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PHYSICAL ACTIVITY AND DEPRESSION IN MOTHERS OF A CHILD WITH A SPECIAL
HEALTH CARE NEED: INFORMING FUTURE INTERVENTIONS

By

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Bachelor of Science, University of North Dakota, 2018

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Submitted to the Graduate Faculty

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for the degree of

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This thesis, submitted by Brianna Black in partial fulfillment of the requirements for the Degree of Master of Science in Kinesiology from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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CHILD WITH A SPECIAL HEALTH CARE NEED: INFORMING
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ABSTRACT

In the United States, approximately 20 percent of all children have a special health care need. Additionally, mothers of a child with a special health care need have worse overall well-being, mental and physical health compared to mothers of typically developing children. Physical activity may improve depressive symptoms and overall health in these mothers; however, little is known about the acceptability of physical activity interventions for mothers of a child with a special health care need. Therefore, the primary aim of this study was to understand more about mother's desire to use physical activity to improve depressive symptoms after having a child diagnosed with a special health care need. The secondary aim was to investigate their experience with physical activity from before pregnancy, to following their child's diagnosis. Methods: Participants were recruited locally and nationally through collaboration with advocacy organizations, email list-serves, and social media (e.g., Facebook). Mothers completed an electronic survey (n =348; age = 39.3 ± 7.3 years; White = 92%; Midwest = 80.1%; employed = 59.2%; prenatal or at birth diagnosis = 51.7%) that assessed physical activity participation before pregnancy, during pregnancy, during postpartum, and currently. Additionally, type of physical activity used to cope with depressive symptoms, as well as interest in using physical activity to cope were assessed. Last, depressive symptomology and how mothers were currently coping were measured. Descriptive data (e.g., means, frequencies, percentages) were calculated. Qualitative responses were summed and categorized. Physical activity and depressive symptoms

were analyzed with Pearson correlations (SPSS v26). Results: Mothers reported participating in moderate-to-vigorous physical activity (at least 150 minutes per week) before their pregnancy (50.9%), during their pregnancy (30.7%), postpartum (30.2%), as well as currently (39.1%). A majority (59.8%) of mothers reported possible depression, and only 17 percent were coping very well raising a child with a special health care need. When asked how they cope with depressive symptoms, talking/engaging with friends or family (74%), physical activity (37%), and with a support group (28%) were reported most frequently. Of those that reported using physical activity to cope with depressive symptoms, they did so to have better quality of life (77%), better overall physical health (76%), weight loss (57%), to help with depressive symptoms (37%), or other (10%). Physical activity to cope with depressive symptoms included walking (66%), house cleaning (56%), yoga (40%), strength training (38%), jogging or running (33%), or other (23%). Participation in any physical activity ($r = -0.178, p < 0.001$), and moderate to vigorous physical activity (150 min/week) ($r = -0.108, p = 0.044$), were negatively associated with depressive symptoms. Discussion: Increasing physical activity in mothers who have a child with a special health care need is an important public health concern, and targeting maternal health may be one way to improve quality of life in these families. This study illuminates an opportunity to improve depressive symptoms in mothers of a child with a special health care need through physical activity following their child's diagnosis. Future research should utilize randomized controlled trials to examine ways to increase physical activity in mothers of a child with a special health care need to improve overall quality of life.

Introduction

An estimated 13.3 million children or 18 percent of all children aged birth to 17 years in the United States have a special health care need (Musumeci & Chidambaram, 2019). Special health care needs are defined as chronic physical, developmental, behavioral, cognitive or emotional disabilities and may occur prior to birth, at birth, or after birth (Kids Count Data Center, 2019). Following their child's special health care need diagnosis, mothers may experience weight gain, increased chronic disease risk, depressive symptoms, anxiety, and added stressors due to family demands with accommodations (Booth et al., 2012). Additionally, mothers of a child with a special health care need have shown to have worse overall well-being and mental health compared to mothers of typically developing children (Almansour et al., 2013; Yamaoka et al., 2016).

Mothers of a child with a special health care need are more prone to chronic feelings of stress, anxiety, social isolation, frustration, discrimination, and financial difficulties (Zhou et al., 2019). Following a child's special health care diagnosis, the mother often has a trauma or death-like reaction (Breiner et al., 2016). Both parents after birth may experience a range of emotions (e.g., shock, grief, anger) that resemble closely to post traumatic stress disorder (Breiner et al., 2016). Stress and anxiety are the most common health conditions examined amongst women after giving birth to a child with a special health care need (Dunkel-Schetter & Tanner, 2012). The stigma on mental health can cause mothers to hide their conditions for fear it will negatively affect their abilities to parent, for fear that they will be reported to child protective agencies, and due to past experiences, a lack of trust in health care providers (Breiner et al., 2016). Several types of parental interventions have shown to have some success in accommodation for the family (e.g., family support system programs, interaction programs, positive behavioral support),

however all of these tend to be “child-centric” (England & Sim, 2009). Families tend to accommodate around the child when they have a diagnosis of a special health care need. Accommodations for families with a child diagnosed with a special health care need may include: more time spent around the child’s routine, a larger number of caregiving hours towards the child (generally time given up by the women), and balancing time as a family compared to just spending time with the one child (Heiman & Berger, 2007).

Mothers who have a child with a special health care need may gain additional benefits from engaging in physical activity and self-care to combat depressive symptoms. Physical activity is a critical component for overall health in women due to physiological changes induced by hormones, pregnancy, and later on the metabolic demands of being a mother (Melzer et al., 2010). Defined, physical activity as any bodily movement produced by the contraction of skeletal muscles that results in a substantial increase in caloric requirements over resting energy expenditure (U.S. Department of Health and Human Services [US DHHS], 2013). Physical activity recommendations for women, pregnant women and women during the postpartum period are to engage in at least 150 minutes of moderate intensity aerobic activity a week (US DHHS, 2019). In the United States, more than 60 percent of women currently do not participate in the recommended amount of physical activity, and more than 25 percent of women are completely inactive (Centers for Disease Control and Prevention, 2013; Booth et al., 2012). In a study conducted by Mascarenhas and colleagues (2018), only 16 percent of mothers meet physical activity recommendations. Physical inactivity is the fourth leading risk factor for early mortality worldwide. Upon finding out of their woman is pregnant status, few women continue to engage in the recommended amounts of physical activity throughout their pregnancy (World Health Organization[WHO], n.d.). In view of a global epidemic of sedentary behavior and obesity-

related pathology, prenatal physical activity has been shown to be beneficial for the prevention and treatment of gestational diabetes and pre-eclampsia (Downs et al., 2012; Melzer et al., 2010).

Women significantly reduce their activity levels as they transition into motherhood. Research from the past 45 years have shown that after having a child, mothers decrease their physical activity at a rate of 14 hours per week, whereas sedentary behaviors and activities such as driving (e.g. running children to activities, work commute), have increased by six hours (Archer et al., 2013; Mascarenhas et al., 2018). Higher levels of moderate physical activity (i.e. walking, biking, house cleaning) in women during life events, particularly with aging, marriage, and having a baby have been shown to be associated with lower depressive symptoms (Dungan et al., 2015). This is of particularly importance, given that stressful life events, such as trying to conceive a baby, are associated with increased depressive symptoms (Bennett et al., 2004). Depression in women is often treated with medications that may have side effects, psychotherapy, or a combination of both (Josefsson et al., 2013). Physical activity improves depressive symptomology in a number of populations and has been shown to be more effective than most psychiatric medications, with no lasting side effects (Ranjbar et al., 2015; Craft & Perna, 2004). Physical inactivity is a modifiable risk factor for clinical depression. Regular physical activity (e.g., aerobics, a mix of aerobics and strength training or strength training), three to five times per week for 30 to 60 minutes can provide a decrease in depressive symptomology, and an increase in overall health benefits (Sharp et al., 2016). Evidence has also shown lower levels of physical activity can still be beneficial, however regular, long-term physical activity can help reduce added stressors and feelings of depression (WHO, n.d.). Furthermore, physical activity during and after pregnancy is associated with fewer depressive symptoms compared to inactive pregnant and post-partum women (Teychenne & York, 2013;

Evenson, 2011; Lewis et al., 2008). Yoga has been perceived as a stress management tool that can assist in alleviating depression and anxiety disorders. Practicing yoga can be considered a supplementary treatment option for all patients with depressive disorders and individuals with elevated levels of depression (Cramer et al., 2013). Yoga has also been shown to increase physical activity and help with mental health in mothers after a traumatic event, such as stillbirth (Huberty et al., 2017). Complementary and alternative medicine methods are becoming more popular amongst pregnant women, and may have a similar benefit for mothers caring for a child with a special health care need (Muzik et al., 2012; Dykens et al., 2014).

Mothers of a child with special health care needs are more willing to seek support for their children than for themselves (US DHHS, 2013). Mothers who care for a child with a special health care are in need of strategies to improve mental health and decrease depressive symptoms. Positive coping strategies that focus on the mother, such as physical activity (e.g. yoga, walking), online or peer support, or spending time by themselves may reduce stress levels and help aid in self-care (Shilling et al., 2013; Lloyd et al., 2016). Unfortunately, a gap exists regarding the type of physical activity interventions that are acceptable for mothers of a child with a special health care need. Mothers of a child with a special health care need, specifically with Autism Spectrum Disorder, report a high level of fatigue, increased parenting stressors, and physical symptoms associated with health-related quality of life (Reed et al., 2016). Thus, the primary aim of this study was to understand more about mother's desire to use physical activity to improve depressive symptoms after having a child diagnosed with a special health care need. The secondary aim was to investigate their experience with physical activity from before pregnancy, to following their child's diagnosis. Understanding specific physical activity strategies for

mothers of a child with a special health care need could inform future randomized controlled trials and interventions.

Method

Participants and Procedures:

Women were eligible to participate in the study if they had a child diagnosed (birth through 17 years of age) with a special health care need or disability. Women living in the United States and Canada who had a child living full time in the home were included. Women who were currently pregnant, who had experienced a still birth, or loss of a child were excluded from this study.

This was a cross-sectional, descriptive exploratory study and was approved by the Institutional Review Board at the University of North Dakota. Participants were recruited locally and nationally through collaboration with advocacy organizations, email list-serves, and social media (e.g., Facebook). Advocacy organizations included Family Voices of North Dakota, Parent to Parent USA, and Encompass Family Support Services. Snowball sampling was also conducted as women shared the survey link with online support groups that they were a part of. Participants were recruited from 28 February 2020 to 10 March 2020. The survey, hosted by Qualtrics at the University of North Dakota, was completely voluntary, and available online to participants. Participants provided informed consent prior to the start of the survey. The first 300 women to complete the survey received a \$10 Amazon e-gift card for their voluntary participation. Participant responses were separated from any identifying information provided in order to receive a gift card.

Measurement:

The survey included the following four sections: (1) Basic information of child and child's diagnosis (7 items). Questions in this section were related to the child's age, description of diagnosis, child's age at time of diagnosis, and whether diagnosis was prenatal. (2) Physical activity over time (before pregnancy, during pregnancy, postpartum period, and currently; 16 items). (3) Depressive Symptomology and Coping (11 items) related to parenting a child with a special health care need. (4) Demographic Characteristics (17 items) included relationship to child, race, ethnicity, income, etc. The average time to complete the survey was 12 minutes.

Prescreening Questions

Participants completed one pre-screening question asking potential participants if they had a child aged birth to 17 years of age with a special health care need living in the home. Once the prescreening question was answered, the questionnaire prompted the participant to continue or if they did not meet eligibility, brought them to the end of the survey.

General Information of Child and Child Diagnosis

Participants were asked to provide general information about their child and their child's diagnosis. Only one child with a special health care need per family was included in this study. Questions in the section included the age of child with a special healthcare need, what is the special health care need, and year of diagnosis. Participants were then asked if there was any indication of a special health care need prior to giving birth (prenatal), and followed with a question asking whether there were any complications with the mother's health during pregnancy. If the mother identified a complication with her health during pregnancy, a list of possible complications was provided and the mother could select from a list (e.g., pre-eclampsia, depression, etc.) or write in their health complication.

Physical Activity Participation and Health of Mother

A modified version of the Physical Activity of Change Questionnaire (Huberty et al., 2014a; Pereria et al., 2007) was used to assess physical activity during four points of time (before pregnancy, during pregnancy, postpartum period, currently). Participants were provided a description of physical activity: Physical activity may include brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate (Centers for Disease Control and Prevention, 2008), and then asked two questions regarding their physical activity at each of the four time points. Participants only completed the second question, if they responded with a yes, that they engage in any physical activity. Participants were then asked to answer, “how do you currently cope with depressive symptoms, anxiety, and/or feelings associated with your child’s special health care need or disability”, and were asked to select all that apply from a list provided (e.g., engaging/talking with friends or family; support group; physical activity; anti-depressive medication; therapist/counselor; meditation; other). Participants could write in text how they cope with depressive symptoms if they selected, “other” (Huberty et al., 2014a). If parents selected “physical activity” as a way of coping with depressive symptoms associated with the diagnosis of their child, they were asked to complete an additional question regarding the type of physical activity they use. Specifically, participants were to select all that apply to them, including, biking, walking, jogging or running, yoga, yard work, house cleaning, physical therapy or occupational therapy, weight lifting or strength training, or other. If participants selected, Other, they could write in the type of physical activity they use to cope with depressive symptoms. Next, participants were asked to rank (1= least important to 4= most important) the reasons why they participate in physical activity. Five responses were provided for reasons they participate in physical activity and included, help with depressive symptoms,

anxiety, grief; weight loss; better overall physical health (i.e., fitness); better quality of life; or other. If they selected, other, they could write in their reason for participating in physical activity.

Next, participants were asked whether they were interested in engaging physical activity as a means to cope with depressive symptoms, anxiety, and/or grief associated with the diagnosis of your child (Yes or No response). The same question was also asked for yoga (Yes or No), and if they had ever tried to use yoga as a means to cope (Yes or No). If they answered yes to being interested in using yoga as a means to cope with depressive symptoms, they ranked the settings (1=most preferred to 5=least preferred) they preferred to participate in yoga (e.g., in your own home, yoga studio, group-based setting at hospital/doctor's office, gym, other). If they selected Other, they could write in the setting they preferred (Huberty et al., 2014a).

Depression and Emotional Health

A modified Edinburgh Postnatal Depression Scale (EPDS) was used to determine depressive symptomatology associated with parenting a child with a special health care need ($\alpha = 0.89$). The 10-question EPDS included 10 statements that described feelings reflective of depression symptoms during the past 7 days on a scale from 0 (never) to 3 (quite often). The clinical threshold of 10 on a 30-point scale was scored as possible depression. The EPDS is a consistent tool for women who have experience extreme emotional duress after having a child (Cox et al., 1987; Wisner et al., 2002). One additional question was asked to participants to assess how well they are coping, "In general, how do you feel that you are coping with the day to day demands of raising a child with a special health care need." Mothers responded on a five-point scale from "Not Very Well at All" to "Very Well" (US DHHS, 2013).

Mother and Child Demographics Information

Participants self-reported (17 items) demographic characteristics, such as relation to the child, age, state and municipality area they currently reside in (e.g. rural, metropolitan), community reside in (American Indian Reservation), race, ethnicity, employment status, and annual income.

Data Analysis

Descriptive statistics (e.g., means, percentages) were calculated for all survey questions. Qualitative responses were summed and categorized to understand their interest in the type of physical activity they preferred. Pearson correlation was used to compare associations between using physical activity to cope with depression, any physical activity participation, meeting physical activity recommendations, depressive symptoms, coping, and time since diagnosis.

Results

Over 2,000 surveys were completed online, however a majority of surveys were excluded from analysis due to blank survey responses (e.g., not 100% completed), having a child older than 17 years of age, incomplete survey response, duplicate IP addresses, duplicate responses, and robo responses (answered yes to every question, for example). The final sample of 348 women was determined based on two researchers going through each survey to ensure accuracy in participation of the survey. Mothers self-reported an average age of 39.3 years (SD = 7.3), were primarily Caucasian (92%), non-Hispanic (95.1%), and lived in the Midwest (80.2%). Almost 40 percent of the sample lived in North Dakota (39.1%), in a metropolitan area (45.1%), and were employed for wages (59.2%). Approximately one-third of mothers (33.1%) received their child's diagnosis within the last three years and over 50 percent of mothers received a prenatal or at birth diagnosis. The average child age at diagnosis was 1.7 years (SD = 3.0), with

the average age of the child currently was 8.3 years (SD = 4.9). Participant demographic characteristics are reported in Table 1.

Table 1. Participant demographic characteristics (n=348)

Mother Age, years (SD)	39.3 (7.3)	
	N	%
Biological Mother	329	94.5
Adoptive Mother	19	5.5
Race		
Caucasian or White	320	92.0
African American or Black	8	2.3
Asian Pacific Islander	6	1.7
American Indian or Alaskan Native	8	2.3
Other	5	1.4
No answer	1	0.3
Ethnicity		
Non-Hispanic	331	95.1
Hispanic	17	4.9
Geographic Region		
Out of USA	1	0.3
Northeast	6	1.7
Midwest	279	80.2
South	32	9.2
West	30	8.6
State of North Dakota		
North Dakota	136	39.1
Other State	212	60.9
Population Density Area		
Rural (< 2,500)	40	11.5
Large Rural (2,500 – 9,999)	54	15.5
Micropolitan (10,000 – 49,999)	95	27.3
Metropolitan (> 50,000)	157	45.1
No answer	2	0.6
Live on American Indian Reservation		
Yes	6	1.7
No	339	97.4
No answer	3	0.9
Employment		
Employed for Wages	206	59.2
Self-Employed	22	6.3
Out of Work <1 yr	6	1.7
Out of Work >1 yr	11	3.2
Homemaker	85	24.4
Student	7	2.0

Retired	1	0.3
Unable to Work	10	2.9
Income		
< than \$20,000	65	18.7
\$20,000-\$39,999	67	19.3
\$40,000-\$59,999	73	21.0
\$60,000-74,999	44	12.6
\$75,000 or more	92	26.4
Missing Data	7	2.0
Prenatal or at birth Diagnosis	180	51.7
Child Age at Time of Diagnosis, yr (SD)	1.69 (3.0)	
Age of Child Now, yr (SD)	8.3 (4.9)	
Time since Child Diagnosis, yr (SD)	6.4 (4.5)	
Less than 1 year	16	4.6
1 to 3 years	99	28.5
4 to 6 years	82	23.6
7 to 9 years	63	18.1
10 years or more	88	25.2

Physical Activity Participation

A decrease in meeting moderate-to-vigorous physical activity guidelines was shown across all four time points, before pregnancy (51%), during pregnancy (31%), postpartum (within one year; 30%), and current participation (39%). Physical activity participation across all four time periods are presented in Table 2.

Table 2. Meeting Physical Activity (PA) Guidelines (n=348)

	N	%
Participated in PA BEFORE Pregnancy	348	
Yes	290	83.3
No	39	11.2
Not Applicable (adoptive)	19	5.5
Met Recommendation of PA BEFORE Pregnancy	348	
Yes	177	50.9
No	152	43.7
Not Applicable (adoptive)	19	5.5
Participated in PA DURING Pregnancy	348	
Yes	255	73.3
No	74	21.3
Not Applicable (adoptive)	19	5.5
Met Recommendation of PA DURING Pregnancy	348	
Yes	107	30.7
No	222	63.8
Not Applicable (adoptive)	19	5.5
Participated in PA in POSTPARTUM Period	348	
Yes	194	55.7
No	135	38.8
Not Applicable (adoptive)	19	5.5
Met Recommendation of PA in POSTPARTUM Period	348	
Yes	105	30.2
No	224	64.4
Not Applicable (adoptive)	19	5.5
Current Participation in PA	348	
Yes	272	78.2
No	76	21.8
Currently Meets PA Recommendation	348	
Yes	136	39.1
No	212	60.9

Physical Activity Participation and Depressive Symptoms

Over half of the participants (59.8%) reported possible depression that was scored at a 10 or higher on the 30-point EPDS. Most participants (85.7%) reported coping somewhat well or very well raising a child with a special health care need or disability (Table 3). Most mothers reported engaging/talking with friends & family (74%), participating in physical activity (37%), taking anti-depressive medication (35%), utilizing a support group (28%), or other (18%) as a

means to cope with their depressive symptoms. Table 4 reports qualitative responses to “other” ways they cope with depression, anxiety, and feelings associated with their child’s special health care need. Of those that reported engaging in physical activity, participants preferred to engage in walking (66%), house cleaning (57%), yoga (40%), strength straining (38%), jogging or running (33%), yard work (20%), biking (16%), or other (23%). Table 5 reports the qualitative responses to other forms of physical activity participants currently engage in. Qualitative responses included forms of physical activity such as: Crossfit or High Intensity Interval Training (HIIT) (n = 7), swimming (n = 5), and hiking (n = 2). Of the sample that self-reported reasons for participating in physical activity (n = 268), the most important reasons were to have a better quality of life (77%), to have better overall physical health (example: cardio respiratory fitness, strength training) (76%), to help with weight loss (57%), and to help with depressive symptoms (37%). Qualitative responses for other reasons they participate in physical activity were mental focus, time for one’s self, to be strong enough to care for my child, and injury prevention. For example, “to be strong enough to care for my daughter”. All qualitative responses for reasons to participate in physical activity are included in Table 6.

A majority of participants (86%) were interested in using physical activity and most (71%) were interested in using yoga, as a means to cope with depression symptoms. Approximately one-third (36%) of participants had tried yoga as a means to cope with depressive symptoms. Of those interested in using yoga, almost half (45%) preferred to participate from their home. In addition, nearly one third of respondents preferred using a studio or gym (36% and 34%), respectively. Qualitative responses to other settings to participate in yoga included outdoors, yoga/support group for parents, any group setting, and their place of work. Qualitative responses to other settings to participate in yoga are presented in Table 7.

Table 3. Physical Activity & Depression (N=348)

	N	%
Edinburgh Postpartum Depression Scale	n=348	
Possible Depression	208	59.8
Not Depressed	140	40.2
Feel coping with raising child with special health care needs	n=348	
Do not know	4	1.1
Not very well at all	9	2.6
Not very well	37	10.6
Somewhat well	239	68.7
Very well	59	17.0
How do you currently cope with depressive symptoms		
Engaging/Talking with Friends/Family	258	74.1
Support Group	97	27.9
Physical Activity	128	36.8
Anti-depressive Medication	120	34.5
Therapist/Counselor	85	24.4
Meditation	45	12.9
Other (Please Specify)	63	18.1
What type of physical activity specifically do you use to cope?	n=128	
Biking	20	15.6
Walking	84	65.6
Jogging or Running	42	32.8
Yoga	51	39.8
Yard Work	25	19.5
House Cleaning	72	56.3
Physical Therapy/Occupational Therapy	4	3.1
Weight Lifting/Strength Training	49	38.3
Other (Please Specify)	29	22.7
Reasons for participating in physical activity ranked from 1 (most important) to 4 (least important) (picked 1 or 2)	n=268	
Help with depressive symptoms	99	36.9
Weight loss	154	57.4
Better overall physical health	204	76.1
Better quality of life	207	77.2
Other	28	10.4
Are you interested in using Physical Activity as a means to “cope” with depressive symptoms, anxiety, and/or grief?		
Yes	298	85.6
No	50	14.4
Have you ever tried to use yoga as a means to “cope” with depressive symptoms, anxiety, and/or grief?		
Yes	126	36.2
No	222	63.8
Are you interested in using yoga to cope with depressive symptoms		
Yes	248	71.3

No	100	28.7
Rank the settings in which you would prefer to participate in yoga from 1 to 5 (most preferred or preferred)	n=248	
In your own home	111	44.8
Yoga studio	88	35.5
Group-based setting at hospital/doctor's office	78	31.0
Gym	83	33.5
Other (Please Specify)	16	6.5

Table 4. Qualitative responses to Other ways to cope with depressive symptoms associated with parenting a child with a special health care need, n=63 (18.1%)

Advocacy (n=1)	Nothing, wait for it to pass (n=3)
Alone time (n=5)	Plans to join a support group (n=1)
Art, Crafts, Quilt, Sewing (n=7)	Prayer and/or Church (n=9)
Television (n=1)	Reading (n=7)
Chocolate (n=2)	Relaxing (n=1)
Cleaning (n=2)	Take a long shower or hot tub (n=2)
Crying (n=2)	Self-care (n=1)
Facebook groups (n=1)	Shopping alone (n=1)
Gaming (n=1)	Sleep (n=2)
Hobbies (n=4)	Spousal support (n=2)
I don't (n=8)	Work (n=2)
Music (n=2)	Yoga (n=1)

Table 5. Qualitative responses to Other physical activities engaged in to cope with depressive symptoms, n=29 (22.7%)

Barrre Classes (n=1)	Horseback riding (n=1)
Crossfit or High Intensity Interval Training (n=7)	Pilates
Cycling or group exercise classes (n=2)	Playing and/or running with my kids
Dancing (n=2)	Swimming (n=5)
Elliptical (n=3)	Tai chi (n=1)
Hiking (n=2)	Zumba (n=2)

Table 6. Qualitative responses to Other reasons to participate in physical activity, n=28 (10.4%)

Art	Better interaction with my kids
Cannot die due to son's needs	Doctor recommended
Energy	Family time
Focus on me	For personal time away
I don't have time to do that but I do some activity with my job and housework	Have to remain fit /strong to physically care for my child
General health	I have to
I walk a lot at work, and quite fast and frequently (I don't exercise outside of work)	To accomplish what the task is (e.g., gardening, travelling to a destination by booking/walking)
Injury prevention	Time to myself
Mental focus	My children are young and I'm almost 50
Needing a break while walking the dog	Respite
Self-love	Spending time being active with my children
To be strong enough to care for my daughter	To do something for myself
To be strong to manage my child physically as needed for his safety	

Table 7. Qualitative responses to Other Setting to participate in Yoga, n= (10.4%)

Any group setting	Family yoga
Friend's home	Group based setting in yoga setting
Local faith based or community group	Other people's homes
Outdoors	Outside
Strongly prefer home	Unknown
With a friend	Work place
Yoga at breweries or with animals	Yoga/support group for parents

Relationship Between Physical Activity Participation and Mental Health

A Pearson correlation examined the relationship between coping with depression using physical activity, participation in any physical activity, meeting physical activity guidelines, depression, coping and time since diagnosis (Table 8). Participation in physical activity to cope with depression ($r = 0.111, p = 0.038$), participation in any physical activity ($r = 0.123, p = 0.022$), and meeting physical activity guidelines ($r = 0.145, p = 0.007$), were all positively associated to their coping ability to parent a child with a special health care need. Depressive symptoms were negatively associated with ability to cope ($r = -0.529, p < 0.001$). Participation in any physical activity ($r = -0.178, p < 0.001$) and meeting physical activity guidelines ($r = -0.108,$

$p = 0.044$) were negatively associated with depressive symptoms. Time since diagnosis of the child's special health care need was not significant with coping with depression, depressive symptoms, or physical activity.

Table 8: Pearson Correlation matrix

Variables	1	2	3	4	5	6
1. Cope with depression via PA	-					
2. Participate in any PA	0.317**	-				
3. Meeting PA guidelines	0.403**	0.423**	-			
4. Edinburgh depression	-0.101	-0.178**	-0.108*	-		
5. Coping	0.111*	0.123*	0.145**	-0.529**	-	
6. Time since diagnosis	0.032	0.029	0.008	-0.038	0.072	-

* $p < 0.05$

** $p < 0.001$

Discussion

To our knowledge, this was the first study to examine the acceptability, preferences and experiences with physical activity for mothers of a child with a special health care need. As such, this research offers insight for healthcare providers to design and implement interventions at the time of their child's diagnosis that includes physical activity and/or yoga to improve mental and physical health in mothers of a child with a special health care need. Thus, the purpose of this study was to understand more about mother's desire to use physical activity to improve depressive symptoms after having a child diagnosed with a special health care need. The secondary aim was to investigate their experience with physical activity from before pregnancy, to following their child's diagnosis.

Across the country, almost 20% of families are raising a child with a special health care need and function differently from other families. Mothers are typically the primary care giver and have the most knowledge regarding the child's health, development, service needs and interactions, and experience higher rates of unrelenting stress and adverse mental health issues (Bourke-Taylor et al., 2018). Although the mother is often the primary care giver, special health care diagnosis affects the entire family, such routines may be based around the child's needs and the family may sacrifice time together, family activities, and their own health for requirements of their child's care (Dodd et al., 2009; Larson, 2010; Bourke-Taylor et al., 2015).

Mothers who have a child with a special health care need are at greater risk for depression, anxiety and stress (Churchill et al., 2008). Mothers who have a child with Autism Spectrum Disorder (ASD) report higher levels of depressive symptoms and fatigue, both stemming from poor quality of sleep, lack of physical activity, and increased need for social support (Giallo et al., 2013). Additionally, Roberts and colleagues (2014) report that maternal posttraumatic stress disorder may be associated with their child's ASD diagnosis. This may be from having maternal stress and due to PTSD and ASD sharing the same genetic risk (Roberts et al., 2014). In a qualitative study by Sheilds and Synnot (2016), parents of a child with ASD can also act as a barrier to their child's physical activity. This barrier or negative parental behavior may stem from lack of knowledge around physical activity, cost of programs for the child with ASD (e.g., occupational therapy, physical therapy, support group) and lack of time (Sheilds & Synnot, 2016). Results from our study suggests that mothers of a child with a special health care need are interested in utilizing physical activity and yoga to cope with depressive symptoms. Thus, it is critical that healthcare providers and support programs for mothers caring for a child

with a special health care need incorporate physical activity into their family-centric strategies to improve both physical and mental health.

A decrease of physical activity from before pregnancy to postpartum was noted. Such reduction can be due to demands of caring for a child who has a special health care need, overall demands of being a mother, and physiological changes to the body (Leiter et al., 2004). Women frequently gain more weight than needed during pregnancy, and then fail to lose the weight by the 6-month postpartum period (Groth & David, 2008). In addition, pre-pregnancy weight has also been shown to contribute to long-term obesity, as women who start pregnancy heavier retain more weight following childbirth (Gunderson et al., 2004). The slight physical activity increase from the postpartum period to currently may be due to the way it makes a woman feel by working out (i.e. strong, empowered), disease/obesity prevention, and women having time to take care of themselves (self-care). After a traumatic birth complication or their child's special health care diagnosis, women may use physical activity to cope, have time alone, and recuperate (Beck, 2004). As physiological changes happen to a woman to meet the demands of being a mother, moderate-to-vigorous physical activity (e.g. walking, biking, yoga) can act as a protective, non-pharmacological method that can be used to decrease depressive symptoms, and reduce manic episodes (Huberty et al., 2014b). Long-term strategies are needed to encourage women to stay active while having a child with a special health care need. In particular, health care providers are in an optimal position to intervene at time of diagnosis, as helping the mother have optimal physical and mental health will also benefit the child. This is especially important as our study suggests that women who have a child with a special health care need and participate in moderate-to-vigorous physical activity have fewer depressive symptoms than women who do not participate in any physical activity. Findings similarly were reported in

women who have PPD after a live birth and participate in exercise programs (Teychenne & York, 2013; Gaston & Cramp, 2011). Specifically, Teychenne and York (2013) found that leisure time physical activity before, during, and after pregnancy may be important for reducing the risk of PPD.

Increased positive health behaviors, such as physical activity, are associated with better mental health outcomes. Results from our study showed that over half of the mothers (60%) exhibited depressive symptoms, and approximately one-third (39%) currently participate in the recommended amount of moderate-to-vigorous physical activity. Additionally, current participation in any physical activity was shown to be associated with fewer depressive symptoms and improved coping ability in mothers. Our study was corroborated by other research that have shown a positive association between physical activity, mental and physical health. Physical activity has been shown to reduce stress, decrease depressive symptoms, and improve obesity and overall fitness in women (Daley, 2008). Teychenne and colleagues (2008) examined over 1,500 adult women and found that at least 3.5 hours per week of leisure-time physical activity had lower depressive symptoms and lower odds of depressive symptoms. Adding or increasing routine bouts of physical activity, especially during a challenging time in their lives (i.e. marriage, birth, new job) has been found to be positively associated with mental health (Brown & Trost, 2003; Albright et al., 2005). Specifically, Brown and Trost (2003) found that women ages 18 – 23 years of age were more likely to become inactive after getting married, having a child, or beginning a new job. Thus, maternal physical activity interventions are needed to improve health, but more importantly, that are appropriate and reasonable in this underserved population of mothers caring for a child with a special health care. Mothers of a child with a

special health care need have unique barriers to physical activity, so understanding what is feasible is of critical public health importance.

In our study, over one-third of participants reported the use of physical activity as a means to cope with depressive symptoms. Others reported engaging with family/friends and using anti-depressive medications to cope with their depressive symptoms. Adapted from an ancient holistic health system, yoga is a newer mainstream practice in the United States, especially as use for coping with mental health symptoms. Yoga is linked to health promotion, gentle physical activity, and coping with stressors and disease (Kinser et al., 2013). In our study, over two-thirds of women were interested in using yoga as a coping mechanism for depressive symptoms, anxiety, and grief. Based on research on pregnant women and yoga as a healing practice, this may be another opportunity to increase maternal physical activity following their child's diagnosis. Yoga has been shown to be effective at reducing depressive symptoms in mothers who have experienced a stillbirth. Women who experience stillbirth, compared to women with a live birth, have a nearly sevenfold increased risk of a positive screen for post-traumatic stress disorder (PTSD) and a fourfold increased risk of depressive symptoms (Huberty et al., 2017). In an article that compared 12 studies and the effects of yoga and exercise, yoga interventions appeared to be equal or superior to all forms of exercise in nearly every health outcome (e.g., blood glucose, oxidative stress, blood lipids) except those for physical fitness performance (Ross & Thomas, 2010). Yoga may be equal to all forms of exercise due to its interventions in different populations and the positive yielded results from interventions with chronic diseases. Populations that include people with diagnosed mental health conditions, menopause, and chronic health conditions (i.e. kidney disease, diabetes) have all shown signs of improvement with symptomology (Gokal et al., 2007; Kharit et al., 2007).

Women, specifically mothers, are less likely to engage in forms of physical activity compared to men due to barriers they may encounter when having a child, such as lack of time due to caring for a child, guilt associated with being away from the child, and lack of energy (Mailey et al., 2014). In our study, walking was the highest ranked form of physical activity by mothers. Walking is often used in health promotion for physical activity, as it is inexpensive, little to no equipment is needed, and it is an activity mothers can accommodate around the family (Clarke et al., 2007). Regardless of the physical activity guideline used, males are more active than women (Azevedo et al., 2007). One strategy that may help improve maternal physical and mental health may be family-centric strategies, such as walking together. Family walks can provide a form of parental influence for the child with a special health care need and encourage a healthy family dynamic (Rhodes & Lim, 2018). Walking regularly is also a good predictor of lowering rates of chronic diseases in women. This in return provides a better quality of life, and helps provide better overall physical health, which is what participants reported in our study (Lee & Buchner, 2008). In our study, mothers reported other reasons to participate in physical activity, such as avoiding injury, self-care, and maintaining a level of strength appropriate to care for their child. Mothers also reported participating in yoga in their own home as the strongest preference. In mothers who were not physically active, this is of utmost concern, as inactivity is associated with reduced stamina, and in turn decreases a mother's ability to care for her child, especially if they have a child with a special health care need. Additionally, a lack of maternal physical activity decreases their ability to take care of their family and perform in their careers (Rychnovsky, 2007). Similar to our study, Ashrafinia and colleagues (2015) showed that mothers exercising in the home (while performing Pilates) increased physical activity, and improved motivation, and daily stamina. The positive benefits of physical activity include strengthened

core muscles (i.e. abdominal, gluteal and dorsal muscles), improved flexibility and stability, decreased risk for chronic disease, as well as the positive mental effects, makes them a useful and practical means for recovering and improving one's quality of life (Woodyard, 2011; Huxel Bliven et al., 2013).

This was the first study to examine physical activity in mothers caring for a child with a special health care need, and has several strengths and limitations. Strengths included the diversity of mothers participating and an important underserved population that affects 20 percent of all families in the United States (Shields et al., 2011). Second, this study focused on maternal health, whereas most research in families with a child with a special health care need are focused on the child (Maher et al., 2010). Third, a large sample size of mothers participated in this study. Fourth, physical activity in mothers is understudied (Brown et al., 2007; Studts et al., 2019). Last, the survey was developed to be minimally invasive, easy to participate, and this research has the potential to make a significant public health impact. There are also several limitations to note. First, the sample was 92 percent Caucasian, most were employed, and almost half lived in a metropolitan area. Thus, our means to understand underserved communities and populations was limited. Second, physical activity was self-reported by mothers and they did not report amount of time (in minutes) of physical activity achieved per week. It is well known that self-reported physical activity can be overestimated and physical activity recommendations may not have actually been met (Schuna, et al 2013). Also, participants were not asked about other health conditions or weight status, which may impact their ability to participate in physical activity in which we cannot rule out reverse causality.

From a public health perspective, the ability to impact maternal and child health through maternal physical activity is of great importance to decrease population obesity and improve

depressive symptoms. Ultimately, focusing on the health of mothers with a child with a special health care need may lead to a significant improvement in maternal and child health outcomes. Future interventions may include promotion of physical activity to improve mental health in mothers after receiving the traumatic news of a child's special health care diagnosis, which may trigger a traumatic death-like response (England & Sim, 2009). Future interventions should include a randomized controlled trial to increase physical activity in mothers who have a child with a special health care need. Following their child's diagnosis, mothers are more willing to seek support for their child than for themselves (Altieri & Kluge, 2005). Thus, mothers are an important population to provide health-based interventions due to the possible negative health outcomes (e.g., weight gain, depressive symptoms, risk of chronic disease). It is important to note that women who have a child with a special health care need are a specific group, and in order for mothers to provide the best care for their child, they need to have optimal physical and mental health (Pelchat et al., 2003). Furthermore, increasing physical activity in mothers who care for a child with special health care needs is an important public health concern, and targeting maternal health may be one way to improve quality of life in families.

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