Mediational models of maternal stress in neonatal intensive care units

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Abstract

Background: Maternal stress in neonatal intensive care units (NICUs) is well acknowledged. However, there is currently no well-defined support at how to best assist mothers during their infants' hospitalization. Not only must they confront at the same time their infant's fragility, but also their own personal trials. In this exploratory study, we examined whether the Multiple-Stressor mediational modeling approach commonly used in Ecology could be used to better assist these parents. This approach calls attention to the overall impact that multiple stressors can have on an organism, i.e., not only in regard to their individual effects, but just as importantly, through their interactions with each other, be they positive or negative. It is hypothesized that the use of such mediational modeling could improve our understanding of the overall impact that multiple stressors can have on NICU mothers.

Methods: At 2 weeks postpartum, 30 mothers with infants born between 24 and 29 weeks gestation responded to the following self-reported psychological outcome measures: Affect Intensity Measure (AIM); Crowne-Marlowe Social Desirability Scale (CM); Edinburgh Postnatal Depression Scale (EDPS); Brief Symptom Inventory-Anxiety (BSI-Anx); Parental Stress Scale: NICU (PSS:NICU); Multidimensional Scale of Perceived Social Support (MSPSS); and Coping Inventory for Stressful Situations (CISS). The "Best Subsets Regression" analysis (www.minitab.com) was used to identify the four interactive maternal outcome measures that best correlated with the mediational stress models of interest, namely, Depression, Anxiety, parental NICU stress, Perceived Social Support, and Coping skills.

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Results: The following mediational models of maternal stress outcomes during their infant's NICU hospitalization were identified: depression, anxiety, stress of the sights and sounds in the NICU, "the looks of my baby", my "inability" to be a parent, perceived social support, and coping skills.

Conclusions: It is advanced that the use of the Multiple-Stressor approach, with its ability to identify factors associated with particular stressors, can offer psychosocial providers a more tangible understanding of the maternal key elements at the source of maternal stress in NICUs. It is expected that to ease the stressful experiences these mothers encounter, such approach will facilitate the development of more effective interventions to assist these parents' challenges than currently available.

Introduction

Hans Selye defined stress as an organism's ability to respond to surrounding stressors or events that threaten its homeostasis (1). Lecic-Tosevski *et al.* (2) distinguishes stress as not only relating to physical and/or physiologic stressors, but also to the degree in which situations are "determined by one's perception of their stressfulness" (3). Such subjectivity is a function of recipients' disposition, traits, and their environment, e.g., resilience/vulnerability, coping skills, life experiences, mental state, age (2). Together, these attributes determine the "tolerance" level that an individual has in managing a situation he/she is confronting at a particular time in life. As such, whether a stressor is truly 'threatening' will depend on our "response intensity or magnitude" to that event with the latter determining our behavioral and/or emotional response.

In the field of Ecology, the use of the Multiple-Stressor modeling approach has gained in popularity. Indeed, researchers have long recognized how the simultaneous interactions of multiple stressors onto an organism could lead to uncertain outcomes as the multitude of potential combinations between these stressors, be they beneficial or detrimental, makes it difficult to predict any likely outcome. As such, not only is it difficult to identify a potential impact on a particular organism, but more importantly, how to best resolve the problem (4,5). Although Multiple-Stressor research is a recognized theoretical framework in understanding stressful impacts on environmental or ecological adaptations, it has not yet received the attention it deserves in the study of stress adaptation/behaviors in humans (6–9). Hale and al. argue that although animals/humans respond behaviorally to individual stressors, it is unclear to what extent the complex interactions of these stressors amongst themselves further contribute to a responder's overall behaviors (8). As such, to better understand human behavioral responses to multiple stressors, a more appropriate approach would be to quantify behavioral responses not only in terms of the impact of the stressors themselves, but also of their interactions, be they synergistic or antagonistic, with each other along with the recipients' attributes.

Maternal stress in neonatal intensive care units (NICU)

With the sustained increase in the survival of preterm infants over the last three decades, parental stress following the birth of a child is undeniable. This is evidenced by the extensive research literature in this domain be they in reviews or studies focused on particular infant's characteristics, parental distress, e.g., depression, anxiety, or imbalanced family situations (10–27). Of interest, studies have shown how such parental stress responses may be associated with a particular condition observed in their infant(s). For instance, Gordo *et al.* in a study conducted on full-term infants identified an association between parental depression and their perceived parenting competence in the care of their child (28). Musabirema *et al.* observed that parental perception of stress during their infants' NICU hospitalization was most impacted by their baby's looks and behavior as monitored by the Parental Stressor Scale:NICU (29,30).

Currently, well-defined intervention protocols for NICU parents are limited (23,31–36). In a systematic review and meta-analysis monitoring NICU parental distress in 1,643 controlled studies published before 2017, the authors concluded that "NICU interventions modestly reduced parental distress" (37). Importance of identifying risk factors for early interventions are critical because the initiation of maternal behavior/motherhood requires the continuous interfacing between mother and child(ren). With the global recognition that "mother's milk is best", breastfeeding support and milk banks availability throughout NICUs have expanded (38–40). However, of importance, it is the appropriate initiation of mother-infant interactions that will ultimately determine their breastfeeding success and the nature of their bond/ attachment (41–45). As NICU hospitalization may become a traumatic experience for both infants and parents, a "trauma-informed" care approach has been recommended between parents and staff to emphasize safety, trustworthiness/transparency, peer support, mutuality, parents and staff empowerment, as well as cultural/historical/gender concerns (46). This brief review of the multitude of differing challenges facing mothers in the NICU illustrates the difficulty facing providers when assisting parents through their infants' hospitalization. This is further exacerbated by the fact that NICU care providers are trained to care for a pediatric population and their parents are not their patients per se.

At present, studies on maternal stress in NICU have focused primarily on alleviating recognized psychological issues such as depression, anxiety (17,27,45,47,48). However, as interactions between multiple stressors may further impact behaviors and maternal mental health, our understanding of the "overall" stress experienced by mothers and the current support we offer is incomplete. There is limited research examining how the stress experienced by mothers in NICUs arise. It is normally reasoned that maternal "response intensity" to postpartum depression/anxiety, for example, results from their personal traits (20,49,50). If correct, given the broad spectrum of "personalities" in our society, one cannot expect that only a "one size fits all" care approach would suffice. Indeed, individuals' attributes such as personality and external socioeconomic factors would contribute to their perception of how stressful their personal situation is.

As the complexity of the stress experienced by mothers in NICUs parallels the environmental perturbations occurring in natural ecological systems, it is hypothesized that the theoretical Multiple-Stressor framework used by environmental researchers can allow

for the development of similar mediational models of specific maternal stress outcomes. If this could be attained, it would be expected that such approach would lead to the development of more effective programs to assist individual NICU mothers as it will offer caregivers a clearer grasp of the varied stressors they are confronting as a function of their respective attributes and socioeconomic environment. Thus, the goal of the present study was to identify maternal attributes that could lead to the development of maternal Multiple-Stressors mediational models. The following models were examined: Depression, Anxiety, NICU Stress, Perceived Social Support, and Coping Skills.

We present the following article in accordance with the MDAR reporting checklist (available at https://dx.doi.org/10.21037/pm-21-35).

Methods

Subjects

Thirty mothers of infants born between 24 and 29 weeks gestation were recruited from a convenient cross-sectional sample of a large prospective study conducted between August 2005 and July 2011 in the NICUs at Texas Children's Hospital, Baylor College of Medicine (Houston, TX, USA). This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Baylor College of Medicine Internal Review Board (H-18036). Written consent form was obtained from mothers.

Assessment of maternal socioeconomic characteristics and psychological traits

Mothers were recruited at least 2 weeks postpartum to ensure that their infants were clinically stable. At that time, social-economic characteristics were collected, e.g., race/ethnicity, age, education, income. Because race is primarily based on one's physical/genetic attributes and ethnicity describes one's cultural expression/tradition, these two descriptors were combined as individuals in our current society may identify themselves through a racial or ethnic background. At the same time, to monitor maternal attributes, mothers responded to the following standard self-reported instruments (Table 1). The Affect Intensity Measure (AIM) monitors the intensity of positive or negative emotions experienced by individuals; the higher the score, the greater their emotional response (51). The Crowne-Marlowe Social Desirability Scale (CM) was used to assess subjects' "social desirability" trait or their need for social approval or avoidance of social disapproval (52,57). It measures subjects' response bias to self-reported psychological questionnaires; the higher the score, the more likely the subjects will respond towards social approval and the lower the score, the more "truthful" the respondents. This measure was used as a covariate in data analyses. The Edinburgh Postnatal Depression Scale (EDPS) monitored maternal depression (53); the higher the score, the greater the depression. The Brief Symptom Inventory is a screening questionnaire that assesses nine adult symptom dimensions, i.e., somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism, and calculates a Global Severity Index, Positive Symptoms Total, and Positive Symptom Distress Index. In this report, only the Anxiety dimension was used [BSI-Anx; Pearsonassessments.com; (54)]. The Parental Stress Scale:NICU monitored maternal stress pertaining to the sight and sounds in the NICU, baby's looks, parenting

role alteration or parental alteration due to their inability to care for their infant as a parent, and their ease in communicating with NICU staff (29). The Multidimensional Scale of Perceived Social Support or Perceived Social Support (MSPSS) was used to evaluate the subjects' perceived stress from family, friends, and significant other (55). The Coping Inventory for Stressful Situations (CISS) differentiated between task-oriented (CISS-Task), emotion-oriented (CISS-Emotion), and avoidance-oriented (CISS-Avoidance) coping skills that individuals may use in handling a difficult event (56). For individuals who are task-oriented, the higher their score, the more likely they will use behavioral or cognitive problem-solving techniques, emotion-oriented individuals will more likely respond with emotional outbursts, self-preoccupation, while avoidance-oriented counterparts will rely on self-distraction with other activities or social diversion. Maternal postpartum health was monitored by the number of postpartum visits mothers had with their own health provider.

Maternal mediational stress models

The following mediational models were considered: Depression; Anxiety; the stress of NICU sights and sounds, baby's looks, parental alteration, and staff communications; Perceived Social Support; and Task-oriented/Emotion-oriented/Avoidance-oriented coping skills.

Statistical analyses

One-way ANOVA was used to compare maternal characteristics and psychological measures by race/ethnicity (Figure 1,Table 2).

To build a mediational model for assessing the potential interactions between maternal attributes, as measured by the self-reported psychological instruments, and a particular maternal stress outcome model, multiple regression analyses were first conducted to identify the maternal attributes significantly associated ($P<0.05$) with each model of stress outcomes. Following this first step, the 'Best Subsets Regression' analysis (www.minitab.com) was used to identify the 4 maternal variables that best correlated with the models of interest. Unlike a stepwise approach whereby a specific set of predictors are added or removed based on their combined statistical significance to result in a single regression model, the Best Subsets approach compared all possible models using the set of maternal predictors identified in the original multiple regression analyses and displays the 'best-fitting' models in order of highest to lowest adjusted R^2 and/or Mallows'Cp close to the number of predictors of interest (in our case 4) to help users choose a final model.

Results

There was no significant difference in maternal socioeconomic status and psychological outcomes between Race/Ethnicity except for Education and Income (P 0.001; Figure 1) and Crowne-Marlowe Social Desirability Scale between Caucasians and African-American mothers (CM; P=0.001; Table 2). As mentioned in an earlier study (45), the latter observation emphasizes the importance in studies using self-reported testing to consider the truthfulness of respondents as it is critical to researchers' ability to conduct accurate studies (45,58–60). As maternal postpartum visits to their own care provider were minimal,

it is presumed that our observations were not impacted by mothers' concern over their own health.

Table 3 presents the individual maternal attributes associated with the different mediational stress models. In Table 4, the 4 maternal attributes that best correlated with each of the mediational stress models are presented. In each of these models, they are listed from their highest to lowest individual P values, be they statistically significant (P<0.05) or not (P>0.05, NS) along with their positive (+) or negative (−) correlation with the respective models. The % adjusted R^2 shows the effect that these 4 predictors together contributed to the original multiple regression analyses. The overall P value is that of the original multiple regression analyses. It is emphasized that this approach does not necessarily identify a 'best' interactive model, but rather allows users to select an 'optimal' model based on their knowledge of the subject area under study (https://support.minitab.com/en-us/minitab-express/1/help-and-how-to/modeling-statistics/regression/how-to/best-subsets/before-you-start/overview/).

Discussion

From the literature review briefly summarized above, it is evident that mothers experience a broad "variety" of stressors during their baby's NICU hospitalization. Along with the stress of having given birth to a premature fragile infant, mothers must confront not only their immediate apprehension of what can happen to their baby(ies), but also their personal daily life challenges. As such, the cumulative risks they experience becomes difficult to gage as it requires identifying not only concerns over their infant(s), but also the impact of how their personality and lifestyle may contribute to their overall NICU experience. On such bases, it may not be surprising that, currently, encouraging mothers to maintain breastfeeding, skin-to-skin contact, or frequent visits to the NICU is often unpredictable.

With the realization that when an individual simultaneously faces multiple stressors, the overall impact he/she experiences becomes difficult to assess as it is not only the resultant of individual stressors themselves, but also of their interactions with each other. Thus, identification of a main "culprit" becomes difficult and any intervention/support aimed at a particular stressor, e.g., depression, anxiety, may not lead to any significant benefit. Given that the current assistance mothers receive in the NICU are deemed to only "modestly" reduce their distress (37), the present exploratory study was initiated to determine whether the Multiple-Stressor theoretical modeling framework, validated by ecologists, could be also applicable to the human paradigm, as the similarities existing between the stressors NICU mothers are exposed to parallel those of organisms in the environment (4,5,7). In addition, the availability of the Best Subset Regression technique offered the opportunity to, not only, identify the stressors implicated in particular stress models, but also to monitor statistically their combined impact on maternal stressors. As such, it is advanced that the combined use of these two techniques can offer NICU care providers a more comprehensive psychosocial understanding of the struggle these mothers face. It is expected that such understanding will allow psychosocial therapists to develop more efficacious support for their mothers as any treatment benefits could be verified by repeated psychological re-evaluation over time. For instance, it is advanced that within the Depression mediational model (Table 4), based on

the maternal attributes identified, if support were offered to reduce mothers' stress for their inability to be a parent (parental alteration), emotion-oriented outbursts (CISS-Emotion), and perception of lack of social support (Perceived Social Support), maternal overall Depression would be decreased. A "chain reaction" resulting from such improved maternal attributes and overall maternal Depression will additionally lead to a decrease in the intensity of the other stressors who are associated with the same maternal attributes. In our example, as overall Depression, parental alteration, CISS-Emotion, and Perceived Social Support are improved, the stress ensuing from one's Baby's Looks via parenting alteration, staff communication via CISS-Emotion, and CISS-Task via Perceived Social Support would be expected to be improved as well. This example illustrates the outreaching impact that such an approach can have due to the normal interactions existing between stressors.

Used in conjunction with maternal support programs (61) under the guidance of social workers/psychotherapists, this analytical approach may help mothers better understand and manage their personal struggles. The latter can be very validating and powerful for parental adaptation and behavioral changes. It would not only benefit parents' personal wellbeing, but also increase their NICU participation in the care of their babies. It is important to remember that parental stress in the NICU does not only pertain to mothers, but also fathers. As such, proper assistance for both parents would be essential to fully support the long-term development of appropriate parent-child dyads in NICUs as well as home (35,44,45,62–68).

In summary, this study explored the applicability of the Multiple Stressor modeling commonly used by ecologists to human studies. Along with the use of the Best Subset Regression analyses, it has been possible to develop statistical mediational models of stressors that were not only associated with differing maternal attributes, but also identify their synergistic/antagonistic interactions. This emphasizes the clinical importance of considering not only individual maternal traits, but also their interactions with each other when assisting parents.

Conclusions

To our knowledge, this is the first study that uses the Multiple-Factor modeling approach to decipher the complex multi-factorial interactions facing mothers following a premature delivery. It is advanced that identification of such key components and their respective interactions with each other will provide a better informed approach to the development of appropriate interventions to alleviate the stress of NICU mothers. If mothers were to receive a more comprehensive psychosocial support that helps identify their personal characteristics/traits most affected in their NICU experience, better focused and individualized support could be offered for their care.

Study limitations/clinical implications/future directions

Due to the exploratory nature of this work, subjects' sample size may appear of concern. However, the observations collected validate the Multiple-Stressor modeling approach as they demonstrated statistically significant associations between maternal traits and NICU-generated stressors. Our results support the notion that such analytical approach could be of

great value to clinical researchers and clinicians as it offers the ability to identify, monitor, and support the various personality traits most at risk in parents of NICU infants.

Acknowledgments

Conflicts of Interest:

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Maternal socioeconomic status by race/ethnicity

	Caucasian	African-American	Hispanic	P**
Number	13	8	9	
Maternal age	31.6±6.5*	26.8±6.6	26.4±6.8	0.128
Education	6.6±1.4[a]	6.2±1.5[b]	4.4±1.6[a,b]	0.001
Income	3.3±0.6[a,b]	2.0±0.8[a]	1.9±1.0[b]	<0.001
Infant's gestational age (wks)	27.8±1.5	26.5±1.4	26.4±2.0	0.131
Infant's birth weight (g)	1,044±233	821±145	970±210	0.070
Maternal health[#]	1.3±1.5	1.4±0.5	0.8±0.4	0.520

Education and income codes

	1	2	3	4	5	6	7	8
Education	<6th grade	6th	8th	10th	12th	14th	16th	<16th
Income	<$10,000	$10,000-49,999	$50,000-99,999	≥ $100,000				

Figure 1.
Maternal socioeconomic status by race/ethnicity. *, Mean ± SD; **, 1 way ANOVA; [a,b], post hoc Fisher LSD: P<0.05 between symbols; [#], Number of visits to a healthcare provider since delivery.

Table 1

Self-reported psychological instruments

Tests	To evaluate	
Affect Intensity Measure (AIM) (51)	•	Trait characterizing an individual's magnitude of emotional response (the higher the score, the greater the emotional response)
Crowne-Marlowe Social Desirability Scale (CM) (52)	•	Trait characterizing an individual's
		– Inclination to be viewed favorably by others
		– Truthfulness of responses
		(the lower the score, the more truthful the response)
Edinburgh Postnatal Depression Scale (EPDS) (53)	•	Postpartum depression (the higher the score, the greater the depression)
Brief Symptom Inventory Anxiety (BSI-Anx) (54)	•	Anxiety (the higher the score, the greater the anxiety)
Parental Stress Scale:NICU (PSS:NICU) (29)	•	Perceived stress in the NICU resulting from:
		– Sights (53) & sounds in NICU (S&S)
		– Baby's looks/behaviors (Looks)
		– Parenting alteration (Parent)
		– Staff communication (Staff)
		(the higher the scores, the more stressful these factors)
Multidimensional Scale of Perceived Social Support (MSPSS) (55)	•	Perceived social support (the higher the score, the greater the perceived social support)
Coping Inventory for stressful Situations (CISS) (56)	•	Task-oriented coping (CISS-Task)
	•	Emotion-oriented coping (CISS-Emotion)
	•	Avoidance-oriented coping (CISS-Avoidance)
Maternal health condition	•	Number of visits to healthcare providers

Table 2

Psychological stress outcomes by race/ethnicity monitored by self-reported instruments

Maternal psychological measures	Caucasian	African-American	Hispanic	P*
Affect intensity measure (AIM)	3.6±0.4[#]	3.8±0.6	3.93±0.5	0.465
Crowne-Marlowe Social Desirability Scale (CM)	16.5±5.8[a,b]	26.4±4.2[a]	22.3±4.2[b]	0.001
Postpartum depression (EPDS)	10.9±4.7	11.6±6.2	13.5±5.5	0.546
Anxiety (BSI-Anx)	57.3±12.3	52.9±8.4	48.9±11.5	0.297
Parental Stress Scale:NICU (PSS:NICU)				
Sight & Sound	3.1±0.7	2.5±1.2	2.3±1.3	0.268
Baby's Looks	3.4±0.7	2.9±1.2	3.3±1.1	0.479
Parenting Alteration	4.3±0.9	4.1±1.1	3.9±1.2	0.736
Staff Communication	2.2±1.0	1.5±0.6	1.7±0.9	0.252
Perceived Social Support (MSPSS)	6.5±0.5	5.5±1.3	6.2±0.9	0.084
Coping Inventory for Stressful Situations (CISS)				
Task-oriented (CISS-Task)	49.7±15.1	56.0±8.6	45.0±10.8	0.273
Emotion-oriented (CISS-Emotion)	48.0±9.4	47.4±11.1	48.5±12.2	0.980
Avoidance-oriented (CISS-Avoidance)	46.5±11.4[a]	59.4±12.5[a]	47.8±10.8	0.060

[#]Mean ± SD;

*One-way ANOVA;

[a,b]Post hoc Fisher LSD: P<0.05 between symbols.

Table 3

Maternal self-reported attributes associated with mediational models of maternal stress outcomes

Maternal attributes*	Mediational models of maternal stress outcomes			
Race/Ethnicity	Depression	NICU Baby's Looks	NICU Parenting Alteration	
Income	Anxiety	NICU Baby's Looks	NICU Staff Communication	Use of Avoidance-oriented coping skill
Education	NICU Sight & Sounds	Use of Task-oriented coping skill		
AIM	Anxiety	PSS:NICU Sight & sounds	Use of Avoidance-oriented coping skill	
CM	NICU Sight & sounds	Perceived Social Support	Use of Emotion-oriented coping skill	
EPDS	NICU Parenting Alteration	NICU Staff Communication	Use of Emotion-oriented coping skill	
BSI-Anx	NICU Parenting Alteration	Use of Task-oriented coping skill	Use of Avoidance-oriented coping skill	
PSS:NICU (Sight & Sounds)	NICU Staff Communication			
PSS:NICU (Baby's Looks)	NICU Sight & sounds	NICU Parenting Alteration	Use of Emotion-oriented coping skill	
PSS:NICU (Parenting Alteration)	Depression	NICU Baby's Looks		
PSS:NICU (Staff Communication)	Depression			
MSPSS	Depression	Use of Task-oriented coping skill		
CISS-Task	Anxiety	Perceived Social Support	Use of Avoidance-oriented coping skill	
CISS-Emotion	Depression	NICU Baby's Looks	NICU Staff Communication	Perceived Social Support
CISS-Avoidance	Anxiety	Use of Task-oriented coping skill		

*Maternal Attributes identified by respective self-reported psychological instruments.

Table 4

Combined 4 maternal attributes contributing best to mediational models of maternal stress outcomes

Maternal stress outcomes models	Combined 4 maternal attributes contributing best to each mediational model				R^2 (adj) %	P^* (overall)
Depression	Parent Alteration (+) [#] (<0.001) [§]	CISS-Emotion (+) (0.001)	Race/Ethnicity (0.002)	Perceived Stress (−) (0.006)	73	<0.001
Anxiety	Income (+) (<0.001)	CISS-Task (−) (0.001)	CISS-Avoidance (+) (0.004)	AIM (−) 0.021	56	0.001
NICU Sights & Sounds	Baby's Looks (+) (0.012)	Social Desirability (−) (0.020)	Education (+) (0.028)	AIM (+) (0.049)	53	<0.001
NICU Stress (Baby's Looks)	Parenting Alteration (+) (<0.001)	Income (+) (0.006)	Race/Ethnicity (0.008)	CISS-Emotion (−) (0.121/NS)	72	<0.001
NICU Stress (Parenting Alteration)	Baby's Looks (+) (<0.001)	Race/Ethnicity (0.002)	EPDS (+) (0.003)	BSI-Anx (−) (0.386/NS)	71	<0.001
NICU Stress (Staff Communication)	EPDS (+) (0.020)	Income (+) (0.075/NS)	CISS-Emotion (−) (0.088/NS)	Sights & Sounds (+) (0.197/NS)	41	0.006
Perceived Social Support	CM (−) (<0.001)	CISS-Emotion (−) (0.008)	CISS-Task (+) (0.032)	AIM (+) (0.092/NS)	52	0.001
Coping Skills (Task-oriented)	Education (+) (0.002)	BSI-Anx (−) (0.002)	Perceived Social Support (+) (0.010)	CISS-Avoidance (+) (0.026)	58	<0.001
Coping Skills (Emotion-oriented)	EPDS (+) (0.001)	CM (−) (0.024)	Baby's Looks (−) (0.062/NS)	AIM (+) (0.369/NS)	45	0.002
Coping skills (Avoidance-oriented)	Income (−) (<0.001)	AIM (+) (<0.001)	CISS-Task (+) (<0.001)	BSI-Anx (+) (0.004)	65	<0.001

[#], (+) positive and (−) negative correlation with corresponding Maternal Stress Models;

[§], individual maternal traits with significant (P<0.05) and non-significant P values (>0.05; NS) within each mediational model;

[*], overall P value of the original multiple regression analysis for individual mediational models.