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Factors Related to Depressive Symptoms in Mothers of Technology-Dependent Children

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Abstract

Mothers caring for technology-dependent children at home often suffer clinically significant and unrecognized depressive symptoms. The study aim was to determine factors related to elevated depressive symptoms and provide information to target interventions that assists mothers in self-management of their mental health. Secondary data analysis from a descriptive, correlational study of 75 mothers was performed. Hierarchical multiple regression analysis results indicate that younger, unpartnered mothers with lower normalization efforts and personal resourcefulness, and less care hours had increased depressive symptoms. The importance of personal resourcefulness and the potential for a resourcefulness training intervention to reduce depressive symptoms are discussed.

Keywords

Maternal Depressive Symptoms; Technology-Dependent Children

Introduction

Technology-dependent children—those who rely on medical equipment such as mechanical ventilation, tracheostomies, or feeding tubes—comprise 20% of all pediatric patients discharged from the hospital to home, (Feudtner et al., 2005), yet they account for 61% of all healthcare use by children (Newacheck & Kim, 2005). An estimated 600,000 children in the United States are technology dependent and live at home, and this population continues to grow (Cristea et al., 2013; Seferian, Lackore, Rahman, Naessens, & Williams, 2006; U. S. Department of Health and Human Services, 2013). As a result, more caregiving responsibilities fall to their mothers, who suffer high rates of psychological distress due to the constant vigilance necessary to monitor the technology and assess the child's condition (Heaton, Noyes, Sloper, & Shah, 2005; Kuster, Badr, Chang, Wuerker, & Benjamin, 2004; Toly, Musil, & Carl, 2012a). Past research indicates that approximately one-third of families

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do not receive home nursing support for the care of their technology-dependent child (Toly, Musil, & Carl, 2012b). In addition to learning how to manage their child's new technologies and daily care, these caregivers also must meet the emotional, social, and relationship needs of the child, and often, other family members (National Alliance of Caregivers, 2009; O'Brien, 2001; Toly et al. 2012a). For many mothers, these caregiving responsibilities will continue for years while the child remains technology dependent (Brehaut et al., 2011; Toly et al., 2012b). Caregiving could potentially extend into the child's adult years leaving caregivers with the emotional stress and worry about who will care for their child if they outlive their parents (Murphy, Christian, Caplin, & Young, 2006). Consequently, a large percentage of these mothers, up to 45%, have depressive symptoms at a level indicative of the need for psychological intervention (Kuster & Badr, 2006; Miles, Holditch-Davis, Burchinal, & Nelson, 1999; Toly et al., 2012a), but few interventions have been designed to address their specific needs. The purpose of this secondary data analysis was to: (a) determine factors related to elevated depressive symptoms in mothers caring for a technology-dependent child at home; and (b) provide information to design interventions to assist mothers in the management of their personal as well as their child's health.

Description of the Problem

Depressive Symptoms in Mothers of Technology-Dependent Children

Few researchers have examined the scope of elevated depressive symptoms in mothers of children who are dependent on technology, but those who have report that 36%–45% of mothers caring for technology dependent children have Center for Epidemiological Studies-Depression (CES-D) scores above the cutoff of 16, indicating elevated risk for clinical depression (Miles et al., 1999; Kuster, 2002; Toly et al. 2012a and b). Psychological distress, including elevated depressive symptoms, negatively impacts outcomes for not only the caregiver, but also for the technology-dependent child (Miles et al., 1999; Raina et al., 2005) because such distress compromises caregiving capacity (Smith, 1999). Specifically, elevated depressive symptoms may interfere with healthy attachment (Grace, Evindar, & Stewart, 2003) and have a negative effect on the quality of interactions between mothers and their technology-dependent infants and children, yielding less attentive and more restrictive interactions (Cho, Holditch-Davis, & Miles, 2008). As with all infants and children, the quality of maternal-child interaction affects the technology-dependent child's growth and social-emotional, cognitive, and behavioral development (Cho et al., 2008; Giallo, Cooklin, Wade, D'Esposito & Nicholson, 2014). A young child's (<6 years old) exposure to a parent with depression places the child at risk for delay in language, personal-social, gross motor, and fine motor development (Gilbert, Bauer, Carroll, & Downs, 2013). This compounds the already increased risk of developmental delays inherent for the chronically ill, technology-dependent child (Rehm & Bradley, 2005). Further, mothers with elevated depressive symptoms take their technology-dependent children to the emergency room more frequently, and their children experience more hospitalizations than do children of mothers who are not depressed (Brooks, Beil, & Beeber, 2014; Carnevale, Alexander, Davis, Rennick, & Troini, 2006; Flynn, Davis, Marcus, Cunningham, & Blow, 2004; Sills, Shetterly, Xu, Magid, & Kempe, 2007). Therefore, it is essential to identify correlates of depressive symptoms that place mothers, and consequently their technology-dependent child, at risk for adverse

outcomes. Unlike the technology-dependent child's complex chronic condition, mothers' depressive symptoms are amenable to improvement via intervention strategies (Beeber et al., 2010; Horowitz et al., 2001).

Many studies have investigated the correlates of depression in the parents of children with chronic illnesses, however, most studies found were over 10 years old. Greater functional limitations in the chronically ill child (Barlow & Ellard, 2006; Churchill, Villareale, Monaghan, Sharp, & Kieckhefer, 2010; Frankel & Wamboldt, 1998), difficult child behavior, frequent child health care visits and unpredictability of symptoms (Ireys & Silver, 1996) are associated with more parental/maternal depressive symptoms. Mothers of chronically ill children reporting low self-esteem and self-efficacy (Silver, Bauman, & Ireys, 1995), limited coping skills (Churchill et al., 2010), dissatisfaction with family relationships and support (Shore, Austin, Huster, & Dunn, 2002; Weiss & Chen, 2002), and maternal role restriction (Silver, Bauman, & Weiss, 1999) are at risk for depression. Fewer resources, including income, younger age, maternal unemployment, and the lack of a partner in the home are socio-demographic correlates (Canning, Harris, & Kelleher, 1996; Churchill et al., 2010; Drotar et al., 1997; Shore et al., 2002; Silver, et al., 1995; van Oers et al., 2014; Weiss & Chen, 2002) of depressive symptoms in this population.

Only a handful of studies have looked at factors associated with depressive symptoms in mothers caring for technology-dependent children at home, but findings generally mirror that of studies examining caregivers of children with chronic illness. Many of these studies examined small numbers of children or included children dependent on a specific medical technology (e.g., mechanical ventilation) or in a specific age group (e.g., infants). Greater caregiving burden, more child health visits or hospitalizations (Kuster & Badr, 2006), worry about the child's health, (Lee, Holditch-Davis, & Miles, 2007; Miles et al., 1999), low social support (Kuster & Badr; Kuster & Merkle, 2004; Thyen, Terres, Yazdgerdi, & Perrin, 1998), lack of partner in the home (Thyen, Kuhlthau, & Perrin, 1999), and poor family functioning (Kuster & Badr) are correlated with more depressive symptoms.

The research support for a relationship between a technology-dependent child's functional status, i.e. the ability to perform age-appropriate daily life activities (Stein et al., 1987), and a mother's depressive symptoms is inconsistent. Some studies have examined the relationship between maternal depressive symptoms and the child's severity of illness (Miles, et al., 1999; Thompson, Oehler, Catlett, & Johndrow, 1993), a broad term that includes physiological severity, functional status, technology dependence, and burden of illness (Stein et al., 1987). Miles et al. (1999) found no relationship between depressive symptoms and severity of illness as measured by level of technology dependence and multisystem diagnosis at discharge and 12 months after birth, nor did Thompson et al. (1993) who used birth weight, gestational age and the Neurobiologic Risk Score (assessment of brain cell injury in preterm infants) to measure severity of illness. Thyen et al. (1998) indicated that the child's functional status and a mother's depressive symptoms are highly correlated, whereas Kuster and Badr (2006) found no significant correlation between the child's functional status and a mother's level of depressive symptoms perhaps due to their study's small sample size (n=38) compared to that of Thyen et al. (n=65). Given that various measures have been used to represent severity of illness and lack of a clear relationship

between the mother's level of depression and severity of illness in the technology-dependent child, applying several indicators of severity of illness such as child's functional status and burden of illness might illuminate the impact of the child's health on the mother's depressive symptoms. .

Depressive Symptoms and Normalization

Despite the health problems, families of children with chronic illness try to incorporate their child's complex care needs into their everyday family life in what has been conceptually termed "normalization" (Deatrick et al., 2006; Deatrick, Knafl, & Murphy-Moore, 1999). Families that demonstrate greater normalization efforts use a continual adjustment process that incorporates a variety of strategies over time to balance both their family needs and child's illness-related needs and live as close to a normal family life as possible. Not all such families view their children and their family life as normal, however. Little quantitative research has been conducted in this area, although a family's efforts at normalization has been correlated with the mother's functioning such as depressive symptoms (Deatrick et al., 2006; Toly et al., 2012a).

Depressive Symptoms and Resourcefulness

Research in this area has not examined factors that could reduce depressive symptoms and that are amenable to intervention. Resourcefulness, an "acquired repertoire of skills and behaviors necessary for the successful execution of self-control behavior" (Rosenbaum, 1990, p. 26), may be such a factor. Resourcefulness skills are learned throughout life by informal training or cognitive-behavioral programs and include the belief that one can cope effectively despite adversity (Rosenbaum, 1990). Skills such as self-instruction, problem-solving, and belief in coping effectiveness and delayed gratification are used to control the effects of disturbing feelings, thoughts, and sensations on the performance of daily tasks (Rosenbaum, 1990). Cognitive and behavioral skills comprising resourcefulness are employed to maintain or regain health and includes personal resourcefulness and social resourcefulness as key components (Zauszniewski, 2012). Personal resourcefulness includes self-help skills to reduce negative emotions through activities such as self-talk, organizing daily activities, and reframing situations positively. Social resourcefulness are help-seeking skills such as relying on family and friends, and seeking professionals or experts that individuals develop over time. Both skill sets have been found to be beneficial for maintaining healthy physical and psychological functioning (Zauszniewski, 2012; Zauszniewski, 1997). Previous research with caregivers of children with autism, adult relatives with serious mental illness, and grandmothers raising grandchildren indicates that resourcefulness is inversely correlated with level of depressive symptoms (Bekhet & Zauszniewski, 2014; Musil, Jeanblanc, Burant, Zauszniewski, & Warner, 2013; Zauszniewski, Bekhet, & Suresky, 2009). To date, resourcefulness has not been studied as a factor of depressive symptoms in mothers caring for a child who is technology dependent. Inclusion of resourcefulness in the analysis of potential factors of depressive symptoms would extend the science in this population of vulnerable children and their caregivers.

Theoretical Framework and Study Purpose

The Family Management Style Framework (Knafl & Deatrick, 2003) guided the design of this study. The Family Management Style Framework (FMS) describes how families manage their everyday family life while still meeting their chronically ill child's care needs and how the family responds to their child's chronic illness. The family's as well as the individual's response to their child's chronic illness is dependent on their definition of the situation, management strategies, and perception of future consequences (Deatrick et al., 2006). The FMS Framework suggests that perception is key in their response to and management of the child's chronic condition and moreover influences individual (depressive symptoms) and family (normalization) outcomes. Mothers who perceive their child's chronic illness as disruptive and as having a substantial impact on family life would experience increased depressive symptoms and lower normalization efforts (Frankel & Wamboldt, 1998). Given the large percentage of mothers identified as being at risk for clinical depression and the possible subsequent negative impact on the chronically ill, technology-dependent child, identifying predictors of depressive symptoms is an important first step to designing interventions to reduce their psychological distress and improve their quality of life.

Therefore, the purpose of this study was to: (a) determine factors related to depressive symptoms in mothers caring for a technology-dependent child at home; and (b) provide information to target interventions to assist mothers in the management of their personal and their child's health. Variables examined in this analysis were identified based upon previous research related to caregivers of chronically ill children and include normalization, and two indicators of severity of illness (child's functional status and number of care hours), resourcefulness (personal and social), duration of caregiving, and demographic characteristics (family income, mother's age, partner status, race/ethnicity and technology-dependent child's age). It was hypothesized that mothers who reported less normalization, higher severity of child's illness (poorer functional status, more care hours), lower maternal resourcefulness and longer duration of caregiving would have more depressive symptoms. Lower family income, and younger, un-partnered, and non-Caucasian mothers with a younger technology-dependent child were also expected to have more depressive symptoms.

Methods

Design and Sample

This was a secondary analysis of data obtained by the first author from mothers who participated in the second of a two wave descriptive, correlational study. A convenience sample of 103 mothers caring for a technology-dependent child participated at Time 1 (Toly et al., 2012a), with 82 continuing at the Time 2 12-month follow-up (Toly et al., 2012b). At Time 2, data on resourcefulness and number of care hours were added as proposed factors related to depressive symptoms, and Time 2 data analyzed here.

This report includes only those mothers whose children remained dependent on technology at Time 2 (n=75). In this study, "mothers" refers to the primary female caregivers (biological/adoptive/foster mothers or grandmothers) for the technology-dependent child.

Eligibility criteria for the study participants: mothers who were: (a) ≥ 18 years of age; (b) caring for a technology-dependent child who required mechanical ventilation, intravenous medication/nutrition substances, or respiratory/nutrition support (Office of Technology Assessment, 1987), age ≤17 years; and (c) able to speak and understand English. Exclusion criteria included mothers of children with cancer due to the grief reactions associated with a cancer diagnosis. Participants were recruited by the first author after being identified by clinic staff from the Pediatric Gastroenterology, Pulmonology, Preterm Infant Follow-Up and Surgery Clinics at a large Midwest Children's Hospital and a pediatric primary care office. The study received IRB approval and informed consent was obtained prior to data collection. Confidentiality was maintained using code numbers on all questionnaires. Data were collected by the first author through face-to-face interviews in a private place such as the clinic, her home, or via the mail according to each mother's preference.

Measures

Six instruments were administered to participants. Depressive symptoms in mothers were measured using the Center for Epidemiological Studies-Depression Scale (CES-D) (Radloff, 1977). The 20-item interval scale (α =.85) measures the response to life events with responses ranging from rarely (0) to most or all of the time (3). Items are summed, and higher scores indicate more depressive symptoms. Possible scores on the CES-D range from 0–60. The instrument asks such questions as how frequently during the past week: "I did not feel like eating; I felt sad." Respondents at increased risk for clinical depression score ≥16. Concurrent validity has been established by clinician's ratings (Radloff, 1977). The Cronbach alpha for this study was .94.

Normalization was measured using the Actual Effect of the Chronic Physical Disorder on the Family, a 10-item subscale (α =.84) of the 25 item Normalization Scale (Murphy & Gottlieb, 1992). This instrument was derived from work by (Knafl & Deatrick, 1990) on normalization attributes and the Family Management Style Framework. It incorporates a visual analog scale format to increase sensitivity and decrease bias. Participants are asked to mark a slash on a 10 cm line between two extremes- a lot and a little, with right angle stops at either end. The slash's distance is then measured in millimeters along the line and equals the score given (0–1000). Content validity was established using three mothers of children with chronic physical disorders and 10 expert nurses with clinical and research experience. The Normalization Scale was then pilot tested with 10 mothers of diabetic children. Construct validity of the scale was assessed using principal components analysis with varimax rotation to identify the scale's statistical structure. The factor, "Actual Effect of the Chronic Physical Disorder on the Family", had an Eigenvalue of 7.0, the highest of all the factors with a range of scores from 140–1000 (*M*=710, *SD*=220) for 76 mothers (Murphy, 1994). The subscale includes items assessing the impact of a chronic physical disorder on the family's activities, hassles related to the disorder. Higher scores indicate greater normalization efforts. Principal components analysis was used to assess construct validity (Murphy & Gottlieb, 1992). Cronbach alpha for this study was .83.

The technology-dependent child's severity of illness was measured using two instruments. Functional status was measured using the Functional Status II-Revised (Stein & Jessop,

1990) and was administered by the first author. The 14-item tool (α=.86) is administered in two parts. Part 1 asks parents about the child's performance of 14 activities or behaviors in the past two weeks. Responses range from never/rarely (0) to almost always (2). Part 2 probes responses indicating poor function to determine if responses were fully (2) or not at all (0) due to illness (Stein & Jessop, 1990). Sample items include whether the child eats well, sleeps through the night, communicated what he/she wanted. Scores on items are summed with a maximum total score of 28; higher scores indicate higher function. Concurrent validity was established by physician assessments and number of hospital days (Stein & Jessop, 1990). Cronbach alpha for this study was .76. The burden of illness component of the child's severity of illness was measured using the Impact on the Family subsection of the National Survey of Children with Special Health Care Needs, 2005–2006 developed by a panel of experts from the National Center of Health Statistics, Centers for Disease Control and Prevention (Child and Adolescent Health Measurement Initiative, 2007). Only Item 3 of this instrument that addresses the number of care hours was used in the analysis for this study.

Resourcefulness was measured using the Resourcefulness Scale, a 28-item scale (α =.85), that assessed both personal (16 items) and social (12 items) resourcefulness (Zauszniewski, Lai, & Tithiphontumrong, 2006). Responses on a 6-point scale range from extremely descriptive (5) to not descriptive (0) with a score range 0–80 for personal resourcefulness, 0–60 for social resourcefulness and a total score of 0–140; higher scores indicate greater resourcefulness. Examples of items include questions regarding use of personal (think positively, keep busy) and social (ask others to help, be with others) resourcefulness when confronting an adversity or challenge. Construct validity was assessed using confirmatory factor analysis. Cronbach alpha for this study was .85.

Demographic characteristics of mothers and their technology-dependent child were measured using the Demographic Characteristics Questionnaire that was developed by the researchers. This instrument included questions about the child's age, mother's age, education, race/ethnicity, family income and duration of caregiving.

Data Analysis

Data were entered into SPSS 15.0, verified, and cleaned. Missing data were imputed using case mean substitution if one more than half of the total items on the questionnaire were answered (Fox-Wasylyshyn & El-Masri, 2005). Descriptive analyses and Pearson correlations were conducted and assumptions for Hierarchical Multiple Regression (independence, homoscedasticity, linearity, normality) were examined and found to be satisfactorily met (Tabachnick & Fidell, 2007). A three-step model was used to highlight entry of the severity of illness factor, potential mediating factors, and demographic factors.

Results

Sample Characteristics

Mothers in this study ranged from 22 to 66 years of age (*M*=38.9, *SD*=9.5) with 39.3% over 40 years of age. A majority of mothers were Caucasian (n=55, 73.3% non-Hispanic/Latina;

n=5, 6.7% Hispanic/Latina), however, 16.0% (n=12) were African-American, 2.7% (n=2) Asian, and 1.3% (n=1) bi-racial. The majority were married (n=53, 70.7%) or living with a partner (n=5, 6.7%) with 8% (n=6) single, 10.7% (n=8) divorced, 8% (n=6) single (never married), 2.7% (n=2) widowed, and 1.3% (n=1) separated. Thus, the majority (n=58, 77.3%) of the sample were partnered, with 22.7% (n=17) un-partnered. Most were the biological mother (n=64, 85.3%) while others were either the adoptive mother (n=8, 10.7%), foster mother (n=2, 2.7%) or the grandmother (n=1, 1.3%) with primary caregiver responsibilities. Approximately half (50.6%) had a yearly total family income of ≤$60,000 (n=38) with 21.3% (n=16) earning $60,001–$80,000 and 26.7% (n=20) earning ≥$80,000. The duration of caregiving for these technology-dependent children ranged from 1.14 to 14.4 years (*M*=5.94, *SD*=3.8).

The mean age for the technology-dependent children in this study was 7.69 years (*SD*=4.53, range 19.8 months–17.8 years). A majority of the children (74.7%, n=56) were dependent on such equipment as supplemental oxygen, feeding tube, or tracheostomy. Fewer children (14.7%, n=11) were dependent on mechanical ventilation or dependent on intravenous medication/nutrition (10.7%, n=8). Almost 60% of the children were dependent on two or more types of technology. The majority of children had a primary diagnosis related to neuromuscular (49.3%, n=37) or respiratory conditions (17.3%, n=13).

Descriptive Statistics: Main Study Variables

The CES-D scores, measuring mothers' depressive symptoms, ranged from 0–57 (*M*=14.12; *SD*=11.96), and 40% (n=30) of mothers had scores ≥16 indicating increased risk for clinical depression while 21.3% (n=16) had scores ≥23 indicating a high risk for clinical depression (Myers & Weissman, 1980) requiring screening for potential suicide risk. Mothers who scored ≥16 were informed of the finding at the end of the interview and given an information sheet that included instructions regarding contacting their primary care provider plus telephone numbers for a 24-hour mental health crisis hotline and other mental health resources.

The "Actual Effect of the Chronic Physical Disorder on the Family" subscale of the Normalization Scale scores (*M*=390.5, *SD*=173.34) ranged from 0–771 with a possible range of 0–1000; higher scores indicate greater normalization efforts. The Functional Status II-Revised (*M*=21.57, *SD*=3.79) measured the child's functional status with scores ranging from 10–28 out of the maximum possible score of 28; higher scores indicate better function. Forty percent (n=30) of the technology-dependent children had scores indicating fair to poor function (20 or lower), 46.6% (n=35) had fairly good function (21–25), and 13.4% (n=10) had very good function. The number of hours per week spent caring for the technology-dependent child ranged from 2 to 168 hours (*M*=50.4, *SD*=44.0) with a median of 40 hours. The Personal Resourcefulness subscale scores (*M*=53.85, *SD*=10.25) ranged from 30–80 out of a possible 0–80; higher scores indicate greater personal resourcefulness. The Social Resourcefulness subscale scores (*M*=33.92, *SD*=10.56) ranged from 10–56 with a possible range 0–60; higher scores indicate greater social resourcefulness.

Correlates of Depressive Symptoms and Significant Predictors

Pearson Correlations indicated significant correlations of normalization, personal resourcefulness, family income, and partner status with depressive symptoms; mother's age approached significance (Table 1). No significant correlation was noted between depressive symptoms and the child's severity of illness (functional status, care hours), or social resourcefulness, technology-dependent children's age, mother's race/ethnicity, and duration of caregiving. Only variables that had a Pearson correlation of .10 or above were retained for further analysis.

Using Hierarchical Multiple Regression (HMR) analysis, mothers' depressive symptoms was regressed on the proposed study variables. In HMR Step 1 (Table 2, Model A), a measure of the child's severity of illness (number of care hours) was added but was non-significant and accounted for less than 1% of the adjusted variance in depressive symptoms (F=.819, p= .369 ns). In HMR Step 2 (Table 2, Model B), the proposed mediator variables (normalization, personal resourcefulness) were added. Both normalization (β= −.325, p=.003) and personal resourcefulness (β= −.392, p=.001) were significant and accounted for 27.0% of the explained variance in depressive symptoms (F=9.371, p= ≤ .001). In HMR Step 3 (Table 2, Model C), demographic control variables (mother's age, partner status, family income) were added to the model. Significant variables in the final model include number of care hours (β= −.212, p=.039), normalization efforts (β= −.328, p=.001), personal resourcefulness (β= −.334, p=.002), mother's age (β= −.232, p=.023), and partner status (β= −.245, p=.038). The final model accounted for 36.2% of the explained variance (F=7.418, p= ≤ .001). Each variable's unique explained variance is shown in Table 2. Care hours, which was not significantly correlated with depressive symptoms at the bivariate level, became significant at Step 3 of the HMR (Table 2, Model C), suggesting it had a suppressor effect on the set of variables, an effect that will be further addressed in the discussion section (Tabachnick & Fidell, 2007). Variables contributing to more depressive symptoms include less normalization, lower resourcefulness, younger age, not having a partner, and providing fewer care hours per week.

Discussion

The major purpose of this study was to examine the factors related to elevated depressive symptoms in mothers caring for a technology-dependent child at home. Few researchers have studied these factors, and prior studies were limited in that they studied only children with one type of medical technology e. g. mechanical ventilators (Kuster & Badr, 2006), a particular age group e. g. infants (Miles et al., 1999), or had very small sample sizes (Kuster & Badr, 2006). In addition, no one has examined resourcefulness (personal, social), normalization, number of care hours, and mother's (primary female caregiver) age or race/ethnicity as factors related to elevated depressive symptoms in this vulnerable population. Our study included children dependent on a variety of medical technologies, from different age groups, with variability in functional status, and to our knowledge, the largest sample size (n=75).

Findings from this study indicate that mothers caring for a technology-dependent child are at a considerably increased risk for clinical depression. Over 40% of mothers in our sample

scored at or above the CES-D cut-off score suggesting an increased risk of clinical depression (Radloff, 1977), consistent with findings from past studies of these mothers (Kuster & Badr, 2006; Miles et al., 1999). In addition, this study helps to elucidate specific factors related to the increased depressive symptoms. As hypothesized, fewer normalization efforts and less personal resourcefulness were correlated with increased depressive symptoms, generally consistent with findings from previous research (Kuster & Badr, 2006; Thyen et al., 1999). In the final model, lower normalization efforts was the largest predictor of depressive symptoms followed by lower personal resourcefulness. The strong relationship between resourcefulness and depressive symptoms, however, is consistent with other studies (Bekhet & Zauszniewski, 2014; Musil et al., 2013; Zauszniewski et al., 2009). To our knowledge, this is the first time that normalization has been examined quantitatively as a predictor of depressive symptoms, but it is theoretically consistent with the Family Management Style Framework (Deatrick et al., 2006). The cross-sectional nature of this study precludes determining causality related to depressive symptoms and resourcefulness, therefore longitudinal data examined using path analysis or structural equation modeling is needed to sufficiently address this.

There were some differences between the bivariate correlations and the multiple regression findings. Particularly unexpected was the finding that fewer care hours explained depressive symptoms in the regression equation. Care hours acted as a suppressor variable, an independent variable whose inclusion in a multiple regression model increases the amount of explained variance (R^2) by its correlation with other independent variables instead of its direct correlation with the dependent variable (Tabachnick & Fidell, 2007). The Pearson (zero order) correlation of number of care hours with depressive symptoms was non-significant (r= −.096, p= .42), however, in HMR Step 3 (Table 2, Model C), when maternal factors of age, partner status and income were included, care hours made a significant contribution to the explained variance (β= −.212, p= .039) with a unique variance contribution of 4.2%.

While counterintuitive, this finding is consistent with previous caregiving research (Aranda & Hayman-White, 2001; Demirtepe-Saygili & Bozo, 2011; Given et al., 2004). It has been posited that the type of task is of greater importance than the actual time spent for caregiving or the number of tasks. Those tasks perceived as difficult or time consuming create more burden for the caregiver (Given et al., 2004). In essence, perception of the level of difficulty of the task is more important than the burden of the task. An additional explanation is that caregiving tasks for children might be perceived differently than tasks in caring for an elderly family member. Caregiving for a child may not be perceived as an extra burden but rather part of their parenting role (Demirtepe-Saygili & Bozo, 2011). In addition, due to this perception that care is part of the parenting role, mothers in this study may have underestimated the amount of care delivered to their technology-dependent child. Therefore, the mothers' perceptions of caregiving had a greater impact on the caregiving experience and consequently depressive symptoms than the actual time spent on caregiving (Kuster & Badr, 2006).

Contrary to our hypotheses, a technology-dependent child's severity of illness (lower functional status, increased care hours) or younger age, and mothers' race, social

resourcefulness, and duration of caregiving were not significantly correlated with depressive symptoms.

A major purpose of this study was to provide evidence to target interventions to assist mothers in the home management of these children. Family functioning, while highly correlated with depressive symptoms in our prior work (Toly et al., 2012a and b), is difficult to influence using intervention due to the entrenched patterns that can be resistant to change over time. Partner status, a significant predictor of depressive symptoms in this study, is not amenable to change by intervention. An individual's level resourcefulness, however, has been shown to be amenable to change and can be learned over time through life events or be taught via intervention. Interestingly, social (help-seeking) resourcefulness was not correlated with mothers' elevated depressive symptoms. Personal (self-help) resourcefulness, however, was highly correlated and one of the strongest predictors of mothers' elevated depressive symptoms. Personal resourcefulness is therefore a promising factor to target in the quest to reduce the level of depressive symptoms in mothers of technology-dependent children and promote their mental health. One explanation for these findings is that mothers' perception of the situation and ability to use personal coping strategies to handle situations they confront when caring for a child who is technology dependent is of greater importance than reaching out to others, or perhaps they may already have external medical and care support resources in place.

A cognitive-behavioral intervention informed by Zauszniewski's Resourcefulness Theory (2012) of teaching personal (self-help) resourcefulness skills to improve the mental health of caregivers has been used in other populations with positive results (Rosswurm et al., 2002; Zauzniewski, Bekhet, Lai, McDonald, & Musil, 2007; Zauszniewski, Eggenschwiler, Preechawong, Roberts, & Morris, 2006). This theory proposes that resourcefulness skills' training increases resourcefulness and decreases depressive symptoms in part by reducing depressive cognitions and negative emotions. A small pilot study using the Resourcefulness Training intervention with mothers caring for a technology-dependent child at home demonstrated promising results for decreasing negative emotions and depressive cognitions thereby positively influencing mental health (Toly, Musil, & Zauszniewski, 2014). Past research indicates better coping skills are significantly associated with fewer depressive symptoms despite the child's functional status and demographic factors (Churchill et al., 2010). Therefore, based upon findings from this study, enhancing personal resourcefulness is a prime target for intervention.

Nurses and other health care providers are of paramount importance in promoting the mental health of these vulnerable caregivers. Promoting the mental health of these mothers concomitantly contributes to the promotion of healthy social-emotional, cognitive, gross/fine motor development of these children by contributing to a positive home environment (Cho et al., 2008; Giallo et al., 2014; Gilbert et al., 2013; Nicholson & Clayfield, 2004). Depression compromises the mother's ability to adequately care of their child due to irritability, sleep disturbances, difficulty with concentration, and feelings of decreased energy (Nicholson & Clayfield, 2004). Further, they may forgo healthful activities such as physical exercise, annual physical checkups, and screenings due to caregiving responsibilities (Kuster et al., 2004) and exhaustion. This study determined correlates of

depressive symptoms that place mothers, and consequently their technology-dependent child, at risk for adverse outcomes. As an important first step, it is essential to assess mothers' mental health status by asking how they are doing at home plus conducting a quick, objective screening for depression using such measures as the CES-D, which is available on-line and in brief versions (Heneghan, Silver, Bauman, & Stein, 2000). In particular, as identified by study findings, young, unpartnered mothers of technology-dependent children are at highest risk for increased depressive symptoms and require careful assessment and supportive intervention as needed.

Limitations

Study limitations include that the majority of the sample is from one Midwest Pediatric Children's Hospital, thus limiting generalizability to the larger population of mothers caring for technology-dependent children. Second, while this is the largest sample examining factors predictive of depressive symptoms in this population, the sample is small (n=75). In particular, the small sample size of non-Caucasian mothers has implications for findings related to race/ethnicity. Third, participants were part of a convenience sample which limits generalizability. Finally, the cross-sectional design limits establishment of a cause-and-effect relationship.

Future Research and Conclusions

In the future, research should focus on ameliorating the high level of depressive symptoms in mothers caring for technology-dependent children at home. In particular, young mothers who are unpartnered are at greater risk for elevated depressive symptoms, and thus should be objectively screened using standardized instruments such as the CES-D. Once identified as high risk for clinical depression using the screening tool, mothers should be given information about steps to receive mental health care, such as instructions to contact their primary care provider as well as telephone numbers for mental health hotlines or other mental health resources. A larger sample size with more racial/ethnic diversity would assist with generalizability of findings. Since only one of the identified predictors of increased depressive symptoms in this study is amenable to change, future descriptive research should focus on factors amenable to improvement, while testing interventions that promote the personal resourcefulness in these mothers is a reasonable next step in addressing ways to maximize the mental health of these mothers.

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Table 1

Pearson Correlations of Predictors with Depressive Symptoms

Variable	Pearson Correlation	Significance (two-tailed)
Family Functioning	.564	≤ .001***
Normalization	− .370	≤ .001***
Personal Resourcefulness	− .403	≤ .001***
Social Resourcefulness	.010	.933
Functional Status	.015	.897
Type of Technology (vent)	− .001	.993
Type of Technology (IV)	.040	.732
Child's age	.015	.900
Mother's age	− .218	.060
Partner status	− .279	.015*
Family income	− .264	.022*
Race/Ethnicity	− .035	.769
Duration of Caregiving	− .012	.918
Care hours	− .096	.420

* p ≤ .05

** p ≤ .01

*** p ≤ .001

Table 2

Summary of Regression Analysis for Maternal Depressive Symptoms

Predictor Variable	UnStd. Beta	Beta	S.E.	Part R^2	Significance
Constant	49.308		11.620		
Family Functioning	.249	.417	.057	.374	<.001***
Normalization	−.012	−.168	.007	−.149	.088
Personal Resourcefulness	−.317	−.272	.108	−.252	.005**
Functional Status	−.102	−.033	.300	−.029	.734
Mother's Age	−.258	−.204	.113	−.197	.025*
Partner Status	−7.368	−.252	3.108	−.203	.021*
Family Income	−.210	−.028	.779	−.023	.788
Care hours	−.062	−.228	.025	−.213	.016*
R^2	.558				
Adjusted R^2	.499				
F	9.470 p ≤ .001***				

* p ≤ .05

** p ≤ .01

*** p ≤ .001