULTS: Child development, specifically communication ($P = .04$), gross ($P = .00$) and fine ($P = .00$) motor skills, problem solving ($P = .00$), and personal-social development ($P = .01$), explained maternal perceptions of responsiveness, an aspect of infant care competence. The best-fit model was obtained for the responsiveness subscale, in which 37% of the variance was explained by mothers' reports of infants' fine motor skills ($P = .000$) and nurturance ($P = .039$) as an aspect of social support and family functioning ($P = .078$).

CONCLUSIONS: Recognition of the importance of infant development to perceived infant care competence, particularly mothers' perceptions of infant responsiveness, may offer targets for intervention. Helping mothers identify infant cues and milestones that signal infant responsiveness may be beneficial. Moreover, social support and family functioning may be targets for intervention to promote perceived infant care competence in mothers affected by postpartum depression.

KEYWORDS: postpartum depression, infant care competence, maternal competence, maternal-infant interaction, predictors

RECEIVED: December 14, 2018. **ACCEPTED:** January 30, 2019.

TYPE: Original Research

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Introduction

Postpartum depression (PPD), also known as postnatal depression, is a mood disorder that is believed to affect approximately 15% of women worldwide.¹ In Canada, PPD affects approximately 15% of new mothers.² According to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*), PPD is categorized as a major depressive disorder with postpartum onset.³ Symptoms can occur throughout pregnancy and within the first 4 weeks postpartum. Other studies have shown that it can last up to 6 months postpartum⁴ or 14 months postpartum.³ Some symptoms include changes in mood, poor appetite, changes in sleep, and concentration. These depressive symptoms can lead to distorted ways of thinking which may lead to feelings of failure as a parent.^{2,4} Postpartum depressive symptoms can have a long-term impact on children's behaviors and health, and may lead to a decrease in the quality of interactions between the mother and infant.⁵

Mothers with PPD may be less sensitive to infant cues than other mothers without PPD that may ultimately affect

maternal competence and care. Research has found that the quality of maternal care predicts a host of healthy developmental outcomes from brain development to mental health and that children of mothers affected by PPD are at risk for poor developmental outcomes.^{6–8} Accordingly, the objective of this study was to explain factors that contribute to perceptions of infant care competence (ICC) among mothers with PPD. With improved understanding of explanatory factors/variables affected by PPD, this study can provide guidance for nurses and other health care providers to improve interventions to promote both perceived and performed competence and ultimately promote healthy development of children whose mothers are affected by PPD.

ICC may be affected by PPD. Perceived ICC refers to the way the mother rates her ability in providing care to her infant as well as how she performs these tasks. Perceptions are based on self-reports of a mother's competence in her infant care role.⁹ Thus, ICC is comprised of both caregiver actions (behavior/observed), such as the quality of mother-infant



interactions, and perceptions (psychological/emotional), such as perceived infant care ability.

Variables explaining ICC for mothers with PPD

To date, no research has explicitly examined explanatory variables of perceived ICC in mothers affected by PPD. Much of the relevant research conducted thus far includes predictors of PPD or the impact of PPD on infant development.^{5,10,11} There have been studies that examined factors that explain or predict ICC (perceived and performed), in related concepts, such as maternal-child interaction quality, sensitivity, and bonding.

Symptoms of PPD disrupt maternal-child interactions¹²⁻¹⁴ and particularly severity of depressive symptoms affect parenting competence, with lower PPD scores associated with higher maternal sensitivity.¹⁵ Similarly, Sockol et al¹⁶ showed that higher scores on the Edinburgh Postnatal Depression Scale (EPDS) (>11) negatively affected bonding between the mother and infant using the Postpartum Bonding Questionnaire (PBQ). Moreover, higher scores on the EPDS were associated with an increase in rejection or anger, as well as risk of abuse toward the infant.

While social support as an explanatory variable for ICC in mothers with PPD has not been explicitly examined, other ICC-related variables such as maternal self-esteem and maternal competence have been. For non-depressed mothers, social support and a strong alliance between partners were positively associated with maternal self-esteem and maternal competence.^{17,18} Shorey et al¹⁹ found that social support was a significant predictor of maternal self-efficacy, a concept related to ICC. Indeed, Dennis and Letourneau²⁰ found social support to be a protective factor among women with depression. Mothers with depression who received support, such as peer support, demonstrated a reduction in depressive symptoms. With reduced symptoms, mothers may be more in tune to their infant's needs thus increasing maternal-infant interaction and possibly ICC.

Family functioning has similarly been examined, but not explicitly with respect to ICC. Angley et al²¹ found that families with better functioning were observed to have improved parenting and parents further reported a greater sense of parental competency and self-efficacy, concepts akin to ICC. The impact of depression on family functioning can lead to marital discord, which can ultimately lead to withdrawn behaviors and decreases in maternal-infant interaction and parenting quality thus affecting ICC.²²

With respect to sociodemographic variables, again none have been explicitly studied with respect to ICC. However, maternal education, income, and marital status are well known to relate to maternal-child interaction quality,²³ a concept related to ICC. Employment status was suggested to have an impact on maternal role competence and satisfaction.¹⁷ Finally, higher parity, associated with the experience that can accrue from having more children, may affect maternal role development²⁴ and likewise ICC.

Researchers have reported that child development, especially cognitive delays,⁵ health issues,⁵ decreased exploratory behaviors,²⁵ and decreased communication²⁶ is affected by or associated with lower ICC of mothers with depression.²⁷ Low ICC in mothers affected by PPD may further lead to behavioral, emotional, and health issues in the infant.^{5,22} For example, Field⁵ studied depressed mother's caregiving including feeding or sleep practices. Mothers were observed to discontinue breastfeeding early or to place infants in unsafe sleep positions, both associated with health problems in infants and children.

In non-depressed mothers, factors such as a child's temperament may affect how a mother perceives and performs her infant care role.²⁸ However, studies have not examined this association in depressed mothers or explored the reverse, that is, how child development may affect ICC in mothers affected by depression. Thus, the aim of the study is to examine how salient variables affect perceived ICC of mothers with PPD. It was hypothesized that lower depression, higher social support, better family functioning, and improved child development scores will be associated with higher perceived ICC.

Methods

Data for this secondary regression analysis were obtained from an original study conducted between 2011 and 2013; a quasi-experimental study of a telephone-based peer support (TBPS) intervention for mothers with PPD. Study details are found in "Quasi-experimental Evaluation of a Telephone-based Peer Support Intervention for Maternal Depression."²⁹ Approval for the initial study was obtained from the New Brunswick Research Ethics Board. Additional approval was obtained from the University of Calgary Conjoint Health Ethics Review Board (CHERB) for the secondary analysis. All participants provided written informed consent, and confidentiality and anonymity were maintained.

Sample and recruitment

A sample of 55 women between the ages of 16 and 45 residing in New Brunswick were recruited from May 2011 to October 2013. Women were recruited using a variety of methods that included advertisements on television, radio, and online. Recruitment was additionally conducted through health care professional referrals.²⁹

Inclusion criteria

Women included in this study had EPDS scores of 12 or greater and were the primary caregiver of an infant 1 to 24 months of age at enrollment. Mothers were English or French speaking and included in the study if there was only a single birth or if the infant had no severe health concerns. Mothers included in the study were also 16 to 45 years of age.

Procedures

Baseline data, obtained before participants received any intervention in the TBPS study,²⁹ were employed in this secondary analysis. Women were screened for depression using the full EPDS and mothers were eligible if they scored at the cutoff of 12 or greater, indicative of the presence of depression.

Data collection

At baseline, multiple parent-report assessments were completed, including sociodemographic data on marital status, education, number of children, maternal and infant age, household income, and area of residence that were included as covariates. In addition, data were collected on the outcome of perceived ICC, and the explanatory variables of depressive symptoms, social support, family functioning, and child development.

Outcome

Perceived ICC was measured using the Infant Care Questionnaire (ICQ). This is a reliable and valid measure that assesses mothers' reports about how they feel as an infant care provider and about their perceived ability to provide infant care.⁹ The scale measures these abilities based on 3 subscales that include mom & baby (how able the mother feels in caring for her infant), emotionality (how frustrated the mother feels with negative infant behavior such as crying), and responsiveness (how the baby responds to the mother). The ICQ is a 22-item questionnaire where higher subscale scores indicate a mother's greater perceived ability to care for her infant. However, it is not intended to be summed. Rather, use of the mom & baby, emotionality, and responsiveness subscales is recommended.⁹ Within each subscale, adding and dividing by the total number of items in that subscale determine the subscale value for each participant.

Explanatory variables

The EPDS measured depressive symptoms and mothers with EPDS ≥ 12 qualified for inclusion in the study. This tool identifies the risk of perinatal depression and measures how a mother felt in the previous week. The EPDS is a reliable and valid tool to assess the symptoms of depression that is commonly administered between 6 and 8 weeks postnatal. The tool is a 10-item self-report questionnaire with scores ranging from 0 to 30. Scores of 10 or greater are indicative of possible depression, with a maximum score of 30.³⁰ EPDS has a sensitivity and specificity of 70% to 85%. According to Sit and Wisner,³¹ this scale is the most frequently used tool to assess symptoms of PPD. Although it does not diagnose PPD, it has been associated with depression in the postpartum period.³² Higher

scores are correlated with more severe symptoms of PPD and scores on the EPDS are associated with physician diagnosis of depression.³² An EPDS score of 12 or greater was used in the original study to determine depressive symptoms, which is consistent in the literature.³²

Social support was measured using the Social Provisions Scale (SPS). This scale measures a mother's perception of her social support, defined as one's belief that they are cared for, valued, and belong to a group or network.³³ The SPS is a 24-item self-report questionnaire that examines 6 different social provisions that are obtained from relationships with other people. These provisions include guidance, reassurance of worth, social interaction, attachment, nurturance, and reliable alliance. It is rated on a 4-point scale, where higher scores indicate higher levels of support.³⁰ The SPS has been widely used among varying populations and has been tested for validity and reliability.³⁴

To measure how a family feels they are functioning together, the Family Functioning Scale (FFS) was used. The total score from this scale examines different aspects of family functioning that include communication, family roles, and overall view of family relationships. This 12-item self-report questionnaire consists of 4 categories that range from 0 to 3. Total scores are from 0 and 36 where higher scores are correlated with greater family dysfunction.³⁵ The Cronbach's alphas for the total scale were .88 and .87 for the variables within the scale.

Mother's self-report of child development was derived using the reliable and valid Ages and Stages Questionnaire (ASQ).³⁶ This self-report, age-standardized scale measures infants' social-emotional and behavioral development from 4 to 60 months of age and can be administered at 2- to 6-month intervals. The ASQ assesses communication skills, gross and fine motor skills, problem-solving abilities, and personal-social development. Mothers report their perceptions based on a series of 30 developmental questions. The purpose of the measure is to identify potential developmental delays.³⁶ Sensitivity of the scale ranges from .75 to .89, and specificity ranges from .82 to .96. Internal consistency showed an overall alpha of .82.

Statistical analysis

Bivariate correlations were run to study the associations between the outcomes (Mom & Baby, Emotionality, and Responsiveness) and explanatory variables (EPDS scores, social support, family functioning, and child development) as well as the sociodemographic covariates (education level, marital status, maternal and infant age, parity, area of residence, and income), to test the hypotheses given, $P < .05$. The assumptions for regression (representativeness, normality, linearity and homoscedasticity) were assessed. The outcomes of interest were continuous variables; therefore, a multiple linear regression model for each outcome was fitted to study the relationship between the outcome(s) and the predictors and covariates in separate model sets.

The model building process was a saturated model that included the main explanatory variables, and covariates fitted for the 3 ICC outcomes separately. The Mallows Cp and the adjusted R^2 were used to select the subset of explanatory variables included in the final model. The Mallows Cp criterion was used to obtain the least biased model (small Cp) while the adjusted R^2 takes into account the number of predictors included in the model.³⁷ The model with higher adjusted R^2 and small Cp was considered. In the final model(s), variance inflation factor (VIF) was used to detect the presence of multicollinearity. A VIF > 10 indicates the presence of multicollinearity problems.³⁸ To check the appropriateness of the selected model, normality of error terms and residuals, constancy of error variance and linearity of the regression model were examined. To detect if outliers exist with respect to the response, the Bonferroni test³⁹ was performed. Furthermore, we tested if the outlying observations are influential cases or not by performing the following tests: Difference in Fits (DFFITs), Difference in Betas (DFBETAS), and the Cook's Distance.⁴⁰

Due to the defined sample size, the strongest explanatory variables were chosen from the literature reviewed. Power analysis using G*Power revealed that a medium-to-large effect size ($f^2=0.27$), models with 6 tested explanatory variables, and a sample of 55 are sufficient to attain power of .8 given, $P=.05$.⁴¹ Moreover, the convention of 5 to 10 cases per variable was also utilized in determining the number of predictors in the model.⁴² The sample size was constrained by the number of responses on the outcome variable ($n=55$) and complete data were available on all other variables.

Results

The sociodemographic characteristics of the study sample are presented in Table 1. The sample of mothers ranged in age between 17 and 43 years with a mean age of 29.7 years ($SD = \pm 4.7$ years). Infant age ranged between 1 and 24 months with a mean age of 7.11 months ($SD = \pm 5.6$ months). A majority of the mothers 74.55% ($n=41$) were married and approximately 45% ($n=25$) were first-time mothers. Most of the mothers (54.55%; $n=30$) had attained education to a technical level and 83.6% ($n=46$) of the mothers were employed; 49% of the sample consisted of mothers earning under \$40 000 CAD annually. A majority of the mothers (52.73%; $n=29$) lived in an urban area.

Infant care and child development (ASQ)

Upon checking assumptions, diagnostics revealed that regression was appropriate to conduct; however, a few variables were mildly skewed (EPDS, communication, gross motor, fine motor, problem solving, personal-social). Given the difficulty interpreting transformed variables, data were left in their original form. When sociodemographic covariates were modeled to predict the outcomes, no combination revealed significant

association with outcomes; thus, sociodemographics were excluded from final models.

Table 2 shows better child development scores, specifically, communication ($P=.04$), gross ($P=.00$) and fine ($P=.00$) motor skills, problem solving ($P=.00$), and personal-social ($P=.01$) were significantly associated (positively) with improved responsiveness on the ICQ. Neither child development, family functioning, nor social provision scores were significantly associated with mom & baby or emotionality outcomes on the ICQ; however, reassurance and reliable alliance approach significance.

The final results for the 4 explanatory variables are presented in Table 3. The maximum VIF value for the predictors is 3.87, which is less than 10, an indication that multicollinearity is likely not influencing the least squares estimates. For the Emotionality subscale, 16% of variance was explained by gross motor, problem-solving abilities, social interaction, and reliable alliance. Three of the variables (problem solving, social interaction, and reliable alliance) were significant with P values of $<.05$; 37% of variance in ICC responsiveness was explained by the predictors, with infant fine motor skills and nurturance as an aspect of social support achieving significance. Finally, only 9% of variance was explained by the mom & baby outcome.

Finally, Table 4 indicates that children scoring below the 50th percentile (median) versus at or above the 50th percentile on the child development measures of gross motor, fine motor, problem solving, and personal-social skills are perceived by their mothers to be significantly diminished with regard to the responsiveness subscale of the ICQ.

Discussion

We set out to identify explanatory variables for perceived ICC in a sample of depressed mothers of infants 1 to 24 months. The variables studied included EPDS, social support, family functioning, ASQ scores, and sociodemographic variables such as maternal education. Bivariate associations revealed that child development specifically communication, gross and fine motor skills, problem solving, and personal-social skills all predicted responsiveness as an aspect of ICC among mothers with PPD symptoms. When examining children who scored at/above the median with those scoring below the median on the child development measures with respect to their mothers' assessment of the infant's responsiveness, significant differences were indeed found for all but for communication, suggesting child development is an important predictor of perceived ICC. Indeed, the best model fit was for responsiveness with 37% of the variance explained by infant fine motor skills, family functioning, and nurturance. The second best model fit was for emotionality as an aspect of ICC, with gross motor, problem solving, social interaction, and reliable alliance explaining 16% of the variance.

It was hypothesized that among this sample of mothers who were depressed, higher scores on the EPDS, indicative of greater severity of symptoms of depression, would play a role

Table 1. Descriptive statistics.

VARIABLE	FREQUENCY	PERCENTAGE OR MEAN (SD), RANGE
Education level		
High school	17	30.90
Technical/university	38	69.10
Marital status		
Single/divorced/separated	14	25.45
Married/common law	41	74.55
Maternal age: mean (SD), range		29.63 (6.74), 17.0-43.0
Infant age: mean (SD), range		7.11 (5.6), 0-23
Number of pregnancies		
1	25	45.45
2	12	21.82
3 and above	18	32.70
Household income		
Under \$40000	18	32.72
\$40000+	19	34.55
No response	18	32.72
Area of residence		
Rural	26	47.27
Urban	29	52.73
Infant care competence		
Mom & Baby		58.60 (6.72), 41-70
Emotionality		14.11 (2.79), 8-20
Responsiveness		17.25 (2.25), 12-20
Family Functioning Status		26.85 (5.53), 12-46
EPDS		15.49 (2.54), 12-20
Social provisions		
Total		70.01 (8.41), 54-94
Guidance		11.80 (1.98), 7-16
Reassurance		11.42 (1.72), 8-16
Social interaction		11.29 (1.90), 7-16
Attachment		10.89 (1.83), 4-15
Nurturance		12.56 (1.80), 9-16
Reliable alliance		12.34 (1.98), 6-16
Child development (ASQ)		
Communication		47.09 (13.46), 10-60
Gross motor		50.46 (13.50), 10-60
Fine motor		48.09 (16.76), 0-60
Problem solving		50.54 (14.19), 0-60
Personal-social		50.91 (15.54), 5-60

Abbreviation: ASQ, Ages and Stages Questionnaire.

Table 2. Pearson correlation coefficients, n=55.

	MOM & BABY	EMOTIONALITY	RESPONSIVENESS
ASQ			
Communication	0.10 (.47)	0.06 (.69)	0.28 (.04)*
Gross motor	0.13 (.35)	0.08 (.58)	0.44 (.00)*
Fine motor	0.16 (.24)	0.12 (.36)	0.53 (.00)*
Problem solving	0.21 (.12)	0.15 (.27)	0.48 (.00)*
Personal-social	0.16 (.23)	0.01 (.94)	0.37 (.01)*
Social provisions			
Total	0.17 (.21)	0.11 (.42)	0.19 (.16)
Guidance	0.19 (.17)	0.03 (.81)	0.12 (.38)
Reassurance	0.16 (.23)	0.16 (.23)	0.23 (.08)
Social interaction	0.14 (.27)	-0.04 (.77)	0.14 (.31)
Attachment	0.02 (.89)	0.05 (.70)	-0.00 (.98)
Nurturance	-0.01 (.95)	0.10 (.47)	0.20 (.15)
Reliable alliance	0.25 (.06)	0.18 (.17)	0.17 (.20)
EPDS	-0.14 (.29)	-0.21 (.13)	-0.01 (.96)
Family functioning	0.14 (.29)	0.02 (.87)	0.13 (.35)

Abbreviation: ASQ, Ages and Stages Questionnaire.

The values in parentheses indicate *P* values.

**P* < .05.

in mothers' perceived ability to care for infants. Null findings were observed. It is possible that an association was not shown as the EPDS scale measures a variety of symptoms and not specific mood disorders.³² Furthermore, an association may not have been found, as the EPDS scores are not normally distributed, therefore making it more difficult to find a positive correlation. There also may have been a ceiling effect, in which an association was not shown because the sample consisted of women with mild depression as opposed to moderate or severe, from 12 to 20, with an average of 15.49 and a standard deviation of 2.54.

While studies have examined the impact of depression on infants' health and development^{5,11,43} and on the severity of symptoms on infants,^{15,44} few have examined the impact of severity of symptoms on ICC or related concepts. An association between depression, but not severity of depression, and maternal role competence and maternal self-efficacy has been observed.^{17,45} Depressive symptoms were associated with decreased self-efficacy; however, depression severity was not studied.^{21,46} Mothers with depression were observed to be more intrusive and less sensitive in maternal-infant interactions.^{47,48} Chronicity of symptoms appeared to play a factor in mother-infant interaction at 6 months postpartum; however, again severity of those symptoms was not explored.⁴⁹ Depression scores (EPDS scores >11) negatively affect

bonding⁴⁴ and parenting competence,¹⁵ but again, a focus on severity was not mentioned. In spite of this study's null findings, other research is required to ensure that this association is not spurious. One of the concerns for researchers may be the ethical and logistical challenges of including severely distressed mothers in samples.

It was further hypothesized that higher social support scores would be associated with higher subscale scores on the ICQ in mothers with depression. Our hypothesis was partially supported; while bivariate findings suggest there was no significant association between social support and ICQ scores, the model building revealed that social interaction and reliable alliance were significant explanatory variables in the emotionality subscale and nurturance was significant in the responsiveness subscale (see Table 3). Studies have shown that social support can improve physical and mental health, specifically reducing depressive symptoms.^{33,50} Although social support may improve depressive symptoms, there is little effect on the maternal-child interaction quality.^{51,52} Further studies reveal that supportive relationships can help women adapt to the parenting role.^{17,53,54} Social support and help with infant care ease depressive symptoms and stress and potentially ICC.⁵⁵

Social support has been shown to affect maternal role competence, parental self-efficacy, maternal interaction, and maternal self-esteem. Ngai et al¹⁷ revealed that mothers

Table 3. Multiple regression analysis for variables predicting infant care competence (n=55).

VARIABLE	ESTIMATE	STANDARD ERROR	T VALUE	P VALUE	VIF	R ²
Emotionality						
Intercept	10.77	2.70	3.98	.000		0.16
Gross motor	-0.061	0.04	-1.36	.181	2.82	
Problem solving	0.096	0.04	2.08	.043	2.69	
Social interaction	-0.629	0.27	-2.30	.026	2.00	
Reliable alliance	0.695	0.26	2.65	.011	1.96	
Responsiveness						
Intercept	7.71	2.37	3.24	.002		0.37
Fine motor	0.07	0.01	5.06	.000	1.02	
Family functioning	0.08	0.04	1.80	.078	1.02	
Nurturance	0.29	0.14	2.12	.039	1.01	
Mom & Baby						
Intercept	41.2	8.26	4.98	.000		0.09
Gross motor	-0.04	0.11	-0.34	.733	2.78	
Problem solving	0.11	0.11	0.96	.344	2.74	
Family functioning	0.17	0.17	1.02	.311	2.27	
Reliable alliance	0.71	0.69	1.01	.317	2.23	
Guidance	0.05	0.68	0.08	.937	1.03	

Abbreviation: VIF, variance inflation factor.

Table 4. Fiftieth percentile comparisons for ASQ scores and ICC responsiveness.

	RESPONSIVENESS		T TEST	P VALUE
	BOTTOM MEAN (SD)	TOP MEAN (SD)		
Communication	44.26 (15.19)	50.0 (10.92)	-1.60	.1164
Gross motor	44.81 (15.90)	56.1 (7.25)	-3.36	.0015
Fine motor	40.53 (19.26)	55.93 (8.55)	-3.80	.0004
Problem solving	45.89 (17.84)	55.37 (6.34)	-2.60	.0119
Personal-social	46.78 (19.16)	55.18 (9.14)	-2.06	.0441

Abbreviations: ASQ, Ages and Stages Questionnaire; ICC, infant care competence.

with inadequate support felt less competent in their role as a parent. This is consistent with the positive relationship between social support and infant care emotionality and responsiveness. Similar findings suggest that high total support showed improved self-efficacy among primiparas and among adolescent mothers.^{21,45} High social support and maternal self-esteem, similar to ICC, were positively associated.⁴³ In summary, our findings are supported by extant literature.

Our third hypothesis is whether higher family functioning scores (an indication of family dysfunction) would be associated with lower perceived ICC. Bivariate associations show that there was no relationship between family functioning scores and scores on any of the ICQ subscales. The model fitting suggests that family functioning, while not significant when considered on its own, approached significance as explanatory variables when considered in the context of the other variables. Some of those variables include fine motor

skills (aspects of child development measures) and nurturance (aspects of social support measures) in the responsiveness subscale.

The role of family functioning in relation to perceived ICC in women with PPD has also not been fully explored in the literature. In non-depressed samples, poor family relationships, characterized by marital dysfunction, can ultimately lead to adjustment problems in children.^{56,57} In addition, marital problems can lead to mothers becoming withdrawn in the relationship with their children.²² While the findings of this study approached significance, it appears that depressed mothers' perceptions of their infant care abilities may not be associated with family functioning. In contrast, a study by Belsky et al⁵⁸ examined marital quality and suggested that a mother may change the way she interacts with her child, as the child gets older. In summary, the impact of family functioning may not operate in infancy, but rather at older ages, at least with respect to caregiving qualities.

Finally, it was hypothesized that lower child development scores would be associated with decreased perceived ICC scores of depressed mothers. Findings supported this hypothesis in that significant bivariate and multivariate associations were found between child development (all variables) and responsiveness as an aspect of ICC, with infants' fine motor skills being particularly noteworthy for its strength of association across statistical tests. Model building revealed infant development, particularly fine motor skills, was a robust explanatory variable of the most successful model of responsiveness, but also emotionality, with problem solving as a significant predictor along with gross motor development (Table 3). With respect to emotionality and child development, model building revealed that problem solving was a significant predictor along with gross motor development and social support variables.

In summary, this study suggests that depressed mothers who rate their infants lower in all developmental domains, especially fine motor skills, will also rate their infants as lower on the ICQ Responsive subscale. Responsiveness reflects the infant's temperament, affect, and the response to mother in interactions.⁹ One explanation for this association may be that mother's ratings of infant development overlap with her ratings of how responsive the infant is in interactions with her. In addition, mothers who rate their infants lower in problem solving and gross motor skills may have diminished ICC in emotionality. Emotionality reflects the emotions the mother feels in response to negative infant behaviors such as crying.⁹ Problem solving typically involves active engagement with objects (eg, toys), and people and gross motor skills are linked to observable abilities (eg, feeding) and demonstrations of affect (eg, smiling, smooth movements like reaching for caregiver); thus, reductions in these aspects of child development may produce more frustrations due to negative infant behavior. Emotionality scores were noted to be low which

may be due to the mothers' depressive symptoms that color her perceptions or dampen her responses to her infant's negative behaviors.¹⁰

Model building not only revealed that infant development was a robust explanatory variable of ICC but that other variables played important roles. Responsiveness was also predicted by family functioning and nurturance (an aspect of social support). Emotionality was also predicted by social support, including social interaction and reliable alliance (Table 3). Decreased feelings of support in the form of not feeling a sense of belonging and not feeling supported in times of need can predict how the mother may feel toward her infant.^{43,53} The mother may feel isolated and thus become frustrated in providing care, as there may not be that assurance from family or friends that is required to feel competent.⁵⁹ She may experience her interactions negatively and inadequately anticipate her infants' needs or miss opportunities to provide comfort. Similarly, if an infant is unable to complete certain tasks, the mother may again have more negative emotions toward her infant's behavior.⁶⁰

There are some limitations to this study, which include the small sample size obtained from the original study and the secondary nature of the analysis. A further limitation is that the information collected from participants was obtained from self-reports. Some participants may have exaggerated responses on the questionnaires or did not disclose information due to feelings of embarrassment or feelings that provided responses might reveal their identity. In addition, rating of child development and ICC may have been influenced by depression. Examination of the depression severity as a predictor may have been limited by the lack of variability or range in the EPDS scores and that most of the mothers were mildly depressed rather than moderate or severely depressed. Furthermore, self-report questionnaires capture how a participant feels at the time the questionnaire is completed, thus assessing participants' perceptions, while depressed, potentially influenced results. The use of clinician assessments of performed maternal competence (such as an observational measure of mother-infant interaction quality) and child development status (cognitive and social) would have further added to the strength of this study. Moreover, as this is a cross-sectional study, it could not assess whether depression symptoms led to lower or more adverse outcomes (child development, ICC), which limits conclusions on predictive variables, nor can it rule out reverse causality. Finally, some of the variables were non-normally distributed; thus, the results of the regression must be interpreted with caution.

This study may have important recommendations for families, clinicians, and for future policies and research. For clinicians, the recognition that mothers with depression may rate their infant's development and responsiveness lower represents important knowledge and potentially the need to objectively assess and intervene to improve infant development or mothers' perceptions. It is as equally important to observe infant

responses to the mother (especially communication, such as smiling, eye contact), which may offer targets for intervention. For example, being explicit and discussing how the infant has achieved developmental milestones, especially those that affect mother-infant interaction, may assist mothers in perceiving themselves as competent in infant care. Alternatively, assisting mothers to identify infant cues that signal infant responsiveness may also be beneficial. Moreover, social support and family functioning remain targets for intervention with depressed mothers as well as helping mothers detect when they are frustrated with negative infant behavior.^{5,10}

Policy and clinical practice recommendations include enhanced education in the clinical setting for health care professionals, where the focus not only remains on screening of PPD symptoms but including ICC. Policies can guide relevant clinical changes in health services. Nurses, psychiatrists, or frontline staff could emphasize ICC during mental health assessments or during postpartum follow-ups specifically in mothers who have depressive symptoms. For example, when nurses evaluate mothers with PPD pre- and postnatally, assessments could include screening of the mother's perceptions on her abilities as a caregiver, specifically focusing on how the mother feels her infant is responding to her. Nurses can also include observations in assessments with a focus on responsiveness and changes as the child develops. Clinicians can introduce early intervention methods such as parenting classes if child deficits such as decreased communication are noted; as well as educating mothers about how the infant is developing and capable of interacting. Intervention programs focused on attuning parents to their infants' cues and signals of responsiveness abound and could be recommended such as Circle of Security⁶¹ or Keys to Caregiving.⁶²

Conclusions

In summary, while mothers' ratings of child development was the most robust predictor of maternal perceived ICC, especially responsiveness, child development, social support, and family functioning combine to predict ICC across domains. Interventions are recommended to not only screen mothers for PPD but also assess aspects of ICC in depressed mothers. Depressed mothers may require information about infant development to understand and promote responsiveness as an aspect of ICC. Education could be completed during early prenatal visits by public health nurses to determine risk factors as well as during postpartum follow-up. Further interventions related to social support and family functioning are also indicated. Nurse clinicians can inform mothers and families about the importance of securing social support and the impact of family cohesiveness on parenting. Educating mothers about support groups, family therapy, or intervention programs designed to promote ICC may be helpful. The ICQ may be an effective tool for assessing maternal perceptions of ICC in the context of PPD.

Author Contributions

Each co-author contributed substantially to the writing and revising of the introduction, methods, results, and discussion sections.

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