The Structure of Maternal Communication in Childhood Cancer: Confirmatory and Exploratory Factor Analysis and Relation to Maternal Distress

By

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Dissertation

Submitted to the Faculty of the

Graduate School of Vanderbilt University

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

in

Psychology

June 30, 2018

Nashville, Tennessee

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ACKNOWLEDGEMENTS

This research was supported by grant R01 CA 118332 from the National Cancer Institute. This dissertation is dedicated to the families who participated in this study, who so generously gave us insight into their lives.

This study would not have been possible without the thoughtful guidance of my research mentor, Dr. Bruce Compas. I am grateful for his constant encouragement of my interests and passions, his commitment to developing my skills as a clinical scientist, and his contagious enthusiasm for the work that we do. Dr. Compas helped me articulate my interest in parent-child communication when I first interviewed at Vanderbilt, and has continued to encourage me to develop this line of inquiry throughout my graduate school training.

I am exceptionally grateful for the time of my committee members. Dr. Sarah Jaser and Dr. Meg Saylor have been invaluable in refining my thinking and learning during each graduate school milestone. And the current study would not have been possible without the mentorship, insights, and patience of Dr. Kris Preacher.

I am also grateful to the Coping and Communication team for their dedication to the lives of families affected by childhood cancer. I am particularly appreciative of the constant support, camaraderie, and encouragement of my cohort, Alex Bettis, Kacie Dougherty, Janet Yarboi, and Rachel Zelkowitz, who helped me find my joy at Vanderbilt and in Nashville.

Finally, I want to thank my parents, Susan and Tom, and my brother, Ben, for encouraging me to pursue my passion in pediatric psychology. They have instilled in me curiosity, activism, compassion, and persistence. I could not have completed my graduate training without their love and support at each step.

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CHAPTER I

BACKGROUND

Every year over 12,000 children and adolescents in the U.S. are diagnosed with cancer and now over 80% survive up to five years post diagnosis (Jemal, Siegel, Xu, & Ward, 2010). While survival rates have increased, childhood cancer is still a source of significant stress for families. Stressors that accompany child cancer include illness uncertainty, ongoing management of potentially complex medical regimens, physical effects of treatment, and increased risk for symptoms of emotional distress in children and parents (Cousino & Hazen, 2013; Mullins et al., 2007; Pinquart & Shen, 2011a; Pinquart & Shen, 2011b; Stark, 2013). One of the most difficult tasks facing parents of children with cancer is communicating with their child about their diagnosis, treatment, and prognosis (Rodriguez et al., 2012).

Although communication has been proposed as a potential mechanism of both risk and resilience in pediatric psychology (Drotar, 1997), a comprehensive understanding of the underlying structure of maternal communication in childhood cancer is absent. Understanding the structure of maternal communication in this population is crucial, as maternal communication is a modifiable factor that can be targeted in clinical interventions to improve psychosocial outcomes (Wysocki et al., 1999; Wysocki et al., 2008). The purpose of this study is two-fold: first to conduct a factor analysis of maternal communication in the context of a child's cancer diagnosis and treatment and second to conduct an initial examination of the association of the identified factor structure with maternal distress. Results have the potential to provide greater understanding of the latent structure of maternal communication in this population. This is an important step needed to elucidate mechanisms of risk to target in interventions as well as

mechanisms of resilience to leverage in order to improve the lives of families affected by pediatric cancer.

I begin by reviewing stress associated with childhood cancer and its effects on children with cancer and their parents. Second, I describe approaches to observing and measuring communication, particularly maternal communication, in child cancer and other childhood chronic illness populations. I then review findings from previous factor analytic studies, consider family communication theory and its application in families with chronically ill children, and then propose a hierarchical structure of maternal communication to be tested in the current study. Finally, I propose an initial test of possible correlates of this factor structure by examining the longitudinal relation between maternal distress and maternal communication.

Stress in Childhood Cancer

The diagnosis and treatment of cancer in childhood are characterized by stress that is both chronic and uncontrollable. Indeed, pediatric cancer involves a range of uncontrollable stressors, such as illness uncertainty, treatment-specific stressors, and disruptions in family life (Mullins et al., 2007; Rodriguez et al., 2012; Sorgen & Manne, 2002; Stark, 2013). In addition, pediatric cancer is now recognized as a chronic, often lifelong condition that involves careful monitoring and risk for late effects of treatment (Oeffinger et al., 2006). Cancer-related stress continues to be uncontrollable and unpredictable over time due to ongoing medical intervention, impact on the family environment, and the child's changing developmental status (van Cleave, 2010). Previous research indicates that uncontrollable stress is more strongly associated with negative outcomes than controllable stress, (e.g., Dickerson & Kemeny, 2004; Gallagher, Bentley, & Barlow, 2014; Southwick, Vythilingam, & Charney, 2005; Treadway, Buckholtz, & Zald, 2013), and past studies have illustrated the adverse effects of long-term chronic stress (Marin, Munch, & Miller,

2009; Miller, Chen, & Cole, 2009; Miller, Chen, & Parker, 2001). Given the impact of chronic and uncontrollable stress, pediatric cancer puts families at increased risk for emotional distress.

One feature of chronic illness in childhood is that it affects the entire family (Cohen et al., 2011; Long & Marsland, 2011) and results in altered family functioning both in the short and long term. Indeed, several researchers have concluded that the impact of pediatric illness is best understood when conducting studies at the family level (e.g., Chaney et al., 1997; Drotar, 1997, Wallander & Varni, 1998), and the Institute of Medicine has called for family-based outcome studies (Cohen et al., 2011). The impact of child chronic illness on families is multifactorial. For example, in a study of families with a child with cancer, parents identified altered roles due to cancer treatment that include concerns about keeping a job, having less time and energy for other family members, and paying bills and family expenses, while children with cancer reported missing school or falling behind in school work, activity limitations, frequent trips to the hospital, and concerns about family and friends (Rodriguez et al., 2012).

Given numerous cancer-specific stressors and altered family functioning, it may be unsurprising that childhood cancer takes a toll on the psychological functioning of family members. Although not without controversy, the result of several systematic reviews indicate that children and parents are at risk for increased levels of emotional distress. A recent meta-analysis found that children with cancer had higher levels of internalizing, externalizing, and total behavioral problems than healthy peers, with the largest effect size for symptoms of anxiety and depression (g = .47; Pinquart & Shen, 2011a). Indeed, the authors concluded that "elevated levels of internalizing and total problems are observed in almost all chronic illnesses" (p. 1014), with cancer being no exception. Reviews and meta-analyses of parents of children with cancer found that mothers and fathers are also at higher risk for emotional distress and symptoms of

internalizing problems, including anxiety, depression, and post-traumatic stress (Barlow & Ellard, 2006; Cabizuca, Marques-Portella, Mendlowicz, Coutinho, & Figueira, 2009; Pai et al., 2007*)*. Although not all children and parents affected by cancer experience heightened distress, and indeed these populations are often characterized by marked resilience (e.g., Kazak & Noll, 2015), the authors of these meta-analyses and reviews have called for regular screenings for psychological distress and increased research into causes and correlates (Pai et al., 2007; Pinquart & Shen, 2011).

Childhood cancer therefore represents a significant stressor for families, results in altered family functioning, and puts family members at risk for increased distress. In order to develop interventions for families affected by pediatric cancer, researchers must identify clinically modifiable risk factors that are linked to trajectories of risk and resilience over time. One such risk factor is maternal communication. In order for this to be targeted and leveraged in clinical interventions, the nature and latent structure of maternal communication in this population must be better understood.

Maternal Communication in Childhood Cancer

Communication was formally identified as a research priority for families of children with chronic illnesses in an influential *Journal of Pediatric Psychology* editorial (Drotar, 1997). Given the numerous stressors associated with childhood chronic illness, the alterations in family functioning, and the risk for emotional distress, it is reasonable to expect that communication may be disrupted in pediatric populations. Indeed, a recent review (Murphy, Murray, & Compas, 2017) has indicated that communication in families of children with chronic illnesses is generally impaired compared to families of healthy, typically developing children. And for parents of

children with cancer, communicating with their child about diagnosis and treatment is itself identified as a significant stressor (Rodriguez et al., 2011).

The focus of the current study is on *maternal* communication in child cancer specifically. The reasons that maternal (as contrasted with paternal) communication has dominated the literature apply to the current study as well, as significantly more mother-child dyads participated in the current observation study than father-child dyads (e.g., Dunn et al., 2009). In addition, we chose to focus on mothers as the coding target, rather than children, as mothers are assumed to take on a scaffolding role with mother-child communication (Fitness, 2013; Koener & Fitzpatrick, 2013). Given this, understanding maternal communication holds potentially great clinical utility. Although terms such as "family communication" or "parental communication" are used when discussing theory and methodology, it is important to note that much of the research has been conducted with mothers (see Murphy et al., 2017; Stamp & Shue, 2013).

Measuring communication. Parental communication has typically been measured with questionnaires, by either asking parents how they communicate with their children or asking children how their parents communicate with them. However, there are several limitations of questionnaire measures. First, family members, particularly children, may have limited insight into communication styles or their ability to accurately recall communication that occurs daily and spans many years (Wysocki, 2015). In addition, like any self-report measure, social desirability has the potential to obscure information that is reported (Stamp & Shue, 2013; Wysocki, 2015). Furthermore, communication is often examined in relation to measures of physical and psychological functioning that are also self-reported, introducing the problem of shared method variance (Holmbeck et al., 2002; La Greca & Lemanek, 1996).

Direct observation is emerging as the gold standard of communication methodology, as it has numerous advantages over questionnaire measures. First, the problems of bias in recall and memory and shared method variance with questionnaire measures of other constructs (e.g., parent or child emotional distress) are reduced. Although social desirability may still affect how families communicate when they know they are being observed, the nature of direct observation is that it allows researchers direct access to the dynamics of communication, rather than rely on the perceptions of children and parents (Feeney & Noller, 2013; Stamp & Shue, 2013; Wysocki, 2015). In addition, direct observation allows researchers to focus on the specific types of interactions that may be of interest (Feeney & Noller, 2013; Stamp & Shue, 2013). For example, interactions during medical tasks may be relevant when examining adherence to medical regimens, and conversations about the stressors associated with an illness may be of interest when examining emotional adjustment. There are also limits of direct observation, as it can be difficult to discern ecological validity of samples of family communication under controlled conditions (Feeney & Noller, 2013; Stamp & Shue, 2013). However, direct observation in pediatric psychology research is gaining attention, and is increasingly recognized as an important and evidence-based methodology to assess communication patterns in families (Chorney, McMurtry, Chambers, & Bakeman, 2015; Murphy et al., 2017; Wysocki, 2015).

Analysis of direct observation of communication includes both macro- and micro-level coding systems. Macro-level coding systems are the most commonly used method to measure observed family communication (Chorney et al., 2015; Feeney & Noller, 2013). These are global ratings based on a relatively broad sample of communication, designed to "capture the larger context of interactions" (Celano et al., 2008, p. 157). Ratings are generally based on a combination of frequency, duration, and intensity; are ordinal or interval in nature; and provide

specific anchors for each point. In contrast, micro-level coding systems capture communication at the level of individual utterances or behaviors. This involves creating categories of utterances, applying coding schemes to each utterance, and tallying the total amount or proportion of total utterances that fall into each category during the course of an interaction (Chorney et al., 2015) and typically requires transcription of observations (Chorney et al., 2015; Feeney & Noller, 2013). Both levels of analysis have been applied to pediatric populations (see Chorney et al., 2015; Murphy et al., 2016a; Rodriguez et al., 2013).

Direct observation also varies by coding target. Some coding systems assign a code to just the ill child, just the parent, a parent-child dyad, or the entire family. The majority of coding systems used in pediatrics focus on parents (Chorney et al., 2016; Murphy et al., 2017), and often include just mothers to the exclusion of fathers. Although this is a marked limitation in the field, as fathers are important members of the family unit whose functioning is also closely tied to their child, there is evidence that fathers can be difficult to recruit and obtain in family studies of adjustment to chronic illness (see Phares et al., 2005). Even when studies have included fathers in family communication research, they are sometimes underpowered to detect effects due to small samples (e.g., Holmbeck et al., 2002; Wood et al., 2008).

To date, the only studies examining direct observation of parent-child communication in childhood cancer have come from Compas and colleagues (Dunn et al., 2011; Murphy et al., 2016; Rodriguez et al., 2013, 2016). The focus of the current study is a macro-level system that has been previously validated for use with families of children with cancer in these studies, the Iowa Family Interaction Rating Scales (IFIRS; Melby & Conger, 2011). Although both macro- and micro-level analyses have been applied to the current sample, the IFIRS was chosen because it affords a broad perspective of maternal communication, yields multiple codes that capture a

variety of aspects of communication, and has been highlighted as a "well-established" measure in a recent review of evidence-based assessment in pediatric psychology (Alderfer et al., 2008).

IFIRS coding system. The IFIRS is a macro-level coding system used to assess family members' verbal and non-verbal communication, behaviors, and emotions in a video-recorded interaction (Melby & Conger, 2001). This coding system is designed to be flexible so that it can be applied to a range of interaction settings, interaction partners, and discussion topics (Melby & Conger, 2001). Codes include individual characteristic scales, dyadic interaction scales, and parenting scales. Individual characteristic scales describe the general mood or state of being of the mother based on verbal and nonverbal behavior (Sadness, Anxiety, Positive Mood, Externalized Negative, and Externalized Negative–Cancer, developed for the current study). Dyadic interaction scales assess the verbal and nonverbal behavior directed by the mother towards her child in an interaction (Hostility, Lecture/Moralize, Denial, Warmth/Support, Listener Responsiveness, Communication, Prosocial, Antisocial, and Avoidant). Parenting scales are specifically used to assess the nature of a parent's interaction with her child (Neglect/Distancing, Indulgent/Permissive, Quality Time, Parental Influence, Child Monitoring, Consistent Discipline, and Positive Reinforcement). The IFIRS has been used with other similar populations of children with chronic health conditions, including diabetes and asthma (e.g., Jaser & Grey, 2010; Lim et al., 2008), and more widely varied populations, including married couples, families faced with economic adversity, and families affected by parental depression (e.g., Grant et al., 2005; Jaser et al., 2008; Williamson, Bradbury, Trail & Karney, 2011).

Previous research with the IFIRS system with children with cancer and their parents has focused on using single scales or composites of scales to address a given theoretical or clinical question. For example, composites of maternal communication codes were created that were

theoretically linked to symptoms of maternal depressive symptoms in mothers of children with cancer, including overall Positive, Withdrawn, and Harsh communication (Rodriguez et al., 2016). Similarly, drawing on relational models of post-traumatic stress, maternal Harsh and Withdrawn communication composites were examined in relation to post-traumatic stress symptoms in children with cancer and their mothers (Murphy et al., 2016). However, in order to explore broad mechanisms of risk and resilience in this population, it is important to examine the structure of maternal communication as a whole. Therefore, this study applied factor analytic methods to better understand the underlying structure of communication of mothers of children with cancer, as measured by the IFIRS system.

Previous factor analyses of direct observation systems. Factor analysis is a statistical method that allows researchers to determine if a set of items or measures reflects shared or distinct underlying constructs. Results of factor analyses can reveal a "parsimonious representation" (Fabrigar & Wegener, 2011, p. 20) of the underlying structure of correlations among variables. Because factor analysis can be used to determine the number and organization of latent variables assessed (Brown, 2015), this is an ideal statistical method for the question at hand: What is the underlying structure of maternal communication in a sample of mothers of children with cancer as measured by the IFIRS system? Confirmatory, or restricted, factor analysis is appropriate when there are firm a priori hypotheses about the latent structure, whereas exploratory factor analysis methods are used when there is little prior research to inform hypotheses, and involve exploring a given dataset to determine the structure (Brown, 2015; Fabrigar & Wegener, 2011).

Relatively few previous studies have applied factor analytic methods to observational systems of family communication. All of these studies have used data-driven, exploratory factor

analytic techniques or principal component analyses. There are only two factor analytic studies of the IFIRS (Raj, Wade, Cassedy, Taylor, Stancin, Brown, & Kirkwood, 2014; Williamson et al., 2011), and a handful of studies with similar direct observation measures. Because previous studies of factor analysis of the IFIRS are limited, systems used with pediatric populations as well as those with other populations are reviewed below.

There have been two previous factor analytic studies of the IFIRS system. Raj et al. (2014) examined maternal communication with adolescents (age 12-17) with Traumatic Brain Injury (TBI). This shares some similarities with the current cancer sample, as a TBI involves sudden, acute diagnosis and can involve long-term follow-up care. Communication was observed during a mother-adolescent problem-solving activity, and 29 codes were applied to mothers (7 individual characteristic and 22 dyadic interaction). Exploratory factor analysis (EFA) was used for data reduction and authors determined a 3-factor solution. Items with high skewness and items that loaded onto more than one factor were excluded, yielding the following factors: Warmth (warmth/support, escalate warmth/support, positive mood, and endearment), Negativity (hostility, escalate hostility, antisocial, angry coercion, and contempt), and Effective Communication (communication, assertiveness, listener responsiveness). Many of the IFIRS scales included in this analysis were also used with the current cancer sample, making this an important related study.

The second IFIRS factor analytic study was a study of low income and ethnically diverse newly married couples. Williamson et al. (2011) observed a series of husband-wife discussions about conflict and support and applied 25 codes to each partner. Interestingly, the authors included both dyadic and individual codes from each partner. Employing EFA, authors determined three factors: Positivity (group enjoyment, warmth/support, positive mood,

humor/laugh, physical affection, endearment, and listener responsiveness), Negativity (hostility, contempt, disruptive process, denial, angry coercion, dominance, verbal attack, and interrogation, externalized negative in husbands, and lecture/moralize in wives), and Effectiveness (solution quantity, solution quality, effective process, assertiveness, and communication). Although some of these codes are similar to the ones utilized in the current study, it should be noted that this was a markedly different sample, involved interactions between marital partners rather than between parents and children, and included codes from both interaction partners. Indeed, the Effectiveness factor largely represented dyadic codes while the Positivity and Negativity factors largely represented individual codes. In addition, the structure of communication between members of a marital dyad may be quite different from the structure of mother-child communication.

Several previous studies have also employed factor analytic methods with other observational coding systems, and these results are also relevant to the current study. For example, Moens et al. (2007) conducted an EFA of the Mealtime Interaction Coding System (MICS; Dickstein et al., 1994), a system used in pediatric populations to examine communication during family meals, in a sample of families with overweight children (7-13 years old). The MICS includes 19 macro-level scales and authors determined a 2-factor solution of Behavioral Control (including items such as showing nonverbal affection, eye contact, and asking about feelings) and Interpersonal Involvement (including items such as responding to child requests, setting limits on behavior, and enforcing table manners). The authors went on to compare communication to a sample of healthy controls, finding that parents of overweight children showed less interpersonal involvement than parents of healthy weight children.

Power et al. (2003) examined observed maternal communication in juvenile rheumatoid arthritis (JRA) and employed principal components analysis (PCA; somewhat similar to factor analysis, see below) for purposes of data reduction. Communication was observed in mother-child dyads (children 6-13 years old) during a structured memory game and coded with a micro-level system developed for the sample with 11 scales. The authors chose a 5-component solution and named the components as follows: Structure and Rule Setting, Prompt for Answer, Specific Clues/Positive Feedback, Questions, and General Clues. Some of these factors likely reflect the highly-structured nature of the task used in this study.

Similarly, Smetana, Yau, Restropo, and Braeges (1991) examined adolescent-parent communication in divorced and married families using the Constraining and Enabling Coding System (CECS), a macro-level system that is used frequently with pediatric Spina Bifida samples (e.g., Holmbeck et al., 2002; Murray et al., 2015). This yields 41 codes that apply to the family unit or to either mothers or adolescents (6^{th} to 11^{th} grade) individually. Interestingly, authors applied PCA to all 41 scales, regardless of coding target, and determined five components: Maternal Communication, Adolescent Communication, Harmonious Family Relationships, Warmth, and Not Enmeshed or Hierarchical (referring to power structure in family unit). The first two components included just maternal or adolescent codes (respectively), while the other three included a combination of mother, adolescent, or dyadic codes.

Although previous studies have applied factor analytic methods to observational systems of communication, these studies have several limitations. First, two studies combined codes across interaction partners, with models that yielded separate factors for each (e.g., Maternal Communication and Adolescent Communication in Smetana et al., 1991). These factors distinguish between two different communication partners, mother and child, but do little to

reveal the structure of communication of each communicative partner. Second, both of the studies examining the structure of the IFIRS yielded factors with labels such as "effective" communication (Raj et al., 2014; Williamson et al., 2011). This may be misleading, as other factors such as "warmth" (Raj et al. 2014) or "positivity" (Williamson et al., 2011) do not necessarily represent ineffective communication. In addition, it seems problematic to label communication as "effective" without determining if it is indeed related to adaptive outcomes. Thus, previous studies have identified and labeled factors with questionable theoretical validity and clinical applicability.

In contrast to the goals of the current study, statistical techniques were employed in previous studies largely for the purposes of data reduction, rather than to explore the underlying structure of communication. Of the five studies reviewed above, three of these studies employed EFA (Moens et al., 2007; Raj et al., 2014; Williamson et al., 2011) and two studies used PCA (Power et al., 2003; Smetana et al., 1991). PCA is often described as being similar to, or a specific type of, factor analysis (Fabrigar et al., 1999), but it has a fundamentally different purpose and often produces very different results. PCA yields components from measured, manifest variables by accounting for the variance of those measured variables, which can often be useful for data reduction. However, it does not account for the structure of these components and thus does not yield a testable model in the way that factor analysis does (Brown, 2015; Fabrigar & Wegener, 2011). Unlike PCA, factor analytic methods attempt to *explain* correlations among measured variables. This yields unobservable latent variables and allows for the identification of testable models. In addition, the use of PCA to answer questions in psychological science is somewhat controversial, partly because PCA does not acknowledge

unique variances, cannot be generalized beyond the specific battery of measures from which it was derived, and has no testable hypotheses (see Brown, 2015; Fabrigar & Wegener, 2011).

Taken together, previous studies have taken data-driven approaches to observations of communication, employing either EFA or PCA techniques, yielding factors and components with limited theoretical and clinical utility. However, there is considerable research and theory that could inform a theory-driven factor analysis approach. Given this, a confirmatory factor analysis of communication of mothers during interactions with their child with cancer is the next step.

Proposed Structure of Maternal Communication in Childhood Cancer

Although the underlying structure of maternal communication in childhood cancer has not yet been fully investigated, previous theory and research is sufficient to make specific hypotheses. Indeed, several comprehensive communication models have characterized family communication as having multiple dimensions. Across these models, there are common themes that evoke dimensions of *warmth* and *control*. This includes circumplex models of family functioning (Beveridge & Berg, 2007; Kiesler, 1996; Olson, Russell, & Sprenkle, 1989); models of family communication environments that consider flexibility and cohesion (Fitzpatrick & Marshall, 1996; Koerner & Fitzpatrick, 2013); and those that emphasize autonomy and self-determination, especially in the context of adolescent development (Allen, Hauser, Bell, & Connor, 1994; Ryan & Deci, 2000). Frameworks that draw on warmth and control have roots in Baumrind's (1968) seminal model of parenting styles, in which the most adaptive form of parenting, authoritative parenting, encompasses both warmth and support as well as developmentally appropriate control, structure, and boundaries.

A framework that draws on warmth and control allows for the examination of a hierarchical model that includes more specific categories of communication beyond "positive" or "negative," such that overall positive communication encompasses high levels of both *warm* and s*tructured* communication patterns, whereas overall negative communication includes high levels of either *hostile/intrusive* or *withdrawn* patterns. Warm communication involves expression of positive affect, affection, sensitivity, and support (Fitness, 2013; Stafford, 2013). Structured communication involves positive reinforcement, consistency, directives, and guidance (Fitness, 2013; Stafford, 2013). In contrast, *hostile/intrusive communication* involves restrictive, over-controlled, and critical family interactions, whereas *withdrawn communication* involves disengaged and uninvolved interactions (Blechman, 1990; Fitness, 2013; Koerner & Fitzpatrick, 2013; Stafford, 2013). These two categories of withdrawn and hostile communication are not simply the opposites of warmth and structure, however, as they contain aspects of both**.** Intrusive communication is the imposition of too much developmentally inappropriate structure, with a lack of warmth. Withdrawn communication, in contrast, represents a lack of both warmth and structure. Overarching, broad-level positive communication would therefore have elements of both warmth and structure, whereas broad-level negative communication would have elements of both harsh and withdrawn communication. See Figure 1 for a representation of this hierarchical structure of communication (from Murphy et al., 2017).

Although the framework presented in Figure 1 was not specifically developed for families of children with cancer, previous studies with pediatric populations have utilized codes that fit within this framework. For example, multiple studies using direct observations of maternal communication have included codes similar to the construct of warm communication, including Interpersonal Involvement (Janicke et al., 2005; Patton et al., 2009; Spieth et al.,

2001), Warmth/Support (Wood et al., 2008), Parental Acceptance (Greenley et al., 2006; Murray et al., 2015), and Emotional Support (Martin et al., 1998), as well as structured communication, including Positive Reinforcement (Jaser & Grey, 2010), Verbal Directives (Chavez & Buriel, 1988), and Behavioral Control (Chisholm et al., 2010; Murray et al., 2015; O'Hara & Holmbeck, 2013). Similarly, previous studies of families with children with chronic health conditions have also employed direct observation codes that are similar to hostile/intrusive communication, including Parental Overprotectiveness/Intrusiveness (Tuminello et al., 2012; Zukerman et al., 2011), Overinvolved Parenting (Lord et al., 2014), and Psychological Control (Murray et al., 2015; O'Hara & Holmbeck, 2013); as well as codes similar to withdrawn communication, including Involvement-reverse coded (Seiffge-Krenke, 2002) and Withdrawn Communication (Murphy et al., 2016). These findings, together with a recent review of direct observation of family communication in pediatric populations (Murphy et al., 2017), indicate that the field of pediatric psychology is converging toward a unifying model of communication that is hierarchical and emphasizes warmth and control.

Importantly, several of the EFA studies reviewed above yielded factors that are similar to the framework presented in Figure 1. Regarding warm communication, both studies using the IFIRS yielded a Warmth factor (Raj et al., 2014; Williamson et al., 2011), as did the CECS (Smetana et al., 1991), and Interpersonal Involvement from the MICS is also similar to these scales reflecting parental warmth (Moens et al., 2007). Two other factors map well onto structured communication, including Behavioral Control from the MICS (Moens et al., 2007) and Structure and Rule Setting from Power et al.'s (2003) system. Regarding negative communication, previous EFAs have settled on more general, less specific aspects of negative family communication. This includes overall Negativity in both previous studies using the IFIRS

(Raj et al., 2014; Williamson et al., 2011). However, unlike the current study, neither of the previous IFIRS studies utilized codes that are likely to capture withdrawn, disengaged communication. Therefore, the Negativity factors extracted from their samples may be better understood as hostile/intrusive communication.

It is also important to consider the possible role of child age and developmental status when considering the structure of maternal communication. Previous research with the current pediatric oncology sample indicates that mean ratings on several IFIRS codes (tapping both negative and positive communication) decrease with child age (Murphy et al., 2016; Rodriguez et al., 2016). This may indicate that younger children engage in behaviors that require parents to simply do more or be more involved (e.g., walking away from the camera, being off task). Alternatively, this may indicate that older children and adolescents are more active during the time-limited interactions, leaving less time for parents to hold the floor. It is notable that the IFIRS system does attempt to account for developmental differences and customizes anchors in the coding system to what would be expected given the child's age and developmental status (Melby & Conger, 2001). In addition, previous literature indicates that while certain aspects of parent-child interaction (e.g., conflict) fluctuate from childhood to early and later adolescence, overall relationship quality does not change (Larson, Richards, Moneta, Holmbeck, & Duckett, 1996; Laursen, Coy & Collins, 1998). However, it is unclear whether mean levels of communication behaviors may change with child age or if the structure of maternal communication itself would change. In general, it will be important to test for similarities and differences in the structure of maternal communication as a function of children's age and developmental level. However, this requires large samples of children distributed across a wide age range, which is beyond the scope of the current study.

Taken together, previous research indicates that a theoretical framework of communication that draws on warmth and control (see Figure 1) may be applicable to mothers of children with cancer. As such, the IFIRS dyadic and parenting codes may reflect an underlying structure of warm, structured, and hostile/intrusive, and withdrawn communication.

A separate but related question that informs this model is the role of affect. While the IFIRS dyadic and parenting codes draw on elements of affect indirectly (see Table 1 for codes and examples), the individual characteristic codes tap *expressed* (or observable) affect directly, such as sadness and anxiety. Although moment-to-moment affective experiences can drive communication patterns (Fitness, 2013), there can be differences between a mother's subjective, experienced affect and her expressed affect. Indeed, in the course of communicating with children, mothers are tasked with regulating their own affect while addressing their child's emotional experiences (Rodriguez at al., 2013). Given this, expressed affect is an important construct that is captured by the IFIRS system.

A central question is whether expressed affect represents a separate factor or is subsumed into the proposed 4-factor model. The five individual characteristic codes in the IFIRS system that examine affect largely capture *negative* affect. This includes Sadness, Anxiety, Externalized Negative, Externalized Negative Cancer, and Positive Mood (which is reverse scored; see Table 1 for definitions and examples). Together, these codes could be hypothesized to load onto a common Negative Affect factor. However, they could also be linked directly to negative communication, loading positively onto hostile/intrusive and withdrawn factors, and to positive communication, loading negatively onto warm and structured factors. This question addresses how emotions are manifested within the structure of maternal communication. Are emotions pervasive in all aspects of communication? Or do they cluster and represent a separate factor, or

perhaps a distinct but related factor? Three competing models were proposed that address these questions.

Initial Test of Factor Structure of Maternal Communication in Childhood Cancer

Contingent on identifying a parsimonious model of maternal communication that has at least adequate fit to the current data, an initial test of correlates of this factor structure will be conducted by examining the longitudinal relation between maternal distress and communication. Specifically, I am interested in the relation between symptoms of maternal distress near the time of the child's cancer diagnosis and maternal communication three months later. This relationship potentially holds both theoretical and clinical importance, and provides an ideal opportunity to test the utility of this factor structure in the current sample. Results could begin to inform the question of how communication may serve as a mechanism of risk and resilience in this population.

As discussed above, previous reviews and meta-analyses have indicated that mothers of children with cancer are at elevated risk for emotional distress and symptoms of internalizing problems, specifically symptoms of anxiety, depression, and post-traumatic stress (Barlow & Ellard, 2006; Cabizuca et al., 2009; Kazak et al., 2004; Pai et al., 2007*)*. Previous research across pediatric populations, including childhood cancer, has indicated that maternal distress and maternal communication are connected. Indeed, several of the communication patterns described above have been examined in relation to maternal distress specifically.

Several studies have found significant relations between maternal distress and positive communication, including warm and structured communication. Previous studies have found that maternal depressive symptoms are significantly, negatively related to positive communication concurrently in pediatric asthma (Lim et al., 2008), and both maternal depressive and post-

traumatic stress symptoms are significantly, negatively related to positive communication longitudinally in pediatric cancer (Rodriguez et al., 2013, and Murphy et al., 2016, respectively). Warm communication has also been linked to maternal distress concurrently. In child asthma, mothers' depressive symptoms were significantly and negatively related to observed warmth/involvement (Celano et al., 2008), and in a study of families with children with Type 1 Diabetes, mothers' depressive symptoms were significantly, negatively related to observed child-centered communication. Interestingly, studies of structured communication patterns, such as observed positive reinforcement, behavioral control, and consistent discipline, have not been shown to be significantly related to maternal distress in spina bifida (Greenley et al., 2006), Type 1 Diabetes (Jaser & Grey, 2010), or asthma (Celano et al., 2008) samples. This suggests that it may be the warm, emotionally supportive aspects of family communication that are compromised when a mother is experiencing greater symptoms of distress, while communication patterns that involve structure are less likely to be affected.

Previous studies have also found significant relations between maternal distress and negative communication, including hostile/intrusive and withdrawn patterns. In studies of children with asthma, negative communication has been significantly, positively related to symptoms of maternal depression and anxiety concurrently (Lim et al., 2008; Wood et al., 2008). Hostile/intrusive patterns have been inconsistently linked to maternal distress. Maternal post-traumatic stress symptoms predicted greater harsh communication over time in child cancer (Murphy et al., 2016), and maternal depressive symptoms were significantly, positively related to hostility concurrently in child asthma (Celano et al., 2008). In contrast, relations between hostile/intrusive communication patterns and maternal distress were not significant in pediatric diabetes and spina bifida populations (Greenley et al., 2006; Jaser & Grey, 2010). Only one

study has examined the relation between maternal distress and withdrawn communication, and found that maternal post-traumatic stress symptoms predicted greater withdrawn communication over time (Murphy et al., 2016).

Previous studies that have examined the relation between mothers' self-reported symptoms of distress and expressed affect in the context of mother-child interactions concurrently have found significant, moderate correlations (Fiese et al., 2010; Lim et al., 2011). This suggests that there is a difference between one's own, internally experienced emotions and expressed affect. Indeed, emotions theorists make distinctions between the subjective experience of an emotion and the observable expression of an emotion (see Izard, 2011). In addition, it is potentially adaptive for a mother who is experiencing distress near the time of diagnosis to attempt to dampen down her expression of negative affect when communicating with her child. Contingent on the factor structure of the IFIRS, it is reasonable to expect modest correlations between mother's reported distress and her expressed negative affect three months later, given that these factors tap distinct constructs and were assessed longitudinally

Taken together, results from previous pediatric studies suggest that maternal self-reported, *experienced* distress is related to both her communication with her child and her expressed affect. These studies have overwhelmingly been cross-sectional, making it difficult to determine the nature of the relation between distress and communication. Previous cross-sectional findings have been used to propose possible directions of these associations that could be tested in prospective studies, such that distress predicts communication over time (Lim et al., 2008; Wood et al., 2008), but these need to be tested longitudinally. In the studies that have included prospective analyses, distress was measured prior to communication (Greenley et al.,

2006); this includes studies from the current pediatric oncology sample (see Murphy et al, 2016; Rodriguez et al., 2013, Rodriguez et al., 2016).

Therefore, contingent on results from the current factor analysis, the relation between symptoms of maternal distress, including depression, anxiety, and post-traumatic stress, near the time of the child's cancer diagnosis and maternal communication three months later was examined. Previous findings suggest that maternal distress may be related to positive communication, negative communication, as well as expressed negative affect over time.

Purpose and Hypotheses

The primary purpose of this study was to explore the latent structure of maternal communication during mother-child discussions of the child's cancer, as measured by the IFIRS. Given previous theory and research in pediatric populations, confirmatory factor analysis was used to test competing, hierarchical models to identify the most parsimonious representation of maternal communication in this high-risk population.

The proposed models include scales from the IFIRS organized within a framework of *warmth and control*. It was expected that IFIRS variables would load onto four factors drawn from family communication theory and previous research in pediatric populations: Warm, Structured, Hostile/Intrusive, and Withdrawn. Specifically, I proposed a hierarchical model, with Warm and Structured representing specific components of Positive Communication and Hostile/Intrusive and Withdrawn representing specific components of Negative Communication (see Table 1). Given that the role of expressed affect is unclear, I also explored and compared a series of alternative models (see Figures 2a-c) that addressed maternal Negative Affect as a distinct, uncorrelated factor (Model A); a distinct but correlated factor (Model B); or individual

manifest variables with cross-loadings onto the existing four communication factors (Model C). Models A and B are nested, whereas model C is separate.

An initial test of the identified factor structure was also conducted by examining its correlations with reported maternal distress using latent variables in longitudinal analyses. It was expected that, contingent on the factor structure of maternal communication, self-reported maternal anxiety, depression, and post-traumatic stress symptoms would predict lower Positive Communication (Warm and Structured), greater Negative Communication (Hostile/Intrusive and Withdrawn), and greater Negative Affect over time.

CHAPTER II

METHOD

Participants

Participants included 115 mothers and children with cancer. Fathers were also invited to participate; however, because of the small number of fathers (n = 23), they were excluded from present analyses. Children ranged from 5 to 17 years old (M = 10.32, SD = 3.86 years) and 48% were female. Of the sample, 80% were Caucasian, 12% were African-American, 1% was American Indian, and 7% reported "other" for their race; 7% were Hispanic/Latino. Cancer diagnoses included leukemia (41%) lymphoma (18%), brain tumor (6%), and other solid tumor (35%). One hundred (96%) were recruited after initial diagnosis and four after a relapse. Mothers were on average aged 37.94 years (SD = 7.78) and came from a range of educational background (high school level to four-year graduate school; M = 3 years of college) as well as family income levels (27% $25,000 or less; 27% $25,001-50,000; 14% $50,001-75,000; 11% $75,001-100,000 21% $100,001 or above).

Procedure

Mothers and children were recruited from two pediatric oncology centers, at Vanderbilt University and Nationwide Children's Hospital. Eligibility requirements included: (a) 5-17 years of age, (b) at least one week post new or relapsed cancer diagnosis at recruitment, (c) receiving treatment through the oncology division at the pediatric centers, and (d) no pre-existing developmental disability. Informed consent was obtained from parents and informed assent from children (ages 5-17). The study was reviewed and approved by Institutional Review Boards at

both sites. Families were compensated for their participation.

Families were originally recruited to participate in a larger study of adjustment to pediatric cancer. At Time 1 (T1) mothers completed information on family demographics and self-reported symptoms of distress (anxiety, depression, posttraumatic stress) an average of 57.21 days (SD = 31.96) after the child's initial diagnosis or relapse. Families who completed questionnaires at T1 were approached approximately three months later at Time 2 (T2) to participate in a videotaped parent-child observation. Of the 239 families who completed the questionnaires, 115 (48%) had a mother-child dyad participate in the observation. Reasons cited for declining included lack of time due to ongoing treatment, not wanting to be videotaped, and lack of interest. Families who completed the observation did not significantly differ from those who declined on child age, race, ethnicity, family income, relapse status, or maternal distress.

During the observation, mother-child dyads first constructed a five-minute tangram puzzle task to warm up to the videotaped observation, then were asked to have a conversation about the child's cancer in whatever way felt natural to them. The observation task lasted 15 minutes and has been validated with a pediatric cancer population (Dunn et al., 2011). Mothers received a card with prompts to help guide the conversation, as needed ("What have we each learned about cancer and how it is treated?" "What parts of your cancer and its treatment have been the hardest for each of us?" "What kinds of feelings or emotions have we each had since we found out you have cancer?" "What are the ways we each try to deal with these feelings and emotions?" "What is it about cancer that has most affected each of our lives?" "How do we each feel about what might happen in the next year and after that?" "If we were writing a book about cancer for other children and parents, what would we each include?"). Maternal communication that was observed and coded during the cancer discussion is the focus of current analyses.

Measures

Mothers' anxiety and depressive symptoms. Mothers completed the Beck Anxiety Inventory (BAI; Beck & Steer, 1990) as a measure of current anxiety symptoms and the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) as a measure of current depressive symptoms at T1. Both the BAI and BDI demonstrate good reliability and validity (Steer, Ranieri, Beck, & Clark, 1993) and are widely used with pediatric populations (see Pinquart & Shen, 2011). The BDI-II and BAI each consist of 21 items; mothers rank symptoms on a 4-point scale from 0 (no change/not at all) to 3 (substantial change/severe). Summary scales are widely used in research and are clinically meaningful (Steer, Ranieri, Beck, & Clark, 1993). Internal consistency reliability in the current sample was $\alpha = .94$ for the BDI-II and $\alpha = .92$ for the BAI.

Maternal post-traumatic stress symptoms (PTSS). Mothers provided self-reports of PTSS specific to cancer diagnosis and treatment on the Impact of Events Scale-Revised (IES-R; Creamer, Bell, & Failla, 2003). Mothers were asked to answer items "using your child's cancer and treatment as the stressful event." The IES-R was developed to parallel DSM-IV-TR criteria for Post-Traumatic Stress Disorder (PTSD); it is composed of 22 items that assess symptoms in the domains of Hyperarousal (e.g., "I was jumpy and easily startled"), Intrusion/Re-experiencing (e.g., "I thought about it when I didn't mean to"), and Avoidance (e.g., "I tried not to think about it.") that have been present in the past 7 days. Responses are on a 5-point scale from 0 (not at all) to 4 (extremely). The IES-R is widely used, demonstrates good reliability and validity, yields a summary scale that is clinically meaningful (Weiss, & Marmar, 1996), and has been used with pediatric cancer populations previously (e.g., Kazak et al., 1997; Kazak et al., 2004). The internal consistency in the current sample was excellent (Cronbach's $\alpha = .94$).

Maternal communication. The IFIRS (Iowa Family Interaction Rating Scales) is a macro-level coding system used to code mothers' verbal and non-verbal communication, behaviors, and emotions in a videotaped interaction (Melby & Conger, 2001). Codes are assigned values from 1 to 9, with 1 reflecting the absence of the behavior or emotion and 9 indicating a behavior or emotion that is "mainly characteristic" of the mother during the interaction (Melby & Conger, 2001). IFIRS may be considered quasi-interval (Likert ratings with greater than 3 anchors) and therefore suitable for factor analysis with ML procedures (Floyd & Widaman, 1995). Table 1 presents code definitions and examples.

All observations were coded by a trained team of graduate and undergraduate students at one of the study sites. All coders first passed a written test of code definitions and examples then were trained to 80% reliability on a series of standard recordings that had been previously coded by expert raters. All observations were double-coded independently by two coders, who then met to discuss and reach consensus. When coders' ratings differed by one point, the higher rating was used. When ratings differed by two or more points, coders reached agreement through discussion. Mean reliability between coders (calculated as Cronbach's α) for individual IFIRS codes was .68.

Data Analytic Approach

Preliminary data analyses. Preliminary analyses included calculating means and standard deviations and examining skewness and kurtosis for all communication variables. Bivariate correlations were conducted to examine relations among manifest communication variables. These preliminary statistical analyses were conducted with the Statistical Package for Social Sciences (SPSS) version 22 (SPSS, 2013).

Confirmatory factor analysis. CFA was conducted with AMOS (Arbuckle, 2013) using Maximum Likelihood (ML). CFA was an appropriate method for the current study as the purpose was to examine theoretically derived, competing hierarchical factor models (Brown, 2015; Fabrigar & Wegener, 2011). Because there were no explicit hypotheses about age, and because the current sample was too small to compare systematically across age groups, a decision was made to partial age out of the correlations instead of formally representing it in the model. For model identification purposes, one factor loading for each latent variable was set to 1.0 and factor variances were estimated.

All three models propose four latent constructs of warm, structured, hostile/intrusive, and withdrawn communication as first-order factors. Warm and structured are specified as two indicators of a second-order positive communication factor and hostile/intrusive and withdrawn communication are specified as two indicators of a second-order negative communication factor. The two second-order factors are hypothesized to be negatively correlated, given results from previous factor analytic research (see Williamson et al., 2011). The primary difference among the three proposed models involves the role of negative affect. Model A specifies a first-order factor of negative affect that is not correlated with positive or negative communication factors, whereas Model B specifies that the same negative affect factor is correlated with both positive and negative communication factors. Model A is nested in Model B. Model C is separate and non-nested, and does not include a negative affect factor; instead, the manifest variables tapping negative affect are cross-loaded onto each of the four first-order factors, representing the pervasiveness of affect across first-order factors. Power was calculated for the root mean square error of approximation (RMSEA) for each model and ranged from .84 to 85.

Each model was evaluated based on goodness of fit, estimates of free parameters, and examination of standard errors for each parameter estimate before being compared. Parameter estimates were first examined based on face validity for indications of an improper solution (i.e., magnitude and sign of estimates). Standardized residual covariances, which are calculated by dividing the residual covariances by their standard errors, were also evaluated. Large residuals (traditional cut-offs include +/-1.96 or more conservatively +/- 2.58; Brown, 2015) suggest that parameters may be strongly overestimating or underestimating relationships. Modification indices were also examined.

Parsimony correction, absolute fit, and comparison fit indices were examined in order to evaluate fit of the CFA solution (Brown, 2015). First, the RMSEA (Steiger & Lind, 1980) and the 90% confidence interval (CI) of RMSEA (MacCallum, Brown, & Sugawara, 1996) were calculated as an index of model fit corrected for complexity. The RMSEA assesses the extent to which a model fits reasonably well in the population, and draws on the non-central χ^2 distribution. Following guidelines by Browne and Cudeck (1992), values of RMSEA lower than .05 indicate close fit, .05-.08 reasonable fit, .08-.10 mediocre fit, and >.10 unacceptable fit. Results from the 90% CI of RMSEA also aid in model evaluation and hypothesis testing, with lower bounds below .05 and narrow intervals being ideal. Second, the standardized root mean square residual (SRMR) was evaluated as a measure of absolute fit. The SRMR represents the average discrepancy between the observed correlations and those predicted by the model; it is calculated by summing the squared elements of the residual correlation matrix, dividing the sum by the number of elements in the matrix, and taking the square root. The SRMR ranges between 0 and 1, with 0 indicating perfect fit (Brown, 2015). Third, the non-normed fit index (NFI; Bentler & Bonett, 1980), which is a comparative fit index, was also calculated. The NNFI yields

a χ^2 statistic, representing the ratio between the improvement of fit of the proposed model over a null model as the numerator, and the improvement of fit of an ideal model over the null model as the denominator. NNFI of close to 1.0 therefore indicates good fit, with scores over .90 considered acceptable (Bentler & Bonett, 1980). And fourth, models were also compared based on model selection criteria with the Bayesian Information Criterion (BIC; Schwarz, 1978) and Akaike's Information Criterion (AIC; Akaike, 1973). Lower AIC and BIC values indicate better fit.

Exploratory factor analysis. Exploratory factor analysis (EFA) was also conducted after examining results from CFA. EFA was conducted with Comprehensive Exploratory Factor Analysis version 3.04 (CEFA; Brown, Cudeck, Tateneni, & Mels, 2010). The Maximum Wishart Likelihood (MWL) discrepancy function was used to fit the model. Maximum Likelihood (ML) is an iterative procedure that assumes a multivariate normal distribution and attempts to find a set of parameter estimates that are maximally likely to have produced the sample data. It was chosen because it allows computation of model fit, confidence intervals, and significance tests; in this way, it provided useful comparison to the model fit indices from CFA. Similar to above, correlations were partialled for child age.

Multiple methods were used to determine the appropriate number of common factors, considering both guidelines with arbitrary cut-offs as well as those requiring subjective interpretation (Fabrigar & Wegener, 2012). First, the Kaiser criterion for initial approximation of number of factors was used by examining the number of eigenvalues that were greater than 1.0 (Guttman, 1954). Given the criticism of the performance of the Kaiser criterion (see Fabrigar & Wegener, 2012), the scree test (Cattell, 1966) was also used to evaluate eigenvalues. The scree test involves examining eigenvalues on a plot and identifying the largest discontinuity or drop

between values, with the number of eigenvalues preceding the last large drop corresponding to the ideal number of factors.

In addition, tests of model fit and measures of model fit were also examined. Likelihood ratio tests were conducted; tests of perfect fit and close fit were examined with the goal of finding the least number of factors that fail to reject the hypothesis that the model fits perfectly or closely to the data. Both RMSEA and AIC were also calculated and evaluated to find the number of factors that resulted in substantially improved values. For evaluating RMSEA, guidelines were used such that any difference greater than .020 was considered substantial while taking into account the width of the confidence intervals and the RMSEA value (Browne & Cudeck, 1992; Fabrigar & Wegener, 2012).

After a small range of optimal number of factors was chosen based on measures of model fit and eigenvalues, each solution was rotated to foster simple structure. Rotations were conducted with both an oblique Quartimax rotation and an oblique Geomin rotation. Oblique rotation procedures permit common factors to be correlated. The Quartimax rotation is part of the Crawford-Ferguson family of rotation criteria and relies on a complexity function to determine the simplest pattern of factor loadings (Crawford & Ferguson, 1970). Geomin rotation was developed by Yates (1987) and is based on a measure of row complexity. Both Quartimax and Geomin rotations are widely used rotation methods (Browne, 2001). Patterns of factor loadings were interpreted with theoretical considerations and were examined to evaluate for solutions that reflected either underfactoring or overfactoring. When necessary, signs of factor loadings were reversed in order to improve interpretability of factors. Correlations among latent factors and communalities of manifest variables, which represent the proportion of each manifest variable's variance explained by common factors, were also examined. Ultimately a solution was

chosen that represented a balance of interpretability, parsimony, theory, and model fit (Fabrigar & Wegener, 2012).

Structural equation modeling. Contingent on outcome from factor analyses, structural equation modeling (SEM) was used to examine relations between manifest variables of maternal distress (depression, anxiety, and post-traumatic stress symptoms) at T1 and latent variables of maternal communication (based on factor analysis results) at T2 using AMOS (Arbuckle, 2013). Manifest variables of distress were used in analyses as the summary scales for each measure of distress (BDI, BAI, and PTSS) are all commonly used in pediatric research and are clinically meaningful (see Alderfer et al., 2008; Pai et al, 2007).

CHAPTER III

RESULTS

Preliminary Analyses

Descriptive statistics for maternal communication variables. The mean, standard deviation, range, and skewness and kurtosis for each IFIRS variable are reported in Table 2. Kurtosis was concerning (exceeding +/- 2; George & Mallery, 2001) for the following variables: Denial, Guilty Coercion, Indulgent/Permissive, Inconsistent Discipline, and Prosocial. Skewness was concerning (exceeding +/- 1; Bulmer, 1979) for several variables as well. Hostility, Denial, Guilty Coercion, Antisocial, Indulgent/Permissive, and Inconsistent Discipline were positively skewed, while Prosocial was negatively skewed. This suggests that mothers in the current sample were infrequently rated high on multiple variables that tapped negative communication behavior. For initial analyses, all variables were retained; this decision is revisited below.

Correlations among communication variables. Correlations among communication variables are reported in Tables 3a-3e, organized by factor. The only alteration to the proposed model made at this stage was to move Positive Mood (reverse coded) from Negative Affect and to keep its original coding (e.g., higher scores representing greater demonstrations of positive mood) to the Warm Communication factor. This decision is discussed further below.

Among variables on the proposed Negative Affect factor (Table 3a), Sadness, Anxiety, and Externalized Negative were all significantly, positively correlated with each other. Externalized Negative–Cancer was not significantly correlated with the other variables, nor was Positive Mood (reverse coded). However, when Positive Mood was not reverse coded, it was

significantly and positively correlated with each code on the Warm Communication factor (see Table 3e). Given these findings, this manifest variable was moved from the Negative Affect factor to the Warm Communication factor. Further analyses were conducted with this adjustment for two reasons. First, there is a body of research that indicates that positive affect is not simply the opposite of negative affect, but that positive and negative valence systems fluctuate in ways that are distinct or independent of one another (Bradburn, 1969; Diener, Larsen, Levine, & Emmons, 1985; Goldstein & Strube, 1994; Thompson, 2007). Second, the definition of Warm Communication encompasses the presence of positive affect, indicating that this manifest variable would fit comfortably within this factor theoretically (Fitness, 2013; Stafford, 2013). This decision is discussed further in the Discussion.

The correlations among variables in the Hostile/Intrusive Communication factor indicated that most variables within this factor were significantly, positively intercorrelated (see Table 3b). The exception was Lecture/Moralizing, which was significantly, positively correlated with Intrusive but none of the other manifest variables.

The pattern of correlations among variables within the Withdrawn Communication factor appeared to indicate two clusters (see Table 3c). Avoidance and Neglect/Distancing were significantly correlated, while Indulgent/Permissive and Inconsistent Discipline were significantly correlated. This suggests that withdrawn communication may have been manifested in two different ways; one by avoiding a child's conversational contributions altogether, and the other by setting expectations then failing to follow through.

Variables on the Structured Communication factor included Parental Influence, Positive Reinforcement, and Child Monitoring (see Table 3d). However, Parental Influence was not significantly correlated with the other two codes; indeed, there were small negative correlations

with Positive Reinforcement and Child Monitoring. Although the IFIRS definition for this code fits comfortably within the definition of Structured Communication, other studies using the IFIRS have characterized Parental Influence as a form of intrusive communication (Jaser & Grey, 2010; Lord et al., 2014). This is discussed further below when conducting the initial CFA.

The pattern of results within the Warm Communication factor indicated that all variables were significantly, positively intercorrelated, and indeed, some correlations were large in magnitude (see Table 3e). This includes Positive Mood, which was moved to this factor.

Correlations between communication variables and age. Correlations between the manifest maternal communication variables and child age were also examined (see Table 4). Child age was significantly, positively correlated with maternal Sadness, Anxiety, Externalized Negative, and Lecture/Moralizing, indicating that mothers of older children were observed engaging in more of these communication patterns. Child age was significantly, negatively correlated with Indulgent/Permissive, Inconsistent Discipline, Parental Influence, Warmth, Listener Responsiveness, and Child Centered, indicating that mothers of younger children were observed engaging in more of these communication patterns.

Because there were no explicit hypotheses about age, and because the current sample is too small to systematically examine age across age groups, child age was partialled out of the correlations instead of being formally represented in the model. Given this, the partial correlations among variables were analyzed in the subsequent factor analysis. This partialling did not meaningfully change the overall pattern of correlations among manifest communication variables. Tables 5a-5e report correlations among variables for each factor partialling for child age.

Initial Confirmatory Factor Analysis

After examining initial descriptive statistics and correlations, and making decisions to (1) move Positive Mood to the Warm Communication factor and (2) partial out child age, confirmatory factor analyses were conducted. For each model, A, B, and C, the solution was initially inadmissible due to negative variances. These are known as Heywood Cases and indicate that certain model constraints may have been inappropriate (Brown, 2015). An iterative approach was taken to examine possible modifications that would result in an admissible solution. The negative variances were the same in each model and consisted of two error variances: the error variance of the Warm factor and the error variance of the Hostile/Intrusive factor.

Modification of initial models for admissible solutions. Models were examined for local areas of strain and interpretability of parameters with the goal of making changes to arrive at an admissible solution (Brown, 2015). First, the Positive Communication factor was examined. When an alternative model was run allowing the two factors of Warm and Structure to be correlated, covariances and correlations indicated that they were strongly correlated (.71, .97, respectively). However, a correlation of such a large magnitude between Warm and Structured Communication undermined their separation as distinct constructs (Brown, 2015) and suggested that instead they should be specified as the same factor. Therefore, Warm and Structured Communication factors were eliminated and their codes were combined into one Positive Communication factor.

Next, regression weights for the Negative Communication factor were examined. When Hostile/Intrusive Communication was specified as 1.00, the estimate for Withdrawn was .039, which was lower than expected. To examine this further, an alternative model was run allowing

these two factors to be correlated and results indicated that the covariance was lower than expected (.09). These results undermined the rationale for a higher order Negative Communication factor; therefore Hostile/Intrusive and Withdrawn Communication factors were retained and allowed to correlate and the higher-order Negative Communication factor was removed.

Finally, regression weights for the codes that comprised the Positive Communication factor were considered. The standardized regression weight for Parental Influence was -.18, while all other weights for this factor were positive and of relatively large magnitude (ranges .48-.88). This may be unsurprising given the results from the initial correlations indicating that Parental Influence was negatively related to the other two codes on this factor (see Tables 3d and 5d). Because prior studies have characterized this code as intrusive (e.g., Jaser & Grey, 2010; Lord et al., 2014), this was examined in relation to other codes in the Hostile/Intrusive Communication factor. Given that Parental Influence was significantly, positively correlated with several manifest variables on the factor (Hostility $r = .33$, $p < .01$; Intrusive $r = .39$ $p < .001$; Guilty Coercion $r = .30$, $p < .01$), it was moved from the Structured Communication factor to the Hostile/Intrusive Communication factor.

In summary, three decisions were made in an iterative fashion to attempt to eliminate negative variances: (1) Warm and Structured Communication factors were eliminated and their codes were combined into one Positive Communication factor; (2) the Negative Communication factor was removed and Harsh and Withdrawn Communication factors were retained without a unifying higher order factor; (3) Parental Influence was moved from the Structured Communication factor to the Hostile/Intrusive Communication factor. After these three

modifications, the solution was admissible and there were no negative variances in any of the three models. In addition, the estimates for each factor loading were positive.

Modification indices were also briefly examined. These included adding covariances among error terms and allowing communication codes to be cross-loaded onto multiple factors. Specifically, for all models, modification indices included allowing several error terms from manifest variables to be intercorrelated. For Model A, modification indices also included loading Positive Reinforcement and Avoidance onto the Negative Affect factor. However, there were no strong theoretical arguments for these modifications, so no modifications were made.

Modified Confirmatory Factor Analysis

Figures 3a – 3c depict the revised Models A, B, and C. Chi-squares were 434.65 (df = 227) for Model A, 426.20 (df = 224) for Model B, and 431.98 (df = 219) for Model C. When examining factor loadings and model fit, Generalized Least Squares (GLS) factor extraction methods were also used in addition to Maximum Likelihood (ML) for purposes of comparison. This was because several variables were highly negatively and positively skewed.

Model fit indices. First, model fit indices were examined (see Tables 6a and 6b). For ML, RMSEA reflected fit that was mediocre to unacceptable (Browne & Cudeck, 1992; Steiger & Lind, 1980) across models. The NNFI was nearly identical across models and within the unacceptable range (scores over .90 are considered acceptable; Bentler & Bonett, 1980). SRMR was also poor (ranges between 0 and 1, with 0 indicating perfect fit; Brown, 2015). For comparisons of nested models A and B, results conflicted across AIC and BIC. AIC suggested that Model B was preferable (with lowest criterion), while BIC suggested Model A was preferable.

With GLS methods, RMSEA was much improved. Point estimates were all within the close fit range (less than .05; Browne & Cudeck, 1992) and confidence intervals indicated fit that was close to reasonable. However, NNFI and SRMR were still both poor. For model comparisons, both AIC and BIC favored Model A.

Taken together, model fit indices reflected poor fit. It should also be noted that when examining standardized residual covariances in each model, multiple residuals were above the traditional cut-off of 1.96 and several were above the more conservative cut-off of 2.58 (Brown, 2105), indicating that parameters may be strongly overestimating or underestimating relationships. Although parameter estimates should be interpreted with caution in the presence of poor fit (Brown, 2015), they are reported below for reference. Given that using GLS was not part of the original statistical approach, only results from ML are reported. Results from GLS are in Appendix A.

Parameter estimates. Tables 7a-c depict parameter estimates for Models A, B, and C, including factor variances, error variances, and both unstandardized and standardized factor loadings. Standardized factor loadings for Models A and B were nearly identical and ranged .29-.52 for Negative Affect, .12-.80 for Hostile/Intrusive Communication, .13-.91 for Withdrawn Communication, and .48-.88 for Positive Communication. Model C differed from Models A and B in that Affect Codes were cross-loaded onto the other communication factors. For Hostile/Intrusive Communication these standardized factor loadings were positive and of relatively large magnitude (.40-.62), for Withdrawn Communication they were negative (-.16 to -.46), and for Positive Communication they ranged .13-.39.

Standardized factor correlations were also examined for each model (Tables 8a-c). Across models, Hostile/Intrusive was significantly, positively correlated with Withdrawn

Communication and significantly, negatively correlated with Positive Communication. Positive Communication was negatively correlated with Withdrawn Communication but this correlation was not statistically significant. Negative Affect, when allowed to correlate (in Model B), was not significantly related to the other factors.

Taken together, the results from the CFA were ambiguous. Even after making modifications to the initial model, and even when considering both GLS and ML methods, no model demonstrated strong fit across indices. Given this ambiguity, an exploratory factor analysis was also conducted.

Exploratory Factor Analysis

Exploratory factor analysis (EFA) was conducted with MWL procedures. Rotations were conducted first with an oblique Quartimax rotation followed by an oblique Geomin rotation.

Determining number of factors. Initial analyses were conducted to first determine the optimal number of factors. Eigenvalues and measures of model fit were examined.

First, the Kaiser criterion for initial approximation of number of factors was used by examining the number of eigenvalues that were greater than 1.0 (Guttman, 1954). Analyses produced six eigenvalues that were greater than 1 (6.54, 2.30, 1.96, 1.53, 1.29, 1.05), implying that 6 factors should be retained. The Scree Test (Cattell, 1966) was also used; this involved examining eigenvalues on a plot and identifying the largest discontinuity. See Figure 4. The last large drop occurred between 5 and 6, implying that 5 factors should be retained.

Model fit measures were also examined; see Table 9. RMSEA results suggested that a model with 6 factors provided close fit, with more factors not providing substantial incremental improvement. Similarly, AIC values were lowest for 6 factors. Finally, tests of close fit and perfect fit were examined. Results indicated that hypotheses of perfect fit in the population were

rejected for 5 factors, but not 6 factors, suggesting that a 6-factor model is plausible. Results indicated that hypotheses of close fit in the population were rejected for 3 factors, but not for 4 factors, with an even larger drop for 5 factors.

Taken together, results from eigenvalues and measures of model fit largely suggested that a model with 5 or 6 factors may be optimal. Taking into account both these results and the original hypotheses (which predicted 5 factors), rotations were conducted for models with 4 to 7 factors and each model was evaluated.

Rotation and interpretation. Two oblique rotations were conducted, first Quartimax then Geomin. Results from Quartimax rotations are reviewed first. If signs were reversed for factors, this was noted in the table. Solutions for 4- and 7-factor models from Quartimax rotations are in Supplemental Tables in Appendix B. The 4-factor solution did not appear readily interpretable (see Supplemental Table 1 in Appendix B). Several manifest variables had cross-loadings onto more than one factor or had low loadings across factors (< .15). While one factor appeared to represent aspects of positive communication (Factor 1) and another aspects of negative communication (Factor 2), the other factors were not readily interpretable and represented possible underfactoring (with codes tapping negative affect and negative communication both loading onto Factor 3). Similarly, the 7-factor solution was not readily interpretable and had a single high factor loading >.30 for Factor 3, which suggested overfactoring (see Supplemental Table 2 in Appendix B).

When comparing the 5- and 6-factor solutions (Tables 10 and 11, respectively), both appeared to have factors that could plausibly represent positive communication, negative affect, and hostile/intrusive communication. However, the 6-factor solution appeared more readily interpretable for several reasons.

The primary difference between the 5- and 6-factor solutions involved factors that tapped aspects of negative communication. The 6-factor model offered a distinct factor that appeared to tap aspects of withdrawn communication (Table 11, Factor 2) with moderate loadings from Avoidance and Neglect/Distancing (.46, .56). In the 5-factor model these loaded onto a factor that was not as well defined (Table 10, Factor 1), which also contained some codes that are thought to represent aspects of hostile/intrusive communication. This could potentially indicate underfactoring, making the 6-factor model preferable. In the 6-factor solution, the factor that appeared to tap Hostile/Intrusive Communication (Table 11, Factor 1) was also more easily interpretable and consistent theoretically, with loadings from Hostility, Intrusive, Denial, Guilty Coercion, and Antisocial Codes (.38-.82).

In addition, the 6-factor solution yielded factors that had patterns of loadings that were slightly preferable for ease of interpretation. First, the factor that appeared to tap negative affect in the 6-factor model (Table 11, Factor 6) had loadings greater than .30 for the three maternal affect codes of Sadness, Anxiety, and Externalized Negative. In contrast, the 5-factor model had a factor with these affect codes along with a moderate loading for a negative communication code, Denial (Table 10, Factor 3), making the 5-factor solution less preferable. Second, the 6-factor solution contained a factor (Table 11, Factor 5) that had high loadings for Indulgent/Permissive and Inconsistent Discipline (.81, .90, respectively) and a smaller loading from Parental Influence (.33). This factor made conceptual sense, as mothers may first be trying to set boundaries before being more lax and inconsistent and/or indulgent. In contrast, the 5-factor model represented a similar factor (Table 10, Factor 4) with similar loadings from those three variables as well as a small loading for Guilty Coercion (.33), which was less readily interpretable.

Both solutions had one factor that appeared to represent aspects of positive communication (Table 10, Factor 5; Table 11, Factor 4) with moderate to strong loadings from Child Monitoring, Warmth, Listener Responsiveness, Communication, Prosocial, and Child Centered Codes. Both solutions also showed another factor (Table 10, Factor 2; Table 11, Factor 3) that had moderate to strong loadings from Lecture/Moralizing, Positive Reinforcement, Warmth, and Positive Mood. Although Externalized Negative - Cancer had low loadings across factors, the highest loading was on this factor (.26, .28 for Tables 10 and 11 respectively), which suggested that mothers who engage in Lecture/Moralizing may also be discussing how children should handle negative aspects of cancer. However, it was unexpected that Lecture/Moralizing and Externalized Negative - Cancer would load onto the same factor as several codes representing positive communication, and may suggest that this factor represents an aspect of communication in which mothers are instructing children how to think or feel yet are nonetheless delivering this information in a warm and supportive manner.

With a preference for the 6-factor model from the oblique Quartimax rotations reviewed above, the oblique Geomin rotation was also examined for each model. Results from both the oblique Quartimax and oblique Geomin rotations reflected similar pattern loadings within 4-, 5-, 6-, and 7-factor models, with the exception of the codes that tapped positive communication. With Geomin rotations, the manifest variables that measured positive communication each had highest loadings on the same factor. Therefore, the results from the 6-factor Geomin rotation (see Table 12) appeared to be more easily interpretable as all positive communication variables had the largest loadings on the same factor (Factor 1) and smaller loadings on the factor with moderate loadings from Lecture/Moralizing and Externalized Negative - Cancer (Factor 4). For this reason, the 6-factor model with oblique Geomin rotation was considered preferable. Table

12 reports factor loadings and highlights the manifest variables thought to be best representative of each factor. Put simply, the highest loading for each manifest variable across factors was highlighted.

Six-factor model. Ultimately the 6-factor model from Geomin rotation was retained due to considerations of model fit, interpretability, parsimony, and theory. Factor 1 was termed Positive Communication, Factor 2 Inconsistent Communication, Factor 3 Negative Affect, Factor 4 Lecturing, Factor 5 Hostile/Intrusive Communication, and Factor 6 Withdrawn Communication. In the 6-factor EFA model in Figure 5, manifest variables were depicted loading onto the single latent variable for which they had the largest factor loading. This corresponds to the shading of the factor loadings in Table 12. As such, this figure does not account for cross-loadings from the same manifest variable onto multiple latent variables.

Correlations among latent variables are reported in Table 13 and correlations among manifest variables for each factor, with age partialled out, are reported in Tables 14a-f. Although correlations among factors were not tested for statistical significance, their magnitudes are of note (see Table 13). First, the Negative Affect factor did not show strong correlations with any of the five communication factors (r's < .20). Positive Communication was negatively correlated with all other factors and most strongly with Hostile/Intrusive (r = -.46). Hostile/Intrusive was most strongly, positively correlated with Inconsistent Communication (r = .35) and Withdrawn Communication (r = .21). This general pattern of correlations was consistent with expectations and with the labels selected for the factors.

However, the 6-factor model is imperfect, and there are several important caveats. First, there were several codes with relatively low communalities (see Table 15), indicating that the proportion of variance in these manifest variables due to common factors was low. Most notable

is the Externalized Negative - Cancer code that had a communality of .12 and did not load strongly (< .30) on any of the factors. This is a code that was modeled after the Externalized Negative code for this study to specifically capture maternal communication pertaining to negative aspects of cancer treatment. In this way, the code taps content in addition to communication style. The low communality suggests that there are other influences on this factor not represented in the current model, including perhaps the type of cancer or treatment (e.g., cancers that require more extensive treatment, such as surgery, radiation, and chemotherapy, would provide more content for discussion). Despite these findings, all manifest variables, including Externalized Negative - Cancer, were retained in the model due to the exploratory nature of the analyses.

In addition, there were several items that had relatively strong negative loadings onto other factors (see the 6-factor solution in Table 12). For example, Neglect/Distancing had a loading of -.37 onto the Positive Communication factor. It would be expected that this item would be negatively correlated with Positive Communication, yet this should be accounted for with the strong negative correlation between Positive Communication and Hostile/Intrusive Communication factors (-.46; see Table 13). Also unexpected were the relatively high positive loadings from Positive Reinforcement, Warmth, and Positive Mood onto Factor 4 (labeled Lecturing). This may indicate that mothers who lecture about negative aspects of cancer do so with accompanying positive affect, suggesting that this factor represents a form of communication where mothers are gently encouraging their children about decisions regarding cancer treatment, as opposed to lecturing with harsh and negative affect.

Finally, a decision was made to represent the final model (depicted in Figure 5) with each manifest variable as an indicator of a single latent variable, without cross-loadings from the same

manifest variable onto multiple latent variables. The limitation of excluding cross-loadings from the model is that this does not take into account the influence of more than one factor on each manifest variable. This decision was made in order to represent a more parsimonious solution and is discussed further below.

When comparing this model with the proposed models tested with CFA, there are several important similarities and differences. Similar to the revised CFA models above (depicted in Figures 3a-3c), all manifest variables that tapped positive communication loaded highly onto the same factor. In addition, a separate factor that appeared to tap negative affect was also represented in the EFA; similar to Model A, its correlations with other factors was minimal. Yet in contrast to the models tested in CFA, the factor structure that emerged from EFA analyses suggested more narrow-band negative communication factors than had originally been hypothesized. Although it was hypothesized that negative communication consisted of hostile/intrusive and withdrawn patterns, there were four factors that appeared to tap various aspects of negative communication. Similar to hypotheses, elements of hostile/intrusive and withdrawn communication patterns were present (Factors 5 and 6, respectively in Table 12). However, the EFA structure also implied separate factors that tapped aspects of communication that involved lecturing (Table 12, Factor 4) and inconsistency (Table 12, Factor 2) as well. The possibility that these factors would load onto a higher-order negative communication factor was not tested in the current EFA, but correlations among these factors were not universally large in magnitude, suggesting that a higher-order factor may not be suitable.

Supplemental Exploratory Factor Analysis

In order to inform future work on factor analysis with the IFIRS, an additional EFA was conducted without the Externalized Negative Affect-Cancer code. This code was developed

specifically for the current sample of families with new pediatric cancer diagnoses. As reflected in the results above, the code presented several challenges as it did not have strong loadings on any of the factors (< .30) and had a relatively small communality (.12). In addition, it would not be applicable to non-cancer samples. In order to test a model with a confirmatory approach with future non-cancer samples, the EFA was re-run without this code. The results are reported as supplemental analyses in Appendix C.

SEM: Maternal Distress and Maternal Communication

As an initial test of the structure of maternal communication revealed with EFA, structural equation modeling (SEM) analyses were conducted that focused on the relation between three measures of maternal distress and the six latent communication factors. Specifically, maternal anxiety, depression, and post-traumatic stress symptoms were examined in relation to Inconsistent Communication, Hostile/Intrusive Communication, Lecturing, Withdrawn Communication, Positive Communication, and Negative Affect (see Figure 6).

Manifest variables of sum scores from self-reports were used for maternal distress, specifically the BAI for anxiety, BDI for depression, and IES-R for post-traumatic stress symptoms. These measures were collected on average three months before maternal communication was observed. Means, standard deviations, and correlations among distress measures are reported in Table 16. Consistent with previous literature, means in the current sample reflected mild to moderate levels of distress (Bruce, 2006; Pai et al., 2007). There were significant positive correlations among the measures of maternal distress (*r's* ranged .65 to .68). The magnitude of the correlations suggested that these measures of distress were related yet still represented somewhat distinct constructs (see Table 16).

Latent variables for communication were created based on EFA results (see Table 12 and Figure 5). Consistent with analyses conducted with CFA and EFA, child age was controlled for by partialling correlations among communication variables. Consistent with the representation of the 6-factor model from EFA in Figure 5, the SEM did not contain loadings from manifest IFIRS variables onto more than one latent communication variable. Instead, and consistent with the shadings presented in Table 12, each manifest IFIRS variable was an indicator of just one latent variable. The drawback of this representation is that it differs slightly from the EFA, constraining the relation between manifest variables and other latent variables to zero, and may have limited model fit. However, model fit can be expected to decrease to some extent when moving from EFA to SEM analyses due to model constraints (Brown, 2015).

In the SEM, the latent communication variables were predicted from manifest distress variables (see Figure 6). In Step 1, distress symptoms were examined separately for each measure of distress (Step 1a: anxiety, Step 1b: depression, Step 1c: post-traumatic stress); in Step 2, all three predictor variables were examined together. Results are reported in Table 17.

Anxiety symptoms, depressive symptoms, and PTSS were each significant predictors of Hostile/Intrusive Communication when entered separately ($B = .41$, $B = .50$, $B = .26$, respectively). In the final step, depressive symptoms remained a significant predictor ($B = .47$, $p < .001$), indicating that mothers who self-reported more depressive symptoms near diagnosis were observed demonstrating higher levels of Hostile/Intrusive Communication. PTSS was a significant predictor of Lecturing when entered separately in Step 1c ($B = .31$, $p < .05$), indicating that mothers who self-reported more symptoms of post-traumatic stress near diagnosis were observed demonstrating higher levels of Lecturing, but PTSS did not remain significant in Step 2. There were no significant predictors of Withdrawn Communication. Anxiety symptoms

were a significant predictor of Inconsistent Communication in Step 1a (B = .21, p < .05), indicating that mothers who self-reported more symptoms of anxiety near diagnosis were observed demonstrating higher levels of Inconsistent Communication, but anxiety did not remain significant in Step 2. Anxiety symptoms, depressive symptoms, and PTSS were each significant predictors of Positive Communication when entered separately (B = -.28, B = -.28, B = -.27, respectively), indicating that mothers who reported more distress symptoms near diagnosis were observed demonstrating lower levels of Positive Communication, but none remained significant in the final step. Depressive symptoms and PTSS were both significant predictors of Negative Affect when entered separately (B = .27, B = .32, respectively), indicating that mothers who reported more symptoms of depression and post-traumatic stress near diagnosis were observed demonstrating higher levels of negative affect, but again, none remained significant in the final step.

CHAPTER IV

DISCUSSION

A childhood cancer diagnosis presents numerous stressors for families and puts family members at increased risk for distress (Barlow & Ellard, 2006; Cabizuca et al., 2009; Kazak et al., 2004; Pai et al., 2007). In order to develop interventions to reduce distress, researchers must identify clinically modifiable factors linked to risk and resilience. The purpose of this study was to investigate one proposed source of risk and resilience, maternal communication with their children, by examining its structure in a sample of families with new pediatric cancer diagnoses. Previous studies of communication in pediatric samples have largely focused on individual communication behaviors to address a given theoretical or clinical question (see Murphy et al., 2017). The current study applied factor analytic methods to better characterize the latent structure of communication in mothers of children with cancer.

Factor analysis allows researchers to determine if a set of items (or behaviors) reflect shared underlying constructs in order to reveal a "parsimonious representation" (Fabrigar & Wegener, 2011, p. 20), yielding unobserved latent variables. The current study examined the underlying structure of maternal communication as measured by the IFIRS, a macro-level coding system that captures direct observation of maternal communication. While two previous studies have applied factor analysis to the IFIRS system (Raj et al., 2014; Williamson et al., 2011), this is the first study to utilize a confirmatory factor analysis (CFA) approach. Initially, a CFA was conducted that was driven by prior research and family communication theory. However, results were ambiguous and did not suggest adequate fit; therefore an exploratory factor analytic

approach (EFA) was taken. Finally, an initial test of the correlates of the structure identified in EFA was conducted by examining the relation between maternal distress symptoms and maternal communication. Results provide important insight into the potential structure of maternal communication in this sample. This structure is contrasted with original hypotheses and clinical and theoretical implications are discussed.

Confirmatory Factor Analytic Approach

Confirmatory factor analytic approaches are used when there is sufficient theory to guide tests of hypothesized structure (Brown, 2015; Fabrigar & Wegener, 2011). In the current study, hypothesized models were based on a theoretical framework of maternal communication that draws on warmth and control (Fitness, 2013; Stafford, 2013). Models A, B, and C each specified a hierarchical structure, with Warm and Structured Communication representing specific components of Positive Communication and Hostile/Intrusive and Withdrawn representing specific components of Negative Communication (see Table 1). The three competing models (Figures 2a-c) addressed the question of maternal Negative Affect; in Model A, it was represented as a distinct, uncorrelated factor; in Model B, a distinct but correlated factor; and in Model C the individual manifest variables had cross-loadings onto the existing four communication factors.

Although previous literature and family communication theory were used to inform the hypothesized factor structure, initial results did not support the proposed factor structure of any of the models. Indeed, when testing Models A, B, and C as presented in the hypotheses, there were negative variances that made the solutions inadmissible. An iterative approach was taken to make modifications to the hypothesized model. Although this resulted in an admissible solution, model fit indices were nonetheless poor, conflicted across indices, and ultimately did not provide

strong support for any of the three models. Results from Models A, B, and C should therefore be interpreted cautiously given poor model fit (Brown, 2015). Changes made to the models are summarized briefly below. Interestingly, each of the changes to the initial CFA models foreshadowed findings from the subsequent EFA.

There were two major changes to the hypothesized factors themselves. First, a single Positive Communication factor was created without differentiating between first-order factors of Warm Communication and Structured Communication. Both the correlations between factors as well as the correlations among the manifest variables suggested that they were highly similar and likely represented the same underlying construct. In contrast, results suggested that the Hostile/Intrusive Communication factor and Withdrawn Communication factor were dissimilar enough that constraining them to load onto a higher order Negative Communication factor was also unsuitable. Taken together, these changes eliminated the need for and utility of a hierarchical factor structure.

There were also changes made to the placement of two manifest variables. Positive Affect was moved from the Negative Affect factor onto the Warmth factor where it correlated significantly and positively with all other items. It was interesting that Positive Affect (reverse coded) was not significantly correlated with any items representing negative affect, such as sadness and anxiety. This is similar to theories of emotion regulation that suggest that positive and negative affect systems operate separately, but not necessarily in opposite ways (Bradburn, 1969; Diener et al., 1985; Goldstein & Strube, 1994; Thompson, 2007).

Although Parental Influence was hypothesized to be part of the Structured Communication factor, it was instead significantly, positively correlated with several items on the Hostile/Intrusive Communication factor. This scale taps the mother's direct and indirect

attempts to influence, regulate, or control her child's behavior. While this includes setting structure for children, this code may specifically be tapping structure that occurs in the absence of warmth. This is similar to previous studies that have categorized this code as a form of harsh, negative communication (Jaser & Grey, 2010; Lord et al., 2014).

Although initial hypotheses were informed by theory (Fitness, 2013; Stafford, 2013) and previous research with pediatric samples (see Murphy et al., 2017), results from the CFA suggested that the hypothesized structure was not a suitable fit to the data. This was true even after shifting from a strict confirmatory approach and making iterative adjustments to the model. While CFA is well suited for comparing competing, theoretically based models, the overall pattern of results suggested that an exploratory factor analysis was an appropriate next step.

Exploratory Factor Analytic Approach

Exploratory factor analytic methods are used when there is insufficient theory to inform specific hypotheses (Brown, 2015; Fabrigar & Wegener, 2011). EFA maximizes fit to data without constraints on which manifest variables should load onto which factors. Results were examined including possible solutions for 4, 5, 6, and 7 factors, with both Oblique Quartimax and Geomin rotations. The 6-factor Geomin rotated solution was chosen based on considerations of parsimony, theory, and fit. While the model fit indices for this solution were strong, results should nonetheless be interpreted with caution as this structure has yet to be tested in an additional sample.

EFA revealed a factor structure that differed from what was predicted in the original hypotheses. Interestingly, it suggested a structure that included one latent variable that appeared to represent positive communication, one latent variable that appeared to represent negative affect, and four latent variables that tapped various aspects of negative communication. Two of

these latent variables are consistent with hypothesized Hostile/Intrusive and Withdrawn communication patterns, while the other two were unexpected and pose interesting theoretical considerations. Each latent variable is discussed in detail below.

Results suggested that the IFIRS codes that tap two broad aspects of positive communication, warmth and structure, load onto the same latent construct. Across both CFA and EFA (including 4-, 5-, 6-, and 7-factor EFA solutions with Geomin rotations), the same eight codes (Warmth, Listener Responsiveness, Communication, Prosocial, Child-Centered, Positive Reinforcement, Child Monitoring, Positive Mood) consistently loaded onto the same factor. Similar to CFA findings discussed above, this suggests that warmth and structure were strongly interrelated or strongly co-occurred in this sample. This also suggests that mothers may have been carrying out two important tasks, providing information and conveying emotional support, simultaneously for their children. For example, codes that were expected to represent structure (e.g., Positive Reinforcement) may inherently be accompanied by maternal warmth, while codes that were expected to represent warmth (e.g., Warmth/Support) may also include structure. This may play out in real time when mothers demonstrate increased levels of Listener Responsiveness when their child is displaying desirable behaviors. Similarly, demonstrations of Positive Reinforcement may themselves be accompanied by demonstrations of warmth such as smiles, hugs, and positive attention. Although this was not originally hypothesized, Positive Mood also loaded strongly onto this latent variable. This suggests that expressions of positive affect, such as smiles, laughter, and verbal statements that convey optimism, are important components of positive communication. These findings also have implications for future research; given that these codes are highly intercorrelated and appear to represent the same latent construct, it may be that researchers do not need to dedicate resources to coding all eight of these variables. For

example, the five codes with the highest factor loadings may be sufficient to capture this construct.

The Hostile/Intrusive factor was indicated by codes that were largely consistent with hypotheses (Hostility, Intrusiveness, Denial, Guilty Coercion, and Antisocial). As predicted, this factor appears to tap over-controlling, restrictive, and critical communication patterns along with low levels of warmth. This factor only differed from hypotheses in that it did not include Lecture/Moralizing, which instead loaded onto a different latent variable, discussed further below. These IFIRS codes have been combined into composites and averaged in order to capture negative communication in previous research with pediatric samples (Lim et al., 2008; Rodriguez et al., 2013).

In contrast, the Withdrawn Communication factor differed from what was originally hypothesized in that it was only indicated by two of the hypothesized four codes. Initial correlational analyses suggested two separate clusters within this proposed latent variable: 1) Avoidance and Neglect/Distancing and 2) Indulgent Permissive and Inconsistent Discipline. The Withdrawn Communication factor that resulted from EFA was indicated by the first two codes, while a separate factor, named Inconsistent Discipline, was indicated by the latter two codes. Mothers are scored high on the Avoidant scale when they physically orient away from their child in order to avoid interaction and high on the Neglect/Distancing scale when they ignore or distance themselves from their child. This suggests that the Withdrawn Communication factor, as it is represented by EFA results, more specifically taps communication patterns that involve consistently withdrawing from and being unavailable to the child, as opposed to alternating between engaging and disengaging.

The Inconsistent Communication factor was indicated by two codes originally hypothesized to be part of Withdrawn Communication factor: Indulgent Permissive and Inconsistent Discipline. Interestingly, Parental Influence also loaded onto this factor, though with a smaller magnitude loading. This latent variable appears to represent communication patterns in which mothers alternate between setting expectations and trying to exert control over their child and indulging or ignoring undesired behavior. Mothers may initially attempt to influence their child, but may not follow through on expectations or give appropriate negative consequences for behavior. This may represent not only inconsistent communication but also inconsistent attempts to implement structure. This also suggests that mothers have difficulty enforcing rules and consequences for behavior when their child is emotionally distressed or physically sick from their treatment. Previous research indicates that cancer diagnosis involves changes in family role functioning and schedules that may pose challenges to consistency (Rodriguez et al, 2012). This is similar to previous findings that some parents have difficulty setting limits with children with cancer and are more likely to rate discipline strategies as unacceptable when their child is under active treatment (Miller, Maine, & Palevsky, 1998; Vance & Eiser, 2004; Young, Dixon-Woods, Findlay, & Heney, 2002).

The 6-factor EFA also yielded an additional, unexpected factor, which was labeled Lecturing**.** This factor had loadings from Lecture/Moralizing and Externalized Negative - Cancer codes. The Externalized Negative - Cancer code was developed specifically for this study and was modeled after the Externalized Negative code, tapping negativity specifically regarding cancer treatment and its effects. The fact that these two codes, Lecture Moralizing and Externalized Negative - Cancer, had the highest loadings on the same factor suggests that mothers may be instructing their child how to think and feel specifically regarding negative

aspects of cancer and its treatment. To some extent, the interaction task in this study may pull for this content, as one prompt asks dyads to discuss what they "would be sure to tell other children and parents" about a cancer diagnosis and treatment. However, this latent variable may represent a pattern of communication in which mothers take over the conversation and instruct their children how to think, feel, and act in regard to negative parts of cancer and treatment. This is similar to previous research with this sample showing that mothers who demonstrate negative communication patterns, as captured by the IFIRS, also engage in reframing; specifically, after a child discloses information, some mothers try to change how the child thinks and feels about cancer without first validating the child's own experience (Rodriguez et al., 2013). While mothers of children with cancer may have a goal of discussing medication and treatment adherence, this factor could represent an overly high level of control or intrusion, especially for older children. This is similar to communication described in families with children with type 1 diabetes, in which parents' treatment monitoring may conflict with their children's developing autonomy (see Jaser, 2001). For example, family discussions of diabetes management, while important for adherence, are sometimes viewed by adolescents as intrusive (Weinger, O'Donnell, & Ritholz, 2001). Of note, EFA results in the current study showed that this latent variable also had moderate cross-loadings from warmth and positive reinforcement, indicating that mothers in this sample may nonetheless be delivering this information in a warm and supportive manner, perhaps resembling compassionate advice or supportive counseling.

The last factor, Negative Affect, was indicated by Sadness, Anxiety, and Externalized Negative codes. This is similar to what was originally hypothesized in Model A and Model B and helps address the question of whether negative emotions are pervasive in all aspects of communication or if they cluster separately. The presence of this factor suggests that negative

affect codes that tap emotional distress and negativity indeed cluster separately from the other communication codes and represent a unique latent variable. And similar to hypothesized Model A, this factor demonstrated low correlations with all other factors (*r*'s < .12). Although many of the communication codes in the IFIRS draw on affective quality (Melby & Conger, 2001), this suggests that demonstrations of negative affect are still distinct from other latent variables tapping communication.

Taken together, the structure of this 6-factor model of maternal communication represents two shifts from the original hypotheses for this study – first, the unitary nature of positive communication, and second, the number and nature of negative communication patterns. The hypothesized model had anchors in warmth and structure (Fitness, 2013; Stafford, 2013), grounded in Baumrind's (1969) seminal theory of parenting. While the latent variables in the 6-factor EFA appear to tap various aspects of warmth and structure, the results differ from the hypothesized hierarchical model that emphasized symmetry in positive and negative communication. In the current sample, warmth and structure appeared inextricable at higher levels, while negative communication appeared to have multiple representations. One of the benefits of a hierarchical structure is that it characterizes communication beyond "good" and "bad." There are more issues to be explored regarding the organization of negative communication in the current sample, however the diversity of negative communication patterns reflected in the 6-factor model holds similar clinical and theoretical implications.

The 6-factor EFA model did not reflect traditional groupings in the IFIRS scales (which are divided into dyadic interaction, individual characteristic, and parenting scales). Most notably, the 6-factor EFA model also differed from two previous EFA studies of the IFIRS. While these studies were conducted with distinct samples (mothers of children with TBI and low-income

marital dyads), they largely found three factors termed Positive, Negative and Effective Communication (Raj et al., 2014; Williamson et al., 2011). In the current sample, multiple codes from "Positive" and "Effective" factors loaded onto the same factor ("Positive Communication"), appearing to tap a single latent construct, while the codes from the "Negative" factor clustered separately, tapping different latent constructs. There are several reasons why results from the current sample would differ from previous findings; Raj et al. (2014) and Williamson et al. (2011) recruited samples that are very different from the current sample, combined codes across dyadic partners (including duplicate codes for husbands and wives), made different data trimming decisions (e.g., excluding codes with low communalities), and conducted different analyses (e.g., using orthogonal rotations, determining number of factors exclusively with scree plots). However, results also suggest that maternal communication may be organized differently in the current sample.

Because the 6-factor EFA model differed from what was hypothesized from family communication theory as well as from previous factor analytic studies of the IFIRS, this suggests that the current sample of maternal communication may be unique in some way. It is possible that this study captured a snapshot of communication during a specific and exceptional time in families' lives. A pediatric cancer diagnosis is accompanied by a host of stressors that has the potential to disrupt family communication and may put mothers at risk of negative communication patterns (Drotar 1999; Rodriguez et al., 2012). However, this population is also characterized by high levels of resilience (Kazak & Noll, 2015), and a pediatric cancer diagnosis may empower some mothers to excel at communicating with their child during a difficult time, incorporating high levels of both warmth and structure. Tests of the structure of maternal communication at a later point in time during recovery and remission of their child's cancer

would provide an important opportunity to examine whether the structure of communication found in the current study is unique to the circumstances of the child's initial diagnosis and treatment. Relations with maternal distress, discussed below, provide greater insight into the nature of these communication patterns.

Initial Test of Correlates: Relation to Maternal Distress

As an initial test of this 6-factor model, and to investigate potential correlates of maternal communication patterns, SEM analyses were conducted examining the relation between maternal distress and maternal communication. Results elucidated several significant relations between distress symptoms, which mothers self-reported near the time of the child's diagnosis, and communication patterns, which were observed three months later. Summary scales of mother's self-reported anxiety, depression, and post-traumatic stress symptoms (PTSS) were used as predictors of latent variables of communication from the 6-factor EFA model. These relations are longitudinal and multi-method, and therefore represent a strong test of correlates of the communication patterns identified in the EFA.

Previous research has indicated that mothers are at risk for increased symptoms of depression, anxiety, and post-traumatic stress after their child's cancer (Barlow & Ellard, 2006; Cabizuca et al., 2009; Kazak et al., 2004; Pai et al., 2007). This was also true for the current sample, as mean levels of anxiety, depression, and PTSS reflected mild to moderate elevations. These three domains of distress were highly intercorrelated in the current sample yet still represented distinct domains. Although the 6-factor model of maternal communication differed from the proposed structure, results were largely consistent with hypotheses; symptoms of distress were significantly, positively correlated with negative communication patterns and significantly, negatively correlated with positive communication. Interestingly, domains of

distress (anxiety, depression, and PTSS) were shared correlates of positive communication but unique correlates of different aspects of negative communication. This is discussed further below.

Maternal anxiety symptoms were the only significant predictor of the Inconsistent Communication factor. Mothers who are rated high on indicators of this factor (Indulgent/Permissive, Inconsistent Discipline, and Parental Influence codes) may have difficulty setting limits and following through on expectations with their children. Symptoms of anxiety may be driving inconsistency by impairing mothers' ability to track their child's behavior and appropriately set limits. In addition, mothers who have increased anxiety after their child's cancer diagnosis may be concerned about the outcomes of cancer treatment, and perhaps less willing to follow through on negative consequences for their child (see Jelalian et al., 1997). Maternal anxiety been linked to inconsistent discipline in child clinical populations as well (e.g., Crawford & Manassis, 2001).

Maternal PTSS was a significant predictor of the Lecturing factor, which was indicated by Lecture/Moralizing and Externalized Negative – Cancer codes. This suggests that mothers who report increased symptoms of avoidance, hyperarousal, and intrusion related to their child's cancer may be more likely to lecture their child about cancer. Perhaps mothers who experience increased PTSS, particularly intrusive memories of the child's diagnosis, may have difficulty disengaging from negative aspects of the child's cancer and may do all that they can to ensure that their child is following necessary steps in their treatment. This is similar to a previous study that found that mothers' PTSS interfered with their ability to validate their child's own cancer experience (Murphy et al., 2016). This is also consistent with previous research suggesting that mothers who experience trauma may engage in communication patterns that involve reenacting

details of the trauma with their child, including discussing specific negative events (Scheeringa & Zeanah, 2001).

All three measures of distress were significant predictors of the Hostile/Intrusive Communication factor and depressive symptoms continued to be a significant predictor after controlling for the other two symptom scales. Mothers who report symptoms of depression near diagnosis, such as sad mood, may have difficulty incorporating warmth into their interactions with their child. Similarly, symptoms such as irritability and fatigue may drive increased hostility. This finding is consistent with previous research in pediatric populations (e.g., Celano et al., 2008) and with a previous meta-analysis of maternal depression and parenting behavior that found that symptoms of depression were associated with increased harsh parenting styles (Lovejoy et al., 2000).

Interestingly, distress symptoms were not significant predictors of the Withdrawn Communication factor. There were theoretical reasons to expect that all three domains of distress, especially PTSS (Scheeringa & Zeanah, 2001) and depression (Lovejoy et al., 2000), would be significant predictors of this factor. Although withdrawn, unavailable, and uninvolved patterns of communication have been observed in families undergoing chronic stress outside the realm of a medical illness (see Lovejoy et al., 2000), this has been examined less frequently in pediatric psychology (see Murphy et al., 2017). Given that the child's cancer diagnosis was the specific topic under discussion, Withdrawn Communication may reflect a mother's reluctance to openly discuss cancer with her child. Perhaps alternative predictors of this communication pattern would include lack of information about cancer or avoidant coping (e.g., Tercyak et al., 2001).

All three measures of distress were significant predictors of the Positive Communication factor (with negative slopes) when examined separately. This suggests that mothers who are experiencing anxiety, depression, or post-traumatic stress symptoms near the time of their child's cancer diagnosis may have difficulty communicating positively with their child when discussing cancer three months later. Symptoms of distress, such as sad and anxious mood, may impair mothers' ability to demonstrate warmth and positive affect during interactions with their children. While previous studies have found that maternal distress is related to the warm, emotionally supportive aspects of positive communication in pediatric asthma (Celano et al., 2008; Lim et al., 2008) and type 1 diabetes (Jaser & Grey, 2010), previous research in pediatrics has not examined the relation between maternal distress and structured communication. However, the negative relations between maternal distress and the Positive Communication factor in this study may be unsurprising, given that this factor is indicated by codes that draw on both high levels of warmth and high levels of structure.

Both depressive symptoms and PTSS were significant predictors of the Negative Affect factor. These results were consistent with hypotheses that symptoms of distress would be moderately correlated with observed negative affect. While the Negative Affect factor is indicated by IFIRS codes that capture observable distress, this is conceptually distinct from internally experienced distress (see Izard, 2011). Indeed, it is potentially adaptive for mothers to dampen down their expression of negative affect when interacting with their child. Nonetheless, results indicated that mothers who self-reported symptoms of depression and PTSS near diagnosis were also more likely to demonstrate higher negative affect when communicating with their child three months later. This is consistent with previous studies with pediatric asthma and cystic fibrosis (Fiese et al., 2010; Lim et al., 2011).

Taken together, the results from SEM are consistent with previous research that indicates that maternal distress and maternal communication are interrelated. However, these analyses expand on previous cross-sectional findings in two ways. First, by examining longitudinal relations between maternal distress near the time of diagnosis and maternal communication three months later, and second, by creating latent variables of maternal communication instead of relying on individual communication codes. Current findings suggest that while symptoms of anxiety, depression, and PTSS may be uniquely related to different aspects of maternal negative communication, each may impair mothers' ability to communicate positively with their children. These results begin to inform the question of how maternal communication may serve as a mechanism of risk and resilience in pediatric cancer.

Limitations

This study is not without limitations, one of which is the unconventional order in which the factor analyses were conducted, with the CFA preceding the EFA. In addition, the CFA itself was not purely confirmatory, as there were multiple alterations made to the hypothesized structure in an iterative fashion. While confirmatory approaches are recommended when there is adequate theory and former research to inform specific hypotheses about structure and are appropriate for testing competing models (Brown, 2015; Fabrigar & Wegener, 2011), given the ambiguous results of the CFA, an exploratory approach was appropriate. Nonetheless, results from the EFA still need to be interpreted cautiously until the structure is tested in other samples.

In addition, the decision was made to retain all IFIRS codes throughout analyses. Several codes were skewed, which is problematic because Maximum Likelihood analyses assume multivariate normal distribution (Brown, 2015; Fabrigar & Wegener, 2011). Generalized Least Squares, an alternate fitting function that is sometimes used with nonnormally distributed

manifest variables, was used for comparison of model fit with CFA; however, model fit remained ambiguous with this approach. In addition, no IFIRS codes were removed during EFA, even though several codes demonstrated low communalities. Given the exploratory nature of the analyses, and the interest in the IFIRS system as a whole, the codes were retained. Finally, several IFIRS codes had inter-rater reliabilities that were lower than optimal, which is consistent with previous research with behavioral observation rating systems (Alder et al., 2008; Holmbeck et al., 2002). Future studies with the IFIRS will need to continue to grapple with codes that convey important information yet are low-frequency and present problems for data analysis.

There were also several limitations to the 6-factor structure that emerged from EFA. Exploratory factor analysis involves a certain level of subjective interpretation; multiple rotations may present appropriate solutions, and ultimately solutions are chosen based on considerations of parsimony, theory, fit, and interpretability (Brown, 2015; Fabrigar & Wegener, 2011). The final solution was the result of oblique Geomin rotation. An alternative representation of maternal communication was also plausible with the 6-factor Quartimax rotation, which depicted several positive communication codes loading onto the factor labeled "Lecturing." If this rotation was chosen, it could be interpreted as a form of structured communication, perhaps similar to what was initially hypothesized. In addition, results from the supplemental EFA (in which Externalized Negative - Cancer was omitted; Appendix C) supported a similar factor structure. Future studies will be presented with the choice of which representation is preferable. Other limitations include the decision to represent the final model without cross-loadings, which does not take into account the influence of more than one factor on each manifest variable. And finally, a drawback of the current model is that there were only two manifest indicators for the Lecturing and Withdrawn latent factors, while three to five measured variables reflecting the

same common factor are generally considered ideal (MacCallum, Widaman, Zhang, & Hong, 1999).

The current study also had a moderate sample size (N = 115 mother-child dyads). Although there is no strict rule for minimum sample size for factor analysis, some guidelines suggest 5 participants for every 1 measured variable (Gorsuch, 1983), or only allow sample sizes of 100 and smaller when communalities are high (>.70, higher than the mean in the current sample; MacCallum et al., 1999, 2001). One of the challenges of conducting research with this population is the relatively low incidence of childhood cancer (Jemal et al., 2010), which poses practical limitations on sample size. And although a strength of the current analyses was the longitudinal design, a more stringent test would account for both distress and communication at both time points. Unfortunately, distress ratings were only collected at T1 and communication was only observed at T2 in order to reduce burden on participating families.

Child age was not examined systematically, but instead was controlled for throughout CFA, EFA, and SEM analyses. This was due to the sample size, which was not sufficiently large enough to stratify by age and compare structure systematically (e.g., Wei, Oakland, Algina, 2008). In addition, the IFIRS system attempts to account for developmental differences and customizes anchors of each scale to what would be expected given the child's age and developmental status (Melby & Conger, 2001). Because there were no a priori hypotheses about child age, it was partialled out in correlations used for factor analysis.

However, correlational analyses did reveal several significant correlations between child age and IFIRS codes. For example, child age was significantly, positively related to maternal Sadness, Anxiety, and Externalized Negative codes (which were all indicators of the Negative Affect latent variable) and Lecture/Moralizing. This suggests that mothers of older children may

be more comfortable expressing their own distress to their child, and similarly, may be more likely to engage in communication that involves lecturing. Interestingly, child age was also significantly, negatively correlated with all three indicators of the Inconsistent Communication factor (Inconsistent Discipline, Indulgent Permissive, and Parental Influence codes). This suggests that mothers of younger children with cancer may have a particularly difficult time setting limits then following through with expectations. Similarly, younger children may be more likely to engage in behaviors that require limit-setting (e.g., Rodriguez et al., 2016). Finally, several indicators of the Positive Communication latent variable (Warmth, Listener Responsiveness, and Child Centered codes) were significantly, negatively correlated with child age, which is consistent with previous research that indicates that positive communication decreases as children move into adolescence (Holmbeck et al., 2010; Rodriguez et al., 2016). Together, these results may guide future hypotheses about the relations between maternal communication and child age. However, with current analyses, it is unclear if mean levels of maternal communication change with child age, or if the structure itself changes.

The current sample also reflected a restricted range of racial and ethnic diversity, and therefore may not be applicable to families of children with cancer that are not Caucasian. For example, some studies have shown that African American parents may demonstrate increased behavioral control and decreased warmth when interacting with their children compared to European American parents, while other studies have suggested that these differences can be accounted for by examining socioeconomic status (see Richman & Mandura, 2013). One of the most striking findings from both the CFA and EFA was that codes conveying high warmth and high control loaded strongly onto the same latent variable. When examining communication in families living in poverty and/or in unsafe neighborhoods, warmth and control may not be

similarly inextricable. Alternatively, a similar structure may hold, but levels of hostile/intrusive communication may be higher.

In addition, this study did not attempt to address gender differences. Previous studies with healthy, typically developing samples have found that mothers communicate with sons and daughters differently, such that conversations with daughters are more likely to evoke more emotional content than conversations with sons (Fivush, Brotman, Buckner, & Goodman, 2000; Reese, Haden, & Fivush, 1996). It is unclear if this pattern would hold in families with chronically ill children who are presented with more emotionally evocative topics related to illness.

The current sample was also restricted to mothers, which is typical of most family studies in pediatrics (see Phares et al., 2005). While fathers play an important role in family function, they are difficult to recruit and retain in research as most studies occur during clinic visits when children are more likely to be accompanied by mothers. This is a limitation of communication research in pediatric samples broadly (see Murphy et al., 2017). In a notable exception, one study of children with type 1 diabetes that included fathers found that fathers of daughters demonstrated more withdrawn communication than fathers of sons (Seiffge-Krenke, 2002). Isolated findings do not provide enough information to draw any general conclusions about the effects of gender, and it will require more research to disentangle the ways in which gender may impact the structure of family communication.

Finally, while maternal communication is discussed in general terms, it is important to acknowledge that communication was operationalized with the IFIRS system. Therefore, the factor structure may not be readily applicable to studies that measure communication using different systems. The IFIRS is a macro-level coding system that was chosen because of its

extensive research base, particularly in pediatric psychology (e.g., Jaser & Grey, 2010; Lim et al., 2008; Rodriguez et al., 2011). It was also highlighted in a review of evidence-based measures in pediatric psychology as meeting "well-established" criteria (Alderfer et al., 2008). Future studies may attempt to validate this 6-factor structure with other observational coding systems or with questionnaire measures of maternal communication. For example, the MICS is a similarly widely used observation coding system (Alderfer et al., 2008) that includes 19 macro-level scales. A previous study conducted an EFA with the MICS in a sample of families with overweight children and authors determined a 2-factor solution was the best fit, labeling the factors Behavioral Control and Interpersonal Involvement (Dickstein et al., 1994). It would therefore be interesting to test the current 6-factor solution in a sample of mother-child communication in pediatric cancer coded with the MICS.

Future Directions

Next steps include testing the model from EFA in additional samples via confirmatory factor analysis. This structure differed in several ways from the hypothesized structure and most markedly in the number and nature of negative communication patterns. This evokes the question: To what extent is the factor structure implied by the EFA results applicable to and replicable in other populations? Although the original hypothesized CFA structure drew on family communication literature and studies with pediatric populations, this is the first factor analytic study of the IFIRS with families of children newly diagnosed with cancer. It may be that this structure is only salient to families that are coping with a new cancer diagnosis, or it may characterize patterns that are present more broadly in other populations undergoing stress.

An initial approach involves testing this structure in other families faced with new child cancer diagnoses. However, it would also be interesting to consider whether this structure holds

in samples with other pediatric diagnoses. This could include samples with a similar trajectory of acute onset and treatment over time (e.g., Crohn's Disease, TBI), as well as samples with more chronic and lifelong conditions (e.g., type 1 diabetes, cystic fibrosis, sickle cell disease). Results from the second EFA (in which Externalized Negative - Cancer was omitted; in Appendix C) could be used to inform this question. A more stringent test would be to examine this structure in other populations undergoing diverse chronic and uncontrollable stressors, such as families in which a parent is depressed or families living in poverty (e.g., Gruhn et al., 2016; Reising et al., 2013). Testing the structure in other samples would help elucidate the extent to which maternal communication that occurs in families with new cancer diagnoses is unique.

Future studies should also examine additional correlates and predictors of maternal communication. The results from the current study suggest that maternal distress is related to maternal communication over time. Another potentially modifiable correlate may include maternal coping. Previous research has indicated that coping is not only directly related to communication (Celano et al., 2008; Fivush & Sales, 2005; Sales & Fivush, 2006) but that coping and distress interact to predict communication over time. For example, in a previous study from this sample (Rodriguez et al., 2016), secondary control coping (or efforts to adapt to sources of stress) predicted lower levels of negative communication and higher levels of positive communication, as measured by the IFIRS. In addition, depressive symptoms mediated the relation between lower levels of secondary control coping and negative communication over time. Future studies should examine the joint roles of coping and distress when predicting communication.

A primary purpose of this study was to better understand the latent structure of maternal communication so that it can further be examined as a potential mechanism of parent and child

distress. To this end, it will be important for future studies to examine these latent maternal communication variables in relation to child outcomes. Previous research has indicated that maternal communication is related to child distress concurrently and over time. For example, in a study of families of children with spina bifida, maternal invalidation was significantly, positively related to child anxiety (Fiese et al., 2008), and in a study of families of children with Type 1 Diabetes, behavioral control was significantly, negatively related to child depression and anxiety symptoms (Chisolm et al., 2014). Further, parental communication has also been shown to be related to children's coping with stress (e.g., Watson et al., 2014). It is therefore reasonable to expect that the latent maternal communication variables in this study may be related to child distress and coping. While this line of research would have important clinical utility, it would also help to further characterize the structure of maternal communication by improving our understanding of the correlates and consequences of the latent variables. The factors that emerged from the EFA were given labels based on theoretical considerations and prior research. However, before settling on terms such as "positive" and "negative," it may be important to establish that they are indeed related to either adaptive or adverse outcomes. Analyzing latent maternal communication variables in relation to child distress may not only guide future research and intervention development, but would continue to clarify the nature of maternal communication itself.

Finally, this study has important implications for intervention. By identifying the latent structure of maternal communication, it is possible to characterize specific patterns of communication that can be targeted in intervention. Future interventions may help target and reduce specific aspects of negative communication, including Hostile/Intrusive, Withdrawn, Lecturing, and Inconsistent Communication. Previous research indicates that intervening on

family communication patterns is possible. For example, studies by Wysocki et al. (1999; 2008) found that a behavioral-family systems therapy intervention for pediatric diabetes was successful at reducing negative communication patterns, such as hostile/intrusive communication styles, with effects persisting to 12-month follow-up.

Interventions aimed at addressing maternal communication could also focus on targeting distress symptoms that may put mothers at risk for specific negative communication patterns. This may include teaching mothers coping skills near the time of their child's cancer diagnosis in order to help them cope effectively with cancer-related stressors and reduce their symptoms of distress (Compas, 2017). Specific coping skills may include identifying and challenging negative cognitions about their child's cancer that may interfere with their ability to communicate effectively as a family (Kazak et al., 2005).

Future interventions should not only focus on curbing negative communication patterns, but also on fostering positive communication skills. For example, Compas et al. (2010) found that a family-based prevention intervention for families with a history of parental depression resulted in improvements in positive parental communication as coded with the IFIRS system (specifically, improvements in Warmth, Child Centered, and Listener Responsiveness codes). Further, these changes in communication partially mediated the intervention's effects on children's depression and anxiety symptoms. In pediatric cancer, preventative interventions may focus on building on mothers' existing communication skills, which predated the cancer diagnosis, and encouraging them to incorporate a balance of warmth and structure in their communication with their child.

Conclusion

Given that direct observation of family communication is emerging as the gold standard of communication methodology (Wysocki, 2015), exploratory and confirmatory factor analytic studies are needed to examine ratings systems in order to better understand the structure of family communication. This study builds on previous research of family communication in child cancer that has largely focused on isolated codes of interest. The current analytical approach also represents several improvements over previous studies of the IFIRS system, including taking a theory-driven approach over a data-reduction approach, utilizing both confirmatory and exploratory factor analytic methods for better examination of the latent structure of maternal communication, and using SEM to examine the relation between clinically-meaningful measures of distress and latent communication variables. The integration of family communication theory, prior research, and multiple statistical techniques was used to identify, characterize, and label latent maternal communication variables to inform future research in risk and resilience in pediatric cancer.

While future studies are needed to test and replicate this model in additional samples, these results provide important insight into the structure of maternal communication in families with new pediatric cancer diagnoses. Unexpectedly, findings illustrate the unity of positive maternal communication and the diversity of negative maternal communication, identifying potential targets for future research. Results also highlight the relation between maternal symptoms of anxiety, depression, and posttraumatic stress and maternal communication. These findings may guide future research into mechanisms of risk and resilience in pediatric cancer. Future studies should continue to examine correlates and consequences of maternal

communication in pediatric oncology, as the field shifts to developing interventions that can effectively build family communication skills and foster resilience.

Table 1

IFIRS Codes, Definitions, and Examples

Code	Definition	Examples
Codes for Hypothesized Factor I: *Warm Communication*		
Warmth/Support	Expressions of care, concern, support, or encouragement toward the child.	"You were really brave" Hugs; thumbs up
Listener Responsiveness	The mother's nonverbal and verbal responsiveness as a listener to the verbalizations of the child through behaviors that validate and indicate attentiveness to the child.	"Wow!"; "I like your idea" Nods, eye contact while the child is speaking
Prosocial	Demonstrations of helpfulness, sensitivity, cooperation, sympathy, and respectfulness toward the child in an age-appropriate manner. Reflects a level of maturity appropriate to one's age.	"I'm sorry, I didn't know that bothered you" Taking turns, self-controlled
Child-Centered	Mother's responses to child are appropriate and based on child's behavior and speech; they offer the right mix of support and independence so child can experience mastery, success, pride, and develop effective self-regulatory skills.	"You've almost got it!" Acknowledges child's affect; Sharing positive affect
Codes for Hypothesized Factor II: *Structured Communication*		
Parental Influence	The mother's direct and indirect attempts to influence, regulate, or control the child's life according to commonly-accepted, age-appropriate standards.	"We always clean up after we play" Requires child to pay attention; confronts child when misbehaves
Positive Reinforcement	The extent to which the mother responds positively to the child's "appropriate" behavior or behavior that meets specific maternal standards.	"You are so good at this" Praise; smiles
Child Monitoring	The extent of the mother's specific knowledge	"You're really good at puzzles"

	and information concerning the child's life and daily activities. Indicates the extent to which the mother accurately tracks the behaviors, activities, and social involvements of the child.	Asking specific questions; tracks child closely during task
Communication	The mother's ability to neutrally or positively express her own point of view, needs, wants, etc. in a clear, appropriate, and reasonable manner, and to demonstrate consideration of the child's point of view. The good communicator promotes rather than inhibits exchange of information.	"This is really important to me because…" Clarifies other's position
Codes for Hypothesized Factor III: *Hostile/Intrusive Communication*		
Hostility	The extent to which hostile, angry, critical, disapproving, rejecting, or contemptuous behavior is directed toward the child's behavior (actions), appearance, or personal characteristics.	"You always do it wrong" Mocking; criticism
Intrusiveness	The extent to which the mother is domineering and overcontrolling in interactions with their child; mother's behavior is adult-centered rather than child-centered.	"I think you should put away all the lego pieces first then the puzzle pieces" Interrupting; Not allowing child to make choices
Denial	Active rejection of the existence of or personal responsibility for a past or present situation for which one actually is responsible or shares responsibility.	"It's not my fault" Blaming the child; Changing the subject
Guilty Coercion	Achieving goals or attempts to control or change the behavior of the child by crying, whining, manipulation, or revealing needs or wants in a whiny or whiny-blaming manner.	"Look at all I've done for you and you don't even appreciate it" Whining; sighing
Lecture/Moralize	Telling the child how to think, feel, etc. in a way that assumes the mother is the expert and/or has superior wisdom; at high levels may provide little opportunity for the child to	"You should know better" Platitudes; chiding

	respond, initiate, or think independently.	
Antisocial	Demonstrations of self-centered, egocentric, acting out, and out-of-control behavior that shows defiance, active resistance, insensitivity toward others, or lack of constraint. Reflects immaturity and age-inappropriate behaviors.	"You can't answer again. It's my turn!" Complaining
Codes for Hypothesized Factor IV: *Withdrawn Communication*		
Avoidant	The extent to which the mother physically orients herself away from the child in such a manner as to avoid interaction.	Looks down or away after child speaks Recoiling; detached
Neglecting/Distancing	The degree to which the mother minimizes the amount of time, contact, or effort she expends on the child; ignoring or psychological/physical distancing in the interaction situation.	"Take care of it yourself" Sitting passively while child completes task; pushing child away
Indulgent/Permissive	The degree to which the mother is excessively lenient and tolerant of the child's misbehavior or has given up attempts to control the child; a laissez faire or a defeated attitude by the mother regarding the child's behavior.	"Do what you want, you don't listen to me anyway" Few attempts to get child to comply with task; acting more like a peer than a parent
Inconsistent Discipline	The degree of maternal inconsistency and lack of follow-through in maintaining and adhering to the rules and standards of conduct for the child's behavior.	"I just couldn't see grounding you for the whole month, so I let you out of your punishment" Idle threats; giving up on instructions
Codes for Hypothesized Factor V: *Expressed Negative Affect*		
Sadness	Emotional distress expressed as despondence, unhappiness, sadness, depression and regret.	"I feel stuck here forever" Crying; listless; head in hands
Anxiety	Emotional distress expressed as nervousness, fear, tension, stress, worry, and concern.	"I'm really worried" Fidgeting; tense, rigid body movements
Externalized Negative	Negativity expressed in the form of anger, hostility, or criticisms regarding people, events, or things outside the immediate setting.	"Those two are really troublemakers" Complaints; impatience
Externalized Negative -	Negativity expressed in the form of anger,	"I hate chemo"

Cancer	hostility, or criticisms regarding cancer treatment and its effects.	Complaints; impatience
Positive Mood (reverse scored)	Expressions of contentment, happiness, and optimism toward self, others, or things in general.	"We can do this!" Laughing; animated gestures

Table 2

Descriptive Statistics for Maternal Communication Codes

Code	Range	Mean (SD)	Skewness	Kurtosis
Sadness	1-8	4.97 (1.44)	-.13	-.22
Anxiety	1-8	4.60 (1.58)	.26	-.77
Externalized Negative	1-7	3.62 (1.65)	.16	-.75
Externalized Negative - Cancer	1-8	2.91 (1.70)	.70	-.22
Hostility	1-8	2.58 (1.54)	1.04	.80
Intrusive	1-8	3.22 (1.63)	.58	-.05
Denial	1-4	1.35 (.67)	2.05	3.83
Guilty Coercion	1-5	1.31 (.75)	2.66	7.16
Antisocial	1-7	2.66 (1.37)	1.05	.85
Lecture Moralizing	1-8	3.27 (1.84)	.59	-.42
Avoidance	1-5	2.11 (1.13)	.93	.23
Neglect Distancing	1-7	2.53 (1.52)	.87	.01
Indulgent Permissive	1-7	1.76 (1.36)	2.05	3.53
Inconsistent Discipline	1-7	1.82 (1.52)	2.05	3.62
Parental Influence	1-7	3.67 (1.63)	.12	-.84
Positive Reinforcement	1-6	2.62 (1.45)	.45	-.88
Child Monitoring	2-9	6.03 (1.34)	-.85	1.01
Warmth	2-9	5.72 (1.59)	-.17	-.38
Listener Responsiveness	3-9	6.70 (1.06)	-.91	1.84
Communication	4-9	7.11 (.89)	-.92	1.72
Prosocial	3-8	6.51 (1.05)	-1.53	3.17
Child Centered	2-9	6.31 (1.30)	-.99	1.15
Positive Mood	2-8	5.67 (1.21)	.30	-.24

Note: Range for IFIRS codes is 1(absence) to 9 (mainly characteristic).

Table 3a

Correlations Among IFIRS Variables on the Hypothesized Negative Affect Factor

Code	Sadness	Anxiety	Externalized Negative	Externalized Negative - Cancer	Positive Mood (reverse)
Sadness	--				
Anxiety	.37***	--			
Externalized Negative	.28**	.34***	--		
Externalized Negative - Cancer	.18	.09	.14	--	
Positive Mood (reverse)	.01	.01	.05	-.04	--

***$p < .001$, **$p < .01$, *$p < .05$

Note: Positive Mood was reverse-coded such that high scores represented lower expressions of positive mood. Positive Mood was later removed from this factor in CFA analyses and placed on the Warmth factor.

Table 3b

Correlations Among IFIRS Variables on the Hypothesized Hostile/Intrusive Communication Factor

Code	Hostility	Intrusive	Denial	Guilty Coercion	Antisocial	Lecture Moralizing
Hostility	--					
Intrusive	.49***	--				
Denial	.28**	.16	--			
Guilty Coercion	.42***	.23*	.09	--		
Antisocial	.58***	.40***	.28**	.19*	--	
Lecture Moralizing	.01	.21*	.14	-.13	.13	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 3c

Correlations Among IFIRS Variables on the Hypothesized Withdrawn Communication Factor

Code	Avoidance	Neglect Distancing	Indulgent Permissive	Inconsistent Discipline
Avoidance	--			
Neglect Distancing	.39***	--		
Indulgent Permissive	.01	.10	--	
Inconsistent Discipline	.07	.16	.73***	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 3d

Correlations Among IFIRS Variables on the Hypothesized Structured Communication Factor

Code	Parental Influence	Positive Reinforcement	Child Monitoring
Parental Influence	--		
Positive Reinforcement	-.11	--	
Child Monitoring	-.13	.30**	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 3e

Correlations Among IFIRS Variables on the Hypothesized Warm Communication Factor

Code	Warmth	Listener Responsiveness	Communication	Prosocial	Child Centered	Positive Mood
Warmth	--					
Listener Responsiveness	.44***	--				
Communication	.56***	.73***	--			
Prosocial	.56***	.70***	.72***	--		
Child Centered	.60***	.65***	.80***	.72***	--	
Positive Mood	.59***	.48***	.55***	.55***	.48***	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 4

Correlations Between Child Age and IFIRS Variables

Code	Correlation with child age
Sadness	.31**
Anxiety	.37**
Externalized Negative	.28**
Externalized Negative - Cancer	-.03
Hostility	-.08
Intrusive	-.10
Denial	.10
Guilty Coercion	-.04
Antisocial	.10
Lecture Moralizing	.28**
Avoidance	.12
Neglect Distancing	.13
Indulgent Permissive	-.19*
Inconsistent Discipline	-.36**
Parental Influence	-.35**
Positive Reinforcement	-.02
Child Monitoring	-.07
Warmth	-.24**
Listener Responsiveness	-.27**
Communication	-.12
Prosocial	-.10
Child Centered	-.20**
Positive Mood	-.08

***$p < .001$, **$p < .01$, *$p < .05$

Table 5a

Correlations Among IFIRS Variables on the Hypothesized Negative Affect Factor Partialling for Child Age

Code	Sadness	Anxiety	Externalized Negative	Externalized Negative - Cancer
Sadness	--			
Anxiety	.29**	--		
Externalized Negative	.21*	.26**	--	
Externalized Negative – Cancer	.20*	.11	.15	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 5b

Correlations Among IFIRS Variables on the Hypothesized Hostile/Intrusive Communication Factor Partialling for Child Age

Code	Hostility	Intrusive	Denial	Guilty Coercion	Antisocial	Lecture Moralizing
Hostility	--					
Intrusive	.49***	--				
Denial	.29**	.17	--			
Guilty Coercion	.42***	.22*	.10	--		
Antisocial	.60***	.41***	.27**	.19*	--	
Lecture Moralizing	.03	.25**	.12	-.12	.10	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 5c

Correlations Among IFIRS Variables on the Hypothesized Withdrawn Communication Factor Partialling for Child Age

Code	Avoidance	Neglect Distancing	Indulgent Permissive	Inconsistent Discipline
Avoidance	--			
Neglect Distancing	.38***	--		
Indulgent Permissive	.04	.13	--	
Inconsistent Discipline	.12	.22*	.72***	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 5d

Correlations Among IFIRS Variables on the Hypothesized Structured Communication Factor Partialling for Child Age

Code	Parental Influence	Positive Reinforcement	Child Monitoring
Parental Influence	--		
Positive Reinforcement	-.13	--	
Child Monitoring	-.16	.30**	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 5e

Correlations Among IFIRS Variables on the Hypothesized Warm Communication Factor Partialling for Child Age

Code	Warmth	Listener Responsiveness	Communication	Prosocial	Child Centered	Positive Mood
Warmth	--					
Listener Responsiveness	.44***	--				
Communication	.56***	.73***	--			
Prosocial	.56***	.70***	.72***	--		
Child Centered	.60***	.65***	.80***	.72***	--	
Positive Mood	.59***	.48***	.55***	.55***	.48***	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 6a

Modified CFA: Model Fit Indices with Maximum Likelihood

Model Fit Index	Model A	Model B	Model C
RMSEA	.09 (.08-.10)	.09 (.08-.10)	.09 (.08-.10)
NFI	.76	.77	.75
SRMR	.11	.11	.11
AIC	580.65	578.20	593.98
BIC	781.03	786.81	816.32

Notes: Parentheses represent confidence intervals; RMSEA = root mean square error of approximation; NNFI = non-normed fit index; SRMR = standardized root mean square residual; AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion

Table 6b

Modified CFA: Model Fit Indices with Generalized Least Squares

Model Fit Index	Model A	Model B	Model C
RMSEA	.04 (0-.05)	.04 (0-.06)	.04 (.01-.06)
NNFI	.32	.33	.33
SRMR	.13	.13	.13
AIC	407.71	410.85	420.92
BIC	608.09	619.46	643.26

Notes: Parentheses represent confidence intervals; RMSEA = root mean square error of approximation; NNFI = non-normed fit index; SRMR = standardized root mean square residual; AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion

Table 7a

Modified CFA: Parameter Estimates for Model A

	Factor Variance	Factor Loading (Standardized)	Error Variance
Negative Affect	.53		
Sadness		1.00 (.51)	1.34
Anxiety		1.05 (.49)	1.53
Externalized Negative		.98 (.43)	1.98
Externalized Negative – Cancer		.71 (.30)	2.61
Hostile/Intrusive Communication	1.50		
Hostility		1.00 (.80)	.84
Intrusive		.84 (.63)	1.55
Denial		.46 (.29)	.41
Guilty Coercion		.25 (.41)	.47
Antisocial		.80 (.71)	.91
Lecture Moralizing		.18 (.12)	3.04
Parental Influence		.50 (.37)	1.95
Withdrawn Communication	.13		
Avoidance		.41 (.13)	1.23
Neglect Distancing		1.00 (.24)	2.12
Indulgent Permissive		2.75 (.72)	.83
Inconsistent Discipline		3.89 (.91)	.11
Positive Communication	1.07		
Positive Reinforcement		.67 (.48)	1.60
Child Monitoring		.72 (.56)	1.20
Warmth		1.00 (.65)	1.30
Listener Responsiveness		.77 (.76)	.40
Communication		.75 (.88)	.16
Prosocial		.84 (.83)	.32
Child Centered		1.06 (.85)	.40
Positive Mood		.74 (.63)	.86

Table 7b

Modified CFA: Parameter Estimates for Model B

	Factor Variance	Factor Loading (Standardized)	Error Variance
Negative Affect	.55		
Sadness		1.00 (.52)	1.31
Anxiety		.97 (.46)	1.59
Externalized Negative		1.01 (.46)	1.92
Externalized Negative – Cancer		.66 (.29)	2.63
Hostile/Intrusive Communication	1.48		
Hostility		1.00 (.79)	.85
Intrusive		.85 (.64)	1.52
Denial		.17 (.30)	.41
Guilty Coercion		.26 (.41)	.47
Antisocial		.80 (.71)	.91
Lecture Moralizing		.19 (.13)	3.03
Parental Influence		.48 (.36)	1.98
Withdrawn Communication	.13		
Avoidance		.40 (.13)	1.23
Neglect Distancing		1.00 (.24)	2.12
Indulgent Permissive		2.75 (.72)	.82
Inconsistent Discipline		3.87 (.91)	.12
Positive Communication	1.07		
Positive Reinforcement		.67 (.48)	1.60
Child Monitoring		.72 (.56)	1.20
Warmth		1.00 (.65)	1.30
Listener Responsiveness		.77 (.76)	.39
Communication		.75 (.88)	.16
Prosocial		.83 (.83)	.32
Child Centered		1.06 (.85)	.40
Positive Mood		.74 (.63)	.86

Table 7c

Modified CFA: Parameter Estimates for Model C

	Factor Variance	Factor Loading (Standardized)	Error Variance
Hostile/Intrusive Communication	1.29		
Hostility		1.00 (.74)	1.05
Intrusive		.92 (.64)	1.52
Denial		.18 (.30)	.41
Guilty Coercion		.26 (.39)	.47
Antisocial		.84 (.70)	.95
Lecture Moralizing		.24 (.15)	3.01
Parental Influence		.47 (.33)	2.04
Sadness		.79(.62)	1.52
Anxiety		.84 (.61)	1.80
Externalized Negative		.87(.60)	2.03
Externalized Negative - Cancer		.60 (.40)	2.72
Withdrawn Communication	.15		
Avoidance		.37 (.13)	1.23
Neglect Distancing		1.00 (.26)	2.09
Indulgent Permissive		2.58 (.74)	.77
Inconsistent Discipline		3.40 (.87)	.26
Sadness		-1.70 (-.46)	1.52
Anxiety		-1.22 (-.31)	1.80
Externalized Negative		-1.31 (-.31)	2.03
Externalized Negative - Cancer		-.70 (-.16)	2.72
Positive Communication	1.07		
Positive Reinforcement		.84 (.48)	1.61
Child Monitoring		1.06 (.56)	1.22
Warmth		1.00 (.65)	1.30
Listener Responsiveness		.77 (.75)	.40
Communication		.76 (.89)	.16
Prosocial		.84 (.84)	.32
Child Centered		1.06 (.85)	.41
Positive Mood		.74 (.63)	.86
Sadness		.48 (.34)	1.52
Anxiety		.59 (.39)	1.80
Externalized Negative		.20 (.13)	2.03
Externalized Negative - Cancer		.40 (.24)	2.72

Table 8a

Modified CFA: Standardized Factor Correlations for Model A

	Hostile/ Intrusive	Withdrawn	Positive
Hostile/Intrusive Communication	--		
Withdrawn Communication	.54*	--	
Positive Communication	-.67**	-.28	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 8b

Modified CFA: Standardized Factor Correlations for Model B

	Negative Affect	Hostile/ Intrusive	Withdrawn	Positive
Negative Affect	--			
Hostile/Intrusive Communication	.25	--		
Withdrawn Communication	-.15	.54*	--	
Positive Communication	-.01	-.67**	-.28	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 8c

Modified CFA: Standardized Factor Correlations for Model C

	Hostile/ Intrusive	Withdrawn	Positive
Hostile/Intrusive Communication	--		
Withdrawn Communication	.58*	--	
Positive Communication	-.72**	-.30	--

***$p < .001$, **$p < .01$, *$p < .05$

Table 9

EFA: Comparison of Measures of Fit for Models with 2 to 7 Factors

Number of factors	F	Test Statistic	df	Parameters	RMSEA	AIC	Test of perfect fit *p*	Test of close fit *p*
2	3.605	411.027	208	68	.093 (.079-.106)	4.798 (4.327-5.339)	<.001	<.001
3	2.798	319.029	187	89	.079 (.064-.093)	4.360 (3.961-4.828)	<.001	.001
4	2.203	251.157	167	109	.066 (.049-.083)	4.115 (3.776-4.524)	<.001	.061
5	1.805	205.807	148	128	.059 (.038-.077)	4.051 (3.754-4.418)	.001	.229
6	1.364	155.450	130	146	.041 (.000-.064)	3.925 (3.702-4.236)	.063	.708
7	1.108	126.369	113	163	.032 (.000-.059)	3.968 (3.851-4.246)	.184	.842

Notes: F = Discrepancy Function; Test Statistic = Chi-Squared; df = degrees of freedom; RMSEA = Root Mean Standard Error of Approximation; AIC = Akaike's Information Criterion

Table 10

EFA: Factor Loadings for 5-Factor Model with Quartimax Rotation

Code	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Sadness	-0.06	0.13	**0.54**	-0.15	-0.22
Anxiety	0.03	-0.12	**0.58**	-0.09	0.09
Externalized Negative	0.25	0.13	**0.36**	-0.03	-0.17
Externalized Negative - Cancer	-0.02	0.26	0.26	0.09	-0.21
Hostility	**0.46**	-0.19	0.24	**0.36**	0.11
Intrusive	**0.49**	-0.04	0.15	0.14	-0.11
Denial	0.27	-0.06	**0.32**	-0.08	0.03
Guilty Coercion	-0.11	-0.22	0.28	**0.33**	-0.07
Antisocial	**0.57**	-0.04	0.07	0.21	-0.08
Lecture Moralizing	**0.45**	**0.40**	-0.03	-0.18	-0.24
Avoidance	**0.43**	-0.08	0.25	0.00	0.29
Neglect Distancing	**0.68**	0.00	0.02	0.04	0.00
Indulgent Permissive	-0.06	0.13	-0.07	**0.82**	-0.13
Inconsistent Discipline	0.06	-0.04	-0.02	**0.87**	0.04
Parental Influence	0.11	-0.19	-0.04	**0.37**	0.13
Positive Reinforcement	-0.01	**0.58**	-0.13	0.14	0.14
Child Monitoring	0.11	0.15	-0.08	-0.05	**0.62**
Warmth	-0.05	**0.56**	-0.04	-0.01	**0.31**
Listener Responsiveness	-0.53	0.21	0.12	0.08	0.27
Communication	-0.49	0.15	0.13	-0.02	**0.46**
Prosocial	-0.44	0.25	0.13	-0.06	**0.34**
Child Centered	-0.12	0.10	-0.01	-0.07	**0.83**
Positive Mood	-0.09	**0.69**	0.07	-0.05	0.10

Note: Bolded factor loadings are > .30.

Table 11

EFA: Factor Loadings for 6-Factor Model with Quartimax Rotation

Code	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Sadness	0.12	-0.13	0.18	-0.21	-0.19	**0.40**
Anxiety	-0.02	0.02	-0.04	0.02	0.00	**0.81**
Externalized Negative	0.20	0.04	0.20	-0.26	-0.06	**0.30**
Externalized Negative - Cancer	0.09	-0.16	0.28	-0.25	0.04	0.17
Hostility	**0.82**	-0.01	-0.08	0.09	0.11	0.03
Intrusive	**0.45**	0.13	0.03	-0.21	0.06	0.04
Denial	**0.38**	0.02	0.02	-0.02	-0.17	0.22
Guilty Coercion	**0.42**	-0.36	-0.16	-0.06	0.13	0.09
Antisocial	**0.59**	0.19	0.04	-0.15	0.04	-0.10
Lecture Moralizing	0.09	0.22	**0.40**	-0.37	-0.15	0.00
Avoidance	0.08	**0.46**	-0.03	0.26	0.08	0.20
Neglect Distancing	0.23	**0.56**	0.05	-0.07	0.07	0.06
Indulgent Permissive	-0.05	-0.01	0.10	-0.11	**0.81**	-0.03
Inconsistent Discipline	0.07	0.01	-0.02	0.03	**0.90**	0.02
Parental Influence	0.17	0.01	-0.16	0.10	**0.33**	-0.02
Positive Reinforcement	0.01	-0.05	**0.54**	0.18	0.09	-0.24
Child Monitoring	0.20	-0.00	0.15	**0.63**	-0.13	-0.12
Warmth	-0.18	0.04	**0.51**	**0.33**	0.03	-0.04
Listener Responsiveness	0.00	-0.58	0.20	**0.33**	-0.01	0.00
Communication	-0.18	-0.31	0.11	**0.55**	-0.03	0.12
Prosocial	-0.21	-0.29	0.22	**0.41**	-0.04	0.13
Child Centered	-0.07	-0.03	0.08	**0.85**	-0.05	0.04
Positive Mood	-0.14	-0.09	**0.64**	0.10	-0.04	0.06

Note: Bolded factor loadings are > .30. The signs for loadings on Factor 2 were each reversed.

Table 12

EFA: Factor Loadings for 6-Factor Model with Geomin Rotation

Code	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Sadness	-0.01	-0.18	**0.39**	0.17	0.07	-0.11
Anxiety	0.04	0.01	**0.81**	-0.03	-0.03	0.14
Externalized Negative	-0.17	-0.07	**0.30**	0.21	0.16	-0.01
Externalized Negative - Cancer	0.01	0.04	0.16	0.26	0.06	-0.17
Hostility	-0.02	0.08	0.02	-0.10	**0.83**	-0.04
Intrusive	-0.31	0.02	0.04	0.07	**0.42**	0.02
Denial	-0.04	-0.18	0.21	0.01	**0.36**	0.01
Guilty Coercion	0.01	0.13	0.08	-0.17	**0.42**	-0.30
Antisocial	-0.28	0.00	-0.11	0.07	**0.57**	0.05
Lecture Moralizing	-0.27	-0.18	0.00	**0.42**	0.03	0.06
Avoidance	0.01	0.07	**0.40**	-0.01	0.09	**0.47**
Neglect Distancing	-0.37	0.03	0.06	0.12	0.21	**0.40**
Indulgent Permissive	-0.05	**0.78**	-0.04	0.11	0.00	-0.02
Inconsistent Discipline	0.00	**0.87**	0.02	-0.01	0.14	0.04
Parental Influence	-0.02	**0.31**	-0.02	-0.15	0.20	0.03
Positive Reinforcement	**0.52**	0.08	-0.25	**0.41**	0.05	-0.02
Child Monitoring	**0.71**	-0.13	-0.13	0.01	0.27	0.14
Warmth	**0.63**	0.04	-0.05	**0.37**	-0.13	0.13
Listener Responsiveness	**0.78**	0.02	-0.01	0.04	0.06	-0.34
Communication	**0.83**	0.01	0.11	-0.03	-0.11	-0.05
Prosocial	**0.74**	-0.01	0.12	0.08	-0.15	-0.07
Child Centered	**0.95**	-0.03	0.03	-0.08	0.03	0.22
Positive Mood	**0.56**	-0.04	0.05	**0.51**	-0.12	-0.01

Note: Bolded factor loadings are > .30. Shaded factor loadings reflect items thought to be representative of the factor.
Factor 1 = Positive Communication, Factor 2 = Inconsistent Communication, Factor 3 = Negative Affect, Factor 4 = Lecturing, Factor 5 = Hostile/Intrusive Communication, Factor 6 = Withdrawn Communication

Table 13

EFA: Correlations Among Factors from 6-Factor Model with Geomin Rotation

	Positive	Inconsistent	Negative Affect	Lecturing	Hostile/Intrusive	Withdrawn
Positive	--					
Inconsistent	-.17	--				
Negative Affect	-.03	-.11	--			
Lecturing	-.05	-.13	-.05	--		
Hostile/Intrusive	-.46	.35	.16	.02	--	
Withdrawn	-.13	.02	-.06	.07	.21	--

Note: Statistical significance not calculated.

Table 14a

EFA: Correlations Among IFIRS Variables on Factor 1: Positive Communication

	Positive Reinforcement	Child Monitoring	Warmth	Listener Responsiveness	Communication	Prosocial	Child Centered	Positive Mood
Positive Reinforcement	--							
Child Monitoring	.30**	--						
Warmth	.50***	.36***	--					
Listener Responsiveness	.40***	.42***	.44***	--				
Communication	.37***	.49***	.56***	.73***	--			
Prosocial	.40***	.42***	.56***	.70***	.72***	--		
Child Centered	.38***	.60***	.60***	.65***	.80***	.72***	--	
Positive Mood	.44***	.35***	.59***	.48***	.55***	.55***	.48***	--

Note: Correlations presented are partialled for child age.
***$p < .001$, **$p < .01$, *$p < .05$

Table 14b

EFA: Correlations Among IFIRS Variables on Factor 2: Inconsistent Communication

	Indulgent Permissive	Inconsistent Discipline	Parental Influence
Indulgent Permissive	--		
Inconsistent Discipline	.72***	--	
Parental Influence	.25**	.41***	--

Note: Correlations presented are partialled for child age.
***$p < .001$, **$p < .01$, *$p < .05$

Table 14c

EFA: Correlations Among IFIRS Variables on Factor 3: Negative Affect

Code	Sadness	Anxiety	Externalized Negative
Sadness	--		
Anxiety	.28**	--	
Externalized Negative	.21*	.26**	--

Note: Correlations presented are partialled for child age.
***$p < .001$, **$p < .01$, *$p < .05$

Table 14d

EFA: Correlations Among IFIRS Variables on Factor 4: Lecturing

Code	Externalized Negative - Cancer	Lecture Moralizing
Externalized Negative - Cancer	--	
Lecture Moralizing	.19*	--

Note: Correlations presented are partialled for child age.
***$p < .001$, **$p < .01$, *$p < .05$

Table 14e

EFA: Correlations Among IFIRS Variables on Factor 5: Hostile/Intrusive Communication

Code	Hostility	Intrusive	Denial	Guilty Coercion	Antisocial
Hostility	--				
Intrusive	.49***	--			
Denial	.29**	.17	--		
Guilty Coercion	.42***	.22*	.10	--	
Antisocial	.60***	.41***	.27**	.19*	--

Note: Correlations presented are partialled for child age.
***$p < .001$, **$p < .01$, *$p < .05$

Table 14f

EFA: Correlations Among IFIRS Variables on Factor 6: Withdrawn Communication

Code	Avoidance	Neglect Distancing
Avoidance	--	
Neglect Distancing	.38***	--

Note: Correlations presented are partialled for child age.
***$p < .001$, **$p < .01$, *$p < .05$

Table 15

EFA: Communalities for each IFIRS variables for 6-Factor Model with Geomin Rotation

Code	Communalities
Sadness	.25
Anxiety	.65
Externalized Negative	.23
Externalized Negative - Cancer	.12
Hostility	.76
Intrusive	.42
Denial	.21
Guilty Coercion	.32
Antisocial	.57
Lecture Moralizing	.31
Avoidance	.40
Neglect Distancing	.53
Indulgent Permissive	.62
Inconsistent Discipline	.87
Parental Influence	.23
Positive Reinforcement	.46
Child Monitoring	.45
Warmth	.59
Listener Responsiveness	.74
Communication	.81
Prosocial	.71
Child Centered	.88
Positive Mood	.62

Note: Communalities represent the proportion of each manifest variable's variance explained by common factors.

Table 16

Means, Standard Deviations, and Correlations Among Maternal Distress Symptoms Self-reported at T1

	M (SD)	Anxiety Symptoms	Depression Symptoms	Post-traumatic Stress Symptoms
Anxiety Symptoms	11.50 (9.54)	--		
Depression Symptoms	13.56 (10.29)	.68***	--	
Post-traumatic Stress Symptoms	27.27 (17.31)	.66***	.65***	--

***$p < .001$, **$p < .01$, *$p < .05$

Notes: Correlation are reported in right side of table with Pearson's *r*.
Anxiety Symptoms measured with the BAI (Beck Anxiety Inventory), Depression Symptoms measured with the BDI (Beck Depression Inventory), and Post-traumatic Stress Symptoms measured with the IES-R (Impact of Events Scale-Revised).

Table 17

SEM: Maternal Distress Symptoms as Predictors of Latent Variables of Maternal Communication

	Hostile/Intrusive Communication		Lecturing		Withdrawn Communication		Inconsistent Communication		Positive Communication		Negative Affect	
	B	R^2	*B*	R^2	*B*	R^2	*B*	R^2	*B*	R^2	*B*	R^2
Step 1a		.17		.01		.01		.04		.08		.03
Anxiety Sx	.41***		.06		.07		.21*		-.28**		.17	
Step 1b		.25		.04		.05		.02		.08		.07
Depression Sx	.50***		.20		.22		.13		-.28**		.27*	
Step 1c		.07		.09		.05		.03		.07		.11
PTSS	.26*		.31*		.21		.18		-.27*		.32*	
Step 2		.27		.16		.07		.05		.10		.13
Anxiety Sx	.22		-.37		-.23		.17		-.11		-.17	
Depression Sx	.47***		.23		.21		-.04		-.13		.18	
PTSS	-.19		.40		.22		.10		-.12		.32	

***$p < .001$, **$p < .01$, *$p < .05$

Notes. All symptoms listed are maternal symptoms self-reported near time of child's diagnosis (T1). All maternal communication observed three months later (T2). Sx = symptoms. Anxiety Symptoms measured with the BAI (Beck Anxiety Inventory), Depression Symptoms measured with the BDI (Beck Depression Inventory), and Post-traumatic Stress Symptoms measured with the IES-R (Impact of Events Scale-Revised).

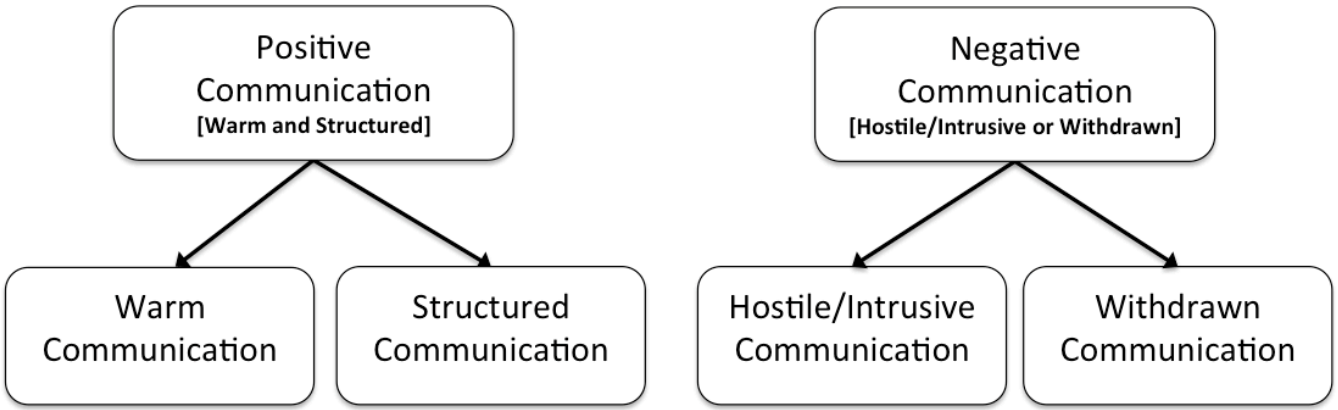


Figure 1. Proposed model of maternal communication (from Murphy, Murray & Compas, 2017)

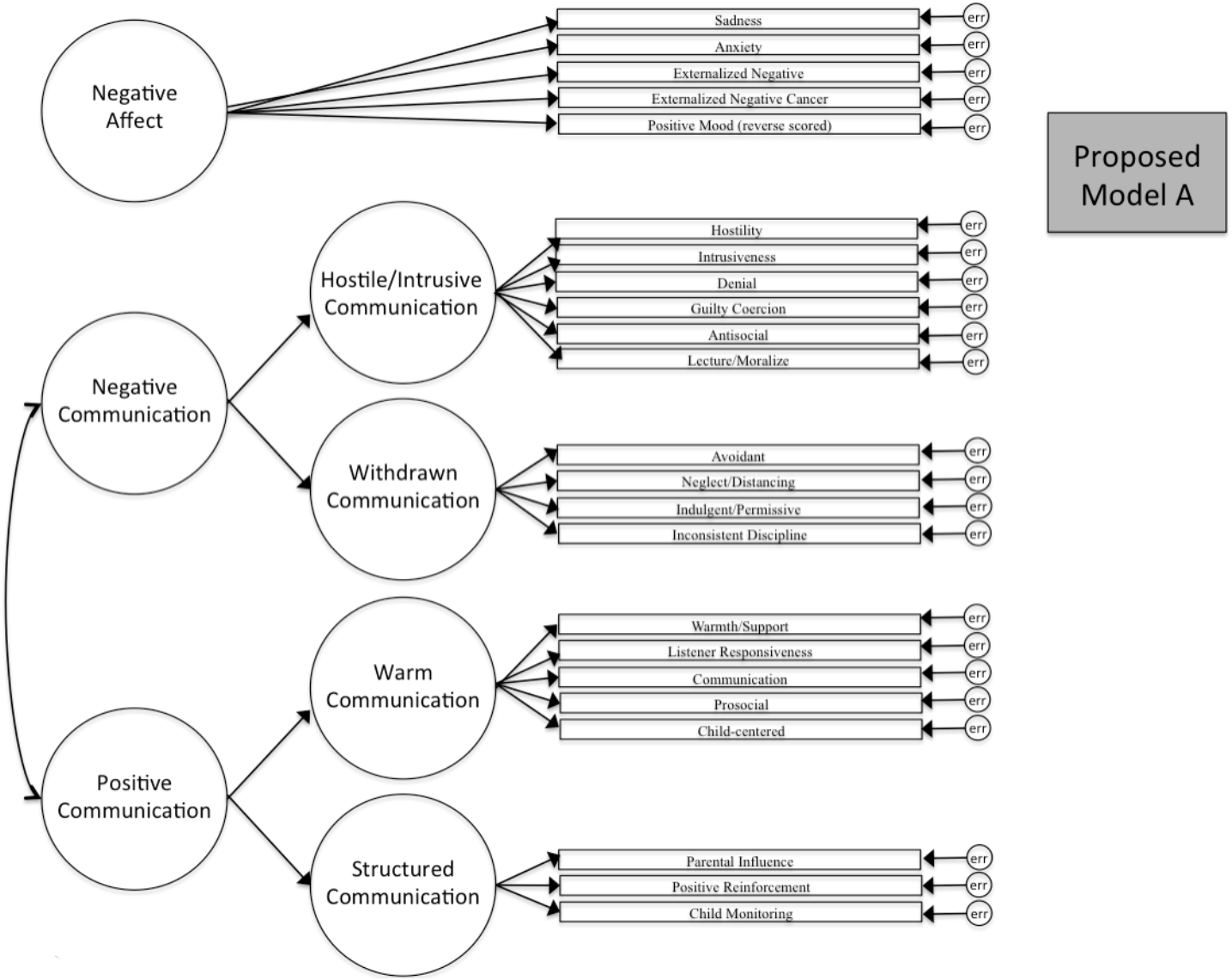


Figure 2a. Proposed factor structure: Model A

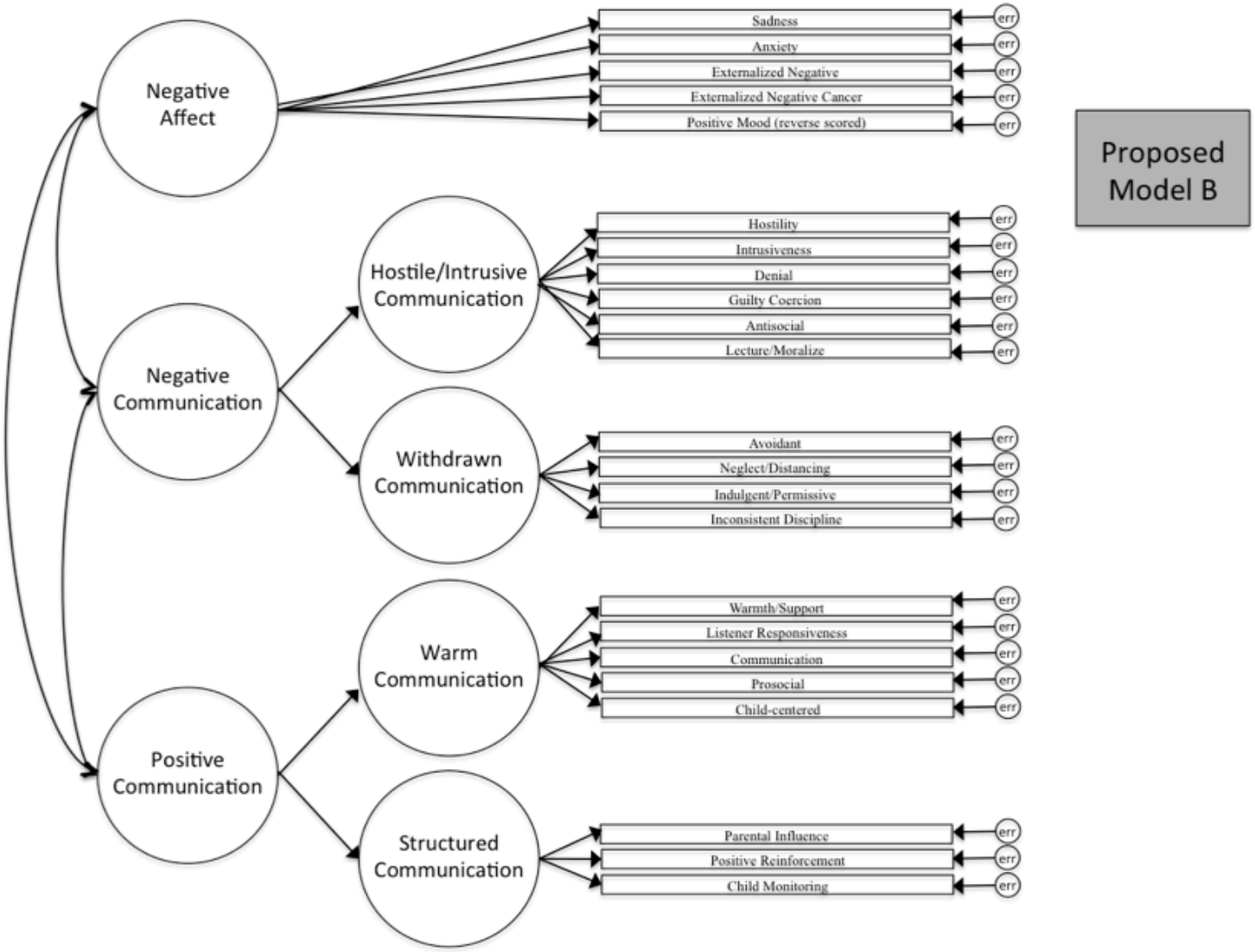


Figure 2b. Proposed factor structure: Model B

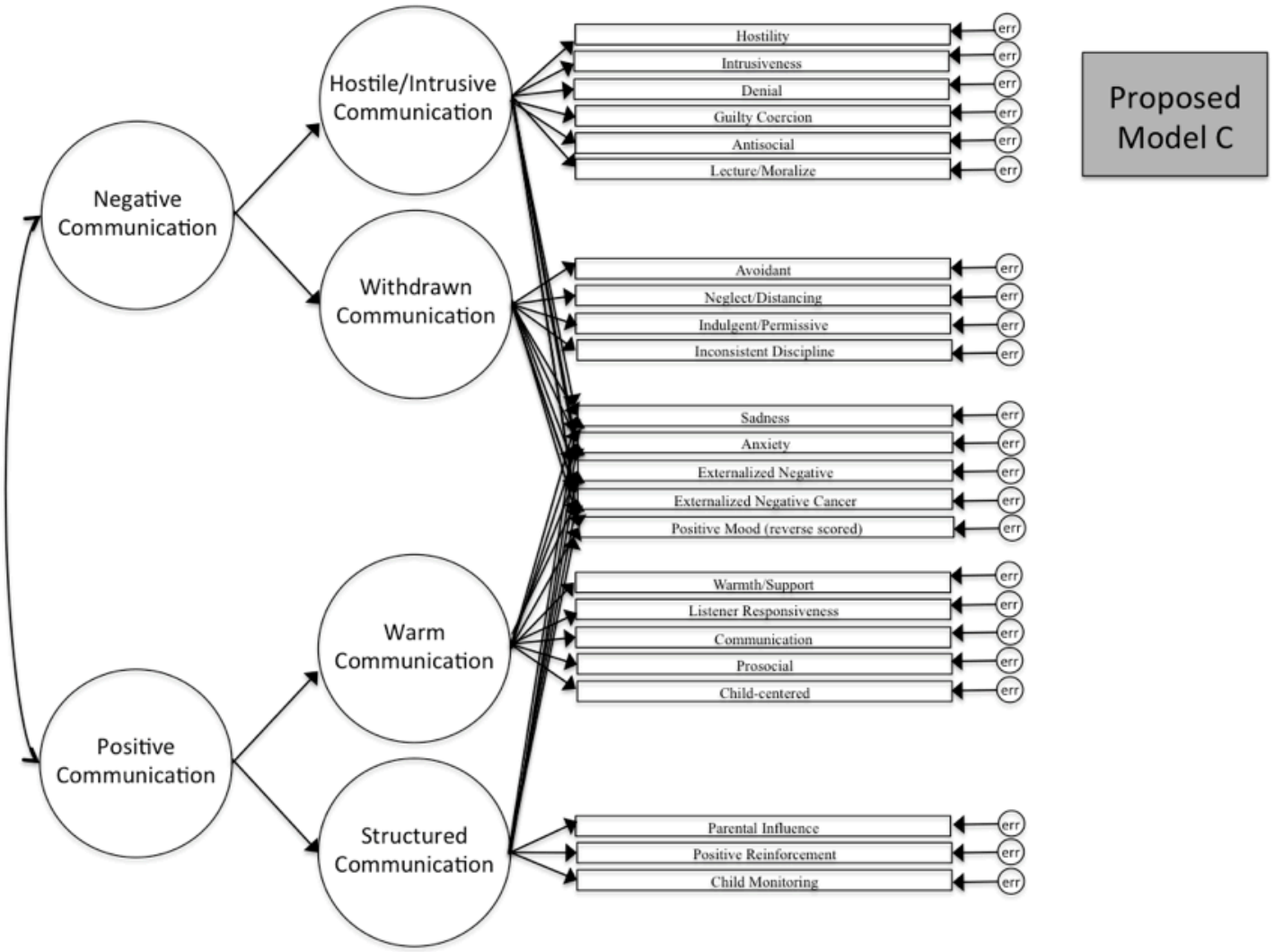


Figure 2c. Proposed factor structure: Model C

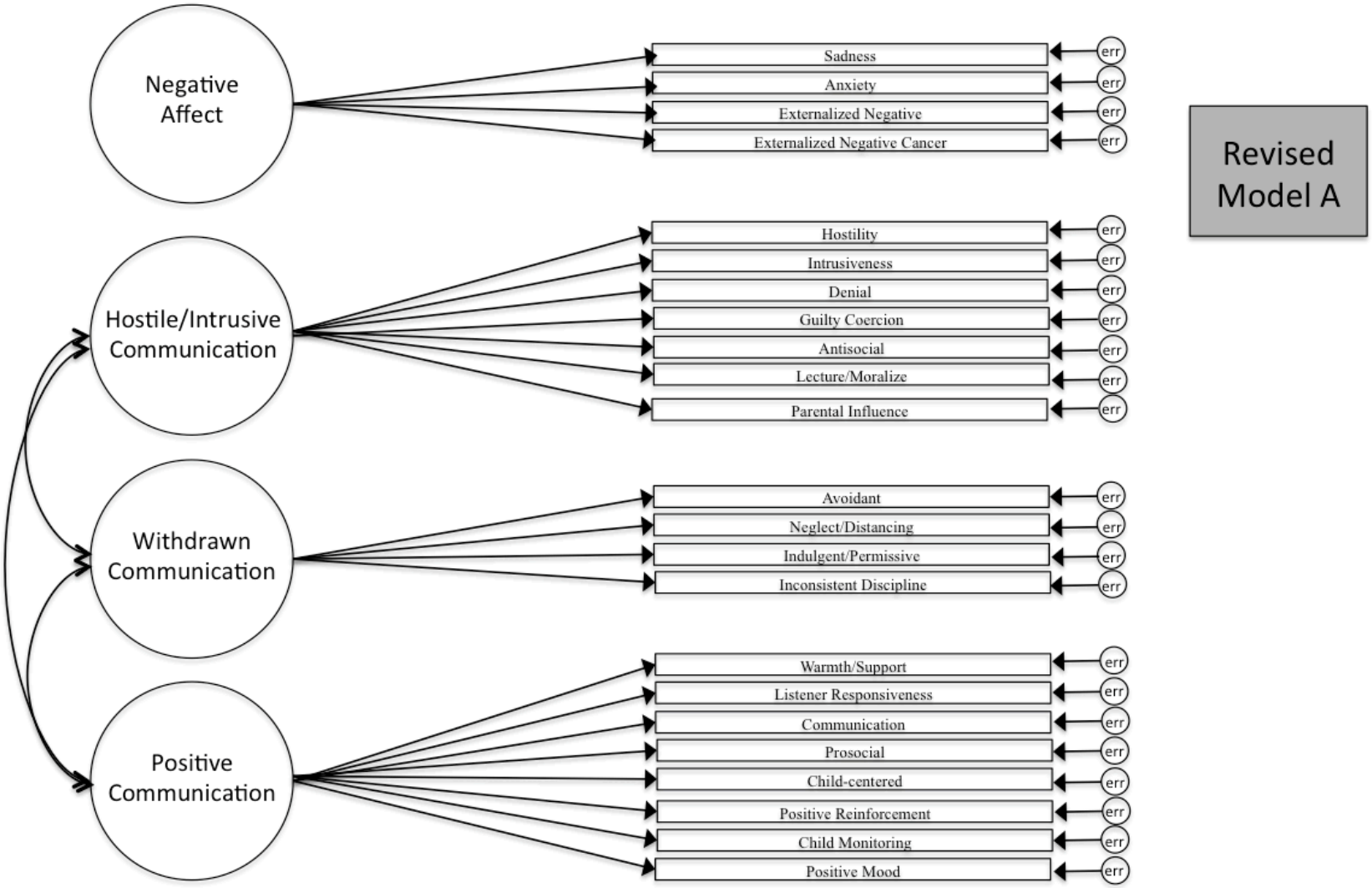


Figure 3a. Revised factor structure: Model A

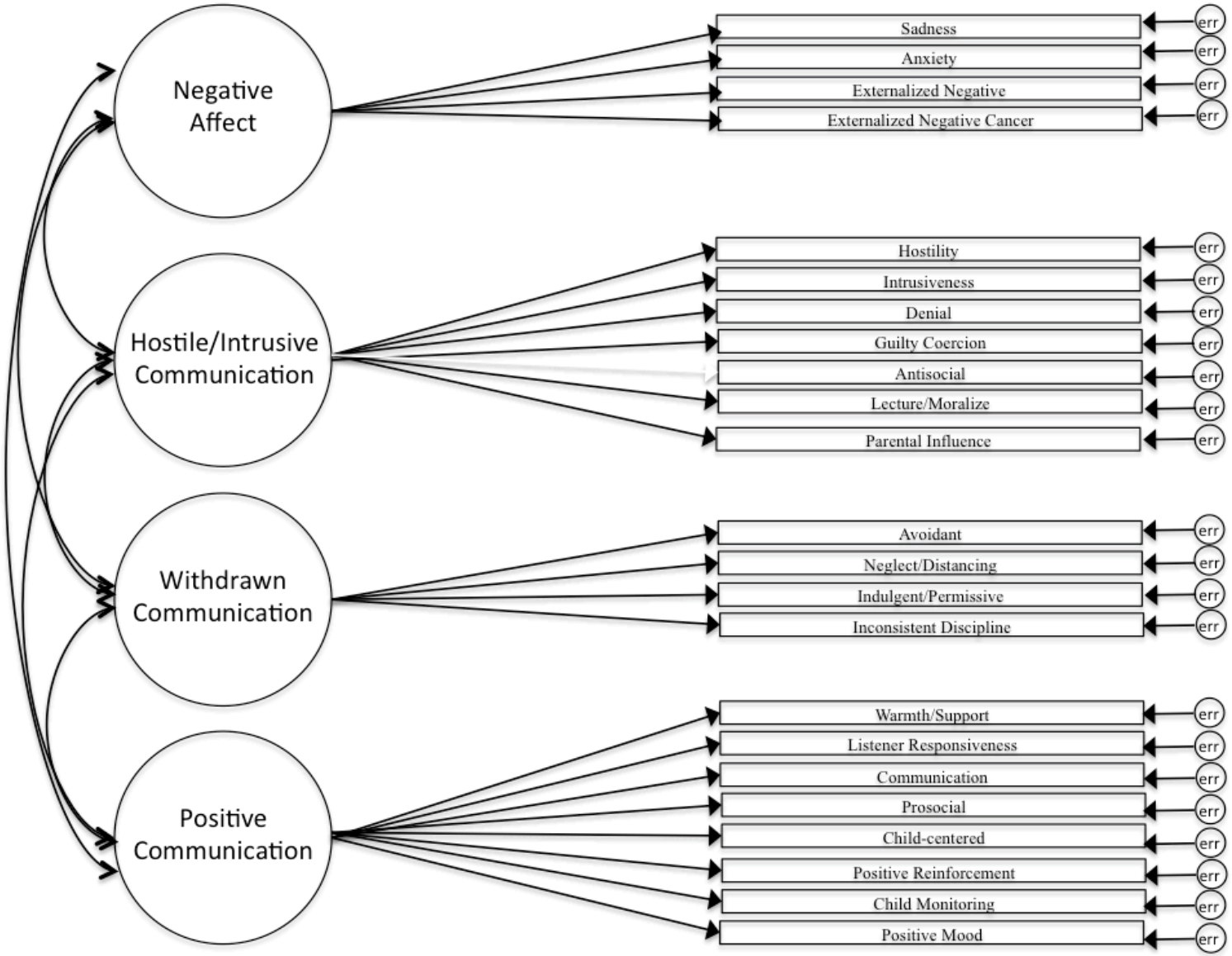


Figure 3b. Revised factor structure: Model B

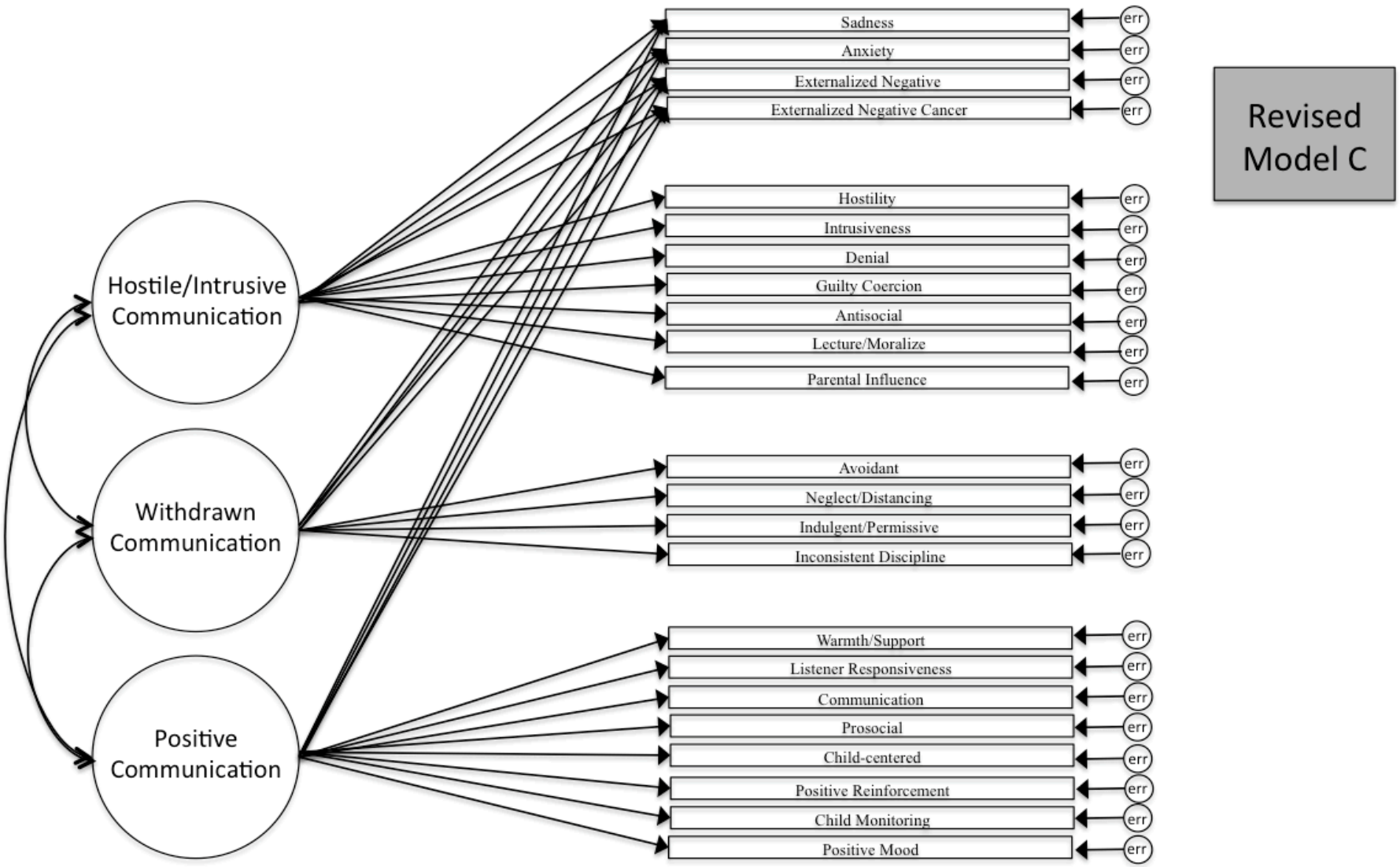


Figure 3c. Revised factor structure: Model C

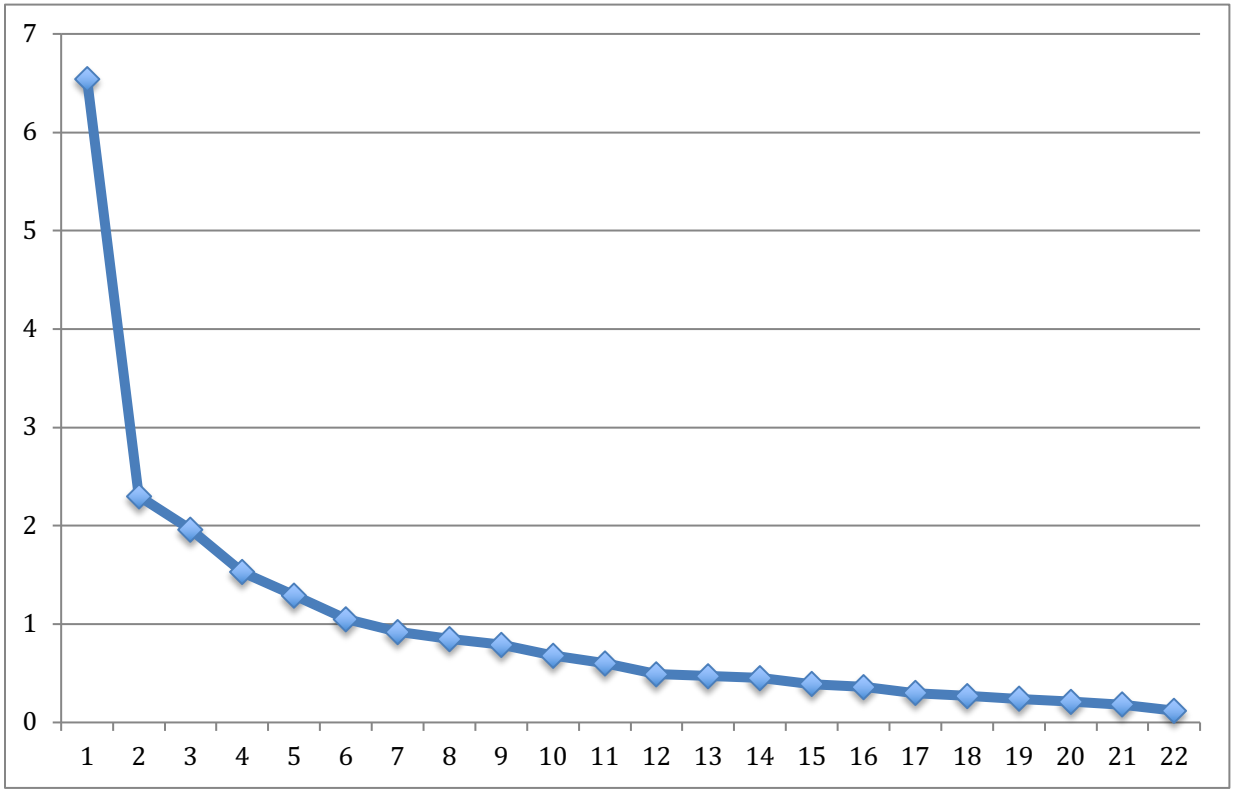


Figure 4. Scree plot of eigenvalues by *m* factors.

Note: Eigenvalues are on the y-axis and factors on the x-axis.

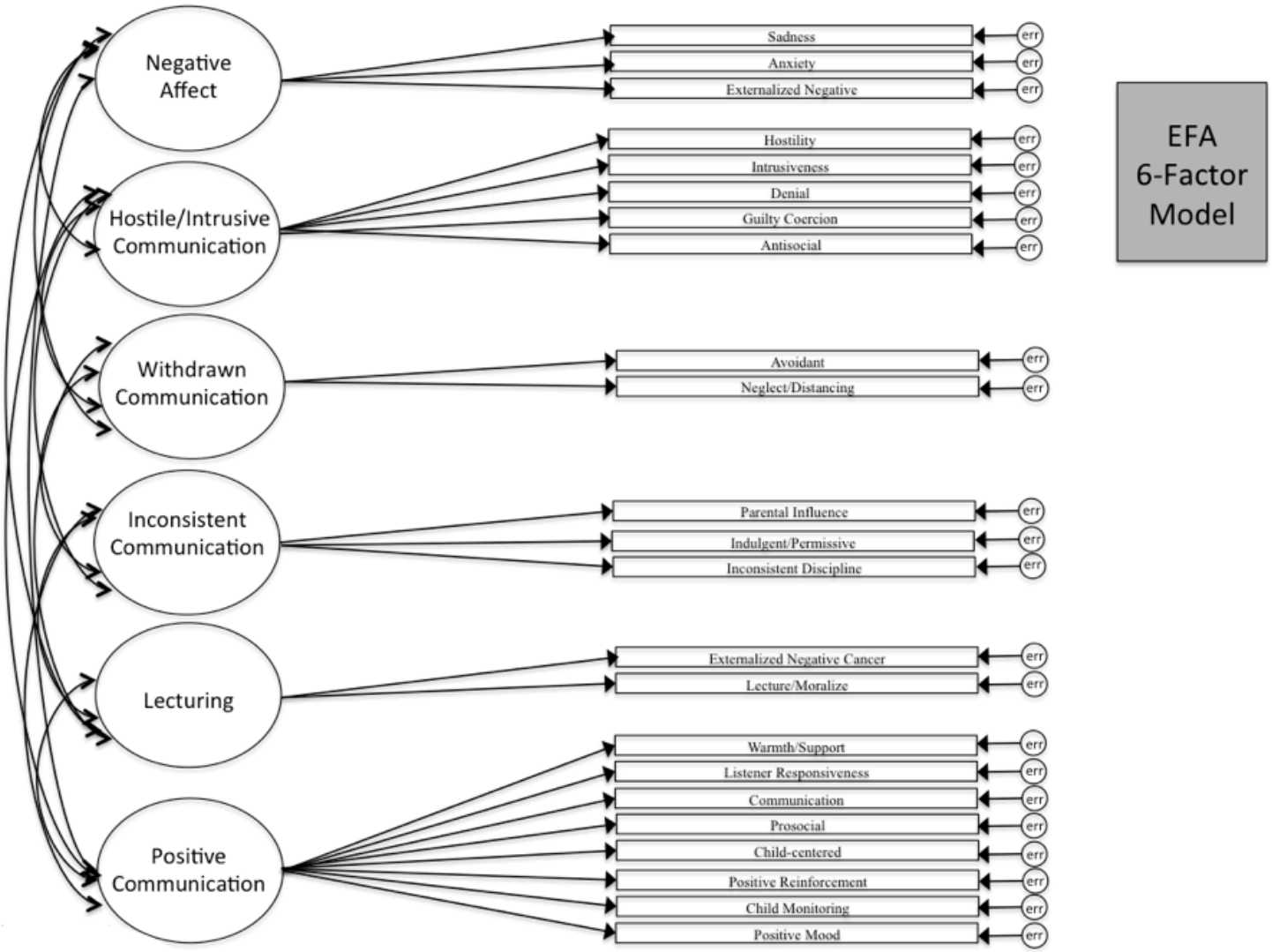


Figure 5. EFA 6-Factor Model

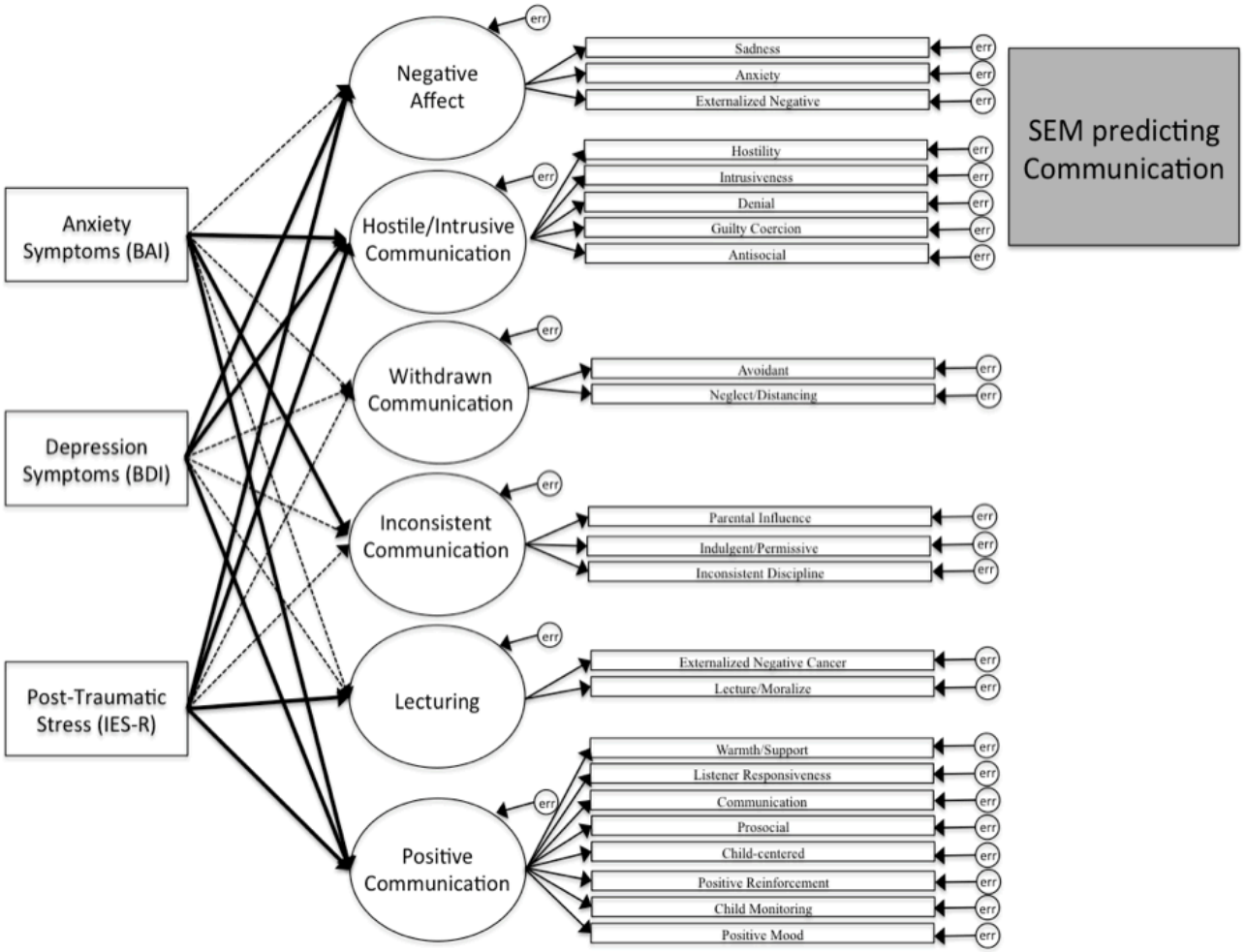


Figure 6. SEM: Maternal distress as a predictor of maternal communication

Notes: Bold lines between manifest distress variables and latent communication variables reflect significant Betas (p<.05) in Steps 1a-1c in regressions. Dashed lines reflect nonsignificant Betas (p>.05). Only the Beta between depression symptoms and hostile/intrusive communication remained significant in Step 2.
Anxiety Symptoms measured with the BAI (Beck Anxiety Inventory), Depression Symptoms measured with the BDI (Beck Depression Inventory), and Post-Traumatic Stress Symptoms measured with the IES-R (Impact of Events Scale-Revised)

APPENDIX A

Supplemental Table 1

Modified CFA: Standardized Regression Weights for Models A, B, and C with Generalized Least Squares

	Model A	Model B	Model C
Negative Affect			
Sadness	.28	.25	-
Anxiety	.43	.51	-
Externalized Negative	.40	.38	-
Externalized Negative - Cancer	.25	.28	-
Hostile/Intrusive Communication			
Hostility	.79	.81	.82
Intrusive	.45	.51	.54
Denial	.15	.25	.27
Guilty Coercion	.60	.62	.62
Antisocial	.61	.64	.64
Lecture Moralizing	-.36	-.27	-.20
Parental Influence	.50	.48	.46
Withdrawn Communication			
Avoidance	.17	.32	.32
Neglect Distancing	.22	.28	.27
Indulgent Permissive	.76	.76	.76
Inconsistent Discipline	.91	.90	.90
Positive Communication			
Positive Reinforcement	.59	.59	.62
Child Monitoring	.66	.66	.61
Warmth	.76	.77	.80
Listener Responsiveness	.63	.64	.64
Communication	.84	.85	.85
Prosocial	.74	.75	.76
Child Centered	.84	.84	.84
Positive Mood	.80	.80	.79
Hostile/Intrusive Communication			
Sadness	-	-	.39
Anxiety	-	-	.20
Externalized Negative	-	-	.09
Externalized Negative - Cancer	-	-	.16
Hostile/Intrusive Communication			
Sadness	-	-	-.13
Anxiety	-	-	.16
Externalized Negative	-	-	.17

Externalized Negative - Cancer	-	-	.09
Positive Communication			
Sadness	-	-	.28
Anxiety	-	-	.08
Externalized Negative	-	-	.09
Externalized Negative - Cancer	-	-	.16

Supplemental Table 2a

Modified CFA: Standardized Factor Correlations for Model A with Generalized Least Squares

Factor	Hostile/ Intrusive	Withdrawn	Positive
Hostile/Intrusive Communication	--		
Withdrawn Communication	.64**	--	
Positive Communication	-.45**	-.31	--

***$p < .001$, **$p < .01$, *$p < .05$

Supplemental Table 2b

Modified CFA: Standardized Factor Correlations for Model B with Generalized Least Squares

Factor	Negative Affect	Hostile/ Intrusive	Withdrawn	Positive
Negative Affect	--			
Hostile/Intrusive Communication	.34	--		
Withdrawn Communication	.36	.64**	--	
Positive Communication	-.03	-.47**	-.32	--

***$p < .001$, **$p < .01$, *$p < .05$

Supplemental Table 2c

Modified CFA: Standardized Factor Correlations for Model C with Generalized Least Squares

Factor	Hostile/ Intrusive	Withdrawn	Positive
Hostile/Intrusive Communication	--		
Withdrawn Communication	.60**	--	
Positive Communication	-.50**	-.32	--

***$p < .001$, **$p < .01$, *$p < .05$

APPENDIX B

Supplemental Table 1

EFA: Factor Loadings for 4-Factor Model with Quartimax Rotation

Code	Factor 1	Factor 2	Factor 3	Factor 4
Sadness	0.08	-0.29	**0.32**	0.00
Anxiety	0.24	-0.20	**0.49**	-0.17
Externalized Negative	-0.15	-0.14	**0.35**	0.11
Externalized Negative - Cancer	0.00	0.00	0.12	0.15
Hostility	-0.10	**0.33**	**0.58**	-0.08
Intrusive	-0.36	0.11	**0.39**	0.08
Denial	-0.03	-0.15	**0.46**	-0.02
Guilty Coercion	0.06	0.25	0.25	-0.26
Antisocial	-0.40	0.20	**0.39**	0.10
Lecture Moralizing	-0.43	-0.20	0.06	**0.47**
Avoidance	0.08	-0.01	**0.49**	0.01
Neglect Distancing	-0.41	0.06	**0.37**	0.18
Indulgent Permissive	-0.04	**0.80**	-0.10	0.06
Inconsistent Discipline	0.02	**0.88**	0.07	-0.04
Parental Influence	-0.01	**0.40**	0.12	-0.11
Positive Reinforcement	**0.34**	0.15	-0.13	**0.46**
Child Monitoring	**0.59**	0.01	0.15	0.15
Warmth	**0.53**	0.01	-0.07	**0.43**
Listener Responsiveness	**0.77**	0.04	-0.09	-0.02
Communication	**0.90**	-0.03	-0.03	-0.06
Prosocial	**0.77**	-0.09	-0.07	0.05
Child Centered	**0.90**	0.00	0.08	0.04
Positive Mood	**0.46**	-0.10	-0.05	**0.48**

Note: Bolded factor loadings are > .30.

Supplemental Table 2

EFA: Factor Loadings for 7-Factor Model with Quartimax Rotation

Code	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Sadness	0.15	-0.13	-0.13	-0.21	0.12	**0.39**	-0.13
Anxiety	-0.04	0.02	0.02	0.02	-0.03	**0.81**	-0.01
Externalized Negative	0.09	0.02	-0.27	-0.20	**0.30**	0.29	0.02
Externalized Negative - Cancer	0.24	-0.18	-0.08	-0.26	0.11	0.18	0.10
Hostility	-0.12	-0.01	0.15	0.09	**0.75**	0.05	0.08
Intrusive	0.08	0.10	0.27	-0.28	**0.44**	0.04	-0.11
Denial	-0.03	0.02	-0.09	0.00	**0.36**	0.23	-0.09
Guilty Coercion	-0.16	-0.36	0.21	-0.09	**0.32**	0.12	0.13
Antisocial	-0.05	0.18	-0.10	-0.08	**0.64**	-0.10	0.10
Lecture Moralizing	**0.43**	0.19	-0.02	-0.44	0.08	0.01	-0.10
Avoidance	-0.03	**0.46**	0.01	0.29	0.10	**0.39**	0.05
Neglect Distancing	0.08	**0.56**	0.08	-0.06	0.26	0.05	0.02
Indulgent Permissive	0.04	0.01	-0.04	-0.03	-0.03	0.00	**1.02**
Inconsistent Discipline	-0.05	-0.01	0.27	0.07	0.18	-0.02	**0.60**
Parental Influence	0.03	0.00	**0.73**	-0.03	0.03	0.01	0.06
Positive Reinforcement	**0.53**	-0.08	-0.06	0.15	0.07	-0.24	0.09
Child Monitoring	0.16	-0.02	-0.15	**0.61**	0.21	-0.11	-0.04
Warmth	**0.65**	0.02	0.12	0.22	-0.18	-0.03	-0.01
Listener Responsiveness	0.18	-0.61	-0.01	**0.30**	0.02	-0.01	-0.07
Communication	0.14	-0.32	-0.04	**0.52**	-0.19	0.12	0.00
Prosocial	0.24	-0.30	-0.05	**0.38**	-0.20	0.12	-0.06
Child Centered	0.17	-0.06	0.03	**0.78**	-0.08	0.05	-0.08
Positive Mood	**0.63**	-0.11	-0.13	0.06	-0.10	0.06	0.02

Note: Bolded factor loadings are > .30. The signs for loadings on Factor 2 were each reversed.

APPENDIX C

Supplemental Exploratory Factor Analysis without Externalized Negative - Cancer Code

A supplemental EFA was conducted with the item Externalized Negative - Cancer removed in order to guide future work on factor analysis with the IFIRS.

Determining number of factors. Initial EFA analyses were conducted to first determine the optimal number of factors. See Supplemental Table 1 for measures of fit. Eigenvalues and measures of model fit were examined.

First, the Kaiser criterion for initial approximation of number of factors was used by examining the number of eigenvalues that were greater than 1.0 (Guttman, 1954). Analyses produced six eigenvalues that were greater than 1 (6.54, 2.29, 1.92, 1.50, 1.19, 1.04), implying that 6 factors should be retained. The Scree Test (Cattell, 1966) was also used; this involved examining eigenvalues on a plot and identifying the largest discontinuity. See Supplemental Figure 1. The last large drop occurred between 5 and 6, implying that 5 factors should be retained.

Model fit measures were also examined; see Supplemental Table 1. RMSEA results suggested that 6 factors provided close fit, with more factors not providing substantial improvement. Similarly, AIC values were lowest for 6 factors. Finally, tests of perfect fit were examined. Results indicated that hypotheses of perfect fit in the population were rejected for 6 factors, but not 7 factors, suggesting that a 7-factor model is plausible.

Taken together, results from eigenvalues and measures of model fit suggested that a model with 6 factors may be optimal. Taking into account both these results and the original hypotheses (which predicted 5 factors), analyses were conducted for models with 4-7 factors.

Rotation and interpretation. Two oblique rotations were conducted, first with Quartimax then Geomin. Results from Quartimax rotations are reviewed first. If signs were reversed for factors, this was noted in the table.

Overall, results were remarkably similar to the EFA reported in the main text with the full IFIRS dataset. Similar to the first EFA, the 4-factor solution suggested probable underfactoring while the 7-factor solution suggested probable overfactoring. When comparing the 5- and 6-factor solutions (Supplemental Tables 2 and 3, respectively), the primary difference again involved factors that tapped aspects of negative communication. The advantage of the 6-factor solution was that there was a distinct factor with moderate to high loadings from both Avoidance and Neglect/Distancing (Supplemental Table 3, Factor 3), which may tap withdrawn communication. However this factor did not emerge in the 5-factor solution (Supplemental Table 2); instead Avoidance loaded highest onto the factor tapping negative affect (Factor 4) and Neglect/Distancing had low loadings across factors (< .30), which limited interpretability.

When comparing the Quartimax rotations to the Geomin rotations, the same patterns emerged as in the EFA with the full dataset. Results from both the oblique Quartimax and oblique Geomin rotations reflected similar pattern loadings within 4-, 5-, 6-, and 7-factor models, with the exception of the factors that tapped positive communication (see Supplemental Table 4). The results from the Geomin rotation showed all positive communication variables with the largest loadings on the same factor (Factor 1). However, this resulted in low loadings within Factor 6. Without the presence of the Externalized Negative - Cancer code, this factor had low loadings across IFIRS codes and indicated possible overfactoring.

Taken together, this pattern of results suggests that the 6-factor model that resulted from Quartimax rotation may be preferable for the current set of IFIRS variables. In Supplemental

Table 3, the highest loading for each manifest variable across factors is highlighted. The pattern of loadings is identical to the 6-factor EFA in the main text for the following factors: Factor 1 (Hostile/Intrusive Communication), Factor 3 (Withdrawn Communication), Factor 5 (Inconsistent Communication), and Factor 6 (Negative Affect). However, Factor 4 contains strongest loadings from Child Monitoring, Listener Responsiveness, Communication, Prosocial, and Child Centered, while Factor 2 contains strongest loadings from Lecture/Moralizing as well as Positive Reinforcement, Warmth, and Positive Mood. This representation differs from the "Lecturing" factor in the first EFA, in that it has a relatively lower loading from Lecture Moralizing, relatively higher loadings from codes representing positive communication, and does not contain the Externalized Negative – Cancer code (as it was excluded from present analyses). In the current analyses, Factor 2 may best represent a form of positive communication in which the mother takes the lead (e.g., providing information, supportive counseling, reinforcement for good behaviors, expressions of warmth), whereas Factor 4 may best represent a form of positive communication in which the mother responds to the child (e.g., responding empathically, tracking the child, making social overtures). For this reason, Factor 2 was tentatively named Instructive Communication and Factor 4 was tentatively named Responsive Communication.

Communalities for this model are reported in Supplemental Table 5 and factor correlations are reported in Supplemental Table 6.

Supplemental Table 1

Supplemental EFA: Comparison of Measures of Fit for Models with 2 to 7 Factors

Number of factors	F	Test Statistic	df	Parameters	RMSEA	AIC	Test of perfect fit *p*	Test of close fit *p*
3	2.63	299.53	168	85	.083 (.067-.098)	4.12	.00	.05
4	2.04	233.20	149	104	.070 (.052-.087)	3.87	.00	.03
5	1.64	186.75	131	122	.061 (.040- .080)	3.78	.00	.18
6	1.25	143.10	114	139	.047 (.014-.070)	3.69	.03	.55
7	1.01	115.43	98	155	.039 (.000-.066)	3.73	.11	.72

Notes. F = Discrepancy Function; Test Statistic = Chi-Squared; df = degrees of freedom; RMSEA = Root Mean Standard Error of Approximation; AIC = Akaike's Information Criterion

Supplemental Table 2

Supplemental EFA: Factor Loadings for 5-Factor Model with Quartimax Rotation

Code	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Sadness	0.07	0.07	0.01	**0.33**	-0.19
Anxiety	-0.01	-0.02	0.08	**0.84**	0.01
Externalized Negative	0.10	0.17	-0.22	**0.30**	-0.05
Hostility	**0.84**	-0.05	0.02	0.04	0.09
Intrusive	**0.35**	0.12	-0.35	0.09	0.10
Denial	**0.35**	0.04	-0.04	0.23	-0.16
Guilty Coercion	**0.42**	-0.29	0.12	0.02	0.08
Antisocial	**0.54**	0.12	-0.33	-0.07	0.03
Lecture Moralizing	-0.05	**0.43**	-0.42	0.04	-0.14
Avoidance	0.17	0.17	-0.03	**0.43**	0.08
Neglect Distancing	0.24	0.29	-0.45	0.13	0.06
Indulgent Permissive	-0.03	0.03	-0.04	-0.07	**0.72**
Inconsistent Discipline	0.01	0.00	0.01	0.03	**1.00**
Parental Influence	0.20	-0.10	0.01	0.00	**0.32**
Positive Reinforcement	0.01	**0.39**	**0.41**	-0.28	0.05
Child Monitoring	0.25	0.14	**0.64**	-0.09	-0.10
Warmth	-0.14	**0.41**	**0.52**	-0.06	0.02
Listener Responsiveness	-0.02	-0.08	**0.80**	-0.07	0.01
Communication	-0.08	-0.07	**0.87**	0.06	-0.04
Prosocial	-0.16	0.05	**0.74**	0.08	-0.03
Child Centered	0.03	0.07	**0.88**	0.06	-0.01
Positive Mood	-0.15	**0.44**	**0.45**	0.03	-0.07

Note: Bolded factor loadings are > .30.

Supplemental Table 3

Supplemental EFA: Factor Loadings for 6-Factor Model with Quartimax Rotation

Code	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Sadness	0.12	0.18	-0.13	-0.22	-0.19	**0.38**
Anxiety	-0.01	-0.03	0.01	0.00	0.00	**0.81**
Externalized Negative	0.20	0.18	0.08	-0.23	-0.06	0.29
Hostility	**0.83**	-0.08	-0.03	0.07	0.11	0.03
Intrusive	**0.44**	0.01	0.16	-0.19	0.06	0.04
Denial	**0.38**	0.01	0.02	-0.03	-0.18	0.21
Guilty Coercion	**0.42**	-0.15	-0.37	-0.08	0.12	0.08
Antisocial	**0.59**	0.03	0.21	-0.12	0.04	-0.10
Lecture Moralizing	0.10	**0.37**	0.29	-0.30	-0.16	-0.01
Avoidance	0.09	-0.03	**0.43**	0.26	0.09	0.40
Neglect Distancing	0.24	0.05	**0.55**	-0.06	0.08	0.07
Indulgent Permissive	-0.04	0.10	-0.01	-0.11	**0.79**	-0.04
Inconsistent Discipline	0.06	-0.02	0.01	0.03	**0.91**	0.03
Parental Influence	0.16	-0.17	0.01	0.11	**0.33**	-0.02
Positive Reinforcement	0.03	**0.55**	-0.05	0.14	0.08	-0.24
Child Monitoring	0.19	0.13	-0.00	**0.63**	-0.13	-0.13
Warmth	-0.16	**0.51**	0.05	**0.31**	0.03	-0.04
Listener Responsiveness	0.01	0.24	-0.61	0.25	-0.01	0.00
Communication	-0.17	0.15	-0.35	**0.49**	-0.03	0.12
Prosocial	-0.20	0.25	-0.32	**0.35**	-0.04	0.13
Child Centered	-0.07	0.06	-0.04	**0.87**	-0.04	0.04
Positive Mood	-0.10	**0.71**	-0.09	0.03	-0.04	0.07

Notes. Bolded factor loadings are > .30. Shaded factor loadings reflect items thought to be representative of the factor. The signs for loadings on Factor 3 were each reversed.
Factor 1 = Hostile/Intrusive Communication, Factor 2 = Supportive Communication, Factor 3 = Withdrawn Communication, Factor 4 = Responsive Communication, Factor 5 = Inconsistent Communication, Factor 6 = Negative Affect

Supplemental Table 4

Supplemental EFA: Factor Loadings for 6-Factor Model with Geomin Rotation

Code	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Sadness	0.03	-0.19	**0.36**	-0.09	0.13	0.23
Anxiety	-0.03	0.01	**0.82**	0.01	-0.01	0.03
Externalized Negative	-0.03	-0.07	0.28	0.12	0.17	0.21
Hostility	0.03	0.08	0.02	0.01	**0.85**	-0.09
Intrusive	-0.17	0.03	0.04	0.19	**0.40**	0.09
Denial	0.00	-0.19	0.21	0.05	**0.37**	0.02
Guilty Coercion	-0.08	0.11	0.05	-0.35	**0.50**	0.00
Antisocial	-0.11	0.01	-0.10	0.24	**0.55**	0.04
Lecture Moralizing	0.01	-0.17	-0.02	**0.34**	0.01	**0.31**
Avoidance	0.05	0.08	**0.44**	**0.43**	0.02	-0.17
Neglect Distancing	-0.16	0.05	0.10	**0.57**	0.13	0.01
Indulgent Permissive	0.01	**0.77**	-0.05	0.01	0.00	0.11
Inconsistent Discipline	0.00	**0.89**	0.02	0.01	0.12	-0.02
Parental Influence	-0.07	**0.32**	-0.01	-0.01	0.19	-0.14
Positive Reinforcement	**0.66**	0.08	-0.26	0.02	0.05	0.18
Child Monitoring	**0.64**	-0.12	-0.11	0.02	0.22	-0.29
Warmth	**0.72**	0.04	-0.05	0.10	-0.15	0.07
Listener Responsiveness	**0.62**	0.01	-0.04	-0.57	0.15	0.03
Communication	**0.64**	0.00	0.11	-0.34	-0.07	-0.16
Prosocial	**0.62**	-0.01	0.11	-0.30	-0.11	-0.03
Child Centered	**0.77**	-0.02	0.06	-0.04	-0.01	-0.43
Positive Mood	**0.73**	-0.03	0.04	0.00	-0.08	**0.33**

Note: Bolded factor loadings are > .30.

Supplemental Table 5

Supplemental EFA: Communalities for each IFIRS variables for 6-Factor Model with Quartimax Rotation

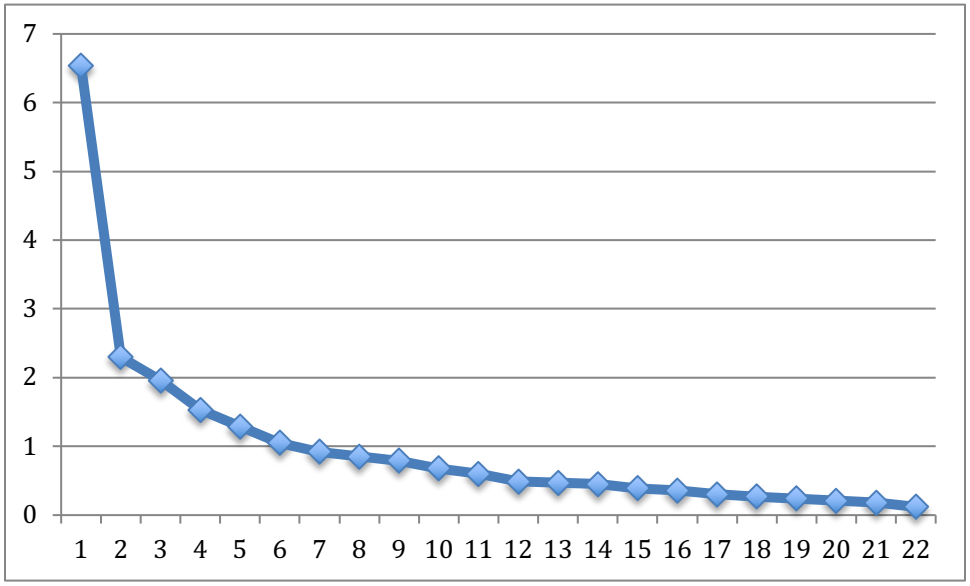
Code	Communalities
Sadness	.24
Anxiety	.66
Externalized Negative	.21
Hostility	.77
Intrusive	.42
Denial	.21
Guilty Coercion	.32
Antisocial	.58
Lecture Moralizing	.29
Avoidance	.38
Neglect Distancing	.52
Indulgent Permissive	.61
Inconsistent Discipline	.88
Parental Influence	.22
Positive Reinforcement	.45
Child Monitoring	.45
Warmth	.59
Listener Responsiveness	.75
Communication	.80
Prosocial	.71
Child Centered	.92
Positive Mood	.66

Supplemental Table 6

Supplemental EFA: Correlations Among Factors from 6-Factor Model with Quartimax Rotation

	Hostile/Intrusive	Instructive	Withdrawn	Responsive	Inconsistent	Negative Affect
Hostile/Intrusive	--					
Instructive	-.34	--				
Withdrawn	.37	-.24	--			
Responsive	-.34	.46	-.46	--		
Inconsistent	.39	-.24	.09	-.11	--	
Negative Affect	.12	-.04	.03	.08	-.11	--

Note: Significance not tested.



Supplemental Figure 1. Scree plot of eigenvalues by *m* factors for supplemental EFA with Externalized Negative – Cancer removed.

Note: Eigenvalues are on the y-axis and factors on the x-axis.

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