University of Cincinnati

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I, Nataraja Sarma Vaitinadin, hereby submit this original work as part of the requirements for the degree of Master of Public Health in Public Health - Health Education/Health Promotion.

It is entitled:
The Ability Of The Health Belief Model To Predict Childhood Obesity Prevention Behaviors Among Upper Elementary School Children in India

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The Ability Of The Health Belief Model To Predict Childhood Obesity Prevention Behaviors Among Upper Elementary School Children In India

A thesis submitted to the Department of Environmental Health in the College of Medicine, at the University of Cincinnati, in partial fulfillment of the requirements for the degree of

Master of Public Health

in Health Education and Promotion

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Committee Chair Bradley R. A. Wilson, Ph. D., M.B.A.
Abstract

The purpose of this study is to determine if the health belief model predicts childhood obesity prevention behaviors among upper elementary school children in a sample drawn from the Chennai region of southern India. The study reports data about three behaviors: less than two hours of screen time, drinking 6 to 8 cups of water instead of sweetened beverages, and eating five or more cups of fruits and vegetables. The health belief model has offered a practical framework for designing primary prevention interventions to reduce other health problems and continues to do so in the West. This study was designed to examine the extent to which selected health belief model constructs could predict the chosen behaviors among upper elementary school children in India. Data were collected using a 47-item valid and reliable scale administered to the sample population. Regression analyses were run to test for variance in behaviors attributable to each of the independent variables. The final regression model revealed that the health belief model predictors were weak in the current context of study, probably due to cultural differences in India compared to the USA where this model originated. Recommendations have been offered to evolve interventions aimed at predicting obesity associated behaviors in children.
Acknowledgements

Conducting research is a sacred endeavor, more so when it comes to research about the health of children. It is with this thought of gratitude that I would like to start. The process of getting this dissertation, in the article format, to completion was arduous, but one which reinforced my faith in humanity and the values of perseverance and focus. I would like to thank Dr. Manoj Sharma, now at the Jackson State University, and Dr. Bradley R. A. Wilson for their time, effort, motivation and support throughout this exercise. But for their guidance and willingness to assume the committee responsibilities, this would not have been possible. I am also grateful to Dr. Jun Ying and Dr. Brittany L Rosen, for kindly stepping forward to take up committee responsibilities at a crucial time, and for their extremely helpful guidance and support in preparing this research. I would also like to record my gratitude to the University of Cincinnati - Institutional Review board, and as well, the other faculty and staff at the program. I would be failing in my duties if I did not thank the experts who so patiently reviewed and helped improve my instrument. My thanks are also due to Sreeshankaran Viswanathan, Lalitha Sreeshankaren and Chandramouli Shankaren for their unflinching support and guidance throughout the years, especially during the conduct of the study in India. That takes me to the school authorities, the children themselves, their parents and families – to all of whom I owe a deep debt of gratitude, for being a part of this endeavor to better the health of children in developing countries like India. Thank you, Aparna, for putting up with me during this struggle and for being a constant source of inspiration and support, holding us together. To Manasvini and Anirudh, I owe my enthusiasm, for during tough times, it was the cheer in their little eyes, and those giggles, that kept me going. One is always in debt to one’s parents, but for their sacrifice and struggle, I
would have never reached here. How can I forget those wonderful people that taught me medicine? My teachers, from kindergarten to medical school and beyond, and my patients have played an indispensable role in shaping my passion for healthcare. I always think about my friends and family, even the ones I do not get to see anymore, and gratefully remember the support and love they have shown me. Finally, I remember my late grandparents, who would have been extremely happy to hear about this endeavor and its successful completion. Thank you, Mahaperiyavaa.
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Introduction

Obesity is a serious impediment to comfortable living at any age (1). The onset of obesity heralds a future fraught with diseases and expenses, making it extremely painful in more ways than we can imagine (1). The 2000 CDC Growth Charts for the United States (US) and expert committee definitions put childhood obesity as a BMI at or above the 95th percentile for children of the same age and sex (2). Not just obese children, even over-weight children, defined as having a BMI in the range of the 85th to the 94th percentile (2), face serious issues. The increase in the prevalence of over-weight children is alarming with some statistics reporting that being overweight in childhood has tripled during the last three decades in the US (3, 4, 5). While this is the case in the US, India seems to be on a similar path, the prevalence of childhood obesity in India has been shown to be anywhere between 12% and 25%, depending on the study (6, 7), and considering the billion plus Indian population, that fraction would lead to a huge challenge for the Indian society in particular, and the world at large. It is recognized that being overweight is an etiological and risk factor association for the entire spectrum of metabolic syndrome pathologies including, but not limited to, obesity, type 2 diabetes, cancer, stroke and heart disease and even mental health issues like depression and social discrimination (8).

As a condition, obesity is multidimensional in its ability to affect health in children, be it their physical health, mental health, and even social health (9). Policy initiatives and programs stemming from the Patient Protection and Affordable Care Act, the Presidential Task Force on Childhood Obesity and efforts like the First Lady’s Let’s Move program have truly helped in establishing a robust template on which future initiatives to combat childhood obesity can be based (10). The National Health and Nutrition Examination Surveys (NHANES) (11) of 1976-
1980 and 2003-2006 showed an increased prevalence of childhood obesity as follows: an increase to 12.4% from 5% for children aged 2-5 years and an increase to 17% from 6.5% for older children. Children who are obese at ages 10-15 years have an 80% increased risk of being obese as an adult (11, 12). Furthermore, obesity before 8 years of age is more likely to result in severe adulthood obesity (11, 12). According to the CDC’s 1998-2008 Pediatric Nutrition Surveillance System (PedNSS) (12), one in seven low-income, preschool-aged children is obese.

Obesity is an imbalance between the intake and the utilization of calories. It is, hence, a result of the complex interactions between a host of factors, including environmental, behavioral and genetic influences. The problem of childhood obesity is multi-faceted and hence needs to be managed in a multi-faceted manner. Racial and ethnic differences seem to play an important role in the development of childhood obesity illustrating the importance of psycho-social factors affecting this condition (13). The factors seem to be relevant from as early as the prenatal period due to maternal depression, during infancy by way of introduction of solid foods before four months of age and restrictive maternal feeding practices (13). Even the early introduction of and excessive exposure to television in bedrooms, high calorie sugar-based beverages and high calorie fast-food have been shown to play a role (13). The environment at home, interaction with parents, and role models at home have a profound impact on childhood food habits, physical activity and, hence, on childhood obesity (1). Since most children in the age group of 5-17 years are likely to be enrolled in schools, the environment and kind of interactions at schools greatly affect obesity in this age group (1). One can extrapolate this argument to all the other environments in which children are likely to be seen. Sedentary behavior and high calorie diet, along with genetic risk factors for high cholesterol and obesity have tremendously increased the prevalence of childhood obesity, and thereby, have enhanced the importance of physical
education and the need to learn about healthy food choices (1). Finally, one cannot ignore the multitude of psycho-social problems arising from the lack of self-esteem among obese children, including, but not limited to, higher rates of sadness, loneliness, nervousness and high-risk behaviors like smoking and alcohol consumption (1, 8, 9, 13, 14, 15).

There are a numerous studies that have attempted to predict childhood obesity prevention behaviors. Broadly speaking, these studies can be classified into those that have employed time-tested theories of health behavior and those that have not. In addition, there are a variety of factors predicting childhood obesity, some are modifiable. Some of the non-modifiable predictors of childhood obesity are age, sex, race and ethnicity (14). A number of non-theory based studies predicted determinants of childhood obesity have also included racial and ethnic factors as predictors (13). The current focus, on modifiable behaviors, is related to physical activity, total screen-time, choosing water instead of sweetened beverages and consuming five servings of fruits and vegetables daily. It was also shown that more physical education hours and less television viewing served as predictors of childhood obesity (15).

Effective research into health behaviors needs a sound theoretical foundation. Childhood obesity is no exception. Such research has the benefit of evolving a template on which to understand the relationships between various constructs, their impacts, predictive capacities and the evolution of future guidelines, intervention and evaluation strategies (16, 17).

The theory of planned behavior (18) is a popular theory employed in studying health behaviors. It has a well-structured theoretical framework that has been extensively used to study physical activity in children (19, 20). A theory of planned behavior based study stated that even parental behavior can serve as a health promoter and predictor of obesity prevention behaviors in children (21). The theory of planned behavior was employed in one study to understand the
predictive value of physical activity in preventing obesity among Mexican-American children and the conclusion was that the theory offered moderate results (22). The theory of planned behavior predicts that children with strong intentions for moderate-to-vigorous activity are more likely, than children with weaker intentions, to engage in physical activity (18). We did come across a study that employed the theory of planned behavior to predict all the aforementioned four behaviors related to childhood obesity (24), the paper focused on the instrument validation process and not on the predictive capacity of the said theory.

The transtheoretical model (25) is another popular theory employed to study health behaviors. It has been demonstrated to possess predictive capability related to physical activity intentions (25). The ability of the transtheoretical model to predict exercise was moderate (27). As for other obesity related behaviors, a study in a Northeastern University concluded the transtheoretical model and the theory of planned behavior demonstrated predictive capabilities for intention towards a plant-based diet (28). We did not come across studies employing the transtheoretical model to predict all the aforementioned childhood obesity related behaviors.

The social cognitive theory (29) is another theory used to study health behaviors. In our search, social cognitive theory presented studies predicting all four childhood obesity behaviors (29, 30, 31, 32), thus reinforcing that this theory offers a reliable framework on which to design future primary interventions for childhood obesity. In the Indian context, there is a significant paucity of theory based study of health behaviors concerning childhood obesity. We identified two studies based on social cognitive theory with mixed results (32, 33).

The Health-Belief Model is a theory, first developed in United States to study health behaviors. The health-belief model has, so far, offered a reliable framework to design primary prevention interventions to overcome health problems in the Western countries (34, 35, 36). The
predictive ability of the health-belief model has been used in the context of health behaviors of college students (37) and in the prevention of severe acute respiratory syndrome (38). The model has improved its predictive capacity especially with the addition of the construct of self-efficacy.

There are studies about the determinants of childhood obesity wherein the framework of inquiry has been based on the health-belief model (39). One specific study concluded that racial, socio-economic, and, as well, ethnic differences seem to have an important role in the development of childhood obesity, reflecting the importance of psycho-social factors affecting this condition throughout life (39). Although there are other studies employing the health-belief model to understand perceptions about obesity related behaviors and foods (40), especially in adults, we did not come across any that focused on the predictive modeling of the aforementioned four behaviors in the context of childhood obesity. Therefore, this research proposes to marry the predictive capacity of the health-belief model with the chosen childhood obesity related behaviors.
Methods

Ethics

The study was conducted under the supervision of and approval from the parent University’s Institutional Review Board. This also included approval from school authorities including the respective Principals, as per IRB requirements, and voluntary student participation and assent.

Target Population

The study was conducted with upper elementary school children of the Chennai area in Southern India. Students enrolled in the fourth, fifth and sixth grades were chosen to participate in the study. There was a written overview at this grade level to help the students decide their participation. A total of 737 students participated in the study, after the completion of the approvals, consents and assents.

Sample Size

The sample size was calculated using G*Power (41, 42, 43). The alpha was set at 0.05, power at 0.80, six predictors and the effect size as 0.02 (based on conservative estimate from previous studies). Based on these parameters a sample size of at least 688 was to be obtained. The estimated number was inflated by 5% for any missing values thus yielding a sample size of 723 which is very close to the one obtained in this study.

Instrumentation

The chosen behaviors were studied using a 47-item scale developed and validated for face and content validity by a panel of six experts. They were all university faculty members. It was designed to have two rounds of expert reviews to confirm face and content validity for the
instrument. During the first round, preliminary suggestions were received from the expert panel and incorporated. Revisions were explained to the experts during the second round and the final instrument draft was confirmed during the second review. There were sets of up to twelve items designed around the behaviors and other informational items towards the end. All six constructs of the health-belief model were incorporated into the questionnaire. The first two items in each set were about *perceived susceptibility* to obesity. The third and fourth items were about the *perceived severity* of consequences in relation to performing the behaviors. The fifth and sixth items were about the *perceived barriers* to performing the behavior. The seventh and eighth items were about *perceived benefits* and ninth and tenth items were about *cues to action*. The eleventh and twelfth items measured *self-efficacy*. There were also items on demographics, age, gender, previous exposure to physical activity and nutrition programs; previous exposure being marked as none, one, two or three and more class lessons. The sets of twelve items were scored from among the following set of choices, using a Likert scale, 1 = Strongly Disagree, 2 = Disagree, 3 = Agree and 4 = Strongly Agree. The total score for the each of the 12 item sets had a range from 1 to 48. Cronbach’s alpha for the chosen subscales of the instrument were all above 0.60 and thus found to be satisfactory for a new scale (43).
Procedures

A cross-sectional design was used in this study. This happens at a given moment in time across a chosen sampling of the target population, which is elementary school aged children. The advantages of the chosen design include low-costs, ethical safety and its inherent simplicity. The absence of interventions reduced the ethical dilemmas to be addressed. Upper elementary school children were the participants. Cross-sectional designs have disadvantages. Often called a “weak short cut to the study of change” (41), this design lacks the ability to directly assess intra-individual change, only the group’s averages are inferred, and also lacks the ability to establish causality, inherent deficiencies regarding recall bias, and confounders’ distribution. There was also a write-up, at about the 5th grade reading level, to help the children understand the study’s process before choosing to participate.

Data Analyses

The statistical package used to compile the data was SPSS, version 22. The responses were analyzed using basic statistical tests, while demographic data were run through descriptive statistics to calculate frequencies and means. Step-wise multiple regressions were employed to model the predictors. The constructs of the health belief model served as the independent variables, while the behaviors themselves served as the dependent variables. The \textit{a priori} criteria of probability of F to enter the predictor in the model was chosen as less than or equal to 0.05 and for removing the predictor as greater than and equal to 0.10.
Results

Demographics

The study reports the responses of 737 students, from among 6 schools, as they completed 80% or more of the survey. The distribution between boys and girls was roughly equal with 360 (48.8%) boys and 377 (51.1%) girls completing the study. The grade distribution was also roughly equal with 372 (50.4%) 5th graders and 365 (49.5%) 6th grade students taking part in the survey. Age-wise, 10-year olds made up 47.6% (n =351) and 11-year olds made up 32.8% (n =242), with the 9 to 11 age group demographic adding up to 93.4% (n =688) of the total participants. Table 1 provides participants’ demographics.

Table 1. Demographic distribution of the participants.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>360</td>
<td>48.8</td>
</tr>
<tr>
<td>Boys</td>
<td>377</td>
<td>51.1</td>
</tr>
<tr>
<td>Total</td>
<td>737</td>
<td>99.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fifth</td>
<td>372</td>
<td>50.4</td>
</tr>
<tr>
<td>Sixth</td>
<td>365</td>
<td>49.5</td>
</tr>
<tr>
<td>Total</td>
<td>737</td>
<td>99.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 years</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>9 years</td>
<td>94</td>
<td>12.7</td>
</tr>
<tr>
<td>10 years</td>
<td>351</td>
<td>47.6</td>
</tr>
<tr>
<td>10.5 years</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>11 years</td>
<td>242</td>
<td>32.8</td>
</tr>
<tr>
<td>12 years</td>
<td>23</td>
<td>3.1</td>
</tr>
<tr>
<td>13 years</td>
<td>21</td>
<td>2.8</td>
</tr>
<tr>
<td>14 years</td>
<td>4</td>
<td>.5</td>
</tr>
<tr>
<td>Total</td>
<td>737</td>
<td>99.9</td>
</tr>
</tbody>
</table>
Summary statistics of the chosen behaviors

The study reports results on three behaviors – total screen time, total cups of fruits and vegetables consumed, and total glasses of water consumed, all during the last 24 hours before reporting. Considerable variability existed in the reported numbers. While some students did report having 0 hours of screen-time, it went up to 11 hours, during the previous 24 hours ($M = 2.42; SD = 1.74$). This mean value is above the recommended $\leq 2$ hours of screen time per day. While some reported consuming no fruits and vegetables in the last 24 hours, the maximum reported was 18 cups during the same period ($M = 4.87; SD = 3.16$). This puts the mean consumption of fruits and vegetables only slightly below the required five-cup limit per 24 hour day. The total glasses of water consumed tallied a minimum of 0 and a maximum of 27 during the previous 24 hours, with a ($M = 9.01; SD = 4.54$). The average reported consumption of about nine glasses of water is above the recommended six to eight glasses of water per 24 hour day.

Table 2 provides descriptive statistics of the chosen behaviors.

Table 2. Descriptive statistics of the chosen behaviors.

<table>
<thead>
<tr>
<th>Behaviors</th>
<th>n</th>
<th>Possible Range</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Screen time</td>
<td>724</td>
<td>.00-11.00</td>
<td>2.43</td>
<td>1.75</td>
</tr>
<tr>
<td>Total cups of fruits and vegetables</td>
<td>726</td>
<td>.00-18.00</td>
<td>4.87</td>
<td>3.17</td>
</tr>
<tr>
<td># Glasses of water last 24 hrs</td>
<td>723</td>
<td>.00-27.00</td>
<td>9.01</td>
<td>4.54</td>
</tr>
</tbody>
</table>
Summary statistics of the health-belief model subscales for the chosen behaviors

Table 3 discusses the reported scores for the various health belief model constructs for the behaviors being studied. Table 3 provides summary statistics of the constructs measuring screen-time behavior, fruit and vegetable consumption, and water consumption turned in higher mean scores. The mean scores for all the behaviors corresponding to their constructs were above the median, except for the construct of cues to action, with regard to water consumption.

Table 3. Summary statistics for the health belief model constructs measuring the chosen behaviors.

<table>
<thead>
<tr>
<th>Health Belief Model Constructs Measuring Screen Time</th>
<th>n</th>
<th>Possible Range</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Susceptibility</td>
<td>731</td>
<td>2.00-8.00</td>
<td>4.37</td>
<td>1.60</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>729</td>
<td>2.00-8.00</td>
<td>5.27</td>
<td>1.72</td>
</tr>
<tr>
<td>Perceived Benefits</td>
<td>729</td>
<td>2.00-8.00</td>
<td>5.11</td>
<td>1.73</td>
</tr>
<tr>
<td>Perceived Barriers</td>
<td>724</td>
<td>2.00-8.00</td>
<td>4.37</td>
<td>1.50</td>
</tr>
<tr>
<td>Cues to Action</td>
<td>732</td>
<td>2.00-8.00</td>
<td>6.32</td>
<td>1.56</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>726</td>
<td>2.00-8.00</td>
<td>6.12</td>
<td>1.59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health Belief Model Constructs Measuring Fruit and Vegetable Consumption</th>
<th>n</th>
<th>Possible Range</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Susceptibility</td>
<td>728</td>
<td>2.00-8.00</td>
<td>4.96</td>
<td>1.53</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>727</td>
<td>2.00-8.00</td>
<td>5.29</td>
<td>1.67</td>
</tr>
<tr>
<td>Perceived Benefits</td>
<td>730</td>
<td>2.00-8.00</td>
<td>6.20</td>
<td>1.41</td>
</tr>
<tr>
<td>Perceived Barriers</td>
<td>728</td>
<td>2.00-8.00</td>
<td>4.33</td>
<td>1.58</td>
</tr>
<tr>
<td>Cues to Action</td>
<td>726</td>
<td>2.00-8.00</td>
<td>6.06</td>
<td>1.49</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>724</td>
<td>2.00-8.00</td>
<td>6.03</td>
<td>1.58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health Belief Model Constructs Measuring Water Consumption</th>
<th>n</th>
<th>Possible Range</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Susceptibility</td>
<td>728</td>
<td>2.00-8.00</td>
<td>5.12</td>
<td>1.70</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>730</td>
<td>2.00-8.00</td>
<td>5.23</td>
<td>1.63</td>
</tr>
<tr>
<td>Perceived Benefits</td>
<td>729</td>
<td>2.00-8.00</td>
<td>5.55</td>
<td>1.51</td>
</tr>
<tr>
<td>Perceived Barriers</td>
<td>732</td>
<td>2.00-8.00</td>
<td>4.31</td>
<td>1.50</td>
</tr>
<tr>
<td>Cues to Action</td>
<td>734</td>
<td>1.00-4.00</td>
<td>3.27</td>
<td>.87</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>734</td>
<td>2.00-8.00</td>
<td>6.03</td>
<td>1.64</td>
</tr>
</tbody>
</table>
Screen Time - Multiple Regression Analysis

Screen time was predicted by perceived health behavior predictors in the multiple regression analysis. Using a step-wise method, the model, shown in Table 4, selected Perceived Barrier and Perceived Severity as two significant predictors. In particular, the screen time was positively related to perceived barrier, with a partial (or adjusted) correlation coefficient (standard coefficient) of 0.124 (p=0.001); while on the other hand, the screen time was found negatively related to perceived severity, with a partial r of -0.118 (p=0.002). Overall, the selected model explained about 2.7% (adjusted $R^2$) of the total variations of the data.

Table 4. Estimates for step-wise multiple regression analysis results of health belief model constructs on screen time behavior (adjusted $R^2 = 0.027$).

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Unstandardized Coefficients</th>
<th>Std, Coeff.</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>2.442</td>
<td>.289</td>
<td>8.448</td>
<td>.000</td>
<td>1.874</td>
</tr>
<tr>
<td>Perceived Barrier</td>
<td>.146</td>
<td>.044</td>
<td>.124</td>
<td>3.283</td>
<td>.001</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>-.119</td>
<td>.038</td>
<td>-.118</td>
<td>-3.115</td>
<td>.002</td>
</tr>
</tbody>
</table>
Water Consumption - Multiple Regression Analysis

Water consumption was predicted by perceived health behavior predictors in the multiple regression analysis. Using a step-wise method, the model, shown in Table 5, selected perceived benefits and perceived severity as two significant predictors. In particular, water consumption was positively related to perceived benefits, with a partial (or adjusted) correlation coefficient (standard coefficient) of 0.082 (p=0.037) and to perceived severity, with a partial r of 0.081 (p=0.038). Overall, the selected model explained about 1.4% (adjusted $R^2$) of the total variations of the data.

Table 5. Estimates for step-wise multiple regression analysis results of health belief model constructs on water consumption behavior (adjusted $R^2 = 0.014$)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Unstandardized Coefficients</th>
<th>Std. Coeff.</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>6.490</td>
<td>.762</td>
<td>8.512</td>
<td>.000</td>
<td>4.993 to 7.987</td>
</tr>
<tr>
<td>Perceived Benefits</td>
<td>.243</td>
<td>.116</td>
<td>.082</td>
<td>2.094</td>
<td>.037 to .471</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>.227</td>
<td>.109</td>
<td>.081</td>
<td>2.084</td>
<td>.038 to .441</td>
</tr>
</tbody>
</table>
**Fruit and Vegetable consumption - Multiple Regression Analysis**

Fruit and vegetable consumption was predicted by health belief model predictors in multiple regression analysis. Using a step-wise method, the model, shown in Table 6, selected self-efficacy as the lone significant predictor. In particular, fruit and vegetable consumption was positively related to self-efficacy, with a partial (or adjusted) correlation coefficient (standard coefficient) of 0.099 (p=0.009). Overall, the selected model explained about 0.8% (adjusted $R^2 = 0.008$) of the total variations of the data.

Table 6. Estimates for step-wise multiple regression analysis results of health belief model constructs on water consumption behavior (Adjusted $R^2 = 0.008$)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Unstandardized Coefficients.</th>
<th>Std, Coeff.</th>
<th>95.0% Confidence Interval for B</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>3.650</td>
<td>.482</td>
<td>7.572</td>
<td>.000</td>
<td>2.703</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>.201</td>
<td>.077</td>
<td>.099</td>
<td>.009</td>
<td>.049</td>
</tr>
</tbody>
</table>


Discussion

The purpose of the study was to determine if the health belief model predicts childhood obesity prevention behaviors among upper elementary school children in a sample drawn from the Chennai region of southern India. The results show this model is not a strong predictor of the three chosen behaviors, namely fruit and vegetable consumption, screen time and water consumption. The Indian children were already consuming an adequate amount of water and fruits and vegetables thus signifying that these behaviors are important in the Indian context. Perhaps the behaviors of portion size and consumption of fried foods are also important in India.

Previous literature lacks a sufficient volume of comparable studies of a similar nature. One previous study of a similar nature (32) using the social cognitive theory did not find any significant predictors. In view of this, the current study can be seen as a useful first step in the process of tailoring health behavior theories to the Indian context in order to evolve predictors more suitable to the local demographics. Also, the increasing obesity epidemic would perpetuate the ongoing problem, ignoring the low cost and more effective preventive options and going after high cost and less effective therapeutic options, thereby wasting valuable resources. This is something a country in India’s position cannot afford to do.

While the health-belief model has been more useful in other situations, the reasons for a less practically significant prediction capacity here could reflect many underlying factors including that the model emphasizes personal decision making (36). The children in our sample might still be under the influence of parents and elders, resulting in a dichotomy between what they believe and perceive and the actual behavior being performed. Further studies would also be required to refine these health behavior theories to the Indian context as opposed to a western template under which they have been evolved over-time. The fact that perceived barrier turned
out to be a statistically significant predictor for screen-time could suggest a role for family, friends and schools in enhancing the understanding of the barriers faced by the children in order to help them overcome the same. Perceived severity, another statistically significant predictor of screen-time, could be utilized as a tool by designing role plays and cartoons illustrating the development of obesity, and its harmful effects, from excessive screen-time behavior. With regard to water consumption, the significant predictors were perceived benefits and perceived severity. The construct of perceived benefits could be used in interventions like meeting with athletes and sports stars who could talk to the children about the benefits of choosing water over sweetened beverages. The construct of perceived severity could be used in interventions where doctors could explain the harmful effects of reduced water consumption through audio visual presentations. Self-efficacy was the significant predictor for fruit and vegetable consumption. This could be leveraged, for the children, through designing experiences of incremental accomplishments that could serve to boost their confidence in their ability to consume adequate amounts of fruits and vegetables. Examples of such interventions could be having them watch other children eat and enjoy fruits and vegetables that they themselves might not have taken to yet. Furthermore, environmental factors such as the influence of parents on diet and physical activity are more important for Indian children which were not studied here, and this aspect is elaborated below under implications for practice.

Limitations and delimitations

The study was delimited to upper elementary school children of the Chennai school area in India, a country with a billion plus population. To be included in the study, participating children had to be at the upper elementary school level affiliated to the participating programs, 4th, 5th or 6th grade. Data were collected during the period between June and September 2014.
The following is a set of limitations considered relevant to the study and the interpretation of the results: 1) like any self-reported study, there may be participant bias and dishonesty among the responses, 2) recall could cause problems during answering the survey questions, 3) not all children would be able to understand the questions and the process equally, resulting in misinterpretation, in spite of the efforts from the pilot study, 4) participants were not randomly selected, 5) the constructs of the health-belief model were measured on a newly developed scale and needed establishment of psychometric properties primarily due to the non-availability of a suitable scale in the literature.

Implications for Practice

The study illustrates some important findings, especially the need to evolve health behavior theories that would be more consistent with the social and cultural differences seen in India. For example, unlike the west, children in India are more under the influence of parents and other elders at their homes. This means that even though they might express their perceptions, the behaviors might be different and more in line with adult demands. As such, the ability of constructs like self-efficacy might be limited in predicting chosen behaviors. Various studies have shown the importance of socio-economic factors in determining nutritional status and health of children (2, 5, 6, 8, 9, 32, 33). These extraneous aspects are not studied directly under the health belief model. More studies, involving existing health behavior theories need to be done to enhance our understanding of obesity prevention behaviors among children in India. As, this and other previous, studies have shown, existing health behavior theories do not capture the gamut of determinants needed to study and predict health behaviors in a non-western culture like India. This necessitates the contextual enhancement of existing, and the development of new, health behavior theories for countries like India. More awareness needs to be created about
health behavior, obesity and the need to evolve prevention strategies, including health behavior theories effective for the Indian context and these need to be done in time to prevent an obesity epidemic in the sub-continent, bearing in mind the detrimental socio-economic impacts of such a catastrophe would far outweigh the effort and cost involved in preventing the same.
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