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Parental Self-Efficacy: Development of a Measure to Reduce Children's Contaminant Exposure

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by

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Abstract

Indoor environmental contaminants (ECs) such as lead, mold, mercury, radon, and bisphenol A (BPA) are prevalent in American homes and have dire consequences to children's development, especially for children under six. To optimize the efficacy of programs aiming to prevent exposure to ECs, it is necessary to investigate parental factors that influence behavioral change. Parental self-efficacy is one such psychological construct which could help explain why and for whom an intervention is effective. The current study presents a measure developed to assess parental self-efficacy for preventing children from being exposed to ECs, the Parental Self-efficacy for Contaminant Exposure Prevention (PS-CEP). The current study aimed to (1) evaluate the factor structure of the developed measure, (2) evaluate the construct validity and (3) examine various characteristics of respondents based on their demonstrated level of self-efficacy. The PS-CEP was administered to 206 parents of children attending a local Head Start and a national sample of 377 parents of children under six drawn from an on-line polling website. An exploratory factor analysis was conducted, convergent and discriminant validity of the PS-CEP was assessed using existing measures, and demographic characteristics as well as parenting styles were examined. Based on model fit indices in the exploratory factor analysis, a four-factor model was the best fit (TLI = .90; RMSEA = .071). Three of the four factors of the PS-CEP demonstrated good validity. Additionally, the PS-CEP differentiated between levels of education, marital status, gender, and ethnicity. Finally, authoritative parenting style was found to correlate with three of the four factors. A measure of this type will allow interventions to be tailored based on parents' self-efficacy to more appropriately support them in taking steps to create healthier environments for their children.

Parental Self-Efficacy: Development of a Measure to Reduce Children's Contaminant Exposure

The principle causes of sickness, disability and death in American children today are chronic and common illnesses, which have been increasing at an alarming rate (Landrigan & Goldman, 2011; Woodruff et al., 2004). The prevalence of childhood asthma has doubled over the past twenty years (Environmental Protection Agency, 2003); birth defects are one of the leading causes of infant death (Paulozzi, Erickson, & Jackson, 1997); obesity has tripled in the past twenty years (Ogden, Carroll, Kit,& Flegal,2012); and despite a lower mortality rate, the number of children diagnosed with acute lymphocytic leukemia, acute myeloid leukemia, non-Hodgkin lymphoma, and testicular germ cell tumors has increased for unknown reasons (Siegel, Ma, Zou, & Jemal,2014). Additionally, the diagnosis rate of autism spectrum disorder and attention deficit disorder continue to rise (Baio, 2012). The economic impact of these diseases and developmental disabilities is significant and is estimated to be $54.9 billion dollars (Landrigan, Schecter, Lipton, Fahs, & Schwartz, 2002).

Each of these health and developmental concerns may potentially be explained by the investigation of children's physical environments, such as their exposure to environmental contaminants (ECs; e.g., lead, mercury, mold, radon, BPA; Braun & Hauser, 2011; Landrigan & Goldman, 2011). Treatments for the adverse effects associated with contaminant exposure are largely unknown, making primary prevention the most effective strategy for protecting children (Bellinger and Bellinger, 2006). Because parents play such a key role in influencing their children's health, one important way to reduce or eliminate children's exposure to ECs is through primary prevention methods targeting parents. Primary, as oppose to secondary, prevention efforts work to reduce or eliminate sources of health related risk before diseases or conditions occur (Nation et al., 2003). These can include raising a parent's awareness to the environmental health issue through education (CDC, 2012).

Primary prevention is often designed and implemented in the context of social-cognitive theories that work to predict health behaviors and help to explain why intention and behavior may not correspond. Within these models, various limiting factors, such as low self-efficacy, could be the barriers for parents to create health behavior change to improve their children's home environment and reduce EC exposure (Schwarzer & Luszcynska, 2008). Therefore, a measure of one of the limiting factors for health behavior change, parental self-efficacy for EC exposure, could be beneficial for prevention efforts and program development. The current paper outlines the development of a measure of parenting self-efficacy for optimizing a child's environment by minimizing EC exposure.

Healthy Homes Initiative: Federal Policy to Improve Children's Physical Environments

Parents are not the only ones that are emotionally and economically invested in preventing their children's exposure to ECs. The United States government has also acknowledged the importance of a healthy physical environment for early child development through the Healthy Homes Initiative (HHI; Irwin, Siddiqi, & Hertzman, 2007). The HHI was launched in 1998 and works to protect children and their families from housing-related health and safety hazards (Miller, Pollack, & Williams, 2011). The U.S. Department of Housing and Urban Development (HUD), the Center for Disease Control and Prevention (CDC), the National Center for Healthy Housing (NCHH), and the Environmental Protection Agency (EPA) all have reference guides for addressing specific contaminants in homes. For example, the CDC recommends four behaviors to prevent lead exposure in children: annual blood testing, safe play areas, regular hand washing and dusting surfaces with a damp cloth (Binns, Campbell, & Brown, 2007). Federal government, state and local agencies continue to collaborate through the HHI to provide training, outreach and education programs that promote health and safety within the home environment (Brown, Ammon, & Grevatt, 2010).

One important goal of the HHI, and the most relevant for this investigation regarding environmental contaminants, is the support of strategic, focused research on links between housing and health and cost-effective methods to address such hazards (Irwin, Siddiqi, & Hertzman, 2007). While protecting the health of infants and children from the impact of ECs has become a priority in research in recent years, the body of work continues to lack evidence of the social and cognitive barriers that parents add to the situation (Landrigan et al., 1998). Early research on lead and mercury exposure were among the first to show the dangers of childhood toxin exposure. These studies resulted in links between exposure to lead and mercury and adverse health effects in children. Research continues to find evidence of a connection between environmental contaminant exposure and disease or developmental delays in children (Axelrad, Bellinger, Ryan,Woodruff, 2007; Canfield, et al.,2003; Landrigan, et al., 1975; Needleman, et al., 1979). Additionally multiple studies have investigated the efficacy of various interventions to prevent or lower children's exposure to environmental contaminants. However, the current literature lacks theoretical justification and evidence regarding the role parents play in intervention efficacy (Michie & Abraham, 2004).

For example, numerous studies focusing on lead as an EC have provided evidence that residential lead hazard control (mitigating hazards associated with lead exposure) can be effective in reducing environmental lead contamination (Charney, Kessler, Farfel, & Jackson, 1983; Niemuth, Wood, Holdcraft, & Burgoon, 1998; Tong, Schirnding, & Prapamontol, 2000). However, the effectiveness of lead hazard control to reduce elevated blood lead levels (BLL) in children is less clear (Charney et al., 1983; Binns et al., 2007; Harvey, 2002). A number of randomized controlled trials of interventions have found moderate declines or no statistically significant decline in the BLLs of children whose families received an educational or environmental intervention (Aschengrau et al., 1997; Brown et al., 2010; Charney et al., 1983; Lanphear et al., 1996; Rhoads et al., 1999). While interventions have demonstrated effectiveness in reducing lead exposure, this does not always translate into decreased BLL for children; one mechanism to explain the varied effectiveness in existing interventions may be characteristics of the parents, such as their ability to implement the education they receive.

Additionally, moisture control to reduce/eliminate mold through de-humidification, improved ventilation, use of air cleaning devices, repeated dry-steam cleaning, and repeated vacuuming were all identified as promising interventions to improve the home environment, but the evidence is not conclusive that these methods help to reduce or prevent children's exposure to mold. HC A large randomized controlled trial of moisture control through building improvements resulted in respiratory health improvements, but the effect of moisture control may be confounded by the addition of insulation and improved thermal benefits (Howden-Chapman et al., 2007). Furthermore, there is clear evidence that active radon mitigation (electric vent fan, failure warning device, vent pipe, and caulking) in high-risk areas is effective in reducing exposure to radon in air to less than 4 pCi/L. However, passive systems (vent pipe and a physical barrier between the soil and home foundation only) have the advantage of being less expensive and not requiring maintenance of mechanical equipment, but they have yet to be shown to be consistently effective (Groves-Kirkby et al., 2006; LaFollette & Dickey, 2001; Najafi, 1998).

The inconsistency of effective interventions to prevent or reduce children's exposure to ECs continues to challenge researchers. It is important to note that the previous research has not included parents as a variable that may enhance or distract from intervention effectiveness. This oversight along with the inconsistent results again highlights the need for a measure that could predict effective parental influence on health behaviors and identify parents who may need additional intervention support to protect their children from exposure to ECs

Children's Susceptibility to EC Exposure

Children are the focus of prevention from EC exposure because they are more susceptible than adults to adverse health effects from ECs (Goldman, 1995). Children have a higher risk of adverse health effects for several reasons. First, the complex processes involved in the growth of the central nervous system and metabolic pathways can be harmed and disrupted very easily because children's immature metabolic pathways lack the enzymes required to clear their bodies of contaminants (National Research Council, 1993). Secondly, children have greater exposure to ECs than adults due to their body weight to exposure ratio (National Research Council, 1993). Six month old babies drink seven times more water per pound than the average adult and take in twice as much air per pound as adults (Ershow & Cantor, 1989). The increased body weights to exposure ratio and the common hand to mouth behavior of children under the age of two further increases the likelihood of contact with ECs (Landrigan & Goldman, 2011). Thirdly, children have a longer time to develop many diseases attributed to EC exposure that grow and change through several stages over a long period of time. Therefore, exposure during the early developmental processes increases the risk for a chronic disease later in life (Landrigan et al., 2005).

Recognition of children's vulnerability to ECs along with the HHI has led to policy changes and the implementation of interventions, but the risk still remains high. This continued risk is perhaps most evident when considering lead exposure. About 23 million housing units still have one or more lead-based paint hazards and an estimated 3.6 million of these homes contain children within the age group most sensitive to lead poisoning (i.e., less than 6 years) (U.S. Department of Housing and Urban Development [HUD], 2011). Additionally, more than 6.8 million housing units have radon exposures above the current EPA action level (HUD, 2011). In September, 2013, the National Center for Healthy Housing (NCHH) found that 35 million (40%) of homes in the U.S. have one or more health and safety hazards as reported in the State of Healthy Housing, a comprehensive study of housing conditions in 46 metropolitan areas of the nation. That study draws on data from the American Housing Survey, which found that approximately 6.3 million housing units are considered to be substandard (Dhongde & Haveman, 2014). Additionally, in the last 50 years more than 80,000 brand new synthetic chemicals have been produced and are used in millions of products such as foods, food packaging, cleaning products, cosmetics, baby bottles, building materials, clothing, toys, and baby bottles (Goldman, 1998; Landrigan & Goldman, 2011). Most of these chemicals have not been tested for safety and may individually or cumulatively contribute to the increase in chronic disease and developmental delays (Goldman, 1998; Landrigan & Goldman, 2011). The grim statistics on the quality of American home environments may be due in part to a lack of effective primary prevention methods that integrate the role of the parents in protecting children from ECs.

Barriers to Health Behavior Change for Parents: Conceptual Framework

Effective primary prevention methods work to decrease health care and education costs as well as improve quality of life. However not all interventions are equally successful. Those most likely to achieve the desired behavioral change use theory as the foundation to explain the dynamics of health behavior change. Models of health behavior change can be classified as continuum based or stage based. Continuum models explain change as a steady process, while stage based theories assume change is non-linear and consists of steps. For example a continuum model applied to smoking cessation behaviors would attribute the changes occurring due to a change in the perception of vulnerability, susceptibility and barriers or benefits to quitting. While a stage based model like the Transtheoretical Model (Figure 4; Prochaska & DiClemente, 1984) would first describe the person as a smoker who does not think that smoking is problematic, after education and intervention the person now thinks that smoking may be harmful, then the person wants to quit smoking before finally actually quitting smoking. Both continuous and stage-based models of health behavior change integrate self-efficacy as a key component for whether health behavior change occurs and are useful in examining how parents can minimize their children's EC exposure (Social Cognitive Theory: Bandura, 1977; Health Belief Model: Rosenstock, Strecher, & Becker, (1988); Transtheoretical Model: Prochaska & DiClemente, 1984; Theory of Planned Behavior: Fishbein & Ajzen, 1975; Health Action Process Approach; Schwarzer & Luszczynska, 2008). As a construct, self-efficacy can explain the belief an individual has in their ability to attain their desired behavioral change. It can also be helpful in determining the most appropriate health behavior interventions suited for the individual's current level of self-efficacy (Hirai, Arai, Tokoro & Naka, 2009).

Self-efficacy theory. This primary theoretical construct originated from Bandura's (1977) Theory of Self Efficacy (Figure 1) which stemmed from his work on Social Cognitive Theory (SCT). The SCT is a continuum model that explains how humans develop, learn and maintain certain behaviors and is often described in relationship to a model of self-efficacy.

Bandura (1977) defined self-efficacy as “as one's belief in one's ability to succeed in specific situations”, and viewed people as more self-regulatory than reactive to their environment. For example, how people perceive their situation can inform their decision to behave a certain way and could lead to an eventual change in their environment. Therefore, people’s behavior can be consistently predicted by knowing the beliefs they have about their own capabilities and environments (Basen-Engquist et al., 2013). People's beliefs regarding their efficacy are developed by four main sources of influence. Self-efficacy can be enhanced through (1) persuasion (verbal encouragement), (2) vicarious experience (modeling), (3) emotional state, and (4) personal mastery experiences (experience success at the task) (Bandura, 1997). The continuum-basis of the model is evident as a greater level of any of these influences would relate to higher self-efficacy and application of the model would suppose that when self-efficacy is achieved, behavioral change is evident. However, application of the stage basis of the model would indicate that some individuals may not be ready for health behavior change and are qualitatively different than those who are making necessary changes.

Health belief model. The Health Belief Model (HBM; Figure 2) was created in an attempt to explain and predict health related behaviors such as preventative screenings (Rosenstock et al., 1988). This continuum model illustrates the likelihood of behavior change based on personal perceptions regarding: susceptibility, severity, benefits, and barriers to health behaviors (Rosenstock et al.1988). The model suggests that behavior is influenced by cues to action and self-efficacy. Self-efficacy was a critical addition to the model to better understand and explain the individual differences in health behaviors. Self-efficacy is instrumental in determining ones’ perception of susceptibility and severity of the risk as well as benefits and barriers to changing health behaviors (Bandura, 1977). Perceived susceptibility refers to a person's assessment of personal risk associated with a behavior and can be one of the most motivating factors to instigate change. Perceived severity refers to a person's idea of how the disease or health risk would impact their life. Perceived benefits and perceived barriers speak to the value or usefulness of a health related behavior when compared with the obstacles (barriers) preventing behavior change. Cues to action are internal or external events that prompt individuals to take action or change their behavior (Schwarzer & Fuchs, 1995). Previous research indicates that stronger self-efficacy beliefs and a greater perception of severity were related to an increase in the frequency of healthy behaviors (Anagnostopoulos, Buchanan, Frousiounioti, & Potamianos, 2011; Davis, Buchanan & Green, 2013). The perceived number of barriers, perception of severity, and level of self-efficacy were consistently found to be strong predictors of parents' lead poisoning prevention behaviors when applying the HBM to assess the beliefs associated with each target behavior (Anagnostopoulos et al., 2011; Bland, Kegler, Escoffery, & Halinka-Malcoe, 2005; Coleman & Karraker, 2000; Kegler et al., 1999).

Theory of planned behavior. The Theory of Planned Behavior (TPB; Figure 3;Ajzen, 1991) derives from the Theory of Reasoned Action (Fishbein, 1979), which is a continuum model that predicts an individual's intent to behave a certain way at a specific time and place. Intent is determined by subjective norms, perceived behavioral control and attitude about the behavior. Self-efficacy can be referred to as a similar or identical construct as perceived behavioral control. Multiple studies of health related behaviors (i.e. alcohol use, food choice) have successfully incorporated self-efficacy in to the TPB model (Conner, Povey, Sparks, James, & Shepherd, 2003). In 2009, a study was published reporting the effectiveness of applying both the transtheoretical model and the theory of planned behavior to the development of an infant feeding curriculum for mothers. Mothers reported an increase in knowledge and self-efficacy for changing and maintaining healthy feeding behaviors for their babies (Brophy-Herb, Silk, Horodynski, Mercer, & Olson, 2009).

Transtheoretical model. In contrast to the other continuous models of health behavior change already presented, the Transtheoretical Model (TTM; Figure 4; Prochaska & Diclemente, 1984) is a popular stage model that conceptualizes the process of intentional behavior change. The model proposes that people, when they are ready, move through five stages of change, before ending in the maintenance stage. A sixth stage, termination, is often added to the model to indicate when the behavior ceases. The TTM incorporates elements of self-efficacy by taking in to account the degree of confidence the individual has in their ability to maintain their desired behavioral change (Hirai et al., 2009). The TTM can be helpful in determining the most appropriate interventions in health behavior change suited for the individual's current stage (Hirai et al, 2009). As compared to the other models, it recognizes that there are individual differences that might make intervention ineffective for some participants if they are not ready to engage in health behavior change.

Health action process approach. The health action process approach (HAPA; Figure 5; Schwarzer & Luszczynska, 2008) is a theory of health behavior change that explains and predicts individual changes in health behaviors while emphasizing the role of perceived self-efficacy throughout. The HAPA model proposes that individuals pass through varying mindsets on their way to behavior change and therefore, interventions that tailor to these changing perceptions would be the most efficient. In this manner, HAPA incorporates both stage and continuum model characteristics, suggesting that the adoption, initiation, and maintenance of health behaviors should be conceived of as a structured process including a motivation phase and a volition phase with changing perceptions of specific types of self-efficacy throughout. The

HAPA model consists of five major principles: (1) motivation and volition, (2) two volitional phases, (3) post-intentional planning, (4) two kinds of mental stimulation, and (5) phase specific self-efficacy.

The motivation and volition principle proposes that people move from deliberation to action. Secondly, the two volitional phases differentiate between people that have translated their intent to action and those that have not; inactive individuals. Individuals in the inactive stage are motivated to change but do not act because they lack the skills or resources (internal or external) to translate intention to action. Therefore, planning becomes an important part of the process of change. Post-intentional planning becomes a mediator between intent and action. Planning can further be divided in to action planning and coping planning. Action planning involves the initiation of health behaviors while coping planning is required for initiation and maintenance. According to the HAPA model, perceived self-efficacy is required throughout the process of health behavior change. However, the challenges that individuals face change during the process, therefore the type of self-efficacy required also changes.

Several studies have examined HAPA based interventions in the context of health behaviors. In a study of the determinants of physical activity intentions and behaviors, application of the HAPA framework identified maintenance self-efficacy as the best predictor of action (Barg et al., 2012). The HAPA framework is also applicable to vaccination behavior. Intention and planning were found to be predictive of the likelihood to get a flu shot (Ernsting, Gellert, Schneider, & Lippke, 2013). Finally, when the HAPA model was used in a smoking cessation context, smokers low in motivation to quit were found to benefit from information and reminders about the serious health problems caused by smoking (Williams, Herzog, & Simmons, 2011).

Each model of health behavior change, whether continuous or stage-based, demonstrates the importance of measuring parental self-efficacy and related characteristics to explain prevention effectiveness for parents. Parenting style is a characteristic often associated with parental self-efficacy (PSE). The construct of PSE has been positively related to warmth and negatively related to controlling parenting styles (Izzo et al. 2000; Dumka et al., 1996).

Parental self-efficacy. While parenting style may predict PSE, PSE itself can also be a predictor of parenting behaviors in intervention programs (Spoth, Redmond, Haggerty, & Ward, 1996). In one of the few studies to investigate the role of caregiver self-efficacy in the abatement of one environmental contaminant (lead exposure), PSE was found to be strongly associated with preventive behaviors (Kegler et al., 1999). Although the role of PSE varies across parents, children, and cultures; its influence cannot be minimized in the role of exposure prevention.

Purpose

Though there are many existing scales that measure aspects of parenting self-efficacy (Coleman & Karraker, 2000), there is currently no measure of parents' perception of abilities to influence their child's environment and health behaviors. Self-efficacy is very domain-specific (Bandura, 1997), therefore the development of a measure assessing parents' beliefs about their ability to construct a home environment that minimizes contaminant exposure for their children would be appropriate for applying models of health behavior change to the healthy homes literature and primary prevention interventions.

The current study presents the development of one such measure, the Parental Self Efficacy for Contaminant Exposure Prevention (PS-CEP) questionnaire. To accomplish this, a total of 36 items were created based on the behavior recommendations of government health agencies, literature and expert feedback (Binns, Campbell, Brown, 2007; Bland, Kegler, Escoffery & Halinka-Malcoe, 2005; Brown, Ammon, & Grevatt, 2010; CDC, 2012). For example, four behaviors recommended by the CDC to reduce lead exposure, which would also contribute to reduce EC exposure more broadly, include hand washing, dusting with a damp cloth, playing in safe areas and annual blood testing.

Additionally, several models of health behavior change incorporate an individuals' perception of risk and attitudes about health. Therefore items used were classified in four domains: general self-efficacy, susceptibility/vulnerability, nutrition and general health. The items were then tested on a community sample of low-income parents and a national sample of parents through an online survey in order to perform an exploratory factor analysis. The reliability of PS-CEP was measured by examining the inter-item correlations and the validity of the measure by investigating its relationship with related and unrelated constructs. The development of a low-cost psychometrically sound measure of this type will expand research questions and intervention tactics in the environmental contaminant exposure and healthy homes literature.

Method

The current investigation of the PS-CEP scale was completed using two samples. The first sample consisted of low-income families attending Head Start in a southeastern region who had children between 3 and 5 years (Head Start sample); the second included a more nationally representative sample collected through an online survey system who had children between zero and six years (Mturk sample). For both samples, thirty-six items were tested in order to explore factors related to parents creating a contaminant free environment for their children. For the Mturk sample, additional measures were added to examine the validity of the PS-CEP. Data from the two samples were combined in an effort to increase the total sample size and make the results more generalizable to families with young children between the ages of zero and six. Each sample will be described separately, and in combination.

Participants

Data for the Head Start sample (*N* = 206) were collected in conjunction with a cross-sectional study of risk and protective factors for lead exposure among families enrolled in seven Head Start programs across five counties in northeast Florida. Table 1 provides demographic information for the communities surrounding the Head Start sites as well as the participants in the Head Start sample. The sample is representative of a heterogeneous population in the southeast United States of low-income families. Resident population estimates for each of the communities surrounding the sites ranged from 27,010 to 866,431 people. The median household income for these communities ranged from $27,026 to $51,277 annually.

Parents and legal guardians (i.e., including biological mothers or fathers, grandparents, and legal guardians) of children enrolled in the Head Start program were recruited during an annual health screening event before the beginning of the 2013-2014 school year. In Fall 2013, the total enrollment at Head Start was comprised of 67% of families that identified themselves as a minority group, 9% were identified as Spanish-speaking households, 64 % rented their home and 100% fell in an income bracket that would be considered impoverished.

The Mturk sample (*N* = 377) was a cross-sectional study recruited online through Amazon's Mechanical Turk (MTurk). Table 2 demonstrates that Mturk was a larger, more educated sample of mostly homeowners in comparison to the Head Start sample. Other variables that could provide information on the validity of the PS-CEP were added to the questionnaire and included: Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), Rosenberg's Self-Esteem Scale (RSES; Rosenberg, 1979), the General Self-Efficacy Scale (GSES; Schwarzer

& Jerusalem, 1995), the Chicago Lead knowledge Test (Mehta & Binns, 1998) and the Parenting Style and Dimensions Questionnaire (PSDQ; Robinson, Mandleco, Olsen, & Hart, 1995) .

Descriptive statistics are presented for demographic data on the participants; percentages, means, and standard deviations were used to describe both samples as well as the samples in combination (Table 2). Descriptive analyses were conducted using SPSS 22 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp). The responses obtained from the Head Start sample came primarily from Caucasian (37.6%) and African American parents (36.7%) who were single (42.4%), female (84.8%), with a high school education (42.9%), and who rented their home (62.9%). However the responses from the Mturk sample came from participants who were Caucasian (55.7%), married (65.5%), both males (45.6%) and females (52.3 %), with a college degree (60.7%), who rented (45.4%) and owned their own homes (51.7%). Both Head Start (M = 30.89, SD = 4.29) and Mturk (M = 30.46, SD = 6.32) had an average age of thirty years old.

Procedure

The Head Start parents/guardians were asked to complete a survey using the online survey system, Qualtrics, when enrolling their children in the Head Start program during health screening days coordinated at seven locations that were held during July and August, 2013. During the process, parents and children were directed through a series of screening stations (e.g., hearing, vision, language). A screening station was devoted to lead exposure and parents were asked if they were willing to complete a survey about lead exposure prevention. If the parents were willing, then a volunteer would further discuss the details of the study and once they consented to participate, help them complete the questionnaire on a tablet. A total of 206 parents completed the PS-CEP questionnaire. Upon completion of the questionnaire, parents were compensated for their time with a free children's book.

Mturk parents and guardians were recruited online. Mturk is an online service operated through Amazon.com. The extant literature has described the data provided by internet methods as of equal quality to that provided by traditional methods of data collection (Gosling, Vazire, Srivastava, & John, 2004). Several steps were taken based on recommendations by Nosek, Banaji, and Greenwald (2002) for collecting data by internet methods. For example, we provided individuals with adequate information (i.e., information on the study and several opportunities to contact the researchers and the IRB); adequate confidentiality (i.e., anonymous data collection); and fairly compensated participants for their time. Participants read a brief description of the study and eligibility requirements on Mturk. If participants chose to accept, Mturk linked to the same web based survey program completed by the Head Start parents, Qualtrics, which began with the consent form. Initial inclusion criteria for participants required parents to have documentation of their children's blood lead levels. This criterion was later amended to ensure adequate data collection by stating it was preferable for parents to have documentation of a recent lead test. A total of 377 parents/guardians completed the questionnaire. Each was paid $1.50 for approximately thirty minutes of their time.

Measures

All measures completed with the Head Start sample were replicated with the Mturk sample. Variables of interest include: demographic, work, finances, neighborhood and housing information, parents' lead knowledge, children's lead risk and nutrition, and parents' self-efficacy for controlling their children's environment. Additionally, measures of self-efficacy and self – esteem were used to assess the convergent and discriminant validity of PS-CEP for the Mturk sample. A measure of stress was included to further examine risk and protective factors for contaminant exposure. Finally, a measure of parenting style was included to further explore role of parenting in preventing children's exposure to ECs.

PS-CEP. A parent's potential to influence the health of their child's environment and the need to measure this concept is apparent. The PS-CEP measure was based largely on the conceptual role of self-efficacy in the previously mentioned theories related to health behavior change and parenting interventions. The development of PS-CEP was based on existing recommendations for preventative behaviors that researchers have previously explored (Bland et al., 2005; Kegler et al., 1999). It is meant to describe task specific parenting self-efficacy relating to creating a contaminant free environment. During the development of PS-CEP, 36 questions were created within four hypothesized domains related to environmental neurotoxin exposure (i.e., lead, mold, mercury, radon, etc): General self-efficacy, "I know where my children are playing"; Susceptibility/vulnerability, "I know whether or not my children are being exposed to toxins like lead, mold, mercury, or radon"; Nutrition, "I am able to find foods that my children will eat that are high in iron and calcium"; General health, "I am able to complete the recommended immunization schedule for my children." The PS-CEP was scored on a scale from 0 to 100 to encourage variability and sum scored. No items were reverse scored.

Demographic and household questionnaire. The demographic and household questionnaire was developed for the purpose of this study and contains items assessing participant age, sex, relationship status (e.g., married, single), racial background, approximate income, approximate age of home, perceived economic situation (e.g., we can't pay our bills or we have plenty of money to pay our bills each month), employment status and type. Research indicates that some of these demographic characteristics may be linked with self-efficacy (Coie et al., 1993; Dumas, 1984a, 1984b; Knapp & Deluty, 1989; Kazdin & Wassell, 2000; Routh, Hill, Steele, Elliot, & Deweys, 1995; Webster-Stratton, 1985, 1992; Webster-Stratton & Hammond, 1990).

Validity measures incorporated with Mturk sample.

General Self- Efficacy Scale (GSES). The GSES is an 8 item measure designed to tap into the construct of perceived self-efficacy (Schwarzer & Jerusalem, 1995). Each item refers to successful coping and implies an internal-stable attribution of success. Perceived self-efficacy is related to subsequent behavior and, therefore, is relevant for behavior change. Psychometrically, the reliability and validity of the measure is good. Cronbach's alphas ranged from .76 to .90, with the majority in the high .80s (Schwarzer & Jerusalem, 1995). Criterion-related validity is documented in numerous correlation studies where positive coefficients were found with favorable emotions, dispositional optimism, and work satisfaction (Schwarzer & Jerusalem, 1995). Negative coefficients were found with depression, anxiety, stress, burnout, and health complaints (Schwarzer & Jerusalem, 1995). In studies with cardiac patients, their recovery over a half-year time period could be predicted by pre-surgery self-efficacy (Schwarzer & Jerusalem, 1995) and more recently self-efficacy was shown to help cardiac patients cope and improve their health related quality of life (Brink, Alsén, Herlitz, Kjellgren, & Cliffordson, 2012). The GSES will be used to estimate concurrent and convergent validity of PS-CEP. A positive correlation between the GSES and PS-CEP would provide evidence that the two instruments are converging on the same concept and it is hypothesized that there will be a strong positive correlation between the two measures.

Rosenberg self-esteem scale (RSES). The RSES is a 10-item measure with items scored on a four-point Likert scale ranging from strongly agree to strongly disagree (Rosenberg, 1979).

Participants rated their level of agreement with statements such as “I feel that I'm a person of worth, at least on an equal plane with others” (Item 1). Responses were scored as follows: strongly agree = 3, agree= 2, disagree = 1, strongly disagree = 0. Items 2, 5, 6, 8, and 9 were reverse scored. Possible scores ranged from 0-30, with 30 being the highest score possible. Scores for the 10 items were summed. Higher scores indicated higher levels of self-esteem (Hagborg, 1993; Kaplan & Pokorny, 1969; McCarthy & Hoge, 1982; Rosenberg, 1965; Shahani, Dipboye, & Phillips, 1990). The RSES has been shown it to have moderate (Silber & Tippet, 1965) to acceptable (Hagborg, 1993; Schmitt & Allik, 2005) concurrent validity and good test-retest reliability (Shahani et al., 1990). The RSES was used to investigate the discriminant validity of the PS-CEP. The average range of scores on the RSES is 15-25. A non-significant correlation between the two instruments would indicate that the two scales are measuring different constructs and would support discriminant validity. We hypothesized that the two scales will demonstrate correlations that provide evidence that the measures are discriminant from each other.

Perceived Stress Scale (PSS). The PSS is a self-report, fourteen item questionnaire that examines the degree to which situations in one’s life are perceived as stressful (Cohen, Kamarck, & Mermelstein, 1983). Items were designed to measure how unpredictable, uncontrollable, and overloaded respondents find their lives. The scale asks participants to indicate how often they feel a certain way in the span of a month ranging from “never” to “always.” Four items are reversed scored and the scores across all items are summed. The higher the PSS score the more likely it is that the respondent perceives that the demands of their life are overwhelming and stressful and they may perceive themselves as having less self-efficacy. The PSS has acceptable reliability and validity ($\alpha = .82\text{-}.87$) as it has been shown to correlate in a predicted ways with other measures of stress (Lee, 2012). A perceived stress score of 13 is considered an average level of stress (Cohen, Kamarck, & Mermelstein, 1983.). However, in high stress groups, such as the Head Start sample in the current study, the average can be closer to 20 (Cohen, Kamarck, & Mermelstein, 1983). Therefore, we hypothesized that the PS-CEP would have a negative correlation with stress.

Parenting Style and Dimensions Questionnaire (PSDQ). The PSDQ, a 30-item Likert-type questionnaire was designed to measure three parenting style variables: permissive, authoritarian, and authoritative parenting (Robinson, Mandleco, Olsen, & Hart, 1995). The test-retest consistency of the scale was found to be relatively high ($\alpha = .63$, $p < .01$; Önder & Gülay, 2009). Additionally, the subscales' internal consistency coefficient is acceptable ($\alpha = .38$, $p < 01$; Önder & Gülay, 2009). We hypothesize that higher levels of self-efficacy will be related to the authoritative parenting style and therefore the PS-CEP will have a positive correlation with that subscale.

Chicago Lead Knowledge Test. The Chicago Lead knowledge Test (Mehta & Binns, 1998) evaluates parental knowledge regarding lead exposure prevention. The measure includes 5 questions related to general information about lead, 11 about lead exposure, 4 about prevention practices and 4 about nutrition. The test-retest reliability of the measure was 0.96 (Campbell et al., 2011; Mehta & Binns, 1998). Based on the principles of self-efficacy theory, parents with prior knowledge of lead should have higher self-efficacy for contaminant exposure prevention behaviors. Therefore, we hypothesized a positive correlation between the PS-CEP and the Chicago Lead Knowledge Test.

Results

The first objective of this study was to evaluate the factor structure of the PS-CEP. Maximum likelihood exploratory factor analysis was used for item reduction and to summarize the interrelationships among the set of original items. Exploratory factor analysis is a method used to discover which variables form coherent subsets, and which variables do not provide extra or relevant information (Williams, Brown, & Onsman, 2012). Variables are then combined into factors which reflect underlying processes that have created the correlations among variables. In order to determine the number of factors to retain, model fit indices; scree plot and parallel analysis were used.

The eigenvalue for a given factor is a measure of the variance in all the variables that is accounted for by that factor. According to the eigenvalue greater than one rule (Kaiser, 1960), only eigenvalues greater than one are retained for interpretation. A scree plot displays the descending order of magnitude of the eigenvalues (Cattell, 1966). Parallel analysis determines the number of factors by comparing eigenvalues of the experimental data with eigenvalues of randomly generated simulated data with the same sample size (Horn, 1965; Buja & Eyuboglu, 1992). A factor was considered significant if the associated eigenvalue was bigger than the mean of those obtained from the simulated data.

The model fit indices are defined by the test statistics which in this investigation were Chi Square, the Tucker Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA). Chi- square, an absolute fit index, represents the difference between the observed covariance matrix and the predicted matrix. If the chi-square is not significant, the model is regarded as acceptable. However, it can easily be affected by sample size, model size, distribution and omission of variables (Tanaka, 1993). The TLI, a relative fit index, compares a chi-square model tested to one that specifies that all the variables are uncorrelated. A model is regarded as acceptable if the TLI exceeds .90 (Byrne, 1994). The RMSEA index is a function of chi-square that measures the difference between the observed and estimated covariance matrices per degree of freedom (Steiger, 1990). Values less than 0.05 indicate good fit, values up to 0.08 reasonable fit and ones between 0.08 and 0.10 indicate mediocre fit (Kenny, D. A., 2011). All factor analyses were completed using Mplus 5 (Muthén & Muthén, 2010) and R (R Development Core Team, 2013).

The second objective was to evaluate the reliability and construct validity of the PS-CEP. Reliability refers to the internal consistency of a questionnaire (Jack & Clarke, 1998). The reliability of PS-CEP was measured by examining the inter-item correlations to determine if items were measuring the same domain. Items with a Cronbach's alpha greater than .70 were considered to have good internal consistency (Bowling 2014; Bryman & Cramer, 1997).

Construct validity was examined by evaluating convergent and discriminant validity. Discriminant and convergent validity are both subsets of construct validity (Robins, Hendin, & Trzesniewski, 2001). Convergent validity can be established if two similar constructs are related to one another, while discriminate validity applies to two dissimilar constructs that are differentiated. A construct can be composed of a number of factors as well as scales based on those factors, which can be correlated with each other. When scales are too highly correlated with each other it is difficult to determine if the measures actually discriminate between the constructs (Cronbach & Meehl, 1955). Campbell and Fiske (1959) recommend that one should always demonstrate the validity of a scale by showing the inter item correlations. Although there is no standard value, a result less than .85 tells us that discriminant validity likely exists between the two measures. A result greater than .85 however, tells us that the two constructs overlap and they are likely measuring the same thing (Campbell & Fiske, 1959).

To determine convergent validity, Pearson product moment correlation coefficients were calculated between the Mturk total score (*N* =377) on the PS-CEP and the total score on the GSES (Table 8). Pearson product moment correlation coefficients were also calculated among the subscale scores of PS-CEP and the total scores on the GSES. Discriminant validity was addressed by calculating Pearson correlation coefficients among the total scores of the Mturk sample on the PS-CEP and the RSES.

Measures used to examine the validity of the PS-CEP were theoretically related to constructs that have previously been linked to self-efficacy and health behavior change. The General Self-Efficacy Scale (GSES; Schwarzer & Jerusalem, 1995) was used to examine concurrent and convergent validity. A high, positive correlation would indicate that the two instruments are converging on the same concept. The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965) was used to examine discriminant validity. A weak negative correlation would indicate the RSES and PS-CEP scales measure different constructs and supported discriminant validity. Additionally, the Perceived Stress Scale (PSS; Cohen et al., 1983), a measure of how unpredictable, uncontrollable, and overloaded respondents find their lives, was included to further support discriminant validity as it is a reliable measure of stress.

A third objective was to examine different characteristics of respondents who demonstrated high or low self-efficacy to prevent contaminant exposure. Correlations between demographic characteristics and parenting style would indicate a statistical dependence between the variables and may help to further elaborate on the relationship between these characteristics and efficacy for contaminant exposure prevention. Generally, a correlation coefficient less than

.3 is considered a weak relationship, .3-.7 moderate and greater than .7 a strong relationship exists (Wackerly, Mendenhall, & Scheaffer, 2007). The Head Start, Mturk and combined data set were analyzed for any possible correlations between the total PS-CEP score and age. Gender, Ethnicity, Marital Status, Education and Home Ownership were also reanalyzed using t-tests and analysis of variance. Additionally, using only the Mturk sample, the total PS-CEP score and the subscales of the measure were correlated with parenting style using the PSDQ in order to determine the nature of the relationship between parenting style and contaminant exposure prevention behaviors. All analyses were conducted using SPSS 22 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp)

Objective 1

The EFA utilized the combined Head Start and Mturk samples in order to ensure sufficient statistical power. A sample size of 553 was achieved, which ensures a large enough sample size to conduct a factor analysis to test for various proposed factor structures; Tabachnick and Fidell (2007) note a sample size of 500 is very good and, which also allowed for more than ten observations per item.

First, the scree plot (Figure 6) was examined to assess how many factors were suggested with an eigenvalue around 1. The eigenvalues of factors 1, 2, 3, 4 and 5 were 14.7, 1.34, 0.82, 0.59, and 0.43 respectively. Based on the eigenvalue >1 rule, two factors would be retained. However, the parallel analysis indicated as many as five factors should be retained (Figure 7). Subsequently, a factor analysis with two, three, four and five factors was compared. Due to a possible correlation of the items, the results were rotated using an oblique oblimin rotation. Items that had poor reliability, weak loadings, or cross loaded were eliminated from the measure. The final measure consisted of 30 items. A final four factor model was chosen based on simple structure, factor interpretation, and acceptable fit indices (Tables 3 and 4). The chi-square was significant at the p <.001 value for all models, indicating that none of the models had a perfect fit. However, the RMSEA for the four factor model is .071 (90% CI [.066, .074]), indicating a reasonable fit and the TLI for the final model was .904, indicating an acceptable fit.

The alpha of the total PS-CEP score was .95 (M = 2513, SD = 446.75). The first factor was named *children's wellness and nutrition* because it was representative of items that demonstrated adherence to medical advice and healthy food choices/limits (α = .92). The second factor, *cleaning*, consisted of items that indicate cleaning practices and routines (α = .94). The third factor, *home maintenance*, was comprised of two items about home improvements and repairs (α = .90). The fourth factor, "action for contaminant exposure" contained item loadings which focused on the course of action a person would take when exposed to ECs (α = .79). Table 4 presents the item loadings for each factor.

Objective 2

The GSES demonstrated high internal consistency (α = .92) and respondents reported higher than average self-efficacy (M = 32.81, SD = 5.13). Results indicated a moderate but significant relationship between the total score of the PS-CEP and the total score of the GSES (r = .45). The correlations calculated between the four subscales of the PS-CEP and the GSES were significant. While the *children's wellness and nutrition*, *cleaning* and *action for contaminant exposure* factors resulted in moderate correlations: r = .45, .44, .34 respectively the third factor, home maintenance, resulted in a very weak positive correlation (r = .11; Table 7).

The RSES demonstrated acceptable internal consistency (α = .4) and indicated that respondents were on the high end of average self-esteem (M = 26.0, SD = 3.70). Results indicated a weak negative significant correlation between the total PS-CEP score and the total

RSES score (r = -.12; Table 7). Weak negative significant correlations between the PS-CEP factors *children's wellness and nutrition* and *cleaning* and the RSES were also obtained (r = -.18, -.14 respectively). However, the *home maintenance* factor had a weak positive significant correlation with the RSES (r = .14).No correlation was found between the *action for contaminant exposure* and the RSES.

Finally, while the PSS was a reliable measure of stress (α = .61), results indicated that the combined sample was a high stress group (M = 24.53, SD = 3.73). Due to the relationship between high stress and self-efficacy a negative correlation was expected. Additionally, due to the expected relationship between the Chicago Lead Knowledge Test and self-efficacy a positive correlation was expected with the PS-CEP. However, there was not a significant correlation between the total PS-CEP score and the PSS score or the Chicago Lead Knowledge Test.

Objective three

Tables 8-10 present correlations, t-tests and ANOVA results of the demographic characteristics and total PS-CEP scores for the combined, Head Start and Mturk samples. First, the Head Start sample scored significantly higher (F (1, 574) = 16.34, $p < .001$) on the PS-CEP (M = 2663.11, SD = 362.57) than the Mturk sample (M = 2518.89, SD = 434.42). Further findings in each sample and in the combined sample are presented below.

The total PS-CEP score for the Head Start sample was not significantly correlated with age (Table 8). Additionally, there was no significant difference in total PS-CEP score based on gender or home ownership. Finally, an ANOVA resulted in no significant differences in PS-CEP score based on education, marital status or ethnicity (Table 9).

The total PS-CEP score for the Mturk sample was not significantly correlated with age (Table 8). Similarly, there was no significant difference in total PS-CEP score based on gender or home ownership (Table 10). However, ANOVA results indicated a significant difference in the mean total PS-CEP score based on level of education (F (3, 348) = 9.97, p < .001). Participants with less than a high school education scored significantly lower (M = 1729.62, SD = 785.41) than participants with a high school education (M = 2577.31, SD = 446.99), some college (M = 2550.55, SD = 390.00) or a college degree (M = 2525.04, SD = 407.84).

The total PS-CEP score for the combined sample was not significantly correlated with age (Table 8) and there was no significant differences based on home ownership (Table 10). However, there was a significant difference in total PS-CEP score based on gender, with females scoring higher (M = 2688.40, SD = 346.06) and with less variance than males (M = 2510.40, SD = 452.83; Table 10). There were also significant differences in the factor scores based on gender. For *children's wellness and nutrition* (F (1,562) = 56.17, p <.001) males scored significantly lower (M = 1170.57, SD = 215.56) than females (M= 1283.99, SD = 143.57). Similarly, males scored significantly lower (F (1,560) = 22.27, p<.001; M = 869.88, 180.86) than females (M = 938.39, SD = 159.39) on the *cleaning* factor. Again there were significant differences for *action for contaminant exposure* (F (1,565) = 16.80, p < .001) with females scoring higher (M = 243.20, SD = 57.26) than males (M = 223.62, SD = 52.85). However, males scored significantly higher (F (1,563) = 17.33, p < .001; M = 216.40, SD = 77.43) than females (M = 190.78, SD = 67.38 on the *home maintenance* factor.

Levene's test indicated unequal variances; therefore non-parametric tests were conducted to determine significant differences among education, marital status and ethnicity. A Kruskal-Wallis one-way ANOVA indicated that there were significant differences among specific reported ethnicities (X^2 (3) = 9.45, p = .02) with a mean rank of 235.07 for Asian /Pacific Islander, a mean rank of 295.01 for African American respondents and a mean rank of 255.06 for

Caucasian individuals. Asian/Pacific Islanders (*n* = 100) scored significantly lower (*M* = 2554.03, *SD* = 437.67) than African Americans (*n* = 91; *M* = 2704.84 *SD* = 347.67). Additionally, African American respondents scored significantly higher than Caucasian individuals (*n* = 285; *M* = 2620.27, *SD* = 369.97). There was also a statistically significant difference among levels of education ($X^2(6) = 16.67$, p = .011) with a mean rank of 185.46 for less than a high school education and 259.70 for those with a college education. Finally, no significant differences were found between individuals that reported being separated or single and those with a partner, living with a partner, or married.

Finally, Table 11 presents the PS-CEP total score and subscales in relation to parenting style. The subscales of the parenting measure: authoritative, authoritarian and permissive all demonstrated acceptable internal consistency (α= .91, α = .93, α = .80 respectively). The results demonstrate that parents scored almost equally on the authoritative subscale (*M* = 66.0, *SD* = 10.03) as they did on the authoritarian subscale (*M*= 67.94, *SD* = 27.81) but much lower on the permissive subscale (*M* = 57, *SD* = 6.24).

The overall PS-CEP score, *children's wellness and nutrition*, *home maintenance* and *action for contaminant exposure* factors all showed weak to moderate correlations with the authoritative subscale (respectively: *r* = .43, .51, .40, .35). However, the PS-CEP factor cleaning showed no significant correlation with the authoritative subscale. Additionally, the overall PS-CEP score, c*hildren's wellness and nutrition, cleaning* and *action for contaminant exposure* again had similar weak to moderate negative correlations with the authoritarian parenting subscale, while the *home maintenance* factor had a significant but weak positive correlation to the subscale. Finally, the overall PS-CEP score, *children's wellness and nutrition, cleaning* and *action for contaminant exposure* factors were negatively correlated with permissive parenting, but again the factor *home maintenance* showed a significant but weak positive correlation (Table 11).

Discussion

The federal government's HHI supports strategic, focused research to address EC exposure (Irwin, Siddiqi, & Hertzman, 2007), for which a measure of parental self-efficacy for EC exposure prevention is both empirically and theoretically justified. Previously, research of primary prevention efforts to reduce children's EC exposure has linked parental self-efficacy to prevention behaviors for children's health and well-being (Kegler et al., 1999; Silva-Sanigorski, Ashbolt, Green, Calache, Keith, et al, 2013). This relationship is explained through models of health behavior change, which propose that self-efficacy is necessary to explain individual health behavior initiation and maintenance (Schwarzer & Luszczynska, 2008). In this manner, domain-specific measures of parental self-efficacy are necessary for determining the value and impact of an intervention (Coleman & Karraker, 1997), but such a measure of EC exposure relevant to parents constructing a healthy home was lacking. The current study was successful in filling this gap in the literature by establishing a measure of parental self-efficacy for contaminant exposure prevention that demonstrated good factor structure, internal consistency, and validity.

In the PS-CEP, three of the four factors established by the EFA could help in program design and implementation by measuring self-efficacy related to health behavior change and tasks that impact exposure prevention The first factor, *children's wellness and nutrition*, included items that require parental supervision and reflect a parent's self-efficacy to supervise their children's specific task related health behaviors, such as hand washing and food choices (CDC, 2012). The second factor, *cleaning*, included items related to cleaning practices and routines. While cleaning was one of the CDC recommended behaviors for exposure prevention, the items on this factor also relate to the concept of task specific self-efficacy to perform health behaviors (Bland, Kegler, Escoffery, & Halinka-Malcoe, 2005). The third factor, *home maintenance*, which consisted of only two items, did not demonstrate similar levels of validity as compared to the other factors. The intent of both items was to indicate a parent's self-efficacy to find resources and the motivation to reduce exposure to possible ECs. Finally, the fourth factor, *action for contaminant exposure*, consisted of items related to the course of action a person would take when they are aware that they or their child are being exposed to ECs. The items loading on this factor indicate a parent's perception of the threat associated with EC exposure and their self-efficacy to take action to remove their child from a situation that causes EC exposure. These items relate to the concept of parental self-efficacy and a parent's perception of the harm caused by EC exposure.

Overall, the measure had good validity as it is moderately correlated with general self-efficacy, negatively correlated with self-esteem and was unrelated to perceived stress and lead knowledge. While high correlations among the PS-CEP, its factors, and a measure of general self-efficacy were expected prior to the analysis, a moderate correlation was found. Specifically, related to convergent validity, the measure of general self-efficacy had positive moderate correlations with *children's wellness and nutrition*, *cleaning*, and *action for contaminant exposure*. This may be due to the fact that the measure of self-efficacy is designed to assess a general sense of perceived self-efficacy (Schwarzer & Jerusalem, 1995); while a more task specific parenting self-efficacy scale might have yielded higher correlations among factors of the PS-CEP (Coleman & Karraker, 1997). It should also be noted that the PS-CEP was designed to measure the self-efficacy to affect someone else's behavior (that of a child), while the measure of general self-efficacy relates only to the respondents' self-efficacy to affect their own behavior.

This is a general challenge in health behavior change as theorists focus more on personal decision making, as opposed to parental decision making for their children's health (Kegler et al, 1999).

While self-esteem reflects one's stable sense of worth (Rosenberg, 1965), self-efficacy is a belief in one's own capabilities to carry out the courses of actions required to manage prospective situations or to reach a certain goal and is more domain specific (Bandura, 1977). However, based on the literature it is likely that there is some overlap between the two constructs (Judge, Erez, Bono, & Thoresen, 2002) Therefore it was expected that the two measures would demonstrate low correlations. This expected relationship was exhibited with a significant negative weak correlation between self-esteem, the overall PS-CEP score and two factors (*children's wellness and nutrition* and *cleaning)*. Additionally, the factor *action for contaminant exposure* had no correlation with the measure of self-esteem, while *home maintenance* had a weak positive correlation (Table 7).

Greater parenting self-efficacy is associated with the tendency to assess stressful situations as less problematic and to feel confident that difficulties can be resolved (Coleman & Karraker, 1998; Coleman & Karraker, 2003; Mash & Johnston, 1990). Additionally, parenting self-efficacy has been shown to be an important buffer against parenting stress (Coleman and Karraker, 1998; Raikes and Thompson, 2005). However, while parental self-efficacy and stress seem to covary the research is varied in reports of origins, outcomes or transactional role (Jones & Prinz, 2005). In the current study, the PS-CEP did not significantly correlate with the measure of stress. Research has also indicated that parental self-efficacy increases or decreases through the resulting success and/or failures as a parent (Jones & Prinz, 2005). Based on this idea of a feedback loop, parents may have perceived self-efficacy for the behaviors measured by the PS-

CEP, while their knowledge base of the subject (high or low) is unrelated. However, the PS-CEP did not correlate with the lead knowledge test indicating that parents' level of self-efficacy for task specific behaviors is likely not associated with their specific knowledge of the subject.

Three of the four factors of the PS-CEP (*children's wellness and nutrition*, *cleaning* and *action for contaminant exposure*) demonstrated further validity as they were correlated with parental reports of authoritative parenting style. The moderate positive correlation between the total PS-CEP score and authoritative parenting would indicate that self-efficacy for preventing EC exposure is associated with parenting that encourages autonomy and independence, yet still places fair and consistent limitations or restrictions on the child's behavior. This is consistent with previous research examining the link between parental self-efficacy, parenting style and the resulting parenting competence. For example, past research findings suggest that mothers with higher PSE have been shown to engage in parenting practices that promote positive child adjustment (Ardelt & Eccles, 2001). Similarly, PSE has been positively linked with parenting acceptance/warmth often described as authoritative parenting (Dumka et al., 1996).

In contrast, permissive parenting, which is often characterized as overly responsive but undemanding (Baumrind, 1991), was negatively correlated with total PS-CEP score, *children's wellness and nutrition*, *cleaning* and *action for contaminant exposure*, indicating that low self-efficacy for task specific behaviors that require supervision and action may be difficult for parents that lack consistent rules and expectations of their children. Additionally, authoritarian parenting was also negatively correlated with the same items, indicating that parents who place a strong focus on discipline and limits may struggle with self-efficacy for these same behaviors. Permissive and authoritarian parenting has been similarly associated with lower levels of parental self-efficacy (Ardelt & Eccles, 2001; Dumka et al., 1996; Gross, Sambrook, & Fogg, 1999).

The factor of *home maintenance* was an irregularity in the PS-CEP as it performed in the exact opposite manner as hypothesized. In contrast to the other three factors, it had a positive correlation with the measure of self-esteem as well as permissive and authoritarian parenting styles. This may be due in part to the lack of construct validity of the two items that constitute the factor, which consist of how confident parents feel they can promptly make repairs and improvements to the home. Confidence in such manners could be more related to trait characteristics, like self-esteem, than the state specific task situations associated with self-efficacy. While *home maintenance* was retained in the exploratory factor analysis, the validity of the factor suggests it should be dropped from the measure.

This study not only examined self-efficacy as an indicator of successfully completing EC preventative behaviors but demographic characteristics were also investigated for associations with parental self-efficacy. While the Head Start sample did not demonstrate different levels of key demographic characteristics (e.g., age, gender, education, ethnicity, marital status and home ownership), several variables resulted in significant differences in the mean PS-CEP score in the Mturk and combined samples. For example, the total PS-CEP score differentiated between levels of education in both the Mturk and combined samples. As the level of education increased, so did the average score on the PS-CEP, indicating that individuals with less education (high school or below) may need additional support to prevent their child’s exposure to ECs. Personal mastery experience is one of four major components of self-efficacy, which could be indicative of higher educational attainment (Bandura, 1997) and has also been shown to interact with self-efficacy to predict key parenting outcomes (Kohlhoff, & Barnett, 2013; Teti & Gelfand, 1991).

In the combined sample, total PS-CEP score was also shown to differentiate between gender and ethnicity. In the combined sample, males consistently scored lower on the PS-CEP as well as three of the four factors, indicating a lower self-efficacy for preventing their child's exposure to ECs. While the role of paternal self-efficacy is understudied compared with maternal self-efficacy, fathers were found to have lower self-efficacy in areas such as infant care (Hudson, 2001) and reading achievement (Lynch, 2002). Furthermore, parenting stress and marital satisfaction were found to be predictors of parental self-efficacy for fathers (Sevigny, 2009). As in the case of infant care and reading achievement, this likely indicates that fathers require additional support in interventions, especially in high stress situations or for those without a partner, and may demonstrate lower parental self-efficacy than mothers.

Finally, the mean PS-CEP score was differentiated based on reported ethnicity in the combined sample. Asian/Pacific Islander individuals scored significantly lower than African Americans. African Americans also scored significantly higher than Caucasian individuals indicating some groups may have lower self-efficacy for EC exposure prevention behaviors. It has been established that contextual factors such as ethnicity play a role in parental self-efficacy and child outcomes (Jones & Prinz, 2005). Past research has indicated that parental self-efficacy for African American mothers, but not Caucasian mothers, can affect academic progress for children (Ardelt & Eccles, 2001). Furthermore, lower maternal self-efficacy for Caucasian mothers, but not African American mothers, is related to higher childhood anxiety (Hill & Bush, 2001). It is likely that the effectiveness of an intervention to target parental self-efficacy for exposure prevention behaviors is influenced by ethnicity. This contextual factor may act as a moderating influence for intervention efficacy, affecting the strength of the program. Any effective prevention connects risk factors with targeted interventions in order to reduce harmful patterns of behavior (Coie, et al, 1993). Based on this knowledge, interventions should consider the influence of contextual factors such as demographic characteristics differentiated by the PS-CEP, including individuals with lower levels of education, males and certain ethnic groups.

Limitations & Future Directions

Though numerous instruments exist to measure different aspects of self-efficacy, no known instrument exists to specifically measure the concept of parental self-efficacy to influence child health behavior in the context of EC exposure. Previously, measures of parenting self-efficacy have been criticized for not being psychometrically sound due to minimal validation and utilization of homogeneous normative samples (Coleman & Karraker, 1998). The current study attempted to address these limitations of previous work, but included several limitations, including the poor validity of one of the four factors.

First, there was the risk of response bias that may have originated from the respondents' intention to respond to the items in a socially desirable fashion. There is a longstanding documented gap between self-reported and actual behaviors (verbal and behavioral data), further identified as informant bias (Knoke and Yang, 2008). Similarly, the Hawthorne effect might have influenced participants to respond differently than they otherwise would (or to answer questions as though they behaved with more parental self-efficacy than they really did), because they were aware of their participation in the study and should be considered as a possible threat to validity (Polit & Beck, 2008). Despite these possibilities as threats to validity, those who chose to participate may have done so because of their desire to improve health behaviors or some other characteristic that separated them from the population. Additionally, in an effort to reduce response bias, an introduction to the measure normed that parents are really busy, and may not be able to accomplish certain things with the best of intentions.

Moreover, the survey used for the Mturk sample was limited to English-speaking respondents. This immediately excluded persons who were unable to read in English. Income was excluded due to the fact that all of the participants in the Head Start sample were required to be income eligible in order to enroll and therefore 100% of the sample fell below the poverty guidelines. In this manner, while this study attempted to obtain a heterogeneous sample that was more nationally representative by pooling from a low-income and an online sample, a sample made of a more diverse population could better examine relationships and determine differences among race, geographic location, education, socioeconomic background and scores. Future psychometric testing should also include further concurrent and discriminant validity testing that includes additional measures. For example, a task-specific parental self-efficacy scale in which the concept would be more closely aligned with self-efficacy of parental ability to influence child health behavior, such as the commonly used tool for measuring parenting self-efficacy, the Parenting Sense of Competence Scale (PSOC; Gibaud-Wallston & Wandersman, 1978; Gilmore & Cuskelly, 2009) would be beneficial. Furthermore, due to the fact that the correlations in the current study are inconsistent with the typical relationship between stress, self-esteem and self-efficacy additional validity measures should be included. Finally, future testing on the PS-CEP should involve determining the predictive validity of the measure. With further scale development and testing, this measure could be integrated into prevention and intervention studies to examine models of health behavior change in the context of contaminant exposure.

Conclusion

Self-efficacy plays an important role in health behavior change and could potentially act to decrease environmental exposures and the adverse health consequences associated with them (Strecher, DeVellis, Becker, & Rosenstock, 1986). However, existing primary prevention tactics have shown unreliable results in reducing or preventing the detrimental consequences of exposure (Bland, Kegler, Escoffery, & Halinka-Malcoe, 2005). The development of a low cost psychometrically sound measure of this type allows interventions to be tailored based on parents' self-efficacy to more appropriately support them in taking steps to create healthier environments for their children. In striving to reach the goal of the HHI, to conduct strategic, focused research on the links between housing and health and cost-effective methods to address hazards, the current study has worked to expand research questions and intervention tactics in environmental contaminant exposure prevention and healthy homes literature.

Tables and Figures

Table 1.

Summary of Community Demographics as of 2013

Variable	Baker County (n = 27,010)	Bradford County (n =28,404)	Clay County (n = 190,891)	Duval County (n=866, 431)	Nassau County n = 73,303)
Race/ethnicity of Children under age 5 in poverty					
White	274	269	1,241	4,428	6,928
Black	37	243	456	8,320	9,158
Hispanic	0	0	284	1,414	1,726
Other	114	44	231	1,774	2,191
Age					
Under 5 years	1,871	1,675	11,623	59,736	3,905
Education					
Less than 9th Grade	6.60%	6.40%	2.60%	3.70%	2.90%
9th - 12th Grade	15.10%	18.70%	7.40%	8.80%	9.00%
HS Grad or GED	47.90%	37.20%	29.90%	28.90%	35.00%
Some college, no degree	15.50%	22.70%	26.40%	24.10%	22.70%
Associate degree	6.60%	6.50%	10.10%	8.90%	7.80%
Bachelor's degree	4.80%	5.10%	15.90%	17.50%	14.80%
Grad or prof degree	3.50%	3.40%	7.60%	8.10%	7.70%

	Baker Site (N=47)	Starke Site (N=12)	Green Cove Springs/Mid dleburg/ Belmont Sites N=84)	N/A	Peck/ Callahan Sites (N =45)
Race/ethnicity of Children under age 5 in poverty					
White	59.60%	25%	26%		44%
Black	36.10%	75%	30%		31%
Hispanic	4.30%		18%		6%
Other			19%		6%
Education					
Less than 9th Grade	10.60%		7%		6%
9th - 12th Grade					
HS Grad or GED	61.60%	50%	39%		56%
Some college, no degree	19.10%	33.30%	26%		27%
College degree	6.40%	8.30%	14%		

Table 2.

Summary of demographics for samples

	Head Start (N=210)	Mturk (N=377)	Combined Data (N=587)
	%	%	%
Gender			
Female	84.8	52.3	60.4
Male	13.8	45.6	39
Ethnicity			
Caucasian	37.6	55.7	49.9
African American	36.7	6.6	17.6
Hispanic	11.9	6.1	8.3
Asian/Pacific Islander	1	21.8	14.5
Other	3.4	3	3.1
Marital Status			
Single	42.4	8.5	20.9
with Partner	1	6.9	4.8
Living with Partner	8.1	13	11.4
Married	35.7	65.5	55.6
Separated	5.7	1.3	2.9
Divorced	1	2.4	0.5
Widowed	4.3	0.3	3.1
Level of Education			
Grade School (grades 1-6)	2.4	1.9	2.1
Middle School (grades 7-9)	4.8	0.3	1.9
High School (10-12)	42.9	6.4	19.7
GED	7.1	1.3	3.5
Vocational Education	5.2	4.5	4.8
Some College	24.3	22.8	23.7
College Degree	11.4	60.7	43.7
Do you rent or own a home?			
Rent	62.9	45.4	52.3
Own	35.7	51.7	46.6
	M (SD)	M (SD)	M (SD)
Age	30.89 (4.29)	30.46(6.32)	30.61(7.45)

Table 3.

Exploratory Factor Analysis Fit Indices for the PS-CEP

# of Factors	Chi Square	TLI	RMSEA (90% CI)	Simple Structure
2	2632.3*	0.81	.10 (.097,.104)	No
3	181.52*	0.86	.085(.08,.088)	No
4	1267.15*	0.9	.071(.066,.074)	Yes
5	964.74*	0.93	.063 (.057,.066)	Yes

**p*<.001

Table 4.
Exploratory Factor Analysis for the PS-CEP.

How confident are you that you can…	Children's Wellness and Nutrition	Cleaning	Home Maintenance	Action for Contaminant Exposure	
1. Follow your physician's medical advice and recommendations for recommendations on your child's health.	**0.91**				
2. Keep areas clean where food is prepared.	**0.81**				
3. Regularly take my children to wellness doctor visits.	**0.77**				
4. Know where my children are playing.	**0.76**				
5. Complete the recommended immunization schedule for my children	**0.72**				
6. Get a doctor to complete any tests or screening that you want completed for your child.	**0.71**				
7. Find and provide my children with healthy, fresh foods.	**0.69**				
8. Find foods my children will eat that are high in iron and calcium (Milk, Yogurt, Cereal, Fish, etc.).	**0.67**				
9. Be sure that my doctor is completing all tests recommended by the American Medical Association.	**0.65**				
10. Regularly get my children to eat the healthy foods.	**0.55**	0.25			
11. Find vegetables that my children will eat.	**0.46**	0.22			
12. Take action to protect my children from being exposed to toxins, like lead, mold, mercury, and radon, at home.	**0.45**	0.21			
13. Be sure that my children always wash their hands before meals.	**0.44**	0.29			
14. Keep my children from chewing or eating things that shouldn't be put in their mouths.	**0.43**	0.21			0.24
15. Maintain a clean home.	0.44	**0.47**			
16. Maintain a low level of dust in my home.		**0.82**			
17. Keep dust from outside my home from being tracked inside.	-0.24	**0.75**			

18. Regularly dust my home		**0.69**			
19. Regularly clean my child's toys.		**0.69**			
20. Remove dirt, dust, and debris from my home.	0.26	**0.65**			
21. Keep a regular cleaning schedule.		**0.62**			
22. Keep the floors in my home clean with regular mopping or vacuuming.	0.36	**0.6**			-0.21
23. Maintain clean floors in my home by limiting the amount of dirt that is tracked in on shoes.	0.22	**0.49**			
24. Limit the amount of food my children eat that is high in fat (processed meat, fried foods, etc.)	0.26	**0.46**			
25. Find resources or help to make repairs to my home if I do not personally have the financial means to pay for necessary repairs.		**0.32**			
26. If you rent: Get your landlord to make repairs that are needed in a timely manner. If you own: Find someone you can trust to make repairs that are needed in a timely manner.			**0.96**		
27. If you rent: Get your landlord to make improvements that you want. If you own: Make improvements to your home that you want.			**0.92**		
28. Take action to protect my children from being exposed to toxins, like lead, mold, mercury, and radon, at school.	0.25				**0.58**
29. Take action to protect my children from being exposed to toxins, like lead, mold, mercury, and radon, in locations outside of the home and school (i.e., family members' home, neighborhood, church, and other locations they visit).	0.37				**0.58**
30. Know whether or not my children are being exposed to toxins, like lead, mold, mercury or radon.		0.26			**0.33**

Table 5.

Correlations between Total PS-CEP and Four Factors for Combination Sample

Factors	Total PS-CEP Score	Children's Wellness and Nutrition	Home Maintenance	Cleaning	Action for Contaminant Exposure
Total PS-CEP Score	1	.92**	.42**	.94**	.79**
Children's Wellness and Nutrition	--	1	.13*	.82**	.68**
Home Maintenance	--	--	1	.31**	.31**
Cleaning	--	--	--	1	.69**
Action for Contaminant Exposure	--	--	--	--	1

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

Table 6.
Correlations between Total PS-CEP and Scales

Factors	Total PS-CEP Score	Lead Knowledge	PSS	GSES	RSES
Total PS-CEP Score	1	.04	.09	.45**	-.12**
Lead Knowledge	--	1	.07	.05	.17**
PSS	--	--	1	.13*	.26**
GSES	--	--	--	1	.04
RSES	--	--	--	--	1

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

Table 7.
Correlations between Four Factors and Scales

Factors	Total PS-CEP Score	Lead Knowledge	PSS	GSES	RSES
1.Total PS-CEP Score	1	.04	.09	.45**	-.12**
2.Children's Wellness and Nutrition	.92**	.02	.06	.45**	-.2**
3.Home Maintenance	.42**	-.18	.13*	.11*	.16**
4.Cleaning	.94**	-.02	.08	.44**	-.14**
5.Action for Contaminant Exposure	.79**	-.09	.06	.32**	-.09

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

Table 8.

Correlations between the Age and Total PS-CEP

	Total PS-CEP
Head Start	
Age	-.07
Mturk	
Age	.01
Combination	
Age	.01

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

Table 9.

Analysis of Variance (ANOVA) Results for Demographics and Total PS-CEP Score

Sample	*df*	*F*	*n*	*p*
Head Start				
Ethnicity	5,205	0.85	206	.52
Marital Status	2,192	2.04	193	.13
Education	3,193	1.23	194	.30
Mturk				
Ethnicity	6,368	1.88	369	.08
Marital Status	2,363	.12	364	.88
Education	3,351	9.98	352	.001
Combined				
Ethnicity	3,520	2.82	521	.04
Marital Status	2,551	2.31	552	.1
Education	6,551	4.12	552	.001

Table 10.

T-Test Results Comparing Gender and Home Ownership on Total PS-CEP Score

Sample		*n*	*M*	*SD*	*t*	*df*	*p*
Head Start							
	Male	28	2618.64	371.62	-.70	204	.92
	Female	178	2670.10	361.70			
	Rent	132	2648.50	381.53	-.77	204	.44
	Own	74	2689.16	326.89			
Mturk							
	Male	197	2456.50	458.78	-3.00	367	.24
	Female	172	2590.36	394.03			
	Rent	171	2498.80	488.71	-.87	364	.38
	Own	195	2538.70	382.53			
Combined							
	Male	220	2510.40	452.83	-5.22	551	.00
	Female	333	2688.40	346.06			
	Rent	289	2614.68	427.70	-.25	548	.8
	Own	261	2623.22	371.03			

Table 11.
Correlations between Mturk Total PS-CEP and subscales of PSDQ

Variable	1	2	3	4	5
1.Total PS-CEP	1	-	-	-	-
2.Children's Wellness and Nutrition	.92**	1	-	-	-
3.Home Maintenance	.42**	.18**	1	-	-
4.Cleaning	.94**	-.08	.82**	1	-
5.Action for Contaminant Exposure	.79**	-.02	.69**	.31**	1
6.Authoritative	.43**	.51**	-.06	.40**	.35**
7.Authoritarian	-.3**	-.40**	.16**	-.28**	-.21**
8.Permissive	-.28**	-0.35**	.16**	-.29**	-.19**

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

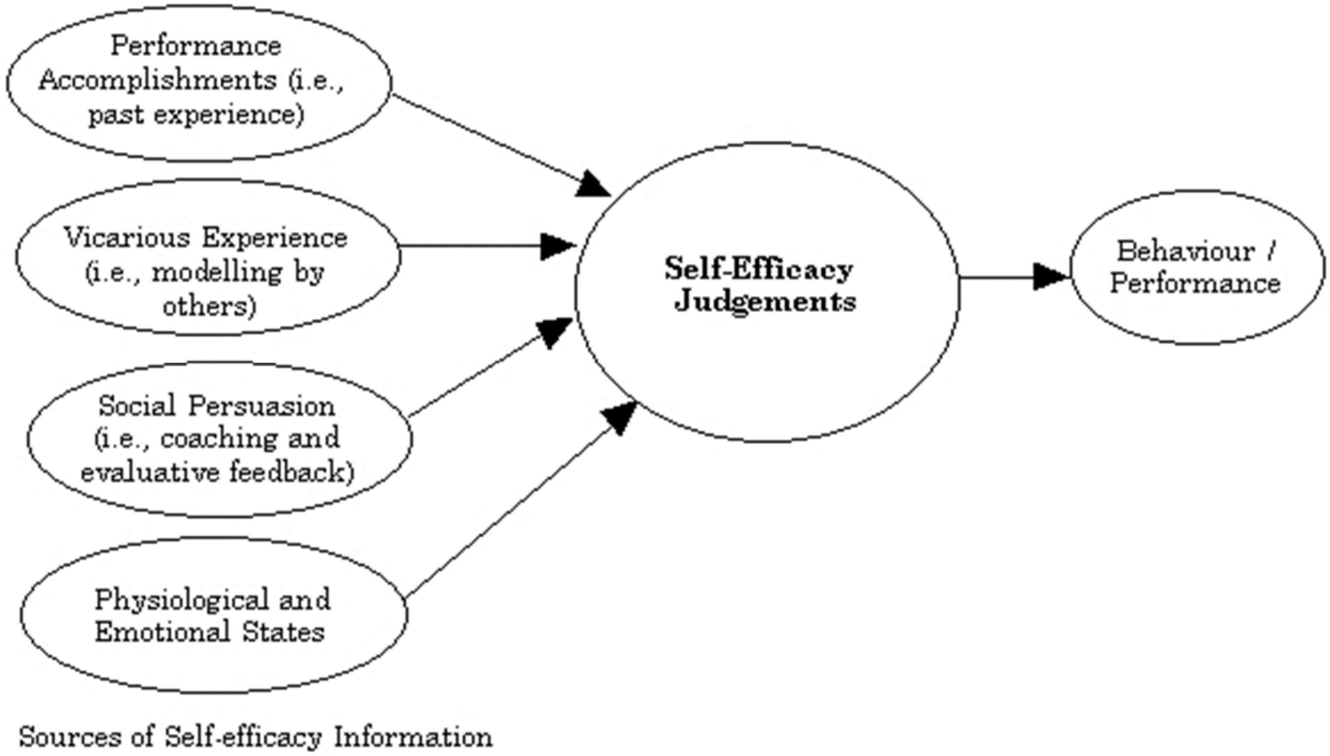

Figure 1. Self-Efficacy Theory

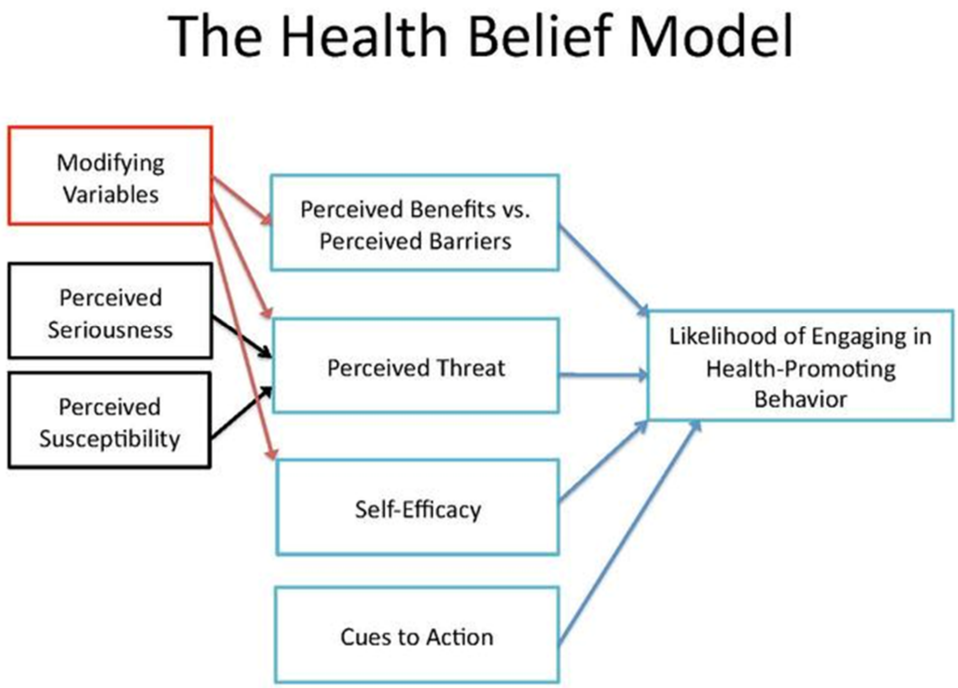

Figure 2. Health Belief Model

Graphic redacted, paper copy available upon request to home institution.

Figure 3. Theory of Planned Behavior

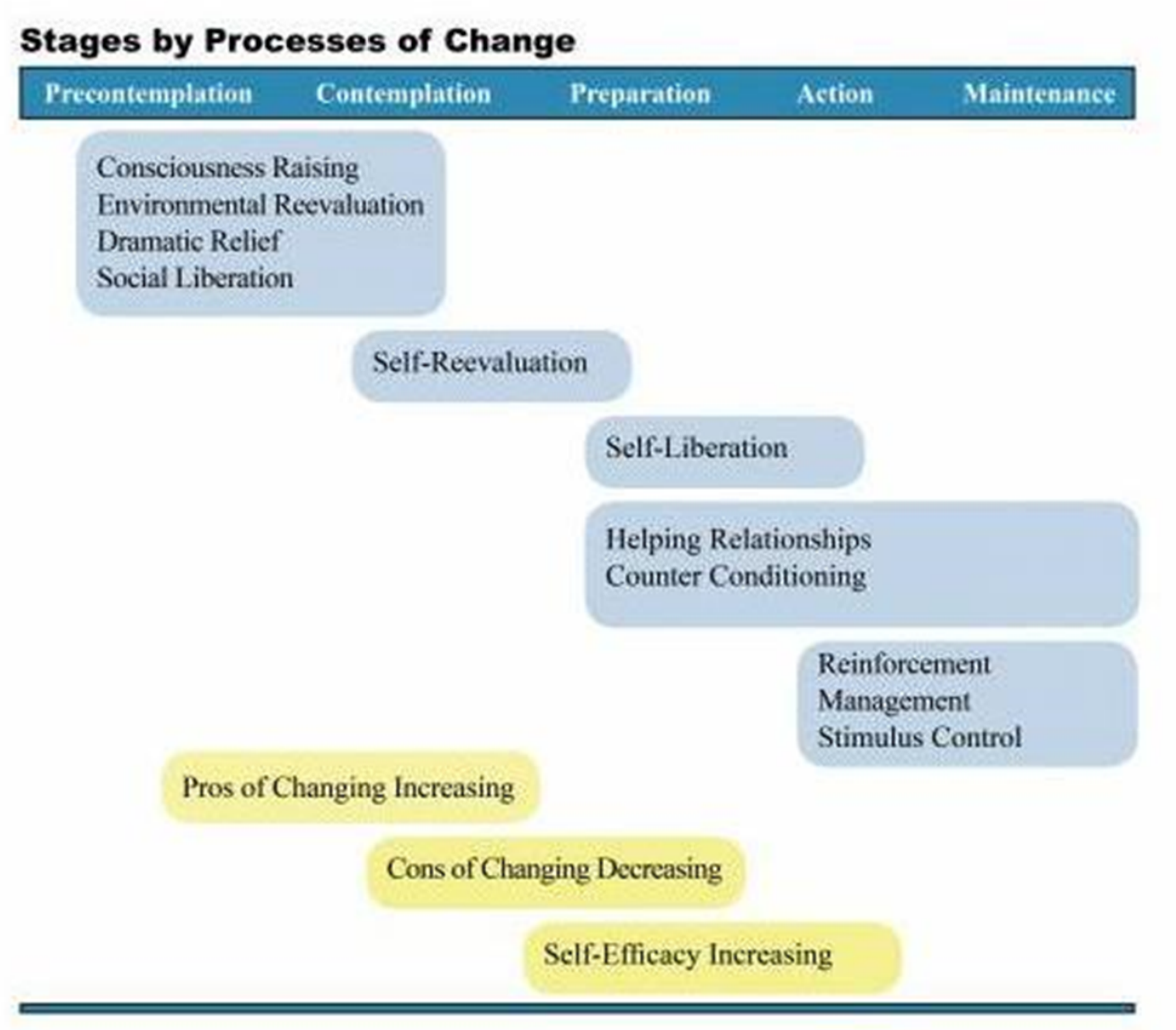

Figure 4. Transtheoretical Model

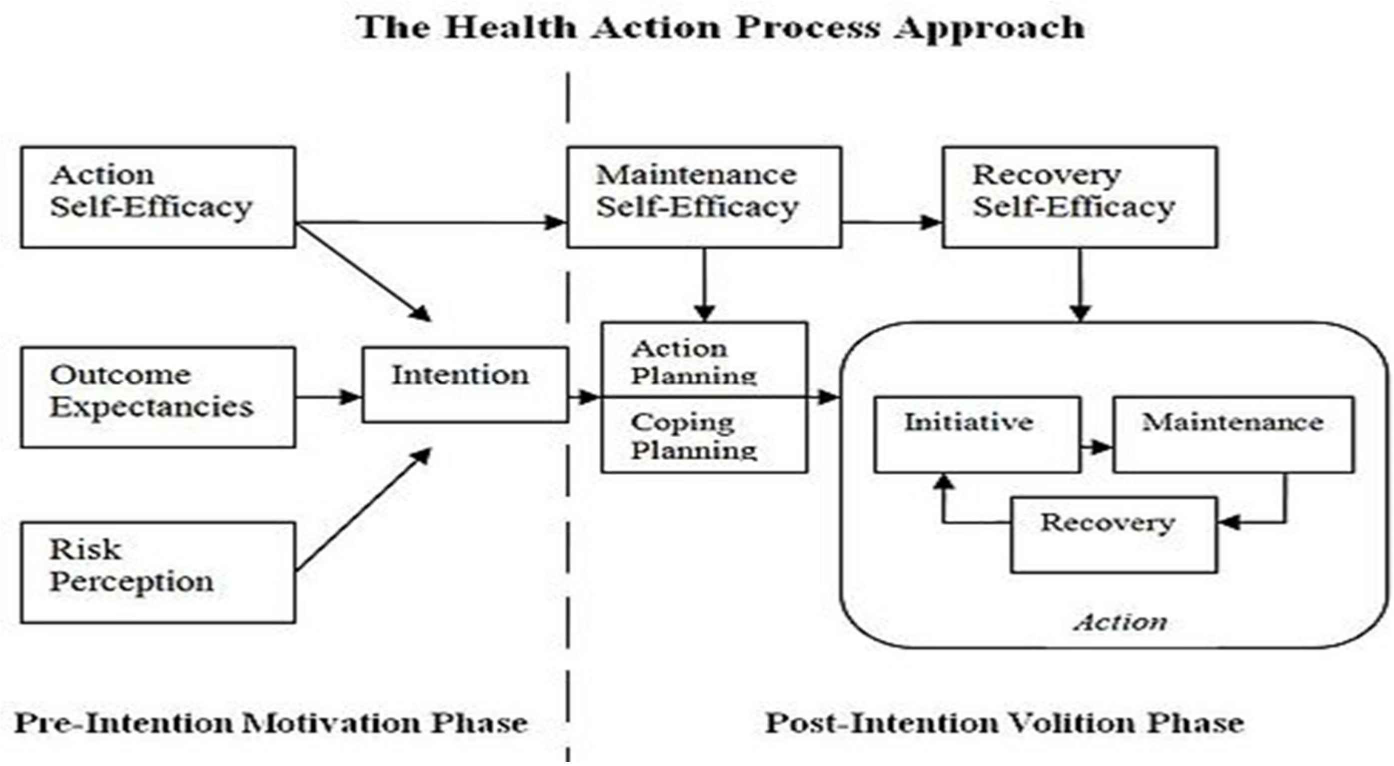

Figure 5. Health Action Process Approach

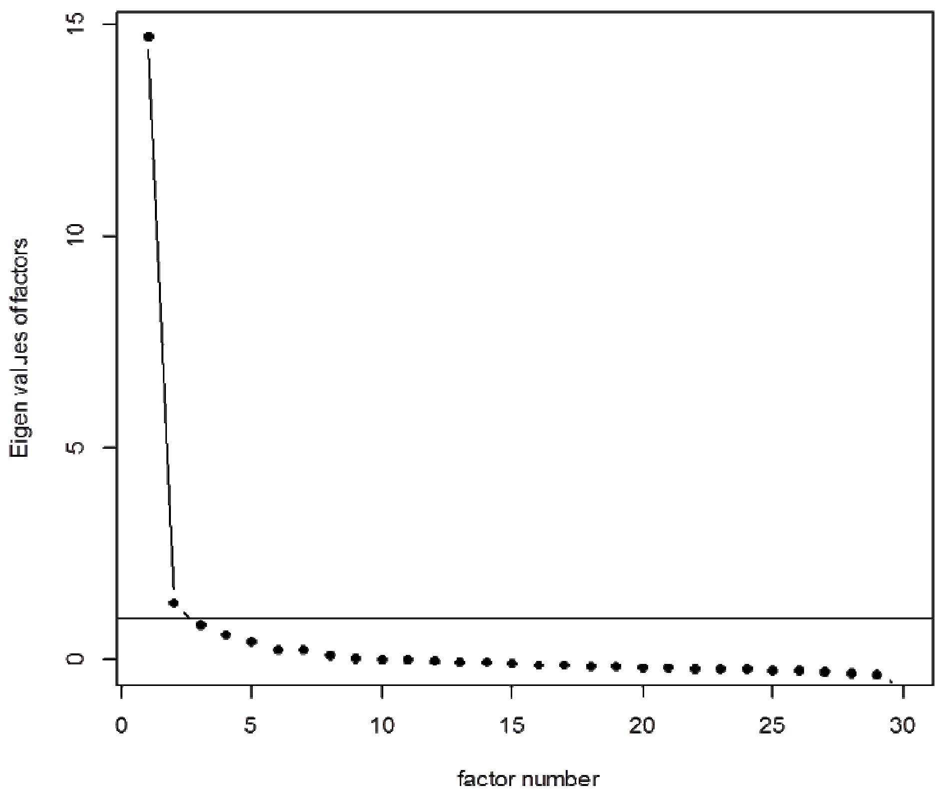

Figure 6. Scree Plot of eigenvalues from the PS-CEP

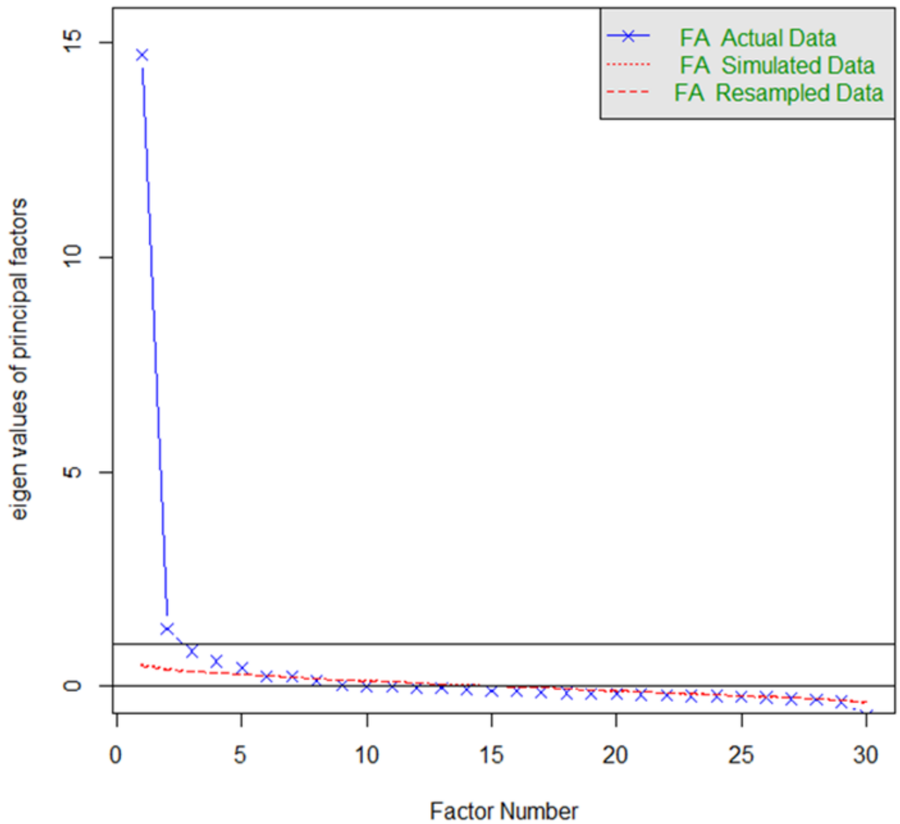

Figure 7. Parallel Analysis Plot of eigenvalues from the PS-CEP.

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