

Evaluation of an Eight-week Yoga Program for Children Living in Orphanages in Haiti:

A Preliminary Study of Child Mental Health

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of Master of Science
in the Duke Global Health Institute
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ABSTRACT

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Abstract

Objective: Posttraumatic stress due to trauma exposure in childhood disconnects the mind and body, producing a chronic state of anxiety and ill health that worsens into adulthood. In order to mitigate the harmful effects of trauma experienced by children living in low-resource settings worldwide, evidence-based research on the effect of feasible mind-body interventions to reduce trauma-related symptoms among this vulnerable population is needed. The complementary and alternative medicine (CAM) practice of yoga holds promise as a mind-body approach to child mental and physical wellbeing. The purpose of this preliminary study was to evaluate the effectiveness, feasibility, and acceptability of an 8-week yoga intervention to reduce trauma-related symptoms and emotional and behavioral difficulties among children living in orphanages in Haiti.

Methods: The study design is a case-control study with random assignment to yoga or aerobic dance plus a non-randomized wait-list control group. The UCLA PTSD Reaction Index and the Strengths and Difficulties Questionnaire measured trauma-related symptoms and emotional and behavioral difficulties, respectively. A supplementary questionnaire evaluated participants' experience in the yoga program.

Results: Our main findings include that participation in either 8-weeks of yoga or aerobic dance classes predicted a reduction in trauma-related symptoms and

emotional and behavioral difficulties, though not statistically significant ($p > .05$). The average yoga class attendance was 14.65 (SD = 2.17) out of 16 classes. Ninety-two percent of respondents (N = 26) reported being satisfied with the yoga program and all reported positive changes in wellbeing.

Conclusion: Although the reductions in trauma-related symptoms and emotional and behavioral difficulties among children in the yoga and aerobic dance groups were not statistically significant, positive feedback suggests that yoga is a feasible, acceptable, and enjoyable activity with benefits to child mental and physical health. Further research is needed to evaluate the effect of yoga to relieve trauma-related mental illness among Haitian youth and to promote sustained health into adulthood. Yoga programs designed to improve health and resilience to stress are essential social justice approaches for investing in the wellbeing of our global youth and creating peace within the community at large.

Dedication

I dedicate this work to the beautiful, courageous children of Haiti.

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1. Introduction

The spiritual and political leader, Mahatma Gandhi once said, “If we are to teach real peace in this world, and if we are to carry on a real war against war, we shall have to begin with the children” (Bedrij, 2011, p. 182). As children¹ represent over one-third of the world’s population, global health experts agree that long-term social and economic progress cannot occur within nations that fail to invest in the wellbeing of their youth (Population Reference Bureau, 2013; U.S. Agency for International Development [USAID], 2013). Yet, the consequences of severe poverty, natural disasters, armed conflict, and the HIV/AIDS epidemic have left 151 million orphaned and abandoned children vulnerable to exploitation, homelessness, and neglect worldwide (USAID, 2013). These crises threaten the rights of children to survival, wellbeing, and cognitive and psychological development, which undermine their potential for health and economic mobility in adulthood (USAID, 2013).

An estimated 10-20% of youth worldwide suffer from mental health problems (Kieling et al., 2011). According to the World Health Organization (WHO) Mental Health Gap Action Programme (MhGAP), approximately half of mental disorders present in adults begin before the age of 14 years (WHO, 2008, p. 31). In low-and-middle income

¹ Throughout this study, the terms children, adolescents, and youth refer to individuals aged 0-17 years, unless otherwise specified.

countries (LMICs), chronic stress and frequent trauma exposure increase children's risk for developing mental illness (Lund et al., 2011; Kieling et al., 2011). In response to the large burden of ill mental health and lack of trained psychiatric health care professionals within LMICs, development of alternative mental illness prevention and treatment strategies to foster wellbeing and healthy development of youth is critically needed (Kieling et al., 2011; Saraceno et al., 2007; The United Nations Children's Fund [UNICEF], 2013).

In the Republic of Haiti, approximately, 420,000 Haitian children have lost one or both parents and are at-risk for experiencing child trafficking, homelessness, or abandonment (Nicholas et al., 2012; UNICEF, 2011; UNICEF, 2013). Research shows that orphaned and abandoned children (OAC) are vulnerable to experiencing multiple traumatic events and suffer poor self-regulation leading to emotional and behavioral difficulties and trauma-related disorders (Eisenberg et al., 2005; Vavrova, Hrbackova, & Hladik, 2014; Whetten, Ostermann, Whetten, O'Donnell, & Thielman, 2011). In order to alleviate the burden of mental illness affecting vulnerable children in Haiti, development of an evidence base for effective and feasible therapeutic interventions is needed.

In the past decade, the ancient Indian philosophy and practice of *Yoga* has gained popularity as a therapeutic mind-body complementary and alternative medicine (CAM) approach to mental and physical wellbeing for a wide range of populations and settings. Research suggests that yoga is effective in reducing stress, somatic ailments, symptoms

of depressive and anxiety disorders in adults, and attention-deficit hyperactivity disorder (ADHD) in children (Balasubramaniam, Telles, & Doraiswamy, 2013; Haffner, Roos, Goldstein, Parzer, & Resch, 2006; Jensen & Kenny, 2004; Saper, Boah, Keosaian, Cerrada, Weinberg, & Sherman, 2013). It is believed that yoga may venture beyond current psychotherapies by holistically treating both mental and physical symptoms of trauma-related pathology (Emerson & Hopper, 2011). As traumatic memories are stored in the physiology of the body, trauma experts are increasingly advocating for additional research on yoga and the added benefits as an adjunct therapy to standard treatment of trauma-related disorders. However, research has yet to evaluate the efficacy of yoga to reduce trauma-related symptoms among vulnerable children.

The purpose of this thesis is to evaluate the effectiveness, feasibility, and acceptability of an 8-week yoga intervention to reduce trauma-related symptoms and emotional and behavioral difficulties among children living within two orphanages in Haiti. The study design is case-control with random assignment to yoga or aerobic dance plus a non-randomized parallel wait-list no-treatment control group. This study pursued two main objectives: 1) to evaluate the effect of an 8-week yoga program to reduce trauma-related symptoms and emotional and behavioral difficulties among children living in orphanages in Haiti; and 2) to determine the feasibility and acceptability of a yoga program for children living in orphanages in Haiti.

To best accomplish the study objectives, this thesis begins with a literature review of vulnerable children in Haiti followed by research on the effects of trauma, posttraumatic stress disorder, and yoga therapy. Next, the study design and quantitative and qualitative analyses are described in detail. Results are explained and illustrated via use of tables. Finally, this thesis is concluded with a discussion of strengths and limitations followed by implications, future research, and development of yoga programs to improve mental health and wellbeing of Haitian children and adolescents.

2. Literature Review

2.1 *The History of Haiti at a Glance*

Haiti, a culturally and spiritually rich country renowned for its beautiful menagerie of mountainous and tropical landscapes, borders the Dominican Republic on the Western one-third of the Caribbean island of Hispaniola. Since the arrival of Spanish explorer, Christopher Columbus, in 1492 and the subsequent enslavement of the Taino natives, an analysis of history suggests that exploitation of people and natural resources, violent dictatorships, and agricultural devastation has led to extreme poverty, thus establishing Haiti as the lowest-income country in the Western Hemisphere (Central Intelligence Agency [CIA], 2013). However, the history of Haiti reveals that Haitians challenge injustice with an empowering resilience stemming from their deep religious beliefs and shared cultural values of community and kinship.

2.1.1 Haiti in the 21st Century

2.1.1.1 The Haiti Earthquake of 2010

On January 12th, 2010 a 7.0 magnitude earthquake, the most powerful natural disaster to strike Haiti in 200 years, hit 10 miles outside of Haiti's capital city, Port-au-Prince (Échevin, 2011; Cerdá et al., 2012). In seconds, approximately 300,000 lives ended and 1.3 million people were displaced (Government of the Republic of Haiti, 2010). Before the earthquake, the United Nations (U.N.) estimated that 380,000 Haitian children were orphaned and/or abandoned; yet, following the earthquake's immense devastation

and subsequent cholera outbreak, estimates surpass 400,000 (Nicholas et al., 2012; UNICEF, 2011; UNICEF, 2013).

As the poorest country in the Western Hemisphere, more than half of Haiti's population of 10 million live below the absolute poverty line of less than \$1 USD per day (Cerdá et al., 2012; Échevin, 2011; Republic of Haiti, 2007; World Bank, 2013). Though the Government of the Republic of Haiti strives to advance the country after the earthquake, frequent droughts, hurricanes, political instability, and the global economic crisis counter these advancement efforts. In consequence, high unemployment and crime rates, inadequate education, sanitation, and health facilities, and widespread food insecurity continue to depress the wellbeing of Haitian communities (CIA, 2013; Joshi, 2009; Republic of Haiti, 2007). In the rural areas where 63% of the population resides, abject poverty is prevalent and vulnerability to economic and health shocks are greatest (Échevin, 2011; Republic of Haiti, 2007).

2.1.1.2 Mental Health in Haiti

In accordance with the WHO declaration that there can be “no health without mental health,” it is essential that countries are aware of the specific mental health needs of their respective populations in order to develop programs to prevent and treat them effectively (Prince et al., 2007). After the earthquake, restoration of infrastructure is deemed a high priority, while long-term mental health needs of the country continue to be neglected and insufficiently addressed. Collaborative research by the Pan American

Health Organization (PAHO) and the WHO revealed that the Haitian health care system lacks capacity to care for those suffering from mental illness (WHO, 2010). In 2003, only 10 psychiatrists and 9 psychiatric nurses were found to be working in Haiti, most of who were based in urban areas (WHO, 2010). Though mental health care expenditures in Haiti are unknown, primary health care costs an average of \$6 USD, thus exceeding the abject poverty line 6-fold (Peragallo Urrutia et al., 2012). These significant barriers to accessing mental health care in Haiti place the burden on families, communities, and traditional healers.

The social causation and social drift hypotheses explain that, poverty and mental illness interact in a negative cycle such that people living in poverty are at a greater risk for developing mental illness and people with mental illness are at a greater risk of entering into or remaining in poverty (Lund et al., 2010, p. 1502; Patel et al., 2010, p. 121). In the poorest regions of Haiti where social welfare and health care systems are absent or inadequate, poor populations are at the greatest risk for exposure to trauma and the adverse effects (Patel et al., 2010). Those most at risk are orphaned and abandoned children who do not have an adult to initiate and provide access to health care. In consequence, the likelihood of this subgroup of children to receive health care services is low, thus increasing the risk of mental disorders among this population.

2.2 The Children of Haiti

According to the Haitian proverb, *timoun se riches malèrè*, meaning ‘children are the wealth of the poor,’ children are essential to family wellbeing and survival (WHO, 2010, p. 5). Although the fertility rate¹ has been steadily declining over the past three decades, children less than 14 years represent 34.6% of the total population of Haiti (UNICEF, 2013; World Bank, 2014). In Haitian culture, a large family unit with several children represents positive values of fertility, wealth, religious devotion, and financial security into the future. Altogether these values increase the status of the family within their community.

Since the family unit is of vital cultural and economic importance, rural Haitian households maintain an average of five children (Daumerie & Hardee, 2010). Yet, recurrent natural disasters, political unrest, the HIV/AIDS epidemic and rise in non-communicable diseases, persistently incapacitate families subjecting children to homelessness, orphanhood, and/or exploitation. While the journey of each Haitian OAC is distinct, research among this population reveals that they are vulnerable to three major life experiences: 1) child trafficking 2) homelessness 3) institutional care. The commonalities shared across these life experiences are explained below.

¹ The fertility rate declined from 6.11 in 1984 to 3.28 births per woman in 2011 (World Bank, 2014)

2.2.1 Restavèk Situation

Families burdened by insufficient food, education, employment, health care and family planning services must weigh the few options available to help their children survive. Often times an extremely poor household in a rural area arranges to surrender childcare responsibilities of their child to a less poor household, usually one with kinship ties in an urban setting (Pan American Development Foundation [PADF], 2009). In exchange for promises of education, food, and shelter, an agreement is made for this child to work for the new caretaker household as a *Restavèk* or unpaid domestic servant.

The Restavèk system in Haiti is a form of child trafficking² and exploitation analogous to child slavery. Although the movement of children for exploitative purposes is not a new phenomenon, research has only just begun to focus on the issue of child trafficking in the context of Haiti. It is known that approximately 3,000 Haitian children are trafficked annually to the Dominican Republic mainly for the purposes of unpaid domestic service, forced begging on the streets, or the sex-trade (U.S. Department of State, 2009, p. 306). Research by the Pan American Development Foundation (PADF) reveals that approximately 225,000 Restavèk children live in the urban areas of Haiti (PADF, 2009). According to the U.S. Department of State 2009

² Child trafficking is simply defined as the movement of persons under the age of 18 years for purposes of exploitation.

Trafficking in Persons (TIP) Report, most Restavèk children come from rural households and the majority are females between the ages of 6 and 14 years (U.S. Department of State, 2009, p. 306). Although sending and receiving families may share kinship ties, research shows that kinship does not guarantee proper care for the trafficked child (PADF, 2009).

The life of a Restavèk child involves severe maltreatment and repeated traumatic experiences. Restavèk children are bound with the stigma of being a slave such that they are considered property, denied education, abused, and discounted from the community (Nicholas et al., 2012). Reports by former Restavèk children reveal extreme physical and emotional abuse, regular humiliation, malnutrition, and hard labor (PADF, 2009).

According to results of a random survey of households in Port-au-Prince, Kolbe and Hutson (2006) discovered that the risk of sexual assault among female Restavèks is 4.5 times greater than the risk of sexual assault among non-Restavèk females (p. 868). Due to Haitian labor laws that mandate payment of domestic workers over the age of 15 years, host families usually release Restavèks to the urban streets when they reach adolescence (U.S. Department of State, 2009, p. 306). However, without education, or workplace training, youth resort to prostitution or join gangs to survive (U.S. Department of State, 2009). In this way, the Restavèk system undermines the potential of Haiti's youth and must be a priority in global child protection policy and child wellbeing research.

2.2.2 Street Children

In order to escape abuse and exploitation, Restavèk children run away from their abusive “caretaker” households and towards their only alternative, life on the urban streets. According to The United Nations Children's Fund (UNICEF), 4,000 children are living on the streets of Haiti’s capital city, Port-au-Prince (Ferreira, 2013). Their perilous street lifestyle combined with poor education, social skills, and hygiene creates barriers for children to return home (Kennedy, 2012; Magazine, 2008). With fear of rejection by their families and communities, Restavèk children frequently resort to the streets rather than risk rejection and being returned to their former Restavèk household (Kennedy, 2012). However, street life frequently leads to additional forms of exploitation such as sex trafficking, begging, or joining violent street gangs (U.S. Department of State, 2013, p. 187).

2.2.3 Institutional Care

Before the earthquake, UNICEF estimated that 50,000 Haitian children lived in institutional care facilities (Lederer, 2010). Due to the impracticality of foster care and the dangers of “kinship care” in this low-resource country burdened by extreme poverty, institutional care is currently the most viable option for protecting vulnerable children in Haiti. Children’s homes are an integral component within the alternative care system in Haiti, as they provide care to thousands of children who have escaped or been rescued from the Restavèk system, life on the streets, and those left parentless due to disease and

natural disasters. Yet, in some cases, understaffing, dependence on international aid, and program funding cuts to orphanages increase children's risk of neglect, insufficient nutrition, and abuse. Therefore, further research on the best care practices for Haitian OAC and coordinated multi-sectoral approaches to provide safe and stable environments for children living in orphanages in Haiti are crucial to protect and promote wellbeing of this vulnerable group.

2.3 Trauma

2.3.1 Maltreatment

As one of the most vulnerable populations in the world, orphaned and abandoned children bear an increased risk of experiencing trauma and maltreatment (Kieling et al., 2011; Whetten et al., 2011). Due to the lack of social support and other coping resources, research shows that OAC, especially double orphans (children with both parents deceased), are most vulnerable to the negative effects of repeated exposure to trauma (Suliman et al., 2009; Whetten et al., 2011). Youth exposed to trauma in the form of chronic maltreatment commonly exhibit impairments in all domains of development, difficulties with emotional and behavioral self-regulation, coping with stress, and problem solving (Moroz, 2005, p. 6). Additional outcomes include low self-esteem, suicidal ideation, and early, unsafe sexual behavior (Kearney, Wechsler, Kaur, & Lemos-Miller, 2010; Moroz, 2005). Left untreated, neuropsychiatric disorders such as substance abuse, depression, personality disorder, and posttraumatic stress disorder

(PTSD) commonly develop among maltreated youth (Kearney et al., 2010, p. 48; Suliman et al., 2009).

Haitian children suffer serious injustices including child labor, abandonment, and maltreatment, which ultimately end in lost childhoods and long-lasting negative consequences. Although the misery of children subjected to the Restavèk situation in Haiti is recognized, programs geared toward mental health therapy of maltreated children are scarce. Research collaboration by several U.S. and Haitian non-governmental organizations found that various traumas during and after being in the Restavèk system negatively affect Restavèk children's mental health (Kennedy, 2012). A qualitative assessment of symptoms observed among Restavèk children revealed reports of sadness, bad memories, excessive negative thoughts, and feeling stressed due to fears related to former traumatization (Kennedy, 2012). Additionally, Restavèk children were reported to have unruly, violent behaviors (Kennedy, 2012). Although this cohort of children were not evaluated with standardized measures of PTSD, it is likely that these internalizing and externalizing behaviors are symptoms of trauma-related distress.

2.4 Posttraumatic Stress Disorder

Posttraumatic stress disorder (PTSD), as classified in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM), is an anxiety disorder characterized by development of re-experiencing, hyperarousal, and avoidance symptoms after,

...direct personal experience of an event that involves actual or threatened death or serious injury, or other threat to one's physical integrity; or witnessing an event that involves death, injury, or a threat to the physical integrity of another person; or learning about unexpected or violent death, serious harm, or threat of death or injury experienced by a family member or other close associate (Criterion A1) (American Psychiatric Association [APA], 1994, p. 424).

Traumatic events such as physical or sexual assault, being kidnapped, tortured, natural or humanitarian emergencies, serious vehicle accidents, or fatal illness are major instigators of posttraumatic stress symptom development within the first three months after the trauma (APA, 1994, p. 424).

2.4.1 DSM-IV Symptom Criteria of PTSD

In order to meet criteria for DSM-IV diagnosis of PTSD, an individual must experience and/or witness a traumatic event and respond to the event with “intense fear, helplessness, or horror” (Criterion A2) (APA, 1994, p. 424). This individual must experience the three genres of symptoms (Criteria B-D) that trigger significant distress and interfere with normal functioning (Criterion F) for more than one month (Criterion E) (APA, 1994, p. 424).³ The re-experiencing symptoms (Criterion B) involve horrifying

³ “...in children, the response must involve disorganized or agitated behavior” (APA, 1994, p. 424).

thoughts, nightmares, and flashbacks related to the traumatic event (APA, 1994, p. 424). The avoidance symptoms (Criterion C) of sustained guilt, depression, or anxiety and memory problems manifest into evasion of places, people, or things that remind him or her of the traumatic stressor (APA, 1994, pp. 424-425). The hyperarousal symptoms (Criterion D) include feeling irritated, fidgety, difficulty sleeping, and/or anger tantrums (APA, 1994, pp. 424-425; Kearney et al., 2010; Moroz, 2005).

2.4.2 Effects of Trauma

When confronted by a traumatic event, a combined physical, emotional, neurobiological, and cognitive response is activated to full capacity in order to avoid harm (Emerson & Hopper, 2011). During the course of a traumatic experience, the line dividing tolerable stress from toxic stress is crossed when a child experiences powerful, recurrent, and/or sustained activation of the body's survival stress-response systems (Shonkoff, Boyce, & McEwen, 2009). Neuroscientists suggest that a sufficiently overwhelming stressor may result in dysregulation of innate physiological and psychological response systems leading to a persistent fear response to trauma-related stimuli (Shonkoff et al., 2009). Effects of this dysregulation involve dissociation leading to learning difficulties and impairments in behavioral control, self-concept, and affect regulation (Cook et al., 2005).

Effects of trauma are held not only in the mind, but also somatically in the framework of the body (Saxe et al., 1994). When avoidance of trauma is impossible,

survivors report feeling betrayed by their bodies and tend towards self-blame and a negative self-image (Emerson & Hopper, 2011, p. 23). In order to dull physical and emotional pain associated with the trauma, survivors disconnect from their bodies by engaging in self-destructive behaviors such as substance abuse, risky sexual behaviors, and/or eating disorders (Emerson & Hopper, 2011, p. 5).

2.4.2.1 Risk Factors for PTSD

Although approximately half of the cases of PTSD recover within the first three months after trauma, many cases experience chronic symptoms beyond twelve months (APA, 1994, p. 426). The likelihood of an individual developing PTSD depends on the “severity, duration, and proximity” of exposure to the traumatic event (APA, 1994, p. 426; Kearney et al., 2010). Research by Suliman et al. (2009) reveal that exposure to multiple traumatic events increases the likelihood of experiencing more severe symptoms of PTSD and depression than does exposure to a single event alone. Additional risk factors include severe poverty, frequent maltreatment, extreme neglect, parental depression and substance abuse (Shonkoff et al., 2009). Evidence suggests that family history, childhood trauma, and pre-existing mental disorders may be risk factors as well (APA, 1994, pp. 426-427).

2.4.3 Incidence and Prevalence Rates of PTSD

2.4.3.1 Large-scale Disasters

High-magnitude traumatic events such as natural disasters involve numerous distressing factors such as loss of loved ones, displacement, injury, and near death experiences. Evidence suggests that exposure to multiple and ongoing stressors after a traumatic event increase the risk for development of PTSD related to the initial traumatizing event (Lloyd & Turner, 2003; Yehuda et al., 1995). Incidence rates of PTSD after natural disasters and other high-impact traumatic events vary due to diverse study procedures, populations, and settings in which the disaster occurred.

Numerous studies on the mental health outcomes of child/adolescent survivors of disasters in a variety of countries found that the incidence of PTSD ranges from 30 to 60% (Yule, 2001). A study by Yule et al. (2000) estimated that among the adolescent survivors (N = 200) evaluated after the 1988 Jupiter cruise shipwreck, 52% met criteria for PTSD when assessed during the study follow-up period (as cited in Yule, 2001, p. 186). A follow-up study revealed that 34% of participants still met criteria 5 to 8 years after the incident (Yule et al., 2000, p. 508).

According to the DSM-IV, prevalence rates within at-risk populations range from 3 to 58% (APA, 1994, p. 426). In China, Wang et al. (2012) reported a 28.4% prevalence rate of PTSD among Chinese adolescent students (N = 1,841) after the 8.0 magnitude Wenchuan earthquake in 2008 (p. 4). In Peru, a 25% prevalence rate of PTSD

was found among adult survivors (N = 298) assessed after the 8.0 Peru magnitude earthquake in 2007 (Cairo et al., 2010). In Haiti, results of a population-based survey of adult survivors (N = 1,323) of the 2010 Haiti earthquake found a high prevalence of PTSD (24.6%) and major depressive disorder (MDD) (28.3%) among this population (Cerdá et al., 2012). However, the prevalence of PTSD in Haitian children exposed to the earthquake was not assessed. These findings reveal that exposure to natural disasters contributes to development of PTSD among populations affected worldwide.

2.4.3.2 Violence and Maltreatment

The most common types of traumatic experiences associated with PTSD in children include sexual assault, physical abuse, and witnessed violence (Kilpatrick et al., 2003; Seedat, Nyamai, Njenga, Vythilingum, & Stein, 2004; Wasserman & McReynolds, 2011). A National Survey of Children's Exposure to Violence in the U.S. found that in a nationally representative sample of 4,549 children aged 0-17, more than half (60.6%) experienced or witnessed victimization in the past year (Finkelhor, Turner, Ormond, & Hamby, 2009). Results of a U.S. nationally representative study of PTSD among 4,023 adolescents ages 12–17, found a 6-month prevalence of 3.7% for boys and 6.3% for girls (Kilpatrick et al., 2003, p. 695).

Additionally, a study by Smith Fawzi et al. (2009) on the mental health of Haitian immigrant youth in the U.S. (15-24 years), found a significant level of depression (14.0%) and PTSD (11.6%), and co-morbid PTSD and depression (7.9%). Within this population,

10% had reported being physically or sexually abused (Smith Fawzi et al., 2009).

Furthermore, research by Seedat et al. (2004), on trauma exposure and PTSD among a sample of urban South African and Kenyan youth (14-22 years), found full-symptom PTSD prevalence rates of approximately 22% and 5%, respectively. Among this sample, witnessing community violence was the most frequently reported traumatic event (Seedat et al., 2004, p. 171). These studies demonstrate that youth populations exposed to violence and maltreatment commonly develop PTSD symptoms and may also suffer co-morbid symptoms of anxiety and depression (Agustini, Asniar, & Matsuo, 2011; Cluver & Orkin, 2009; Copeland, Keeler, Angold, & Costello, 2007; Kilpatrick et al., 2003; Seedat et al., 2004; Wang et al., 2012).

2.4.4 Effects of Posttraumatic Stress on Quality of Life

Traumatic stress is initiated at the point in which a victim is physically incapable of escaping the impending traumatic event. Failing to complete the fight or flight response results in sustained hyperarousal of the autonomic nervous system, which generates persistent feelings of hyperawareness or always being “on edge” (Emerson & Hopper, 2011; Tareen, Garralda, Hodes, 2007). Trauma survivors with posttraumatic stress symptoms struggle with stress response regulation, feeling safe within their own bodies, and dealing with additional life stressors (Emerson & Hopper, 2011).

Research shows that in an effort to function normally amidst the recurrent reminders of the painful memories of trauma, trauma survivors’ capacity to enjoy the

pleasures of life becomes diminished (van der Kolk, 2013). In order to dull the physical sensations of pain, horror, and discomfort associated with trauma, trauma survivors dissociate from their bodies, which also results in their incapacity to feel the positive physical sensations of joy, love, and pleasure (Emerson & Hopper, 2011; Saxe et al., 1994; van der Kolk, 2013). As a result, trauma survivors frequently show symptoms of depression, irregular breathing patterns, unhealthy eating habits, emotional regulation difficulties and sleep disturbances (Carei, Fyfe-Johnson, Breuner, & Brown, 2010; Germain, 2013; Herbert & Wetmore, 2014).

PTSD symptoms and common co-morbid conditions such as depression, anxiety, conduct disorders, and somatic symptoms affect youth by interfering with relationships, schoolwork, and completing routine tasks (Moroz, 2005; Saxe et al., 1994). Difficulty functioning in society is associated with an increased risk of substance-use disorders, depression, self-harm, and experiencing further traumatic events throughout adult life (Courtois, 2004; Felitti et al., 1998). The stigma of being abandoned combined with the stigma of mental illness, positions the OAC population at a high risk for experiencing a poor quality of life (Lund et al., 2011). In response to the substantial challenges that PTSD poses to youth development and functioning, interventions that promote the resilience of vulnerable children to the negative compounding effects of being an abandoned child are needed.

2.4.5 Treatment for PTSD

In the United States, standard treatments for children with trauma-related disorders include psychotropic medications and/or psychotherapy. However, the WHO advises against the use of antidepressants to manage PTSD in children and adolescents and instead suggests implementing “psychological treatment based on stress management” that can be easily administered by lay persons (WHO, 2013, p. 190). The alternative to psychotropic medications includes evidence-based psychotherapies such as cognitive behavioral therapy (CBT), dialectical behavioral therapy (DBT), trauma-focused cognitive behavioral therapy (TF-CBT), and eye movement desensitization and reprocessing (EMDR) (Forman-Hoffman et al., 2013).

Although evidence suggests effectiveness in reducing trauma-related psychopathology among children, these psychotherapies require administration by trained therapists and clinicians (Forman-Hoffman et al., 2013). The limited availability of professional mental health care, high costs associated with treatment services, and the stigma associated with seeking psychiatric help often prevent individuals from receiving treatment in LMICs (Forman-Hoffman et al., 2013; Lund et al., 2011). Additionally, since not all patients respond to traditional psychotherapy, alternative therapies that enhance both mental and physical wellbeing may be more acceptable to this population.

The trauma research community is increasingly recognizing the significant impact of somatic symptoms in determining the treatment outcomes for trauma-related

disorders (Emerson, Sharma, Chaudhry, & Turner, 2009; Emerson & Hopper, 2011). In 2012, the Institute of Medicine (IOM) declared the need for further research on the effectiveness of complementary and alternative medicine (CAM) mind-body approaches to treat PTSD (Institute of Medicine [IOM], 2012). One such mind-body therapy that has been steadily gaining popularity within the general public and also scientific community since the 1950's is the ancient practice of yoga (Quilty, Saper, Goldstein, & Khalsa, 2013).

2.5 Yoga

The revered 5000-year-old ancient Indian philosophy and practice of yoga has been renowned for its enhancement of mental, physical, and spiritual health through a combination of movement, meditation, and breathing techniques (Desikachar, 1995). The word 'yoga' comes from the Sanskrit root 'yug,' which takes on several meanings such as "to unite" or "to tie the strands of the mind together" indicating a focus on connection of body, mind, and spirit (Desikachar, 1995, p. 5). *Hatha* yoga, the most common form of yoga practiced in the U.S., is a three-component practice that strives to integrate physical poses (*asana*), meditation (*dhyana*), and breath (*pranayama*), in order to achieve an intimate union of body, mind, and spirit (Uebelacker et al., 2010).

The physical postures, meditation and breathing techniques are hypothesized to down-regulate the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic nervous system (SNS) to release stress (Brown & Gerbarg, 2009; Ross & Thomas, 2010). The physical poses enhance physical strength, flexibility, balance, and coordination; the

meditation component develops mindfulness skills, improvements in attention capacity, emotional regulation, and perception of stress; and the breath work component regulates the arousal systems of the brain (van der Kolk, 2013; Uebelacker et al., 2010; Ospina et al., 2008; Arch & Craske, 2006). In order to connect the mind and body to a shared experience of the present moment, yoga teaches practitioners to synchronize their conscious breath with physical movement, while remaining mindfully aware and nonreactive to physical sensations (Emerson & Hopper, 2011). In this way, yoga enables a transformation of reactions to and perceptions of stress and ultimately promotes resilience to stressors in everyday life.

Due to the immediate stress releasing and mood-boosting effects of yoga, interest in the practice has been steadily increasing in the U.S. According to a study conducted by the Harris Interactive Service Bureau in 2012, 20.4 million American adults practice yoga, indicating a 29% increase since 2008 (as cited in Yoga Journal, 2012). Additionally, a 2008 National Health Statistics Report reported that 6% of American children practice yoga (Barnes, Bloom, & Nahin, 2008). The adaptability of yoga to different age groups, varying physical capacities, and settings makes yoga a distinct practice from other methods of exercise. Evidence supporting the feasibility of yoga has resulted in increased availability of yoga classes for children and adolescents in U.S. schools and health centers (Khalsa, Hickey-Schultz, Cohen, Steiner, & Cope 2012; Spinazzola, Rhodes, Emerson, Earle, & Monroe, 2011).

2.5.1 Yoga Therapy

Research examining the health benefits of yoga reveals promising evidence-based support for employing yoga as a therapeutic approach to mental and physical health conditions. Thus far, research evidence supports the use of yoga to address PTSD, depression, chronic pain, dissociative disorders, attention-deficit hyperactivity disorders (ADHD), and emotional/behavioral regulation, which are difficult to target through mainstream therapies (Follette, Palm, & Pearson, 2006; Mitchell et al., 2014; Saper et al., 2013; van der Kolk, 2006).

2.5.1.1 Yoga for Individuals with PTSD

Mind-body CAM approaches such as yoga focus on first making a connection to one's physical being, and then integrating mental awareness of thoughts and emotions (Emerson & Hopper, 2011). Since PTSD involves both physiological and psychological symptoms, yoga has been employed as an alternative therapy to address trauma-related illness. Research has yet to rigorously evaluate the effect of yoga on the re-experiencing, hyperarousal, and avoidance symptoms criteria of PTSD; however, the mindfulness, breathing, and movement components of yoga have been hypothesized to target these symptoms through various pathways.

Since trauma survivors are known to avoid intrusive sensory experiences, mindfulness practice may be helpful in reducing avoidance symptoms of PTSD by emphasizing concentration on the present moment and awareness of sensations,

thoughts, and feelings without reaction or judgment (Emerson & Hopper, 2011; Follette et al., 2006). These mindfulness techniques may foster tolerance to unpleasant reminders of the traumatic event (Follette et al., 2006; Mitchell et al., 2014). Improved mindfulness may also increase self-acceptance and comprehension of reactions to stress, which is hypothesized to enhance emotional regulation abilities, thus reducing avoidance and re-experiencing symptoms of PTSD (Holzel et al., 2011; Mitchell et al., 2014).

Additionally, people suffering with PTSD experience a persistent stress response to trauma-related stimuli. In order to successfully recover from a traumatic experience, survivors must learn how to regulate their arousal region of the brain, the brainstem, which controls autonomic functions such as breathing, digestion, sleep, emotions, and attachment responses (van der Kolk, 2013). The breathing component of yoga may help to reduce the hyperarousal symptoms of PTSD through down-regulation of the HPA axis and the SNS (Ross & Thomas, 2010). Practicing breath awareness also helps to reconnect the yoga practitioner to the present moment, thus preventing cognitive dissociation (Emerson & Hopper, 2011, p. 41).

The physical postures of yoga increase strength and flexibility leading to boosts in self-esteem and self-confidence, which could lead to engagement in other healthy behaviors (Mitchell et al., 2014; Uebelacker et al., 2010). The attention to body posture and alignment help to center the yoga practitioner, thus encouraging interoception and management of somatic dissociation (Emerson & Hopper, 2011, pp. 41-45). Therefore,

yoga has the potential to enhance trauma survivors' physical and mental wellbeing that can lead to improved functioning in daily life.

Research on the effectiveness of yoga to reduce symptoms of PTSD among trauma survivors is growing. Yoga programs have been specifically tailored to address symptoms of PTSD affecting U.S. military veterans and populations resistant to standard treatment (Balasubramaniam, Telles, & Doraiswamy, 2013; Dusek & Benson, 2009; Libby, Reddy, Pilver, & Desai, 2012). A pilot study conducted by Staples, Hamilton, and Uddo (2013) evaluating the feasibility and effectiveness of a 6-week yoga program as an adjunctive therapy to alleviate PTSD among military veterans (N = 12) found evidence of improvements in hyperarousal symptoms and sleep quality. Additionally, a study by Mitchell et al. (2014) reported that a 12-session Kripalu-based yoga intervention resulted in reduced PTSD symptoms of hyperarousal and re-experiencing among the adult women (N = 38) in the U.S. with full or partial PTSD diagnoses. While there is promising evidence that yoga benefits adult trauma survivors' recovery, further research is needed on the effectiveness of yoga to increase resilience to stressors and to reduce trauma-related symptoms among vulnerable children.

2.5.1.2 Yoga for Child Development

Benefits of yoga on child development demonstrate the value of incorporating yoga as an adjunct therapy for children with autistic disorders and attention-deficit and disruptive behavior disorders (Haffner et al., 2006; Jensen & Kenny, 2004; Rosenblatt et

al., 2011). Jensen & Kenny (2004) conducted a study to evaluate the effect of yoga as an adjunct treatment to psychotropic therapy on symptoms of ADHD and behavioral problems among boys (N = 19) ages 8 to 13 years. Parents of ADHD-diagnosed children report that after 20-sessions of yoga, their children's homework compliance improved and the calming effects of breathing practice reduced behavior problems among the children (Jensen & Kenny, 2004). Furthermore, Manjunath and Telles (2004) found that after a 10-day "yoga camp" intervention, participants (N = 90) ages 11-16 years showed a significant increase of 43% in spatial memory scores.

Since evidence suggests that practicing yoga is advantageous for educational achievement, behavior regulation, and cognitive development, yoga is increasingly being incorporated into schools and residential care facilities to promote mental and physical health of youth (Hampel, Meier, & Kummel, 2007; Khalsa et al., 2012; Kraag, Zeegers, Kok, Hosman, & Abu-Saad, 2006; Spinazzola et al., 2011). Due to the limited materials and instruction required, yoga empowers practitioners to modify their practice according to specific needs and locales. Therefore, yoga has the potential to be an effective and feasible mental health intervention for a wide variety of populations and settings (Balasubramaniam, Telles, & Doraiswamy, 2013).

2.5.1.3 Yoga for Traumatized Youth

Although research has yet to confirm the effectiveness of yoga in the treatment of children/adolescents with PTSD, several studies support yoga as a complementary

therapy for a variety of anxiety-related disorders. Evidence demonstrates the effectiveness of yoga as an adjunct treatment in reducing symptoms of eating disorders in adolescents compared to standard care alone (Carei et al., 2010; McIver, O'Halloran, & McGartland, 2009). In a study on the effect of a yoga-based intervention for traumatized youth living in residential treatment facilities in the U.S., Spinazzola et al. (2011) found yoga to be both physically and mentally beneficial. The authors report,

...the potential for yoga to play an important role in helping shift chronically traumatized adolescents' relationship to their bodies from negligence, gross indulgence, numbing, or self-harm toward the capacity to feel safe in and accepting of their bodies, to increase tolerance and regulation of painful affect states and behavior impulses, and to begin to identify, cultivate, and positively appraise physical competencies (Spinazzola et al., 2011, p. 432).

Thus, evidence from prior research suggests that yoga may positively impact a range of symptoms affecting traumatized youth in a U.S. residential environment. However, research has yet to investigate the effectiveness of yoga on mental health problems affecting traumatized youth living in residential care in LMICs.

2.5.1.4 Yoga for Survivors of Large-scale Disasters

Due to the negative cycle between mental illness and poverty, youth living in LMICs are at a greater risk for mental illness when exposed to large-scale traumatic events such as natural and humanitarian disasters. Without adequate mental health care

coverage in LMICs, the demand for effective, sustainable, and feasible post-disaster programs in low resource environments has increased. In the past decade, an evidence base for the effect of yoga on posttraumatic stress among populations affected by disaster has emerged. A non-randomized study by Descilo et al. (2010) evaluated the effect of a yoga breath program versus a combined yoga breath program plus an exposure element on PTSD and depression in survivors of the South-East Asian tsunami in 2004. Results revealed greater reductions in PTSD symptoms among individuals in the yoga breath group and the combined yoga breath plus exposure group compared to the wait-list control group (Descilo et al., 2010).

Additionally, the Art of Living Foundation (AOLF) and the International Association for Human Values (IAHV) provided post-disaster stress-relief programs based on yoga breathing to child and adult survivors of the 9/11 World Trade Center terrorist attacks and Hurricane Katrina (Gerbarg & Brown, 2005). Retrospective reports of participants' experiences included increased energy, improved sleep and self-image, and decreased tension and aggressive behavior (Gerbarg & Brown, 2005). Research findings and participant feedback provide support for incorporating yoga breath-based interventions in post-disaster response programs to help survivors relieve psychological distress. Although numerous studies suggest positive outcomes of yoga among a variety of study populations, results cannot be generalized to other populations and contexts.

Therefore, further research is needed to investigate the efficacy of yoga in the prevention and treatment of mental illness among youth exposed to large-scale disasters.

2.5.1.5 Yoga for Trauma-burdened Children in Haiti

Due to the benefits of yoga for child development and self-regulation, survivors of mass disasters, and overall wellbeing, the practice of yoga may be an effective and feasible intervention for trauma-burdened youth in LMICs. Currently, no studies to date have investigated the effectiveness of yoga to reduce trauma-related symptoms among orphaned and abandoned children living in Haiti. Therefore, to our knowledge, this study is the first to provide quantitative data on the effect of yoga to reduce trauma-related symptoms and emotional and behavioral difficulties in addition to qualitative data on the acceptability and feasibility of yoga programs within children's homes in Haiti. Preliminary evidence of the feasibility, acceptability, and effectiveness of yoga to improve the mental health of trauma-burdened youth would add support for incorporation of yoga into programs focused on child wellbeing in low-resource settings.

3. Methods

3.1 Study Setting and Timeline

This study was conducted between June and November 2013 within the Ouest Department of Haiti. The research study sites are two orphanages for youth between the ages 1 and 20 years. Study sites were selected based on their care of Haitian children between ages 7 and 17 years and receipt of consent from the orphanage Director to conduct the study at their institution.

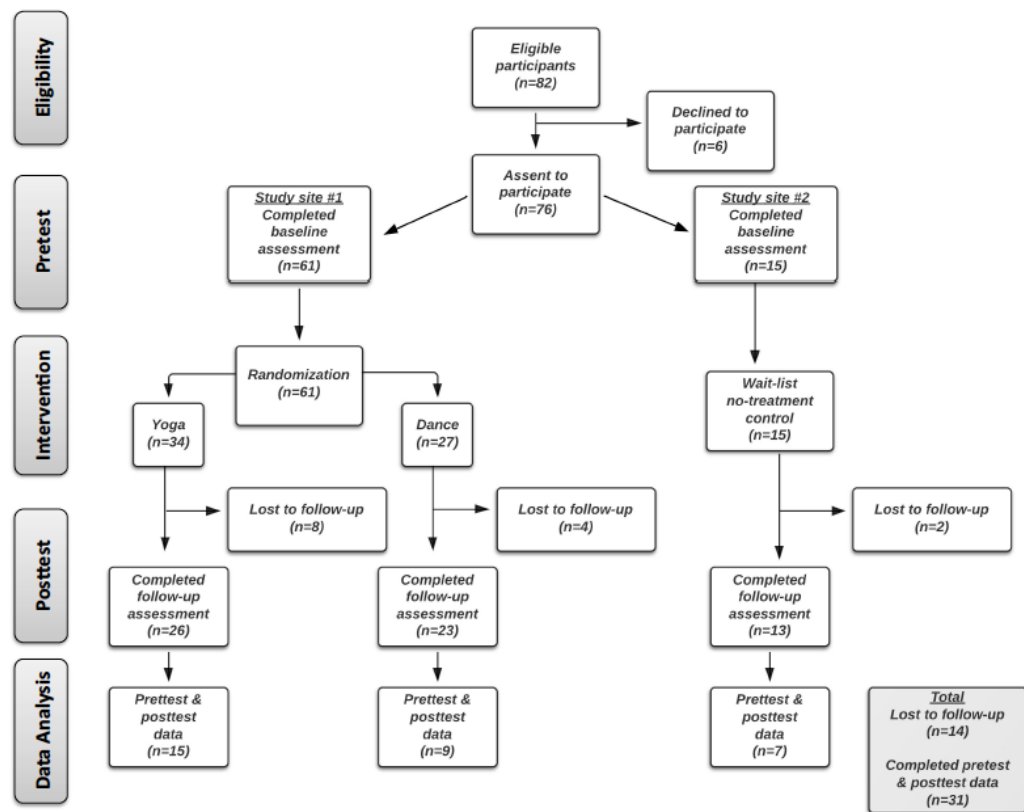


Figure 1: Participant Flow Diagram. Participants at Study Site 1 Were Randomized to Either Twice-Weekly Yoga or Aerobic Dance Classes for 8 Weeks. Participants at Study Site 2 Were Allocated to the No-treatment, Wait-list Control Group for 8 Weeks.

3.2 Study Preparation

A local Haitian Pastor facilitated initial introductions of the primary researcher to both orphanage Directors. Information about the study was presented in person to Directors of both orphanages in March 2013. The study was explained and examples of consent forms were provided to the Directors to reference components of the study protocol. Regular contact between the research team and the Directors were maintained in order to discuss logistics and timeline of the study protocol.

3.3 Selection of Study Participants

3.3.1 Eligibility Criteria

Study participants were selected from the two study sites based on the respective orphanage Director's consent for each eligible child to participate. Inclusion criteria were individuals between the ages of 7 and 17 years and official resident of either study site where the participant's legal guardian is the Director. Exclusion criteria excluded individuals with severe cognitive or physical disability and/or illness that could restrict ability to provide true assent for study participation and/or in the case that exercise would threaten his/her health. In advance of the consent process, caregivers were asked to identify children incapable of understanding and performing the study procedures. However, no children were identified as being at risk for study participation and thus all individuals who met inclusion criteria were offered the opportunity to participate.

3.3.2 Participant Selection

Before the study began, children were assembled by their caretakers and briefed on the study procedures and components by the research team. Both Directors consented for all individuals between the ages of 7 and 17 to participate in the study. A trained interviewer and native Haitian Creole speaker met with each child individually and explained the contents of the assent form. All individuals who assented to participate in this study agreed to complete assessments for trauma-related symptoms and emotional and behavioral difficulties before and after participation in 8 weeks of the activity to which they would be randomly assigned.

3.4 Study Design

This study design involves a case-control study in which participants at study site 1 were randomly assigned to a yoga intervention or aerobic dance intervention (active control) and study site 2 served as the no-treatment wait-list control group (Figure 1). Our research questions included: 1) what is the effect of an 8-week yoga program on trauma-related symptoms among children living in orphanages in Haiti compared to an 8-week aerobic dance program or no treatment at all for 8 weeks? 2) what is the effect of an 8-week yoga program on emotional and behavioral difficulties among children living in orphanages in Haiti compared to an 8-week aerobic dance program or no treatment at all for 8 weeks?; and 3) is yoga a feasible and acceptable

intervention for children living in orphanages in Haiti? The following hypotheses represent the foundation upon which our research proposal is based,

Primary hypothesis

- A greater reduction in trauma-related symptoms will result within children and adolescents randomized to the yoga group compared to control groups.

Secondary hypothesis

- A greater reduction in emotional and behavioral difficulties will result within children and adolescents randomized to the yoga group compared to control groups.

Tertiary hypothesis

- The yoga program proposed in this study is an acceptable and feasible therapy in the context of Haitian culture and orphanages in Haiti.

3.4.1 Measures

Trauma-related symptoms and emotional and behavioral difficulties were assessed pre- and post-intervention through use of the UCLA PTSD Reaction Index for DSM-IV and the Strengths and Difficulties Questionnaire (SDQ). The authors of these research instruments granted permission for use in this study.

3.4.1.1 UCLA PTSD-Reaction Index (children and adolescents - DSM IV (revision))

The UCLA PTSD Reaction Index (UCLA PTSD-RI) for DSM-IV is one of the most widely used instruments for the assessment of trauma exposure and posttraumatic stress symptoms among children and adolescents ages 7 to 17 years (Steinberg, Brymer, Decker, & Pynoos, 2004). The instrument has been frequently used among children/adolescents after exposure to natural disasters, political and community violence, and terrorist attacks (Fairbrother, Stuber, Galea, Fleischman, & Pfefferbaum, 2003; Goenjian et al., 2001; Koplewicz et al., 2002; Saltzman, Pynoos, Layne, Steinberg, & Aisenberg, 2001; Shaw & Harris, 2003). Due to the evolution of PTSD diagnostic criteria and expansion of global health research over the past three decades, the UCLA PTSD-RI has been submitted for multiple revisions, modifications, and translations for use in clinical assessments, trauma studies, and post-disaster programs worldwide (Danielson et al., 2012; Leenarts, Diehle, Doreleijers, Jansma, & Lindauer, 2012; Lyshak-Stelzer, Singer, Patricia, & Chemtob, 2007; Steinberg et al., 2004). Prior studies investigating the test-retest reliability of past versions revealed results ranging from good to excellent (Steinberg et al., 2004, p. 98). Psychometric studies on successive versions of the instrument estimate an average Cronbach's alpha of 0.90 (Steinberg et al., 2004).

In accordance with DSM-IV PTSD diagnostic criteria, the instrument involves three main sections. Part 1 is a brief lifetime trauma assessment, which includes thirteen 'yes/no' response questions to identify potentially traumatic events (PTE) (Criterion A1).

If an individual answers 'yes' to more than one PTE, then he/she is asked to select only one PTE that he/she considers most traumatic (Steinberg et al., 2004). Part 2 evaluates the presence or absence of A2 criteria (intense fear, helplessness, or horror) in response to the PTE declared most traumatic (Criterion A1) (Steinberg et al., 2004). Part 3 assesses the severity of trauma-related symptom frequency during the past month (Criteria B, C, and D). Severity of trauma-related symptom frequency is calculated based on a 5-point Likert scale ranging from 'none' (0) to 'most' (4). A frequency-rating sheet with calendar images accompanies part 3 (Steinberg et al., 2004).

The child and adolescent combined version used in this study contains all three parts explained above plus an additional clinician-administered lifetime trauma history profile supplement. However, this portion was not used in our study due to the absence of adults with sufficient information about the participants' trauma history.

Additionally, the frequency-rating sheet was replaced by images of water bottles containing distinct levels of water (Figure 2). This decision was made based on the premise that use of calendars is relatively uncommon among Haitian youth. The idea to use water glasses was inspired by Kohrt et al. (2011), which evaluated the benefits of this method in assisting Nepali children with responses to child PTSD symptoms scales. The English and Haitian Creole versions of the UCLA PTSD-RI used in this study are included in appendices A and B.



Figure 2: Response Set Water Bottle Illustration

A child's PTSD severity score¹ is calculated with the sum of his/her responses to 20 items on the frequency of trauma-related symptoms section (Part 3) of the UCLA PTSD-RI (Rodriguez, Steinberg, & Pynoos, 1999). In order to meet full PTSD criteria, a child must meet criteria A, B, C, and D, with a score of ≥ 38 . Whereas partial PTSD criteria is met when a child meets criterion A, and only two out of three of the symptom sub-categories. Research shows that the greatest sensitivity and specificity for detecting full PTSD related to a single traumatic event is attained when using the cut-off point ≥ 38 (Steinberg et al., 2004, p. 97). This instrument was chosen for this study due to its feasibility of use, psychometric properties, and history of use in numerous studies related to trauma exposure and PTSD among children and adolescents.

¹ Since diagnosis of PTSD was not an objective for this study, PTSD severity scores will be reported as trauma-related symptoms scores

3.4.1.2 Strengths and Difficulties Questionnaire (adolescent self-report version)

The Strengths and Difficulties Questionnaire (SDQ) is a 25-item behavioral screening instrument for potential psychopathology among children and adolescents ages 3 to 16 years (Goodman, 2001). Several studies have used the SDQ to identify mental health needs of children and adolescents across cultures, including OAC populations (Goodman, 2001; Whetten et al., 2011; Youth in Mind, 2009). Results of an evaluation of the psychometric properties of the SDQ by Goodman (2001), deemed the SDQ's reliability satisfactory in which the internal consistency was estimated by Cronbach's $\alpha = 0.73$. Validity was supported due to high correlations between SDQ scores above the 90th percentile and higher probabilities for diagnosed psychiatric disorders (Goodman, 2001).

The SDQ contains 5 subscales: emotional symptoms, conduct problems, hyperactivity, peer problems, and prosocial behavior. All scale scores except the prosocial behavior score sum to produce an overall outcome measure of emotional and behavioral difficulties (Goodman, 1997; Youth in Mind, 2009). Each score can be classified as normal, borderline, or abnormal based on defined thresholds. The SDQ is scored according to respondent's answers on a 3-point Likert scale in which the numeric value ranges from 0 to 2 (Youth in Mind, 2009). The answer, 'somewhat true' is always scored as 1, however the points associated with 'not true' and 'certainly true' change depending on the item. The score ranges from 0 to 10 points for each of the 5 scales

(Youth in Mind, 2009). The SDQ was chosen due to its simple language, prior use in Haiti, and ability to provide a general assessment of the emotional and behavioral strengths and difficulties within this population of Haitian children and adolescents. The translated Haitian Creole version of the SDQ was used in this study.

3.4.1.3 Yoga Experience Questionnaire

The post-intervention follow-up assessment included a brief 15-item questionnaire to assess yoga participants' perceptions of their experience in the yoga program. Our questionnaire was adapted from a survey used by Uebelacker et al. (2010) to assess the feasibility and acceptability of an 8-week open trial vinyasa yoga program for persistently depressed adults (Uebelacker et al., 2010, p. 254). Questions assessed the possible barriers to attending yoga classes, perceptions of yoga poses and class activities, and overall satisfaction with the program. Our study participants were asked to explain what they liked and disliked about the class and their teacher. Questions also investigated participants' perceptions of how yoga affected their behavior and wellbeing. English and Haitian Creole versions are located in appendices C and D.

3.5 Procedures

3.5.1 Research Arms

The period to complete the 8-week intervention and data collection extended from June to September 2013 (Figure 3). The additional two months from mid-

September to early November 2013 involved fulfilling the guarantee of providing the 8-week yoga and aerobic dance program to the wait-list control group.

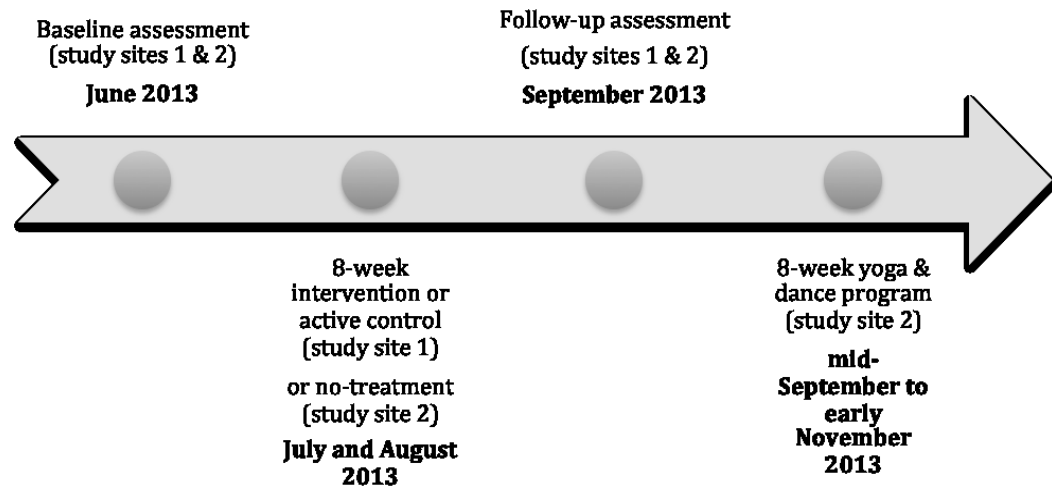


Figure 3: Study Protocol Timeline

The primary research site consisted of 4 intervention arms. The yoga intervention arm consisted of an 8-week yoga program involving two groups of 45-minute yoga classes twice per week. The dance active control arm consisted of an 8-week aerobic dance program involving two groups of 45-minute aerobic dance classes twice per week. Classes took place in a school classroom located at the primary research site. The wait-list control arm (study site 2) received no-treatment for 8 weeks.

Each intervention arm at the primary research site was divided into two groups based on age. Children ages 7-11 assigned to the yoga group attended yoga classes on Mondays and Wednesdays 8-8:45am and children ages 7-11 assigned to the aerobic

dance group attended aerobic dance classes on Mondays and Wednesdays 9-9:45am for a total of 8 weeks. Children/adolescents ages 12-17 assigned to the yoga group attended yoga classes on Tuesdays and Thursdays 8-8:45am and children/adolescents ages 12-17 assigned to the aerobic dance group attended aerobic dance classes on Tuesdays and Thursdays 9-9:45am for a total of 8 weeks.

3.5.2 Description of Interventions

3.5.2.1 Intervention: yoga

Children in the yoga intervention groups participated in 8-weeks of yoga classes led by the primary researcher. Hatha yoga was chosen as the foundation of our yoga program due to its suitability for beginners and preferred use with children and trauma survivors. The primary researcher created the yoga program curriculum and named the program, *Solèyoga*, in which *solèy* means sun in Haitian Creole. This name was created in order to represent the fact that the yoga program was purposefully created to be culturally relevant and sensitive to the needs and abilities of Haitian children living in orphanages. The program was developed while taking into consideration religious beliefs, sociocultural factors of personal space and interaction, physical ability, trauma-related pathology, time constraints, and peer relationships.

The overall aim of the Solèyoga program is to promote overall wellbeing and resilience of yoga participants. The specific objectives of the yoga program include: 1) reintegration of the mind and body processes through breath-movement

synchronization; 2) promotion of tranquility, peace, and resilience via utilization of breathing techniques; 3) improved mindfulness and self-awareness via utilization of meditative practices; and 4) promotion of trust and comfort through experiencing tranquil, relaxed states in the presence of peers. Additional goals included: improvements in body awareness, deep breathing, balance, posture, muscle strength, flexibility, and stress relief.

The components of the yoga program were guided by a kid's yoga teacher-training manual issued by Rainbow Kids Yoga, LLC (Yaffe, n.d.). Yoga classes were taught via use of the three main methodologies: the *Yoga Pretzels: 50 Fun Yoga Activities for Kids and Grownups* card deck (Guber, Kalish, & Fatus, 2005), which equipped children with visual step-by-step instructions on how to do yoga poses, demonstrations of poses by the yoga instructor, and verbal cues in Haitian Creole by the yoga instructor and an interpreter. A typical 45-minute session was centered on a specific theme and included 5 main components: 1) warm-up sequence of poses and breathing techniques; 2) sequence of approximately 10 yoga poses; 3) game or story involving yoga poses; 4) breathing techniques; and 5) meditation and/or silent relaxation (Appendix E). Themes included nature, kindness, resilience/stress management, non-violence, courage, trust, and friendship. Although a curriculum was planned beforehand, class routines varied based on the needs and abilities of individuals. Competition between participants was de-

emphasized and children were praised for doing their best. A mix of child/adolescent and culturally appropriate music was played throughout the class.

3.5.2.2 Active Control: aerobic dance

Children in the dance active control group participated in 8-weeks of Latin-inspired aerobic dance classes led by the primary researcher. Aerobic dance was selected as the comparison activity due to its known feasibility, cultural relevance, and acceptability in the context of Haitian children's homes. Classes were structured with 4 main components: 1) warm-up dance and stretches; 2) approximately 4-5 kid-friendly aerobic dance routines choreographed to various Latin music varieties; 3) dance-inspired game; and 4) cool-down routine consisting of a cool-down dance and stretching. A 10-minute break time was incorporated into each class session due to the extreme summer heat in Haiti. The dance choreography mostly consisted of mainstream kids aerobic dance routines mixed with Latin-infused dance rhythms such as basic merengue, reggaeton, cumbia, and salsa.

3.5.3 Randomization Schedule

The randomization schedule was prepared based on stratifications of age and sex. Randomization was conducted after the children completed eligibility and baseline assessments. Each eligible child was given a number and stratification was performed according to ages between 7-11 and 12-17 and then by sex. Randomization was conducted using an online random number generator that randomly allocated

participants at study site 1 to either the yoga group (intervention) or dance group (active control group) (Urbaniak & Plous, 2013). The allocation ratio between the intervention arm and active control arm was set to 1:1. The wait-list no-treatment control group was not involved in the randomization process and is therefore not a random sample. It was impossible to blind treatment allocation in this study; however, the research team was blinded to the baseline symptoms scores during the randomization procedures.

3.6 Data Collection

3.6.1 Baseline Data Collection

Data was obtained from the UCLA PTSD-RI for DSM-IV (child/adolescent combined version) and the SDQ (self-report version) at baseline. Information collected at baseline assessment included demographics, emotional and behavioral difficulties, trauma history, frequency of DSM-IV PTSD symptoms, and reactions to trauma. A trained interviewer verbally administered the UCLA PTSD-RI to youth between the ages of 7 and 17 years in their native language, Haitian Creole.

3.6.2 Follow-up Data Collection

Follow-up assessments were conducted after completion of 8-weeks of yoga classes, aerobic dance classes, or no-treatment. The same assessments were administered plus an additional survey to evaluate the experience of youth in the yoga intervention (Appendices C and D). Participants were reminded of their rights to assent to or deny participation in the follow-up interview. All participants received a certificate of

completion and a free t-shirt regardless of participation in the interviews. Attendance was recorded at each yoga and dance class throughout the program.

3.7 Analysis Plan

3.7.1 Study Conceptual Model

This study investigated the effect of an 8-week yoga program on symptoms of posttraumatic stress disorder (PTSD) and emotional and behavioral difficulties among children living in orphanages in Haiti. Based on prior research evidence of the factors associated with trauma-related symptoms in conjunction with the variables available, we proposed the causal diagram below (Figure 4). We planned to conduct our analysis of these variables while adjusting for covariates in order to reveal a true relationship between yoga and trauma-related symptoms in our study population.

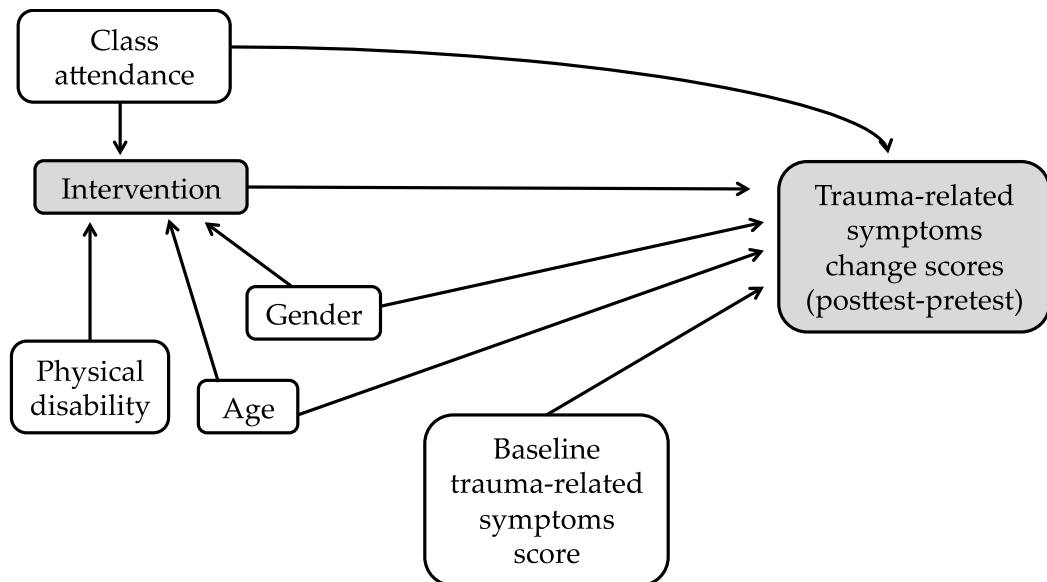


Figure 4: Study Conceptual Model

3.7.2 Hypothesis Testing

Due to previous research investigating mental health disorders among trauma-burdened children and adolescents, we assumed a significant prevalence of trauma-related symptoms among our study population. To test the primary hypothesis we calculated the change in trauma-related symptoms score (posttest – pretest) as the dependent variable and the variables listed in Table 1 as independent predictor variables. In the same way, we tested the secondary hypothesis by calculating the change in total difficulties score (posttest – pretest). We tested the tertiary hypothesis by analyzing feasibility and acceptability according to average class attendance and yoga participants' responses on the qualitative survey included with the posttest assessment.

Table 1: Proposed linear regression modeling equation, dependent variable and independent variables

$$Y = \beta_1 X_1 + \beta_2 X_2 + \dots \beta_n X_n + \varepsilon$$

| Variable | Description | Possible values |
|---|-------------|--|
| y_1 = trauma-related symptoms change score (posttest – pretest) | continuous | 0 to 80 |
| x_1 = class attendance (# attended) | continuous | 2 to 16 |
| x_2 = age | continuous | 7 to 16 |
| x_3 = gender | categorical | 0 = "male" 1 = "female" |
| x_4 = intervention group | categorical | 0 = "waitlist control" 1 = "active control" 2 = "yoga" |
| x_5 = baseline trauma-related symptoms score | continuous | 0 to 80 |

3.7.3 Definition of Key Analysis Variables

3.7.3.1 Outcome Variables

The primary outcome measure is the change in trauma-related symptoms scores (posttest – pretest). The secondary outcome measure is the change in total difficulties

score (posttest – pretest). Both are continuous variables measured at pretest (baseline) and posttest (follow-up).

3.7.3.2 Independent variables

We included the independent variables listed in table 1 such as, intervention group (0 = wait-list control, 1 = active control, 2 = yoga), into our linear regression models.

3.7.4 Sample Size Calculation

Due to the limited number of children at each study site, we relied on convenience sampling; thus, sample size was not calculated beforehand.

3.7.5 Statistical Methods

Statistical analyses were conducted using STATA version 13.1 (StataCorp, 2013). Descriptive statistics such as mean \pm SD were calculated for baseline and follow-up characteristics. For the primary analysis of trauma-related symptoms and total difficulties scores, we calculated change scores by subtracting posttest (follow-up) scores from pretest (baseline) scores.

Pearson chi-square, Fisher's exact tests, and one-way analysis of variance (ANOVA) followed by independent post-hoc Sidak t-tests were conducted to investigate baseline mean differences between the yoga intervention and control groups. Pearson chi-square analyses and Fisher's exact tests were used to analyze categorical data. One-way ANOVAs followed by post-hoc Sidak t-tests were carried out for continuous

variables. ANOVA was used to determine whether significant differences exist between the means of three or more independent groups and the post-hoc Sidak t-tests were used to identify the location of between-group mean differences. We conducted univariable and multivariable linear regression analyses to determine the significant predictors of variation in outcome variables. The variables shown to be possible confounders were included in the final adjusted model. Levels of significance were reported at $p < .05$.

3.8 Ethical Concerns

This study protocol was approved by the Duke University Institutional Review Board. Since the Directors of each study site are the legal guardians of all children in residence, they were presented with consent forms in Haitian Creole, in order to provide official permission for the children under their care to participate in the study. After the Directors provided consent, a trained interviewer and local native Haitian Creole speaker, interviewed each eligible child in a confidential location at the children's home to discuss the terms of the study. The trained interviewer explained the assent form in Haitian Creole. Verbal assent and signature were provided by each child. Only 6 out of 67 eligible children at study site 1 declined to participate in the assessment portion of the study. However, they were offered opportunity to participate in the exercise portion of the study and allocated to either the yoga or dance group. These children were treated equally with children who completed the baseline assessment.

Identifying information such as age, gender, and residential location of participants were collected on paper-based questionnaires. Names were only recorded on consent and assent forms and not on the paper-based questionnaires. No Haitian national identification numbers were collected. A unique ID number was written on each child's questionnaire, which was used as the child's identifier for all data logging and analysis. A record connecting unique ID numbers with participant names were filed along with the questionnaires in a secure safe in Haiti.

As the questionnaires were completed, they were recorded into Microsoft Excel on a password-protected laptop computer. The online encrypted file management system, Box.net, was used to store all confidential documents containing data related to the study. No one besides the primary investigator was granted access to this information. This process ensured participant confidentiality as guaranteed in the consent and assent forms. Participant data was kept confidential except when it was deemed necessary to protect the child. Children presenting with mental or physical health concerns were referred to the nurse on staff at their respective institution and/or to a health care provider at a nearby health center.

No more than minimal risk is expected for this study protocol; however, children and adolescents may experience distress from answering questions about their trauma history. Before the study began, the interviewer was trained to recognize common signs of distress known to occur among youth when discussing sensitive topics such as

experiencing maltreatment and witnessing death. The interviewer reassured the child/adolescent that he or she could stop answering questions at any time and for any reason. Children who were ineligible to participate in this program continued to participate in the normal activities arranged by caregivers at their institution.

Since yoga involves physical activity, it is possible to hurt oneself by not being careful and pushing too hard. Children were encouraged to declare immediately if any of the yoga exercises cause discomfort or pain and instructed to suspend the particular exercise. Modifications for yoga poses were offered in order to accommodate varying physical capabilities.

After follow-up questionnaires were completed, all children were provided with the opportunity to learn the alternative activity. Additionally, after completion of follow-up assessments, the wait-list control group received 8-weeks of yoga and aerobic dance classes. All materials used for the yoga and dance classes including music CDs and yoga mats were donated to each study site to continue the program. Caregivers at both study sites participated in several yoga and dance classes in order to observe and learn how to use the materials appropriately. The primary researcher, Kathryn Culver, is a Yoga Alliance Registered Yoga Teacher (RYT-200), certified Rainbow Kids Yoga™ instructor, and former licensed Zumba Gold® and Zumbatomic® dance instructor.

4. Results

4.1 Baseline Characteristics

A total of 82 youth were deemed eligible for participation in this study, of which 76 assented to participate. Sixty-one children (80%) from study site 1 were randomly assigned to either yoga or aerobic dance classes for 8 weeks. Fifteen children (20%) from study site 2 were allocated to the wait-list control group for 8 weeks. After completion of follow-up assessments, a total of 62 participants (82%) from study sites 1 and 2 had provided complete SDQ pretest and posttest questionnaires (53% male, 47% female). However, only 31 (41%) participants had provided complete pretest and posttest UCLA PTSD-RI questionnaires (58% male, 42% female). 14 participants were lost to follow-up due to reasons such as being transferred to another children's home or being reunited with their families (Figure 1).

The average age of all participants (N = 76) at baseline was 11.23 (SD = 2.15) with a range of 7 to 16 years of age. The average age of all participants completing at least both pretest and posttest SDQ questionnaires (N = 62) was 11.10 years (SD = 2.12). The average age of all participants completing both pretest and posttest UCLA PTSD-RI questionnaires (N = 31) was 10.90 years (SD = 1.99) (data not shown). The total study population (N = 76) consisted of 33% abandoned children, 22% single orphaned children, and 12% double orphaned children. However, 33% of children did not know if one or both parents were alive. Baseline characteristics of participants (N = 76) in each

treatment condition are shown in table 2. Analysis of total difficulties and categorical sub-scale scores were restricted to ages 11-17 years (N = 36) (Table 3). Trauma-related symptoms were not restricted by age (N = 39) (Table 3).

Table 2: Baseline Characteristics of Study Population (N = 76) at Randomization

| Characteristics | Yoga | | Dance control | | Wait-list control | |
|-----------------|-------|------|---------------|------|-------------------|------|
| | n | % | n | % | n | % |
| Gender | | | | | | |
| Female | 17 | 50 | 11 | 41 | 4 | 27 |
| Male | 17 | 50 | 16 | 59 | 11 | 73 |
| OAC | | | | | | |
| Abandoned child | 6 | 18 | 11 | 41 | 8 | 53 |
| Single orphan | 11 | 32 | 2 | 7 | 4 | 27 |
| Double orphan | 5 | 15 | 4 | 15 | 0 | 0 |
| | Mean | SD | Mean | SD | Mean | SD |
| Age (years) | 11.21 | 2.35 | 11.22 | 1.69 | 10.93 | 2.55 |

Note. OAC: Orphaned and abandoned children

Table 3: Baseline Characteristics of Study Population According to UCLA PTSD-RI and SDQ Questionnaire Completion at Randomization

| Characteristics | Yoga | | Dance control | | Wait-list control | |
|---------------------------------------|-------|------|---------------|------|-------------------|------|
| | Mean | SD | Mean | SD | Mean | SD |
| Trauma-related symptoms (N = 39) | 28.60 | 9.36 | 22.60 | 6.98 | 18.11 | 4.34 |
| SDQ total difficulties score (N = 36) | 13.38 | 3.50 | 14.50 | 4.07 | 17.50 | 5.61 |
| Emotional symptoms | 5.13 | 2.63 | 5.43 | 2.38 | 5.17 | 2.71 |
| Conduct problems | 1.56 | 1.82 | 2.57 | 1.95 | 4.00 | 1.10 |
| Hyperactivity | 2.56 | 1.41 | 3.14 | 1.70 | 4.50 | 1.22 |
| Peer Problems | 4.00 | 2.16 | 3.29 | 2.27 | 3.83 | 2.48 |
| Prosocial behavior | 9.00 | 2.07 | 9.57 | 0.51 | 9.83 | 0.41 |

Note. SDQ: Strengths and Difficulties Questionnaire

Table 4 describes the frequency of reported potentially traumatic events (PTEs) at baseline. Approximately 43% of children (N = 46) reported experiencing more than one traumatic event in their lifetime. The average number of potentially traumatic events

reported at baseline was 2.52 (SD = 1.59) with a range of 1 to 7. The top three most frequent PTEs reported by children (N = 46) at baseline were the recent earthquake in 2010 (93%), being in a place where war was going on (33%), and seeing someone get beaten up, shot at or killed (28%) (Table 4). The top two PTEs most frequently reported as being most traumatic were the earthquake in 2010 (53%) and seeing someone get beaten up, shot at or killed (8%) (N = 38) (data not shown).

Table 4: Frequency of Potentially Traumatic Events Reported at Baseline

| Potentially traumatic events | Percentage of youth reporting | |
|---|-------------------------------|----|
| | n | % |
| Being in a disaster, like an earthquake, wildfire, hurricane, tornado or flood. | 43 | 93 |
| Being in a bad accident, like a serious car accident or fall. | 2 | 4 |
| Being in place where a war was going on around you. | 15 | 33 |
| Being hit, punched, or kicked very hard at home. | 11 | 24 |
| Seeing a family member being hit, punched or kicked very hard at home. | 3 | 7 |
| Being beaten up, shot at or threatened to be hurt badly in your school, neighborhood or town. | 2 | 4 |
| Seeing someone in your neighborhood or town beaten up, shot at or killed. | 13 | 28 |
| Seeing a dead body in your neighborhood or town (not including funerals). | 11 | 24 |
| Having an adult or someone much older touch your private sexual body parts when you did not want them to. | 1 | 2 |
| Hearing about the violent death or serious injury of a loved one. | 10 | 22 |
| Having painful and scary medical treatment in a hospital when you were very sick or badly injured. | 4 | 9 |
| Forced to have sex with someone against your will. | 0 | 0 |
| Other | 1 | 2 |

Note. Based on 46 child self-reports.

Table 5 describes results of our Pearson chi-square and Fisher's exact test analyses revealing baseline differences across yoga and control groups. Across the three treatment conditions, there were no significant differences in age ($X^2(2, N = 62) = 0.40, p = .82$) or gender ($p = .28$). Importantly, there were no significant differences in meeting criteria for partial PTSD ($p = .71$) or full PTSD ($p = .67$) between groups at baseline.

However, significant differences were found between groups for OAC status ($p = .02$) and baseline total difficulties symptom categories ($p = .03$) (Table 5).

Table 5: Group Differences at Baseline

| Variable | Intervention arm | | | | | | Total | | p-value |
|---------------------------------------|------------------|----|----------------|----|-------------------|-----|-------|----|---------|
| | Yoga | | Active control | | Wait-list control | | | | |
| | # | % | # | % | # | % | # | % | |
| Age (years) | | | | | | | | | |
| 7 to 11 | 17 | 65 | 13 | 57 | 8 | 62 | 38 | 61 | 0.817 |
| 12 to 16 | 9 | 35 | 10 | 43 | 5 | 38 | 24 | 39 | |
| Total | 26 | | 23 | | 13 | | 62 | | |
| Gender | | | | | | | | | |
| Male | 11 | 42 | 13 | 57 | 9 | 69 | 33 | 53 | 0.277 |
| Female | 15 | 58 | 10 | 43 | 4 | 31 | 29 | 47 | |
| Total | 26 | | 23 | | 13 | | 62 | | |
| OAC | | | | | | | | | |
| Abandoned child | 6 | 27 | 11 | 65 | 8 | 67 | 25 | 49 | 0.020* |
| Single orphan | 11 | 50 | 2 | 12 | 4 | 33 | 17 | 33 | |
| Double orphan | 5 | 23 | 4 | 24 | 0 | 0 | 9 | 18 | |
| Total | 22 | | 17 | | 12 | | 51 | | |
| Baseline partial PTSD | | | | | | | | | |
| No | 8 | 53 | 6 | 67 | 5 | 71 | 19 | 61 | 0.708 |
| Yes | 7 | 47 | 3 | 33 | 2 | 29 | 12 | 39 | |
| Total | 15 | | 9 | | 7 | | 31 | | |
| Baseline full PTSD | | | | | | | | | |
| No: <38 | 14 | 93 | 8 | 89 | 7 | 100 | 29 | 94 | 1.000 |
| Yes: >38 | 1 | 7 | 1 | 11 | 0 | 0 | 2 | 6 | |
| Total | 15 | | 9 | | 7 | | 31 | | |
| Baseline SDQ total difficulties score | | | | | | | | | |
| Normal | 12 | 75 | 8 | 57 | 3 | 50 | 23 | 64 | 0.032* |
| Borderline | 4 | 25 | 5 | 36 | 0 | 0 | 9 | 25 | |
| Abnormal | 0 | 6 | 1 | 7 | 3 | 50 | 4 | 11 | |
| Total | 16 | | 14 | | 6 | | 36 | | |

Note. OAC: Orphaned and abandoned children; PTSD: Posttraumatic stress disorder; SDQ: Strengths and Difficulties Questionnaire; * $p < .05$. ** $p < .01$.

4.1.1 Baseline PTSD Severity Scores

The average trauma-related symptoms score for participants at baseline ($N = 39$) was 24.6 ($SD = 8.86$) with scores ranging from 0 to 80. Approximately 39% of participants had a possible partial PTSD diagnosis at baseline according to DSM-IV PTSD diagnostic criteria requiring at least one re-experiencing symptom (Criterion B), three avoidance

symptoms (Criterion C), and two hyperarousal symptoms (Criterion D) in which item scores of 3 and above indicated symptom presence (Steinberg et al., 2004). Using a cutoff score of ≥ 38 , 10% of participants met criteria for possible full diagnosis of PTSD.

4.1.2 Baseline Emotional and Behavioral Difficulties Scores

The average SDQ total difficulties score for participants (ages 11-17) (N = 36) at baseline was 14.5 (SD = 4.25) with scores ranging from 0 to 25. We used the defined SDQ symptom classification ranges to categorize the SDQ total difficulties and sub-category scores into normal, borderline, and abnormal.¹ At baseline, approximately 11% met criteria for abnormal total difficulties, 25% abnormal emotional symptoms, 11% abnormal conduct problems, 0% abnormal hyperactivity, 28% abnormal peer problems, and 6% abnormal prosocial behavior (data not shown in table).

4.2 Group Differences in Trauma-related Symptoms

Table 6 describes the results of the ANOVA and Sidak post-hoc analyses. There was a statistically significant difference between yoga and comparison groups for baseline trauma-related symptoms scores ($p = .01$). However, there were no statistically significant differences between groups for trauma-related symptoms scores ($p = .19$) at follow-up.

¹ Based on norms published with the SDQ tool, which may or may not be applicable to this population.

Results show that over time (from baseline to follow-up) all three groups experienced a reduction in the frequency of trauma-related symptoms as measured by the UCLA PTSD-RI. The post-hoc model p-value of .05 indicates statistical significance between groups for the trauma-related symptoms change scores (posttest-pretest) ($F(2,28) = 3.30, p = .05$) (Table 6). Within this model, there was a statistically significant effect of treatment on trauma-related symptoms as shown by a greater reduction in trauma-related symptoms change scores for the yoga group compared to the waitlist control group ($p = .05$).

4.3 Group Differences in Emotional and Behavioral Difficulties

Table 6 reveals considerable variation in the effects of treatment on total difficulties, yet there were no statistically significant differences found among the total difficulties scores between groups at baseline ($p = .13$) or follow-up ($p = .06$). Results show that from baseline to follow-up, total difficulties scores increased among the yoga and wait-list control groups. However, the dance group showed a slight decrease in scores. Ultimately, there were no significant differences observed between groups for the total difficulties change scores ($F(2,33) = 2.65, p = .09$) (Table 6).

Table 6: Differences in Mean Trauma-related Symptoms and Total Difficulties Scores at Baseline, Follow-up, and Posttest-pretest Across Intervention Groups

| Outcome measure | Group | Pretest (Baseline) | | | | Group | Posttest (Follow-up) | | | | Group | Posttest-Pretest | | | |
|-------------------------------|---------------------|--------------------|-------|-------------------|------------------|---------------------|----------------------|-------|------------------|------------------|---------------------|------------------|-------|------------------|------------------|
| | | N | Mean | SD | post-hoc p-value | | N | Mean | SD | post-hoc p-value | | N | Mean | SD | post-hoc p-value |
| Trauma-related symptoms score | Yoga | 15 | 28.60 | 8.48 | | Yoga | 15 | 18.93 | 7.81 | | Yoga | 15 | -9.67 | 6.87 | |
| | Dance control | 9 | 21.78 | 6.87 | | Dance control | 9 | 14.33 | 7.02 | | Dance control | 9 | -7.44 | 4.30 | |
| | WL control | 7 | 18.14 | 4.45 | | WL control | 7 | 16.71 | 8.64 | | WL control | 7 | -1.43 | 9.74 | |
| | Difference (Y-DC) | | 6.82 | 1.61 | 0.169 | Difference (Y-DC) | | 4.60 | 0.79 | 0.535 | Difference (Y-DC) | | -2.22 | 2.57 | 0.842 |
| | Difference (Y-WLC) | | 10.46 | 4.02 | *0.007 | Difference (Y-WLC) | | 2.22 | -0.83 | 0.237 | Difference (Y-WLC) | | -8.24 | -2.87 | *0.047 |
| | Difference (DC-WLC) | | 3.63 | 2.42 | 0.534 | Difference (DC-WLC) | | -2.38 | -1.62 | 0.867 | Difference (DC-WLC) | | -6.02 | -5.44 | 0.271 |
| | | | | *Model (Prob > F) | 0.006 | | | | Model (Prob > F) | 0.193 | | | | Model (Prob > F) | 0.052 |
| SDQ total difficulties score | Yoga | 16 | 13.38 | 3.50 | | Yoga | 16 | 16.63 | 5.19 | | Yoga | 16 | 3.25 | 4.42 | |
| | Dance control | 14 | 14.50 | 4.07 | | Dance control | 14 | 13.93 | 3.97 | | Dance control | 14 | -0.57 | 3.96 | |
| | WL control | 6 | 17.50 | 5.61 | | WL control | 6 | 19.67 | 5.85 | | WL control | 6 | 2.17 | 6.27 | |
| | Difference (Y-DC) | | -1.13 | -0.57 | 0.842 | Difference (Y-DC) | | 2.70 | 1.22 | 0.362 | Difference (Y-DC) | | 3.82 | 0.46 | 0.085 |
| | Difference (Y-WLC) | | -4.13 | -2.11 | 0.125 | Difference (Y-WLC) | | -3.04 | -0.67 | 0.489 | Difference (Y-WLC) | | 1.08 | -1.85 | 0.947 |
| | Difference (DC-WLC) | | -3.00 | -1.54 | 0.373 | Difference (DC-WLC) | | -5.74 | -1.88 | 0.062 | Difference (DC-WLC) | | -2.74 | -2.32 | 0.543 |
| | | | | Model (Prob > F) | 0.127 | | | | Model (Prob > F) | 0.058 | | | | Model (Prob > F) | 0.085 |

Note. SDQ: Strengths and Difficulties Questionnaire; *p < .05. **p < .01.

4.4 Univariable and Multivariable Linear Regression Analyses

Table 7 presents the variables identified as independent predictors of the trauma-related symptoms change scores (posttest-pretest). Univariable linear regression analyses indicated that the yoga intervention and baseline trauma-related symptoms scores significantly predicted the trauma-related symptoms change scores ($p < .05$) (Table 7). The variables included in the final multivariable linear regression model are shown in table 8. Results of the final multivariable linear regression model reveal that the baseline trauma-related symptoms score ($\beta = -0.40, p = .03$) was the only significant predictor of the trauma-related symptoms change scores (Table 8).

Table 7: Summary of Independent Predictors of the Change in Trauma-Related Symptoms (N = 31)

| Predictor variables | β | SE | p-value | Adjusted R ² |
|-------------------------|---------|------|---------|-------------------------|
| Intervention group | | | | 0.13 |
| Yoga | -8.24 | 3.21 | 0.016* | |
| Dance control | -6.02 | 3.54 | 0.100 | |
| Wait-list control | -1.43 | 2.65 | 0.594 | |
| Trauma-related symptoms | -0.47 | 0.14 | 0.002** | 0.25 |
| Class attendance | 0.94 | 0.53 | 0.088 | 0.09 |
| Age | 0.89 | 0.68 | 0.204 | 0.02 |
| Gender | -0.38 | 2.79 | 0.891 | -0.03 |

Note. * $p < .05$. ** $p < .01$.

Table 8: Final Multivariable Regression Model Assessing Predictor Variables of the Change in Trauma-Related Symptoms (N = 31)

| Predictor variables | Adjusted R ² | β | SE | p-value | 95% CI |
|-------------------------|-------------------------|---------|------|---------|---------------|
| Final model | 0.25 | | | | |
| Intervention group | | | | | |
| Yoga | | -3.84 | 3.44 | 0.329 | -11.83; 4.16 |
| Dance control | | -4.84 | 3.28 | 0.166 | -11.86; 2.17 |
| Wait-list control | | -3.45 | 7.52 | 0.668 | -19.30; 12.40 |
| Trauma-related symptoms | | -0.41 | 0.17 | 0.02* | -0.76; -0.04 |
| Age | | 0.84 | 0.60 | 0.175 | -0.43; 2.09 |
| Gender | | 0.67 | 2.65 | 0.803 | -4.79; 6.12 |

Note. *p < .05. **p < .01.

Table 9 presents the variables identified as independent predictors of the total difficulties change scores (posttest-pretest). Univariable linear regression analyses revealed that the baseline total difficulties score was the only significant predictor of the total difficulties change scores ($p < .05$) (Table 9). The variables included in the final multivariable linear regression model are shown in table 10. Results of the final multivariable linear regression model indicated that the total difficulties score ($\beta = -0.43$, $p = .03$) was the only significant predictor of total difficulties change scores (Table 10).

Table 9: Summary of Independent Predictors of the Change in Total Difficulties Scores (N = 36)

| Predictor variables | β | SE | p-value | Adjusted R ² |
|------------------------------|---------|------|---------|-------------------------|
| Intervention group | | | | 0.09 |
| Yoga | 1.08 | 2.19 | 0.625 | |
| Dance control | -2.74 | 2.24 | 0.230 | |
| Wait-list control | 2.17 | 1.87 | 0.255 | |
| SDQ total difficulties score | -0.40 | 0.18 | 0.032* | 0.10 |
| Class attendance | 0.21 | 0.32 | 0.519 | -0.02 |
| Age | -0.12 | 0.55 | 0.825 | -0.03 |
| Gender | -0.57 | 1.62 | 0.729 | -0.03 |

Note. SDQ: Strengths and Difficulties Questionnaire; *p < .05. **p < .01.

Table 10: Final Multivariable Regression Models Assessing Predictor Variables of the Change in Total Difficulties Scores (N = 36)

| Predictor variables | Adjusted R ² | β | SE | p-value | 95% CI |
|------------------------------|-------------------------|-------|------|---------|--------------|
| Final model | 0.15 | | | | |
| Intervention group | | | | | |
| Yoga | | -0.20 | 2.36 | 0.933 | -5.03; 4.63 |
| Dance control | | -3.63 | 2.30 | 0.125 | -8.34; 1.07 |
| Wait-list control | | 11.00 | 7.02 | 0.128 | -3.34; 25.34 |
| SDQ total difficulties score | | -0.43 | 0.19 | 0.033* | -0.82; -0.04 |
| Age | | -0.10 | 0.52 | 0.855 | -1.16; 0.96 |
| Gender | | -1.00 | 1.57 | 0.530 | -4.22; 2.22 |

Note. SDQ: Strengths and Difficulties Questionnaire; *p < .05. **p < .01.

4.5 Feasibility and Acceptability of Yoga

Altogether, participants in the yoga and dance groups attended an average of 14.47 (SD = 2.39) out of 16 total classes. The average number of yoga classes attended was 14.65 (SD = 2.17). The average number of dance classes attended was 14.26 (SD = 2.65). Reasons for missing classes included: responsibilities in the kitchen, sickness, and indifference (“I just didn’t go” (male, age 16)).

4.5.1 General Perceptions of Yoga Program

The yoga experience questionnaire yielded the following information on participant’s perspectives of their experience in the yoga program. When asked if they liked yoga and why or why not, all children responded, “Yes.” Responses included, “I loved yoga because it helps me develop my muscles” (female, age 16), “I loved yoga because we learn stuff that can protect us” (female, age 11), “I loved yoga because it is a kind of sport” (male, age 10), and “I loved yoga because I was able to relax my body and

do exercises” (male, age 10). When asked what they liked about the class, most responded: 1) everything 2) the poses; or 3) meditation. When asked what they liked or disliked about the yoga teacher, the majority children of children declared, “I loved everything that she did.”

4.5.2 Favorite and Least Favorite Yoga Poses

Their favorite yoga poses included: baby pose, snake pose, sun pose, and car pose, tree pose, warrior II, warrior III, and frog pose. Some children described their preference for certain poses in comments such as, “happy baby pose because I love to see when babies are happy” (female, age 16), “tree pose because I feel like I am a tree when I’m doing it” (male, age 12), and “warrior III because when you do it you’re concentrated” (male, age 13). Three children reported enjoying certain poses to relieve muscle tension and pain saying, “frog pose because it used to stretch my feet” (male, age 10), “rock pose because my lower back stretched and it doesn’t hurt anymore” (male, age 12), and “baby pose because it helps me stretch my back” (female, age 8).

The majority of respondents reported that they loved all the poses; however, two children reported they did not like mountain pose, one child did not like baby pose, and another did not like dog pose. Reasons for disliking a yoga pose included feeling physical discomfort during the activity. For example, one child reported, “I don’t like the mountain pose because my belly hurts when I do it” (female, age 11).

4.5.3 Structure of Yoga Class

In response to whether kids liked slow or fast-paced classes better, the majority (69%) of children preferred slower-paced classes. Reasons for liking the slower paced classes included, "I liked it slowly because I learned more" (female, age 13), "I love the class when it goes slowly because I learned a lot of exercises" (male, age 10), "I liked it slowly so that I can learn the poses really well" (male, age 12), "I like the slow class because we took a break" (male, age 8), and "I liked it when it was slow because we have time to do the poses better" (female, age 8). Children reported their reasons for liking the faster-paced classes better saying, "I loved when it's fast because we feel hot and sweaty" (female, age 16) and "I like when it's fast because we're done fast" (female, age 12). When asked the question what a good yoga class would emphasize: poses, meditation or both components equally, a large majority of respondents (88%) answered both components equally.

In response to the question, "If you were designing yoga classes, what would you make sure to include (e.g., specific postures, games, meditative techniques, etc.)?" Forty-two percent of respondents selected poses and 39% selected meditation. Other responses included games and everything. When asked what they would not include in the yoga classes, 65% of children stated that they would not put games in the class. This answer closely resembled answers to the next question of what would they change about the class in which 77% of children reported that they would change the games.

4.5.4 Effect of Yoga on Wellbeing

All children affirmed that their involvement in yoga changed their feelings of wellbeing. When asked if yoga helped regulate their mood, children commonly answered feeling calmer, less angry, and less stressed. Responses included, “Yes, it helps me to be calmed down. When I’m angry I breathe” (female, age 16), “Yes, it helps me to stretch my body when I hurt myself” (female, age 12), “Yes, it helped me because when I’m stressed out I do some poses and I feel good” (male, age 10), “Yes, when I’m cold yoga helps me to get warm” (male, age 13), “Yes, it helps me to respect my friends” (female, age 13), and “Yes, it helps me. I am kind of calm and I breathe when I have a problem” (male, age 8).

4.5.5 Overall Satisfaction with Yoga Program

In response to the last question, “what is your overall satisfaction with your participation in the program?” 92% of children reported feeling very satisfied with the program. The remaining 8% reported feeling indifferent or mildly dissatisfied. Final comments included, “I love yoga and I would like to continue doing yoga” (male, age 13). One child that participated in almost all yoga classes, but was not involved in data collection due to arriving late at study site 1 reported, “I love yoga and I would like to continue doing yoga for the rest of my life” (male, age 11). Several children requested that the yoga and dance program continue.

5. Discussion

This preliminary study of child mental health is the first to evaluate symptoms of posttraumatic stress and emotional and behavioral difficulties among Haitian children living in orphanages. It is also the first to implement and evaluate a yoga program for this population of children in Haiti. The newness of our research protocol provides novel insight into the mental health and traumatic experiences of orphaned and abandoned Haitian youth. The observed reductions in the frequency of trauma-related symptoms and emotional and behavioral difficulties among participants in both yoga and dance groups provide evidence that mind-body CAM approaches benefit children's wellbeing.

5.1 Population Characteristics

Baseline characteristics revealed that one-third (33%) of our study population were abandoned children indicating that they believed both parents were alive. Possible reasons for this finding include the fact that Haitian parents living in extreme poverty are persistently challenged in their abilities to provide adequate care for their children. In hopes of a better life for their child, parents may abandon their child with the prospect of him/her being rescued by social welfare services and entered into institutional care. Alternatively, parents may arrange for their child to serve as a Restavèk for a wealthier household with the expectation that their child will be given the opportunity to attend school. The fact that the majority of residents at the two children's

homes in our study are abandoned children is not surprising since the consequences of extreme poverty have led to a large proportion of abandoned children in orphanages worldwide (Dozier, Zeanah, Wallin, & Shauffer, 2012; PADF, 2009; Walakira, Ochen, Bukuluki, & Allan, 2014).

Almost half (43%) of our study population reported experiencing one or more potentially traumatic events (PTEs) in their lifetime, in which the most commonly reported PTE was the 2010 Haiti earthquake. The earthquake was also identified as the most traumatic event experienced by the majority of children reporting trauma. With the negative impact of the earthquake on family cohesion and infrastructure in Haiti in addition to the potential for repeated exposure to trauma associated with large-scale disaster, it is not surprising that a large proportion of the children in our study were exposed to more than one traumatic event. These findings are supported by Whetten et al. (2011), which found high rates of PTEs reported among orphaned and abandoned children across five LMICs (p. 178).

5.2 Trauma-related Symptoms

Results of our baseline evaluation of trauma-related symptoms are consistent with findings from prior research on child PTSD among similar populations. The average trauma-related symptoms score for our study participants at baseline (N = 39) was 24.6 (SD = 8.86). This value is similar to the results of a study by Contractor et al.

(2014), which found an average trauma-related symptom score of 19.5 (SD = 15.97) in children/adolescents attending school near the 2008 Mumbai terrorist attacks.

The primary research question addressed in this study was whether an 8-week yoga program is effective in reducing trauma-related symptoms among orphaned and abandoned children compared to control groups. The main finding of the present study is that over time, there was a greater reduction in trauma-related symptoms scores from baseline to follow-up among children randomized to the yoga and dance interventions compared to the wait-list control group. However, our small sample size may have limited the power of our analyses to detect statistically significant effects of our treatment groups on the outcome variable.

In the preliminary ANOVA analyses, we observed a reduction in trauma-related symptoms across treatment groups (Table 6). A statistically significant effect ($F(2,28) = 3.30, p = .05$) of the yoga intervention on the change in trauma-related symptom scores (posttest-pretest) was discovered (Table 6). Results of the univariable and multivariable regression analyses showed a consistent reduction in trauma-related symptoms scores across treatment groups. The final multivariable regression analyses revealed a 3.8-point reduction, 4.8-point reduction, and a 3.5-point reduction in trauma-related symptoms scores for the yoga, dance, and wait-list control groups, respectively (Table 8). However, we found no evidence of a statistically significant relationship between the changes in trauma-related symptoms and any of the intervention groups ($p > .05$). The only

statistically significant predictor of the change in trauma-related symptoms score was found to be the baseline trauma-related symptom score indicating that participants with high baseline trauma-related symptoms scores may have benefitted more over the course of the 8-weeks (Table 8).

These results suggest that engagement in yoga or aerobic dance alleviates trauma-related symptoms to a greater degree compared to no-treatment at all. However, we are unable to make conclusions about these results due to p-values above the level of significance of $p > .05$, which may be due to our small sample size ($N = 31$). Nevertheless, these results suggest that children who participated in 8-weeks of yoga or aerobic dance classes benefitted more than children who received no treatment at all.

This finding is supported by a study examining stress-related outcomes, by West, Otte, Geher, Johnson, & Mohr (2004) which compared the effects of a single Hatha yoga class to an African dance class and a college lecture among college students ($N = 69$). The researchers found that participants in both the African dance and Hatha yoga classes perceived a reduction in stress and negative affect, however cortisol levels were found to have increased in participants in the African dance class and decreased in participants in the Hatha yoga class (West et al., 2004). Thus, dance and yoga may have different effects on the mind and body, which calls for further research into the beneficial components of these CAM interventions.

5.3 Emotional and Behavioral Difficulties

Results of our baseline evaluation of emotional and behavioral difficulties are consistent with findings from prior research among similar populations. The average total difficulties score for our study participants (ages 11-17) at baseline (N = 36) was 14.5 (SD = 4.25). This result is similar to findings from a study by Smith Fawzi et al. (2012), which found an average total difficulties score of 14.7 among HIV-affected Haitian youth.

The secondary research question addressed in this study was whether an 8-week yoga program is effective in reducing emotional and behavioral difficulties among orphaned and abandoned children compared to control groups. Our main findings include that over time, there was an observed reduction in emotional and behavioral difficulties among the yoga and dance groups compared to the wait-list control group. However, our results are limited due to the small sample size conferring reduced analytical power to detect statistical significance.

In our preliminary ANOVA analyses, we observed considerable variation in the effects of treatment on total difficulties scores across treatment groups. We did not observe a significant effect of the treatment groups on the change in total difficulties scores (posttest-pretest) ($p = .09$) (Table 6). Results of the ANOVA and univariable regression analyses revealed a consistent reduction in the total difficulties change scores

among the dance group and worsening of symptoms among the yoga and wait-list control groups (Tables 6 and 9).

However, after adjusting for variables included in the final multivariable regression model, the negative effect of the yoga intervention on total difficulties scores was reversed. The final multivariable regression analyses revealed a 0.2-point reduction and a 4-point reduction in the total difficulties scores among the yoga and dance groups, respectively (Table 10). We observed an 11-point increase in total difficulties scores among the wait-list control group, signifying that emotional and behavioral difficulties worsened over time, from baseline to follow-up. However, we found no evidence of a statistically significant relationship between the changes in total difficulties scores and any of the intervention groups ($p > .05$). The only statistically significant predictor of the change in total difficulties score was the baseline total difficulties score, indicating that participants with high baseline total difficulties scores may have benefitted more over the course of the 8-weeks (Table 10).

These results suggest that yoga and aerobic dance may relieve emotional and behavioral difficulties compared to no-treatment at all. Nonetheless, we cannot draw conclusions about the effect of the yoga or aerobic dance interventions on emotional and behavioral difficulties due to p -values above the level of significance of $p > .05$. Our small sample size ($N = 36$) and the simplicity of the SDQ to screen for a wide range of emotional and behavioral difficulties may have contributed to these findings.

5.4 Perceptions of Yoga Program

Our tertiary research question addressed whether yoga is an acceptable and feasible intervention in the context of orphanages in Haiti. Average class attendance of participants in the yoga group was 92% (N = 26). Of the 26 respondents to the yoga experience questionnaire, 92% reported being satisfied with the yoga program. Although not formally evaluated, the orphanage Directors and staff were very supportive of the program and became even more enthusiastic as they began to see children's positive responses to the program. Staff informally reported their appreciation of the project and noticed improvements in children's overall demeanor.

The favorable responses from children in the qualitative posttest questionnaire provide insight into participants' experience in the yoga program. As children were encouraged to use their imagination to create and embody yoga poses, the response, "tree pose because I felt like I am a tree when I'm doing it" (male, age 12) provides evidence that some children were able to accomplish this. Also, the reason behind a 13-year-old boy's favorite yoga pose offers insight into the successfulness of the yoga program to teach yoga postures and mindfulness. The boy declared that his favorite yoga pose was, "warrior III because when you do it you're concentrated," signifying his ability to practice concentrated mindfulness while engaging in a standing yoga pose. Finally, the shared experience present within group-based yoga classes has been shown to benefit trauma survivors by helping them reestablish a human connection to their

community (Emerson & Hopper, 2011). A 13-year old girl's account that yoga "helps me [the girl] to respect my [her] friends" reveals that yoga has the potential to benefit not only the individual's relationship with peers but to also create peace within the community as a whole.

Participants' perspectives on the benefits of yoga on personal wellbeing reveal that yoga enhanced their emotional and behavioral self-regulation, coping mechanisms, and resilience. Improved emotional self-regulation was indicated by the response, "...it [yoga] helps me to be calmed down. When I'm angry I breathe" (female, age 16). Additionally, participants experienced the stress-releasing effects of yoga as reported by a 10-year old boy that said, "... it [yoga] helped me because when I'm stressed out I do some poses and I feel good" (male, age 10). Lastly, the report by an 8-year old boy exemplifies the impact of yoga on his ability to down-regulate his hyperarousal systems and foster resilience, saying, "it [yoga] helps me. I am kind of calm and I breathe when I have a problem" (male, age 8). The reported use of breath to release stress and negative emotions reveals that children's awareness of breath served as coping mechanism to manage behavior and emotions in the face of adversity. In this way, these results reveal the success of our yoga program to reduce anxiety and improve self-regulation and resilience to stressors.

We found it interesting that the children would choose to exclude games in future yoga classes. Instead of games, children reported prioritizing yoga poses and

meditation as being more important components of the yoga classes. In addition, the fact that the majority of children reported enjoying the slower-paced classes more than faster-paced classes suggests their sincere interest to learn yoga as indicated in the response, “I liked it slowly because I learned more” (female, age 13).

Since the yoga classes were held in schoolrooms at each study site, children were already familiar with the location, which may have alleviated some stress associated with learning a new activity. A familiar context is especially important for children with trauma-related psychopathology because of their need for a safe and predictable environment to help them best recover from prior trauma exposure(s) (Emerson et al., 2009; Emerson & Hopper, 2011). Children were also given the freedom to attend class at their own free will, which provided participants with an element of autonomy to make decisions. The liberty to make personal choices has also proven to be advantageous for individuals recovering from trauma (Emerson et al., 2009; Emerson & Hopper, 2011). Altogether, these elements of the program may have contributed to the high satisfaction reported by yoga participants.

5.5 Strengths

Our study had multiple strengths such as the use of cross-culturally validated assessment tools, quantitative and qualitative methods, two control groups, and low-risk activities. The wait-list control group was an especially important aspect of our study to assess potential time-related changes in symptoms unrelated to the

interventions. Lastly, the qualitative questionnaire posttest supplement provided supporting information on children's perceptions of their experience in the yoga program. This information can help guide the design and implementation of future yoga programs in Haiti.

5.6 Limitations

Nevertheless, our study had several limitations. Due to ethical guidelines that advise against a randomized controlled trial in the context of children's homes, we randomly assigned children to yoga or dance groups at study site 1, while study site 2 served as the wait-list control group. As a result, some baseline differences existed between groups, which were likely due to the small sample size and the inability to randomize at the individual level across study sites. Additional limitations include inability to blind participants to their treatment assignment, differing population sizes between residential institutions, use of self-report measures concerning interviewer and reporting bias, and no long-term follow-up.

Another limitation of this study is attributed to the fact that the UCLA PTSD-RI was developed based on the DSM-IV PTSD diagnostic criteria, which stem from Western definitions of mental health. Wagenaar, Hagaman, Kaiser, McLean, and Kohrt (2012) explain that cultural and religious factors influence the perceptions and interpretations of psychological distress and mental illness in Haiti. Therefore, it is difficult to effectively assess symptoms within a culture different from that in which the

instrument was created. Also, the UCLA PTSD-RI (child/adolescent combined version) was translated into Haitian Creole for the purpose of this study and has not been validated in this context. Thus, it is unknown whether or not the questions captured the symptoms of traumatic stress as they relate to Haitian expressions of mental health.

Much debate exists around the adequacy of the DSM-IV diagnostic criteria to identify PTSD symptoms in children. It is widely known that diagnosing PTSD is challenging, especially among young children who manifest symptoms of posttraumatic stress differently than adults. Tareen et al. (2007) explain that the intrinsic avoidance symptoms associated with PTSD may deter children, who are suffering from posttraumatic stress, from freely reporting their symptoms. Additionally, feelings of self-blame, guilt, and isolation may make children less likely to report their distress regarding a traumatic event (Tareen et al., 2007).

Since the majority of children (43%) reported experiencing more than one PTE at baseline, these children may have a more complex form of PTSD. Research shows that children experiencing complex trauma, especially during childhood are at a higher risk for development of complex PTSD (CPTSD) (Courtois, 2004). Since the UCLA PTSD-RI does not evaluate CPTSD, it is unknown whether or not some children may have CPTSD symptoms that were not adequately identified by the UCLA PTSD-RI.

5.7 Implications and Future Research

Although further evidence of the efficacy of yoga to reduce trauma-related symptoms among vulnerable children is needed, our findings support integration of yoga into child development and youth mental illness prevention programs. Since untreated childhood trauma frequently leads to long-lasting, adverse health and behavior outcomes, early intervention strategies that are effective and require limited training and resources are promising therapeutic approaches for children at-risk for developing mental illness. Our research demonstrates that yoga is a feasible and enjoyable activity with potential for generating positive physical and mental health outcomes among children. These findings may encourage stakeholders involved in implementing child protection strategies to incorporate yoga into programs geared toward support of healthy development and wellbeing of youth.

Future studies are needed to expand the knowledge base of the mental health issues affecting youth in Haiti. Since mental illness was not clinically diagnosed in our study population, we suggest that future studies incorporate mental health professionals to screen and provide probable diagnoses for participants. Due to the results of prior research showing comorbidity of PTSD and depression, future research should include the Beck Depression Inventory (BDI) to capture depressive symptoms affecting trauma-burdened youth (Beck, Steer, & Garbin, 1988).

Since incorporation of the mind-body components of yoga has shown to enhance evidence-based psychotherapies, future research should continue to examine the added benefits of integrative therapy. For example, trauma-focused cognitive behavioral therapy (TF-CBT), which includes mindfulness skills practice, has been shown to significantly reduce symptoms of PTSD among children (Cohen, Deblinger, Mannarino, & Steer, 2004). Thus, future research should investigate the additional benefits of incorporating yoga as an adjunct treatment to established comprehensive trauma prevention and treatment programs.

Additionally, research shows that children exposed to trauma commonly report sleep problems and somatic complaints. Therefore, incorporation of instruments to measure sleep and physical health issues in data collection would be helpful in gaining a greater understanding of the health problems affecting this population. However, due to the known short attention span of children, careful selection of questionnaires is important for ensuring reliability of the data collected.

Research is also needed to understand the expression of trauma-related symptoms among children in Haiti. Focus group discussions with children and staff at children's homes could provide valuable information on the mental health of children exposed to trauma. Lastly, orphanage staff should be involved in the design and implementation of the mental health and wellbeing programs to ensure adequate investment, ownership, and long-term sustainability of these programs.

6. Conclusion

An estimated 10-20% of youth worldwide suffer from mental illness (Kieling et al., 2011). Research shows that children in low-income countries are frequently exposed to various types of traumatic events such as maltreatment, natural disasters, war, and community violence (Seedat et al., 2004; Whetten et al., 2011; Forman-Hoffman et al., 2013). Although protection from all types of trauma exposure during a lifetime is impossible, prevention efforts to offset potential negative mental health outcomes among children is a necessary component of child protection and wellbeing programs. Effective, culturally acceptable, and enjoyable secondary prevention strategies should be included in efforts to improve the mental health and wellbeing of vulnerable children.

Our research reveals that mind-body CAM therapies such as yoga and aerobic dance positively impact child mental health and wellbeing. Research on the mechanisms in which the components of yoga breathing, meditation, and poses lead to psychological and physiological benefits is growing (Balasubramaniam, Telles, & Doraiswamy, 2013; Ross & Thomas, 2010; Mitchell et al., 2014). While dance-based interventions reveal improvements in mental health outcomes, evidence suggests that yoga may be more effective in releasing stress at the physiological level and preventing adverse stress-related health outcomes (Ross & Thomas, 2010; West et al., 2004). Thus, further investigation into the benefits of yoga for children is needed to provide support for the

integration of yoga into evidence-based mental health therapy and child development programs worldwide.

Furthermore, our research findings provide evidence that yoga is a feasible, acceptable, and enjoyable exercise therapy for youth living in children's homes in Haiti. Although we did not observe statistically significant relationships between our intervention groups and the changes in trauma-related symptoms or emotional and behavioral difficulties, the reported enjoyment, positive health outcomes, and high rates of attendance in the yoga classes provides support for incorporating yoga into established standards of care within children's homes in Haiti. Yoga programs designed to foster healthy development and resilience are essential social justice approaches for investing in the wellbeing of our global youth and creating peace within the community at large.

Appendix A: UCLA PTSD-RI for Children and Adolescents - DSM IV (revision) (English)

SELF-REPORT TRAUMA HISTORY PROFILE (Ask the child/adolescent: Below is a list of scary or violent things. These can be times when someone was or could have been hurt badly or killed. For each question, check "Yes" if this has happened to you; check "No" if this did NOT happen to you.)

| | | |
|--|------------------------------|-----------------------------|
| 1. Being in a disaster , like an earthquake, wildfire, hurricane, tornado or flood. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 2. Being in a bad accident , like a serious car accident or fall. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3. Being in place where a war was going on around you. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4. Being hit, punched, or kicked very hard at home (DO NOT INCLUDE ordinary fights between brothers and sisters). | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 5. Seeing a family member being hit, punched or kicked very hard at home. (DO NOT INCLUDE ordinary fights between brothers and sisters). | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 6. Being beaten up, shot at or threatened to be hurt badly in your school, neighborhood or town. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 7. Seeing someone in your neighborhood or town beaten up, shot at or killed . | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 8. Seeing a dead body in your neighborhood or town (do not include funerals). | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 9. Having an adult or someone much older touch your private sexual body parts when you did not want them to. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 10. Hearing about the violent death or serious injury of a loved one. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 11. Having painful and scary medical treatment in a hospital when you were very sick or badly injured. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 12. Being forced to have sex with someone against your will. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 13. OTHER than the things described above, has ANYTHING ELSE ever happened to you that was REALLY SCARY, DANGEROUS, OR VIOLENT? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

If you answered "YES" to only ONE thing in the above list of questions (# 1 to #12), place the number of that thing (#1 to #13) in this blank: # _____ If you answered "YES" to MORE THAN ONE THING, place the number of the thing that **BOTHERS YOU THE MOST NOW** in this blank: # _____
 About how long ago did this bad thing happen to you? _____

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Please write what happened: _____

For the next questions, indicate how you felt **during or right after** the bad thing that you wrote about. Answer "Yes" if it happened and "No" if it did not happen. Circle (0, 1, 2, 3 or 4) to indicate how much you felt that way.

| | 0= None; | 1=Little; | 2= Some; | 3= A Lot; | 4= A Whole Lot |
|--|------------------------------|-----------------------------|----------|-----------|----------------|
| 14. Were you scared that you would die? | 0 | 1 | 2 | 3 | 4 |
| 15. Were you scared that you would be hurt badly? | 0 | 1 | 2 | 3 | 4 |
| 16. Were you hurt badly? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| 17. Were you scared that someone else would be hurt badly? | 0 | 1 | 2 | 3 | 4 |
| 18. Was someone else hurt badly? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| 19. Were you scared that someone else would die? | 0 | 1 | 2 | 3 | 4 |
| 20. Did someone else die? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| 21. Were you very scared, like this was one of your most scary experiences? (INTENSE FEAR) | 0 | 1 | 2 | 3 | 4 |
| 22. Did you feel that you could not stop what was happening or that you needed someone to help? (HELPLESSNESS) | 0 | 1 | 2 | 3 | 4 |
| 23. Did you feel that what you saw was disgusting or gross? (HORROR) | 0 | 1 | 2 | 3 | 4 |

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Here is a list of problems people can have after bad things happen. Please **THINK** about the bad thing that happened to you and for each problem **CIRCLE ONE** of the numbers (0, 1, 2, 3 or 4) that tells how often the problem happened to you **in the past month**. Use the **Rating Sheet** to help you decide how often the problem happened **in the past month**.

| HOW MUCH OF THE TIME DURING THE PAST MONTH | | None | Little | Some | Much | Most |
|--|--|------|--------|------|------|------|
| 1 _{D4} | I watch out for danger or things that I am afraid of. | 0 | 1 | 2 | 3 | 4 |
| 2 _{B4} | When something reminds me of what happened I get very upset, afraid or sad. | 0 | 1 | 2 | 3 | 4 |
| 3 _{B1} | I have upsetting thoughts, pictures, or sounds of what happened come into my mind when I do not want them to. | 0 | 1 | 2 | 3 | 4 |
| 4 _{D2} | I feel grouchy, angry or mad. | 0 | 1 | 2 | 3 | 4 |
| 5 _{B2} | I have dreams about what happened or other bad dreams. | 0 | 1 | 2 | 3 | 4 |
| 6 _{B3} | I feel like I am back at the time when the bad thing happened, living through it again. | 0 | 1 | 2 | 3 | 4 |
| 7 _{C4} | I feel like staying by myself and not being with my friends. | 0 | 1 | 2 | 3 | 4 |
| 8 _{C5} | I feel alone inside and not close to other people. | 0 | 1 | 2 | 3 | 4 |
| 9 _{C1} | I try not to talk about, think about, or have feelings about what happened. | 0 | 1 | 2 | 3 | 4 |
| 10 _{C6} | I have trouble feeling happiness or love. | 0 | 1 | 2 | 3 | 4 |
| 11 _{C6} | I have trouble feeling sadness or anger. | 0 | 1 | 2 | 3 | 4 |
| 12 _{D5} | I feel jumpy or startle easily, like when I hear a loud noise or when something surprises me. | 0 | 1 | 2 | 3 | 4 |
| 13 _{D1} | I have trouble going to sleep or I wake up often during the night. | 0 | 1 | 2 | 3 | 4 |
| 14 _{AF} | I think that some part of what happened is my fault. | 0 | 1 | 2 | 3 | 4 |
| 15 _{C3} | I have trouble remembering important parts of what happened. | 0 | 1 | 2 | 3 | 4 |
| 16 _{D3} | I have trouble concentrating or paying attention. | 0 | 1 | 2 | 3 | 4 |
| 17 _{C2} | I try to stay away from people, places, or things that make me remember what happened. | 0 | 1 | 2 | 3 | 4 |
| 18 _{R5} | When something reminds me of what happened, I have strong feelings in my body, like my heart beats fast, my head aches, or my stomach aches. | 0 | 1 | 2 | 3 | 4 |
| 19 _{C7} | I think that I will not live a long life. | 0 | 1 | 2 | 3 | 4 |
| 20 _{D2} | I have arguments or physical fights. | 0 | 1 | 2 | 3 | 4 |
| 21 _{C7} | I feel worried or negative about my future. | 0 | 1 | 2 | 3 | 4 |
| 22 _{AF} | I am afraid that the bad thing will happen again. | 0 | 1 | 2 | 3 | 4 |

UCLA PTSD-RI FOR CHILDREN AND ADOLESCENTS - DSM IV (Revision) ©

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Appendix B: UCLA PTSD-RI for Children and Adolescents - DSM IV (revision) (Haitian Creole)

M'AP BAY PROFIL ISTWA SOU TROMATIZASYON LA VIM (Poze timoun kesyon/adolesan: Anba se yon lis kesyon ki ka fè w pè oubyen bagay vyolan kite rive'w. Sa yo kapab lè yon moun te frape ou grav oubyen mouri. Pou tout kesyon sa yo di "WI" si sa te rive'w oubyen "NON" si li pat rive'w.)

| | | |
|--|-----------------------------|------------------------------|
| 1. Eske m te viv yon dezas , tankou tranbleman tè, dife, siklòn, tonad oubyen inondasyon? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 2. Eske m te nan yon move aksidan , tankou yon gwo aksidan machin oubyen tonbe? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 3. Eske m te konn wè vyolans k'ap fèt nan zòn ou? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 4. Eske m te frape, kout pwen , oubyen banm gwo kout pye lakay mwen oubyen isit nan CAD/HHH? (PA METE batay ou konn fè avèk frè ak sè) | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 5. Eske w te wè yon manb nan fanmi w ki frape oubyen pran kout pwen oubyen kout pye lakay ou oubyen isit nan CAD/HHH? (PA METE batay frè ak sè) | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 6. Eske yo konn bat, tire nan, oubyen trete'w mal nan lekòl ou, nan katye lakay ou oubyen lavil oubyen isit nan CAD/HHH? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 7. Eske w konn wè kèk moun nan katye lakay ou ke yo ap bat, tire, oubyen touye ? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 8. Eske w konn wè kò moun ki mouri nan katye lakay ou oubyen nan vil, pa mete antèman? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 9. Eske w konn gen granmoun oubyen moun ki pi gran pase'w konn touche pati seksyèl ou san ou pat vle? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 10. Eske w konn tande lanmò vyolan oubyen yon blese grav de yon moun ki renmen? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 11. Eske w konn gen doulè e trètman medical ki konn fè w pè nan lopital lè ou te malad oubyen blese grav? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 12. Eske gen moun ki konn fose w fè bagay avèk li san ou pa vle? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| 13. Pa gen lòt bagay ankò ki konn fè w pè oubyen danje oubyen vyolan pase sa ki dekrit nan kesyon yo anlè a? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non |
| <p>Si ou te reponn "WI" pou yon bagay, nan lis kesyon yo ki anlè a (1 a 12), mete nimewo kesyon an (1 a 13) nan espas vid sa: # _____ . Si ou te reponn "WI" PLIS PASE YON SEL BAGAY, tanpri mete nimewo bagay KI BA OU PLIS PWOBLEM NAN, nan espas vid sa: # _____</p> <p>Depi kilè bagay sa te rive'w? _____</p> | | |

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Tanpri ekri sak te rive:

Pou lòt kesyon yo, endike kijan w te santi w pandan oubyen aprè ou tap ekri bagay ki te rive w la. Reponn WI si li te rive w e NON si li pat rive w. Antoure (0, 1, 2, 3, 4) pou'w ka di kijan w te santi w.

0 = Non; 1 = Tou piti; 2 = Kèk fwa; 3 = Anpil; 4 = Prèske tout tan

| | | | | | |
|---|-----------------------------|------------------------------|---|---|---|
| 14. Eske w te pè paske w tap mouri? | 0 | 1 | 2 | 3 | 4 |
| 15. Eske w te pè paske ou ta pral frape gravman? | 0 | 1 | 2 | 3 | 4 |
| 16. Ou te frape grav? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non | | | |
| 17. Eske w te pè paske yon lot moun ta pral frape grav? | 0 | 1 | 2 | 3 | 4 |
| 18. Te gen lòt moun kite frape grav? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non | | | |
| 19. Eske w te pè paske yon lot moun ta pral mouri? | 0 | 1 | 2 | 3 | 4 |
| 20. Eske te gen yon lòt moun mouri? | <input type="checkbox"/> Wi | <input type="checkbox"/> Non | | | |
| 21. Eske'w te pè anpil, tankou se te premye eksperyans kite pi fè'w pè? | 0 | 1 | 2 | 3 | 4 |
| 22. Eske w te santi w ke ou pat ka kanpe sak tap rive a oubyen ou te bezwen yon moun pou ede w? | 0 | 1 | 2 | 3 | 4 |
| 23. Eske w te santi ke sa w te wè te degoutan? | 0 | 1 | 2 | 3 | 4 |

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Men lis bagay ki ka rive moun aprè yon move bagay rive yo. Tanpri **PANSE** sou move bagay sa kite rive'w la, e pou chak pwoblèm antoure nimewo (0, 1, 2, 3 or 4) ki di pi souvan ke sa te rive'w **nan mwa kite pase a**. Itilize **BOUTEY DLO** ki gen mezi pou ou de ou deside ki pi souvan pwoblèm sa te rive'w **nan mwa kite pase a**.

| KONBYEN TAN NAN MWA KI TE PASE | Non | Tou piti | Kèk fwa | Anpil | Prèske tout tan |
|---|------------|-----------------|----------------|--------------|------------------------|
| 1 _{D4} Mwen gade danje oubyen bagay ke mwen pè. | 0 | 1 | 2 | 3 | 4 |
| 2 _{B4} Lè gen yon bagay ki fè m sonje sak te rive m nan, mwen fache, pè oubyen tris. | 0 | 1 | 2 | 3 | 4 |
| 3 _{B1} Mwen gen move panse nan tèt mwen, imaj, oubyen son bagay kite rive m nan lè m pa vle sa. | 0 | 1 | 2 | 3 | 4 |
| 4 _{D2} Mwen santi m nève, fache, move. | 0 | 1 | 2 | 3 | 4 |
| 5 _{B2} Mwen fè rèv de sak kite rive a oubyen lòt move rèv. | 0 | 1 | 2 | 3 | 4 |
| 6 _{B3} Mwen santi m tounen nan moman bagay la te rive m nan, reviv li ankò. | 0 | 1 | 2 | 3 | 4 |
| 7 _{C4} Mwen santi m ta rete pou kòm e pa rete avèk zanmi mwen yo. | 0 | 1 | 2 | 3 | 4 |
| 8 _{C5} Mwen santi m pou kont mwen andanm e pa pwòch lòt moun. | 0 | 1 | 2 | 3 | 4 |
| 9 _{C1} Mwen eseye pa pale, pa panse, oubyen resanti sak te rive m nan. | 0 | 1 | 2 | 3 | 4 |
| 10 _{C6} Mwen gen pwoblèm pou m santi bonè oubyen lanmou. | 0 | 1 | 2 | 3 | 4 |
| 11 _{C6} Mwen gen pwoblèm lè m santi m tris oubyen an kòlè. | 0 | 1 | 2 | 3 | 4 |
| 12 _{D5} Mwen santi m ta sote, ponpe lè m tande yon gwo bri ki fè ke m sote. | 0 | 1 | 2 | 3 | 4 |
| 13 _{D1} Mwen gen pwoblèm dòmi oubyen mwen reveye anpil nan mitan nwit la. | 0 | 1 | 2 | 3 | 4 |
| 14 _{AF} Defwa m panse se fòt mwen ki fè sa te rive m. | 0 | 1 | 2 | 3 | 4 |
| 15 _{C3} Mwen gen pwoblèm pou m sonje pati ki empòtan nan sa kite rive a. | 0 | 1 | 2 | 3 | 4 |
| 16 _{D3} Mwen gen pwoblèm pou m konsantre oubyen fè atansyon. | 0 | 1 | 2 | 3 | 4 |
| 17 _{C2} Mwen eseye rete lwen moun, plas, oubyen bagay k'ap fè m sonje sa kite rive a. | 0 | 1 | 2 | 3 | 4 |
| 18 _{B5} Lè yon bagay fè m sonje sak te rive a li fè kè m bat fò, li ban m tèt fè mal, vant fè mal. | 0 | 1 | 2 | 3 | 4 |
| 19 _{C7} Mwen panse ke m p'ap viv pou lontan. | 0 | 1 | 2 | 3 | 4 |
| 20 _{D2} Mwen konn joure oubyen goumen. | 0 | 1 | 2 | 3 | 4 |
| 21 _{C7} Mwen santi m enkyete oubyen negatif pou aveni mwen. | 0 | 1 | 2 | 3 | 4 |
| 22 _{AF} Mwen pè pou move bagay pa rive m ankò. | 0 | 1 | 2 | 3 | 4 |

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Appendix C: Posttest Supplement – Yoga Experience Questionnaire (English)

Yoga experience questionnaire

1. Did you like yoga? Why or why not?
2. Were there things that got in the way of you attending yoga classes? If so, what were they?
3. What things did you like about the class?
4. What did you like or dislike about your yoga teacher?
5. Which pose was your favorite? Why?
6. Which pose was your least favorite? Why?
7. Which classes did you enjoy more: faster-paced or slower-paced? Why?
8. In your opinion, a good yoga class would emphasize . . .
 - (a) poses = 1
 - (b) meditation = 2, or
 - (c) both components equally = 3
9. Has your involvement in yoga changed your feeling of wellbeing?
10. Did it help you to regulate your mood? How so?
11. If you were designing yoga classes, what would you make sure to include (e.g., specific postures, games, meditative techniques, etc.)?
12. What would you NOT include?
13. What would you change if you were given the opportunity to do the program again?
14. What is your overall satisfaction with your participation in the program?
 - (a) quite dissatisfied = 1
 - (b) indifferent or mildly dissatisfied = 2
 - (c) mostly satisfied = 3
 - (d) very satisfied = 4
15. Any other comments or concerns?

Appendix D: Posttest Supplement – Yoga Experience Questionnaire (Haitian Creole)

Kesyon sou eksperyans pwogram yoga

1. Eske w te renmen yoga? Poukisa ou renmen li? Poukisa ou pa renmen li?
2. Eske w te gen bagay kite anpeche w swiv klas la? Tankou maladi.... elatriye?
3. Ki bagay ke ou te renmen nan klas la?
4. Kisa ou te renmen oubyen pat renmen nan pwofesè yoga?
5. Ki pòz ou te pi renmen? Poukisa?
6. Ki pòz ou pat twò renmen? Poukisa?
7. Ki klas ou te pi renmen: rapid oubyen dousman? Poukisa?
8. Selon ou menm yon bon klas yoga ta dwe gen.
(a) pòz = 1
(b) meditasyon = 2, oubyen
(c) tout = 3
9. Eske yoga chanje konpòtman w?
10. Eske li te ede w jere tanperaman w yo? Kijan?
11. Si w tap fè yon desen klas yoga kisa ou tap mete?
Kèk bon pòz, jwet, teknik pou medite, elatriye?
12. Kisa ou pa tap mete?
13. Kisa w tap chanje si ou ta gen opòtinite pou ou jwenn pwogram sa ankò?
14. Kijan mwayenn satisfasyon ou fè nan pwogram nan?
(a) pa satisfè = 1
(b) endiferan oubyen demi pa satisfè = 2
(c) plis satisfè = 3
(d) trè satisfè = 4
15. Nenpòt lòt kòmantè?

Appendix E: Yoga Class Components – (English/Haitian Creole)

| English | Haitian Creole |
|----------------------------|----------------------|
| Integration poses | |
| Mountain pose | Pòz mòn |
| Standing forward bend pose | Pòz koube |
| Standing half forward bend | Pòz mwatye koube |
| High plank pose | Pòz planch |
| Cobra pose | Pòz koulev |
| Downward facing dog pose | Pòz chen |
| Table top pose | Pòz tab |
| Cow pose | Pòz bèf |
| Cat pose | Pòz chat |
| Child's pose | Pòz bebe |
| Standing poses | |
| Warrior I | Pòz sòlda I |
| Warrior II | Pòz sòlda II |
| Reverse Warrior II | Pòz sòlda II fè bak |
| Warrior III | Pòz sòlda III |
| Extended side angle | Pòz panche yon bò |
| Triangle pose | Pòz triyang |
| Crescent warrior pose | Pòz sòlda moso lalin |
| Chair pose | Pòz chèz |
| Tree pose | Pòz pyebwa |
| Eagle pose | Pòz èg |
| Airplane pose | Pòz avyon |
| Dancer pose | Pòz dansè |
| Frog pose | Pòz krapo |

| English | Haitian Creole |
|-------------------------------|-------------------------|
| Seated/reclining poses | |
| Butterfly pose | Pòz papiyon |
| Head-to-knee pose | Pòz tèt sou jenou |
| Easy pose | Pòz chita |
| Seated twist pose | Pòz chita tòde |
| Seated forward bend pose | Pòz chita koube devan |
| Lying down twist pose | Pòz kouche tòde |
| Bridge pose | Pòz pon |
| Knees-to-chest pose | Pòz jenou sou pwatrin |
| Goddess pose | Pòz larenn |
| Happy baby pose | Pòz bebe kontan |
| Corpse pose | Pòz kouche |
| Rock pose | Pòz wòch |
| Breathing techniques | |
| Ocean breath | Souf lanmè |
| Rabbit breath | Souf lapen |
| Lion breath | Souf lyon |
| Bee breath | Souf myèl |
| Meditation practice | |
| Candy meditation | Meditasyon avèk sirèt |
| Counting meditation | Konte pandan meditasyon |
| Guided meditation | Gid pou meditasyon |

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