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A Mixed Methods Analysis of Beverage Choices in Adolescents and Their Parents Using the Theory of Planned Behavior

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Abstract

Background—Added sugar intake in the form of sugar-sweetened beverages (SSB) has been considered a contributor to weight gain and cardiometabolic dysfunction in adults and youth. Adolescents are some of the highest consumers of added sugars, taking in ~16% of their total calories from added sugars with ~40% of these calories coming from SSB. Youth's food preferences and self-regulation of dietary intake can be influenced by parents.

Objective—To evaluate the Theory of Planned Behavior's (TPB) effectiveness in understanding and predicting adolescents' SSB consumption, identify which constructs are the most important

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No authors of the manuscript titled "A mixed methods analysis of beverage choices in adolescents and their parents using the Theory of Planned Behavior" report a conflict of interest.

when evaluating SSB consumption in adolescents, and determine if and how adolescents' beverage choices are influenced by parents' reactions to their beverage choices.

Design—Measurements for this cross-sectional study included four record-assisted 24-hour dietary recalls and responses to a SSB-specific TPB questionnaire from 100 adolescents. Consenting parents completed a beverage intake questionnaire, a TPB questionnaire, and Parent Response to Beverage Choice Questionnaire.

Results—The TPB explained 34% of the variance in adolescents' and parents' intention to limit SSB to less than one cup per day. Parents' perceived behavioral control (b=1.35, p=0.002) and adolescents' subjective norms (b=0.57, p=0.001) were the strongest predictors of intention, and intention was the strongest predictor of SSB consumption in both adolescents and parents (b=−37, p=0.026, b=−49, p=0.003). The TPB explained more variance in parent SSB consumption (R^2=0.38) than adolescents (R^2=0.22). Parents did more discouraging of SSB and encouraging of non-SSB. Adolescents' intention to limit SSB moderated the relationship between parents' reactions encouraging SSB and adolescents' predicted SSB consumption (p=0.021).

Conclusions—The TPB explained a small, but significant amount of variance in adolescents' SSB consumption. When addressing adolescent SSB intake, people in addition to parents may influence their intentions and SSB consumption.

Keywords

adolescents; parents; sugar-sweetened beverages; sugary drinks; Theory of Planned Behavior

Introduction

Adolescence is a time characterized by dramatic changes psychologically, socially, and physiologically.[1] Despite adolescents' attempts to become autonomous,[2] with greaterfreedom and responsibility, parents remain primary sources of nourishment physically and emotionallyby providing food, economic support, and empathy.[1] More specifically, during adolescence there is greater consumption of energy-dense foods and conventional eating patterns can be shunned, [2,3] potentially resulting in overweight and obesity.

About one-third of US youth are overweight or obese,[4] and excessive weight gain in youth may track into adulthood and contribute to cardiovascular risk.[5] The development of overweight and obesity in youth may result from overconsumption of added sugars, specifically sugar-sweetened beverages (SSB),[6] which are beverages that contain added caloric sweeteners and include soda, energy drinks, sweet tea, sports drinks, and fruit drinks.[7] Ervin and colleagues found that 2-18 year olds consume about 16% of total energy from added sugars with approximately 41% of these calories coming from SSB.[8] However, the Scientific Report of the 2015 Dietary Guidelines Advisory Committee has recommendations for limiting added sugar intake, which includes SSB, to a maximum of 10% of daily calories.[9] In adolescents, excessive SSB intake has been associated with increased risk of diabetes[10] and cardiovascular disease risk.[11]

Youth aged 2-19 years consume approximately 155 kcal, or about 12 fl. oz. of soda, per day from SSB,[12] which is in excess of the American Heart Association's recommendation of 450 kcal per week from added sugars.[13] While consumption of soda, previously the highest contributor to SSB intake in adolescents,[14] has recently decreased,[12] 100% fruit juice,[15] sweetened coffee and tea, and sports and energy drink[12] consumption has increased. Sports and energy drink consumption has increased threefold since 1988[14] and continues to rise, especially in adolescents.[12] Sports drink consumption has also been associated with increases in youth's BMI.[16] The American Academy of Pediatrics recommends that sports and energy drinks not be consumed regularly by adolescents, as these beverages can contribute to excessive energy intake.[17]

Parents are known to help mold youth's attitudes and beliefs about food and eating practices.[18] Modeling overconsumption and parent feeding practices that are controlling or restrictive have detrimental effects on children's BMI[19] and food regulatory behaviors and preferences.[20] Thus, parents may play a crucial role influencing food beliefs and behaviors inadolescents.[21]

Theory-based models for predicting health behaviors may be more successful when examining health behavior change, compared to those not grounded in theory.[22] The Theory of Planned Behavior (TPB)[23] is one psychosocial theory that can be used to address adolescent eating behaviors. According to the TPB, behavioral action occurs from the influence attitude, subjective norm, and perceived behavioral control have on intention, the most proximal determinant of behavior.[23] The Theory has been successful in predicting and understanding many health-related behaviors,[24-26] and the information gained from application of the TPB can help create customized, relevant, and possibly more effective interventions.[25] A recent review of the TPB's use in predicting and understanding youth's diet-related behaviors identified eight publications that investigated sugary drink intake; however, many were conducted outside the United States, have limitations on SSB consumption assessment, and did not directly measure parents' responses to their child's sugary beverage consumption.[27]

The purpose of this investigation was to evaluate the TPB's ability to predict adolescents' and parents' SSB consumption, identify which constructs are the most important when evaluating SSB consumption in adolescents and parents, and determine the degree to which adolescents' beverage choices are associated with parents' reactions to their beverage choices. Also explored was the mediating role the TPB played when examining the potential relationship between parental response and adolescents SSB consumption. It is hypothesized that 1) all TPB constructs will be correlated to adolescents' intention, 2) attitude will be the strongest predictor of adolescents' behavioral intention, 3) behavioral intention will be the strongest predictor of adolescents' behavior (i.e., SSB intake), 4) adolescents and parents will have different TPB constructs emerge as the most predictive of intention to limit SSB intake, and 5) adolescents' attitude and intention will moderate the relationship between parental responses to adolescents' beverage choices and SSB consumption.

Methods

A convenience sample of 102 adolescents aged 12-18 years were recruited through email listservs, community newspapers, paper flyers, and word of mouth for participation in this cross-sectionalinvestigation. A sample of this size can provide adequate power to detect associations between individual's nutrient intakes and have the greatest statistical precision when each participant provides three days or more of dietary information.[28] Interested adolescents were included once parental permission was obtained and if they met the specified age criteria; could read, write, and speak English; and were willing to comply with study procedures. Adolescents were targeted in this investigation due to their obesity prevalence rate[4] and known high added sugar and SSB consumption.[8] Furthermore, in the National Health and Nutrition Examination Survey (NHANES)[29] adolescents do not need proxy reporters (i.e. parents) when disclosing their dietary intake. Parents accompanying children were also invited to participate and completed questionnaires at their child's first study visit.

This investigation was part of a larger, ongoing dietary assessment trial, which included randomizing visit sequences; thus, adolescent participants were randomized to one of two visit sequences, and completed four laboratory sessions within a one to three week period (**Figure 1**). Overthe entire study duration, adolescents completed four 24-hour dietary recalls (24HR), the TPB questionnaire at two separate visits, a health history questionnaire, and had their height and weight measured. Consenting parents completed a health history questionnaire, the beverage intake questionnaire(BEVQ-15)[30], the TPB tool[31], the Parent Response to Beverage Choice Questionnaire (Par-B-Q), and had their height and weight measured. For both adolescents and parents, height was measured and recorded in centimeters without shoes using a wall mounted stadiometer (Seca 216, Hamburg, Germany), and body weight was measured in light clothing without shoes, to the nearest 0.1 kg using a digital scale (Scale-Tronix, Wheaton, IL). Body mass index (BMI) [kg/m^2] and BMI-for-age percentile were calculated for each adolescent,[32] and BMI was calculated for each parent. Study procedures and questionnaires were pilot tested with three adolescents and their parents; modifications were made according to their feedback. The Virginia Polytechnic Institute and State University Institutional Review Board approved the study protocol. Adolescent participants provided written assent or informed consent depending on age (below or above the age of 18, respectively) and parent participants provided informed consent prior to any data collection.

Adolescent and Parent Beverage Intake Assessment

Adolescents had a record-assisted 24HR administered at each study session. Adolescents' dietary intake is known to vary from day-to-day;[33] thus, four 24HR were collected since this has been identified as optimal for examining usual intake of most nutrients and foods in youth.[34,35] Recalls were obtained on non-consecutive days using the automated multiple pass method (AMPM), similar to procedures used in NHANES.[29] The AMPM provides a more accurate diet recall with decreased subject burden,[36] when administered by a trained individual. Participants were provided with a food-recording booklet that was to be used the day prior to each study session, and would serve as a reference when being administered the

24HR. Participants were told they can record as much information as they felt necessary, but were asked to provide the time, location, and list of foods and beverages consumed minus portion sizes and descriptions.[37] Sessions were scheduled to collect data from weekdays and weekend days since added sugar intake in children and adolescents is known to be higher on Fridays and Saturdays versus other days of the week.[35] Recalls were entered and analyzed using nutritional analysis software (Nutrition Data System for Research [NDS-R], University of Minnesota, Minneapolis, MN, 2013). The average water fluid ounces (fl. oz.), SSB fl. oz. and kcal, and total beverage fl. oz., and kcal consumed were calculated from the four 24HR.

Parents completed the Beverage Intake Questionnaire (BEVQ-15) at their visit, which typically was the adolescents' first session. The BEVQ-15 is a quantitative food frequency questionnaire providing an estimate of habitual beverage intake across 15 beverage categories that evaluates total beverage and SSB intake (i.e., grams and kcal).[30] This tool is valid and reliable in adults[30] and is sensitive to detect changes in beverage intake patterns over time.[38]It includes individual items for soda, diet soda, 100% fruit juice, sports and energy drinks,coffee and tea with added cream and sweetener, and coffee and tea without added cream and/or sweetener, among others. Water included drinking water from the tap, bottles, and fountains, not water found in foods. Beverages with added sugars (i.e. sweetened juice beverage/drinks, regularsoft drinks, sweetened tea, coffee/tea with added creamer and/or sugar, mixed alcoholic drinks, and energy and sports drinks) were considered SSB.[30]

Parent and Adolescent Theory of Planned Behavior Questionnaires

Parents and their children were administered different TPB questionnaires, and the reference behavior was "less than one cup of sugar-sweetened drinks each day." Adolescents were administered the TPB questionnaire two times (time 1=TPB 1, time 2=TPB 2), with anywhere from threeto 14 days between measures, to assess test-re-test reliability. The TPB questionnaire previously validated and used in adults[31] was modified for adolescents to relate to their language andcognitive capacity since during the pilot testing participants expressed confusion with some of the wording contained within items. For example, the seven-point semantic differential scale used in theadult TPB tool was reduced to five responses omitting the "slightly…" categories from each question and changing the "quite…" responses to "sort-of…" and the word “value” was replaced with “care about” in subjective norm items. Internal consistency was evaluated for each of the TPB constructs at both time 1 and time 2 using Cronbach's alpha (α).[39] While this metric has received criticism[40] it is widely accepted for assessing internal reliability of questionnaires and surveys used in research. Values below 0.50 may beacceptable in original research[41] and values less than 0.70[42] can be acceptable in psychological research. Attitude was measured with six categories of responses (e.g. enjoyable-unenjoyable, healthy-unhealthy, unsatisfying-satisfying, wise-unwise, boring-exciting, and harmful-beneficial) to the prompt ‘For you, drinking less than 1 cup of SSB each day would be….’ Cronbach (α) for attitude on TPB 1 and 2 increased to 0.64 and 0.67, respectively, after deletion of the third belief measure. Three items each were used to assess subjective norm (e.g. ‘Most people who are important to you want you to drink less than 1 cup of sugary drinks each day.’; α TPB

1=0.55, TPB 2=0.70) and perceived behavior control (e.g.‘You have complete personal control over limiting your sugary drinks to less than 1 cup each day, if you really wanted to.’; α TPB 1=0.64, α TPB 2=0.62after deletion of barrier three), and four items for intention (e.g. ‘How motivated are you to limit your sugary drinks to less than 1 cup each day?’; α TPB 1=0.81, α TPB 2=0.88 after removing motivation item 2).

The parents' TPB questionnaire was used to elicit their attitudes, subjective norms, and perceived behavioral control, and behavioral intention constructs in relation to drinking "less than one sugar-sweetened drink each day."[31] Prior work evaluating the TPB questionnaire in adults revealed that the primary TPB constructs explained an acceptable amount of variance (R^2=0.38, p<.05) in SSB consumption and had moderate to high internal consistency (Cronbach αs ranging from 0.51 with perceived behavioral control to 0.93 with intentions).[31]

Parent Response to Beverage Choice Questionnaire (Par-B-Q)

The Par-B-Q was adapted from the validated Coping with Children's Negative Emotions Scale (CCNES).[43] The CCNES contains six subscales demonstrating various responses to hypotheticaltroublesome circumstances parents may experience with their child/children; it is a self-reported measure of parents' reactivity to their child's emotions during bothersome situations.[43]

The questionnaire was tailored to parents' responses to their child drinking the following beverages "at home" or "outside the home," since adolescents consume more SSB at home versus out of the home:[8,12] coffee-type, sports or energy drinks, regular soda, juice drinks (all considered SSB), diet soda, and 100% fruit juice (both considered non-SSB). The Par-B-Q was pilot tested in three parents and has not been validated. It retains five of the original CCNES subscales (i.e. distress reaction: "get angry or upset"; punitive reaction: "take it away or restrict him/her from drinking [specific beverage]"; expressive encouragement: "encourage him/her to drink [specific beverage]"; problem-focused reaction: "offer a different drink or ask why he/she chose that drink"; minimization reaction: "do nothing") adapted for relation to beverages. Responses for each respective beverage and subscale ranged from one (i.e. "Very Unlikely") to seven (i.e. "Very Likely"). Mean scores for subscales suggesting encouragement of SSB consumption (i.e. Expressive Encouragement and Minimization Reaction) and subscales suggestive of discouraging SSB intake (i.e. Distress Reaction, Punitive Reaction, Problem Focused Reaction) were calculated for SSB and non-SSB in and outside of the home. Cronbach alphas were acceptable (i.e. α>0.70)[44] for all constructs measuring discouraging SSB and non-SSB in and out ofthe home, while constructs measuring encouraging SSB and non-SSB intake in and out of the home were lower (αs ranged from 0.18-0.63). Responses from the Par-B-Q were primarily used to answer the question: are parents' responses to adolescents' beverage choices more discouraging of SSB or encouraging of non-SSB at home/out of the home?

The Par-B-Q last section contained open-ended questions for the parents to complete. The first question was “How often do you talk with your child about beverage choices she/he makes?” with responses of “Often,” “Sometimes,” and “Never.” Other questions pertained to the beverages parents allowed or did not allow their child to drink or purchase, why they

discussed beverage choices with their children, and what was important to discuss with their child/children about in regards to beverage choices. Qualitative analyses were conducted with an inductive approach.[45] Briefly, themes were identified through open coding and grouping categories and frequency of responses were recorded in Microsoft Excel. Attempts were made to preserve the quality of data while reducing its length (i.e. condensation). *Major themes* were considered similar responses from ≥50% of parent participants, while*minor themes* were considered similar responses from 25-49% of parent participants. [46]

Statistical Analyses

Descriptive statistics including means, standard deviations (for TPB responses), standard errors of the mean, and frequencies were used to summarize responses for continuous variables. The assumption of univariate normality was checked by examining skewness and kurtosis for all variables using a cutoff of +/− 3. Simple and bivariate correlations, paired and independent sample*t*-tests, frequencies, and analysis of variance (ANOVA) were used to assess associations among variables and group differences (e.g., sequence, gender, weight status). To explore the relationship of beverage choices between parent-child dyads, Pearson correlations were assessed for water fl. oz., SSB kcal, and total beverage kcal. Step-wise multiple regression was conducted to assess the TPB questionnaire's utility in predicting adolescents' and parents' SSB consumption. Four separate steps were generated to predict SSB intake using intention in the first, adding perceived behavioral control in the second, then adding attitude and subjective norm in the third, and gender, age, and BMI percentile (BMI for parents) in the fourth. Gender was dummy coded. The resulting correlation and regression coefficients and confidence intervals are presented. Adjusted R^2 is also reported due to the acknowledged limitations of using R^2 (e.g. overestimation of population variance) in TPB research.[47]

A moderator analysis was conducted to determine if adolescents' attitude and intention moderated the relationship between parents' responses to adolescents' beverage choices in and out of the home (e.g. encouraging or discouraging SSB and non-SSB consumption in the home, out of the home, andoverall [i.e. combination of responses in or out of the home]) and adolescents' SSB consumption. The SPSS PROCESS macro [48] was used to conduct the moderator and mediator analyses. For the moderator analysis, the PROCESS macro centers variables and creates interaction terms. If the interaction terms were statistically significant a simple slopes analysis, which involves fitting regression equations for the predictor and outcome variables at high (one standard deviation above the mean), average (mean), and low (one standard deviation below the mean), of the moderator wasused to assess the conditional effect a predictor has on an outcome.[48,49] Adolescents' attitude towards SSB and intention to limit sugary beverage intake to less than one cup per day were chosen as moderators because these constructs were found to be the most consistently associated with adolescents' dietary intentions and behaviors, respectively.[27,50]

For the mediation analysis, we examined whether adolescents' TPB constructs mediated the relationship between parental response and adolescents' SSB intake. The significance of the mediation effects was tested using bias-corrected bootstrapping of confidence intervals.[49,51]

This method is more powerful than other commonly used mediation tests and has more accurate Type 1 error rates because it computes asymmetric confidence limits based on the distribution of the product rather than the normal dispersion, thus correcting for minor asymmetries in the distribution.[51] Indirect effects were considered significant when the 95% confidence interval did not include zero.[51] An *a priori* significance level of $p \leq 0.05$ was chosen and all statistical analyses were carried out using PASW Statistics (version 22, SPSS Inc., Chicago, IL, 2013).

Results

Demographics

One hundred-twenty individuals completed an online screening form and 18 did not respond to communications for scheduling the first study session (**Figure 1**). Fifty-five adolescents wererandomized to sequence one and 47 to sequence two; two participants from sequence one discontinued participation after the initial session, leaving 53 sequence one adolescents for data analyses (**Figure 1**). The total number of adolescent participants enrolled was 102 and 100 completed all study procedures.

Adolescent participants were primarily white (93%) and of normal weight (75%) with just over half being male (52%) (**Table 1**). Twenty adolescents each reported theirlast completed grade as 7th and 8th, 15 each reported 6th and 11th, 13 reported 10th, 11 reported 9th, and two reported 12th as their last grade completed. There were no significant differences between sequences in gender, age, and BMI-for-age classification.

A total of 66 parents consented to participate in the study. The majority of parents were female (86%), white (97%), married (88%), highly educated (97%) (**Table 1**), and reported a household income of ≥$55,000 (n=52, 80%). Just under half of parents were considered of normal weight (45%) and BMI ranged from 16-53 kg/m^2 (mean±SE=26±1).

Beverage Intake of Adolescents and Parents

Table 1 outlines adolescents' and parents' intake of major beverage categories (i.e. water, SSB, and total beverages). No significant differences were observed in parents when examiningBMI category and main beverage categories from the BEVQ-15. In adolescents, there were no significant differences between sequences in water, SSB, and total beverage intake. However, there were significant differences between genders on SSB and total beverage intake, with females having lower SSB and total beverage fl. oz. and kcal versus males (all $p<0.05$). On average, male adolescents consumed 57 fl. oz. (SE=3) of total beverages per day, 31 fl. oz. (SE=3) of water,and 12 fl. oz. (SE=1) of SSB. Females drank, on average, 43 fl. oz. (SE=2) of total beverages, 26 fl. oz. (SE=3) of water, and 6 fl. oz. (SE=0.0) of SSB daily. Significant differences were observed between adolescents of differing BMI classifications for total beverage fl.oz. consumption ($F(3,96)=3.69$, $p=0.01$) with underweight participants drinking more than normal ($p=0.02$) and overweight ($p=0.03$) adolescents, respectively. After splitting the data by last grade completed (i.e. middle school: ≤8th and high school: 9th-12th), differences were observed in water intake with high

school participants consuming more than middle school participants ($p<0.041$; data not shown).

Sixty-four parent-adolescent dyads were available for assessment of correlated beverage intake. No associations were noted between parent and child water ($r=0.10$, $p>0.05$), SSB kcal ($r=0.12$, $p>0.05$), and total beverage kcal ($r=0.17$, $p>0.05$). After splitting the sample according to adolescent age (i.e. ≤14 years and ≥15years) correlations were reassessed; no statistically significant associations were noted between beverage intake in younger adolescents and parents (water: $r=0.20$, SSB kcal: $r=0.13$, total beverage kcal: $r=0.16$, all $p>0.05$), or between older adolescents and parents (water: $r=0.03$, SSB kcal: $r=0.14$, total beverage kcal: $r=0.27$, all $p>0.05$).

Predicting Sugary Beverage Consumption in Adolescents and Parents: the Theory of Planned Behavior

There were no significant differences between sequences in mean TPB scores; however, adolescent females had higher mean scores on attitude ($p=0.030$), subjective norm ($p=0.018$), and intention ($p=0.001$) scores versus male adolescents. Middle school participants had significantly lower mean attitude and perceived behavioral control scores versus high school participants (both $p\leq0.01$; Online Supplemental Table). Interestingly, normal weight and obese parents differed in their responses to perceptions of control on the TPB questionnaire ($F(3,61)=5.00$, $p=0.004$), with obese individuals having less perceptionof control versus their normal weight counterparts (mean difference=−.710, $p=0.003$; Online Supplemental Table). All other TPB constructs were not different between BMI categories.

The intercorrelations between sugary beverage intake and TPB constructs of adolescents and parents are displayed in **Table 2**. Test-re-test reliability of the TPB in adolescents was acceptable with Pearson correlation coefficients ranging from moderate ($r=0.39$ with perceived behavioral control) to strong ($r=0.79$ with intention, all $p<0.001$). As hypothesized, all TPB constructs were significantly correlated with adolescents' intentions. Intention had the strongest relationship with SSB consumption in both adolescents and parents (both $p<0.001$). In adolescents, subjective norm ($p<0.001$) had the highest correlation with behavioral intention, while in adults perceived behavioral control had the highest correlation with intention. In both adolescents and parents attitude had the lowest correlation with behavioral intention (adolescents $p=0.019$; parents $p=0.018$).

Thirty-two percent of the variance in adolescents' ($F(3,96)=16.81$, $p<0.001$) and 31% of the variance in parents' ($F(3,62)=10.57$, $p<0.001$) intention to limit sugary beverage consumption to less than one cup per day could be accounted for by the TPB's three main constructs (i.e. attitude, subjective norms, and perceived behavioralcontrol). As hypothesized, different TPB constructs emerged as the most predictive of intention to limit SSB to less than one cup per day between adolescents and parents. The strongest and only significant predictor of behavioral intention in parents was perceived behavioral control (b ±SE=1.35±0.36, 95% bias corrected and accelerated CI [95% BCa]=0.67, 2.07, $p=0.002$), while different from what was hypothesized, subjective norm was the strongest predictor in adolescents (b±SE=0.57±0.11, 95% BCa=0.35, 0.72, $p=0.001$). Also, a significant predictor

in adolescents was perceived behavioral control (b±SE=0.39±0.11, 95% BCa=0.18, 0.62, p=0.002).

The multiple linear regression results for TPB constructs with SSB kcal consumption in adolescents and parents are presented in **Table 3**. The Durbin-Watson test statistics of 2.03 and 1.86 for adolescent and parent models, respectively suggests the assumption of independent errors is met,[49] and average variance inflation factors of 1.26 and 1.36 suggests the regression models for adolescents and parents, respectively is not biased.[49] Each of the models overallwere statistically significant (**Table 3**). Parent R^2 and adjusted R^2 values were higher than those observed for adolescents at all steps of the regression model (**Table 3**); meaning that more variance in SSB consumption could be accounted for by the TPBin parents versus adolescents. In both adolescents and parents, intention was a significant predictor of SSB consumption, although stronger in parents (**Table 3**; adolescents: b=−37, p=0.026; parents: b=−49, p≤0.003). For every one-point increase in adolescents' and parents' intention to limit sugary beverages, SSB consumption is predicted to decrease by 37 and 49 kcal, respectively. In adolescents, gender was a significant predictor of intention to limit sugary beverages to less than one cup every day (b=− 49, p=0.033); females consumed 49 kcal less per day of SSB than their male counterparts.

Moderator and Mediator Analysis

Two adolescent participants discontinued participation in the study after the initial visit and the associated parent data was not included in the moderator or mediator analyses, leaving 64 parent participants with useable responses for the moderator and mediator analyses. Two moderator models were statistically significant (**Table 3**): the interactions between adolescent intention and parental encouragement of sugary beverage intake 1) overall (b= −43, p=0.02), and 2) outside the home (b=−55, p<0.01). Contrary to hypotheses, no parental response to adolescents' beverage choice in or out of the home had a significant interaction with adolescents' attitude toward SSB.

The conditional effect of parent responses that are suggestive of encouraging adolescents' SSB overall on adolescent SSB consumption at low, average [i.e. mean], and high values of adolescent intention to limit SSB intake (i.e. the simple slopes) is depicted in **Figure 2**. When parents' responses encouraging SSB are high and adolescents' intention to limit sugary beverages is low, adolescents' predicted SSB kcal intake is highest (i.e. 214 kcal). Similar patterns emerged for beverage consumption outside of the home.

All indirect effects' confidence intervals contained zero suggesting mediation was not present (data not shown). Thus, further analyses were ceased.

Parent Response to Adolescents' Beverage Choices

No significant differences were observed when examining BMI category and means responses on the Par-B-Q. The means and SEs for encouraging and discouraging SSB and non-SSB in and out of the home and overall are depicted in **Table 4**. Overall parents did significantly more discouraging of SSB and encouraging of non-SSB, as apposed to encouraging SSB and discouraging non-SSB (both p≤0.01). When considering environment,

parents' responses suggest they did more encouragingof non-SSB (*M*=2.95) versus discouraging of SSB (*M*=2.49) out of the home (*t*(65)=−2.69, *p*=0.009). However, at home parents' reactions are more discouraging of SSB (*M*=3.17) compared to encouraging non-SSB (*M*=2.95; *t*(65)=3.69, *p*<0.001).

Qualitative Results—Sixty-five percent of parents (n=42) stated they speak with their child "sometimes," ~32% (n=21) stated "often," and ~3% (n=2) "never" speak totheir child about beverage choices. One major and one minor theme emerged from parent responses to why they spoke with their child about beverage choices: they believed "health was impacted by choices" (55% of responses), and they wanted to "have a positive influence on beverage choices" (35% of responses). Parents thought it was important to speak with children about "how choices can impact their [i.e. the child's] health" (45% of responses), "how sugary drinks are not good/too much sugar is not good" (38% of responses), to "encourage water/ water is important for health" (34% of responses), and "moderation" (28% of responses). Beverages parents permitted their child to drink or purchase included water (71% of responses), 100% fruit juice (63% of responses), soda on special occasions (58% ofresponses), milk (48% of responses), sports drinks (including low-calorie sports drinks, 31% of responses), and sweet tea/lemonade (26% of responses). Beverages that parents do not like their child to drink or purchase included energy drinks (62% of responses), soda (46% of responses), coffee (32% of responses), caffeinated drinks (29% of responses), SSB/ sweet tea (28% of responses), and artificially sweetened drinks/diet soda (25% of responses).

Discussion

The present investigation found the TPB to be an effective means to understand and predict adolescent and parent SSB consumption. Subjective norm in adolescents and perceptions of control in parents were the strongest predictors of intention to limit SSB, and intention was the strongest predictor of adolescents' and parents' SSB consumption. Results from the moderation analysis revealed that at lower levels of adolescent's intention to limit SSB and higher levels of parents' encouragement of SSB, adolescents' predicted SSB intake was highest, suggesting that some adolescents are influenced by their parents when making decisions to drink SSB.

Adolescent and Parent Beverage Intake

Male and female adolescents drank less than established upper limits for SSB[52,53]and this is consistent with recent research indicating that youth's SSB consumption has been declining.[12] Parents' SSB consumption exceeded recommendations of less than eight ounces per day;[53] however, their level was less than that recently reported.[12] This sample reported a high income and education attainment which may also contribute to these findings versus that of others. Continuing to target reducing SSB intake and increasing water consumption, as emphasized in the Scientific Report of the 2015 Dietary Guidelines Advisory Committee,[9] may promote weight management and optimal health and well-being in youth and adults.

Effectiveness of the Theory of Planned Behavior in Adolescents and Parents

Research supports the usefulness of the TPB in the prediction of intention and behavior for a wide variety of health behaviors.[24-26] and the present results are similar to one studyassessing soft drink consumption in adolescents.[54] In the present sample, the TPB explained a significant amount of variance in adolescents' and parents' SSB consumption; however, a majority of the variance remains unexplained. Adolescents' health behaviors may include two processes (i.e.“heuristic” and evaluative) and a theoretical model incorporating both operations may be more effective in predicting adolescents' health behaviors versus a traditional expectancy-value model, such as the TPB.[55] Adding behavioral willingness to the TPB model may help to better understand adolescents SSB consumption.[55] Future research attempting to understand adolescents' SSB consumption can include incorporating this “dual-processing perspective,”[55] which may provide further reasoning as to why adolescents choose specific beverages over others.

The explained variance in behavioral intention is comparable between adolescents and parentsas seen in prior work.[26] Intentions can change over time; thus, the closer intention is measured to behavioral action, the more likely it can predict behavior.[56] Adolescents' andparents' behavioral intention was the strongest predictor of SSB consumption, and this may be because SSB intake (i.e. behavior) was measured at the same time as intention. Previous works show similarpatterns in adults[24-26] and adolescents.[26] As age increases processing of stimuli changes from being emotional-based to more rational/evaluative[57] and adolescents’ may be in the midst of this transition. Perceived behavioral control in parents and subjective norm in adolescents having the strongest association with behavioral intention may further support this idea. Adolescents' affect might be more heavily influenced by peers and social acceptance,and the persona they portray may be important to them during this life stage, which can then influence beverage choices and ultimately health. Forthcoming work can elicit the normative beliefs and motivation to comply with important social factors influencing adolescents' SSB consumption and then incorporate these revelations into an intervention possibly delivered by the important social influencers.

Disinhibition, the loss of control when consuming foods that are typically considered "off-limits",[58] is associated with increased energy intake,[59] weight gain in those with depression,[60] and dietary helplessness.[58] Furthermore, disinhibition has been observed to be the strongest factor distinguishing between obese and non-obese women.[59] Thus, obese parents having less perceptions of control versus normal weight parents might represent their beliefs that dietary behaviors, specifically SSB intake, are immutable; they can hold an entity theory.[61] That is, their lack of control around SSB intake may be viewed as being unchangeable; some may believe they are predetermined to drink such beverages in excess. Lay theories (i.e. theories that posit the changeability of personal characteristics) have been investigated in dieters and understanding which lay theory individuals' hold (e.g. incremental or entity) might facilitate weight loss and setting sustaining and achievable weight management goals.[61,62] Taking the present results into account, distinguishing between entity and incremental theorists[61] in future work can provide further direction for creating strategies to decrease excessive SSB consumption in parents. This approach may impact adolescents since parents, who hold specific beliefs about self-control, sometimes

unintentionally project their beliefs onto their children.[63] This in turn could influence beverage choices.

Moderation Analysis and Parent Responses to Adolescents' Beverage Choices

The moderation analysis suggests that when adolescents' intentions to limit SSB are low or moderate, parents' encouragement to consume SSB matters (and is associated with increased SSB consumption by adolescents), but when adolescents' intentions to limit SSB are high, parents' encouragement may not affect adolescents' SSB intake. Some teens may have the autonomy typically sought during this developmental stage of life[2] and this may be the reason for the difference observed inpredicted SSB consumption at high levels of intention versus low levels of intention. Subsequent work can evaluate adolescents' perception and level of autonomy and how this may influence SSB consumption.

Considering over 95% of parents spoke to their child about beverage choices indicatesthat, like previous work, parents may influence some adolescents' SSB intake.[64,65] However, parents reported drinking more than the recommended upper limits of SSB indicating that availability is an area for attention. It has been suggested that positive modeling may be the best approach to promote healthy diet choices in youth.[66] An intervention might target parents of low intention teens to encourage non-SSB intake and reduce SSB availability. On the other hand, some teens that hold greater intentions to limit SSB might have influences beyond parents. Peers have been shown to influence children's soft drink intake[67] and future work can investigate how much of an impact adolescents' peer network, older family members, those in authority (e.g. religious leaders, captains on sports teams, and coaches), and other role models have on SSB intake using the TPB.

The Par-B-Q qualitative results suggest that parents may be aware of the health benefits of water consumption[68,69] and seek to have a positive influence on their child's health through beverage choices. This may be further exemplified by energy drinks being the most frequently identified beverage parents do not like their child to drink or purchase. Understanding how adolescents' perceive their parents' parenting practices around beverage choices might lend more insight into how this pressure influences adolescents' decision processes in relation to SSB intake.

Strengths and Limitations

Despite the varied age distribution, and high retention rate of the current investigation, some limitations are acknowledged. First, the cross-sectional design does not permit casual relationships. Second, in adolescents there is not one method of diet evaluation that is considered superior to another,[33] and obtaining accurate dietary intake data can be challenging due to youth's day-to-day variability in food intake, poor ability to estimate portion sizes, and decreased recall ability.[33,37] However, the present analysis used four record-assisted 24HR, a dietary assessment method suggested to better estimate food intake at the individual level in adolescents[70] and provide satisfactory nutrient and food data representative of regular consumption patterns.[34,35] Third, the sample of adolescents and parents were from the Blacksburg, VA area; thus, results may not generalize to others of different regions or socioeconomic status. Approximately 15% and 12% of VA's adolescents

are considered overweight and obese respectively,and our sample having 7% of participants being identified as obese is below the state average.[71] Fourth, Cronbach αs for some Par-B-Q constructs measuring parent responses encouraging SSB and non-SSB consumption in and out of the home were low; responses from the questionnaire, and thus, the moderation analysis should be considered in light of this limitation as the questionnaire may need modifications to better evaluate parents' reactions to their child's beverage choices. Fifth, Ajzen highlights the importance of conducting formative research when developing a TPB questionnaire[72] and this sample of adolescents may hold different salient beliefs than those identified for development of the administered TPB tool.[31]

Practice Implications

The current findings add to the literature on parent and adolescent SSB intake and provide potential guidance on how registered dietitians/nutritionists and other health professionals can strategize nutrition therapy provided to parents and adolescents related to beverage intake. A Behavioral Family Systems therapy approach[73] and including motivational interviewing techniques[74,75] and problem solving skill training[74] can be used with parents who lack perceptions of control and adolescents who lack intentions to limit SSB. These techniques and approaches might facilitate self-led changes in parent’s and adolescent’s beverage choices directly and indirectly. Registered dietitians/nutritionists and other health professionalscan highlight alternative beverage choices and help parent clients feel more empowered to change unhealthy beverage choices through decreasing SSB availability, which can potentially be transmitted tochildren with the hopes of increasing teen’s intentions around SSBs and improving health outcomes and quality of life.

Conclusions

In summary, the TPB explains a significant amount of variance in adolescents' SSB consumption and intention to limit SSB. Contrary to hypotheses, subjective norm was the strongest predictor ofadolescents' intention to limit SSB while, as hypothesized, intention was the strongest predictor ofSSB consumption. No TPB constructs mediated the relationship between parent responses to adolescents' beverage choices and adolescent SSB consumption. However, the moderator analysis suggests that adolescents with low intentions to limit SSB have the highest SSB consumption when parent responses areencouraging of SSB. In addition to parents, social figures such as older role models in the community, on sports teams, within the family, and in classrooms, can be targeted in future investigations attempting to limit adolescents' SSB intake. Together, parents and other social influences can directly deliver interventions promoting decreased SSB consumption using motivational strategies to promote consumption of healthy beverage options in adolescents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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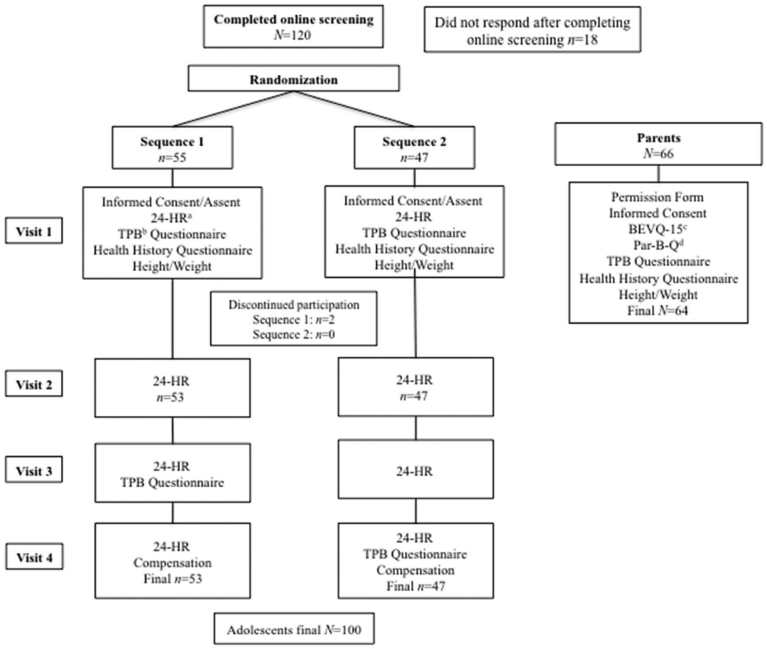

Figure 1.

Study procedures for a Mixed Methods Analysis of Beverage Choices in Adolescents and Their Parents using the Theory of Planned Behavior with participation.

[a]Record assisted 24-hour dietary recall

[b]Theory of Planned Behavior

[c]Beverage intake questionnaire-1530

[d]Parent response to beverage choice questionnaire

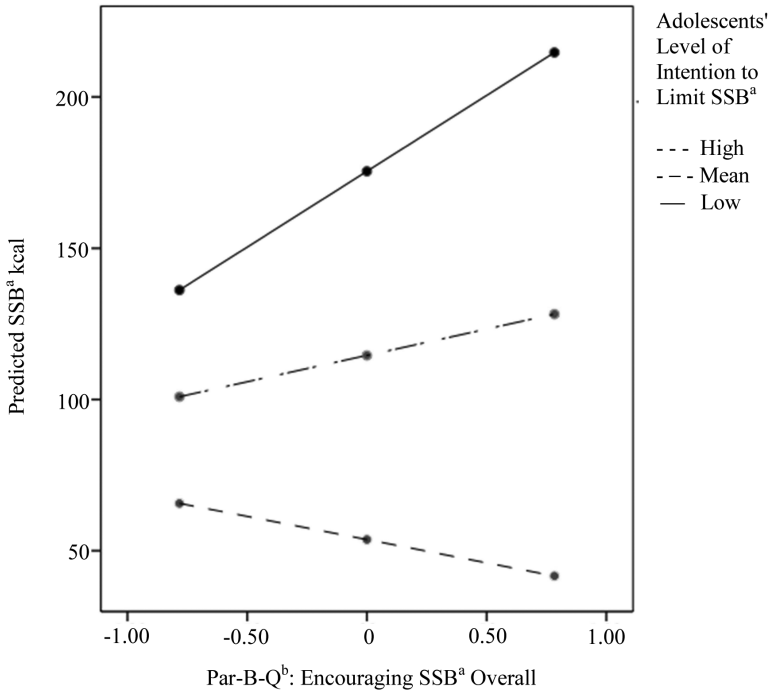

Figure 2.

Simple slopes for conditional effect of parent responses encouraging sugar-sweetened beverage (SSB)[a] in and out of the home combined (i.e., overall) on predicted SSB[a] consumption (kcal) at low (−1 standard deviation [SD]), average (i.e., mean), and high values (+1 SD) of adolescents' intention to limit SSB[a].

[a]Sugar-sweetened beverages include regular soft drinks, juice drinks, sweetened tea, coffee/tea with cream and/or sugar, mixed alcoholic drinks, and energy and sports drinks.[30]

[b]Parent Response to Beverage Choice Questionnaire

Table 1

Demographics and mean beverage intake and Theory of Planned Behavior scores of adolescent and parent participants from a Mixed Methods Analysis of Beverage Choices in Adolescents and Parents using the Theory of Planned Behavior.

Characteristic	Adolescents (*N*=100)	Parents (*N*=66)
Gender, *n* (%)		
Male	52 (52)	9 (14)
Female	48 (48)	57 (86)
Age, years		
Mean age±SE	14±0.2	46±0.7
Race/ethnicity, *n* (%)		
White	93 (93)	64 (97)
Black	2 (2)	0
Asian	2 (2)	1 (1.5)
Hispanic	0	2 (3)
More than one race	2 (2)	0
Not sure	0	1 (1.5)
Other	1 (1)	0
BMI status, *n*(%)		
Underweight	3 (3) [a]	4 (6) [b]
Normal weight	75 (75) [a]	29 (45) [b]
Overweight	15 (15) [a]	18 (28) [b]
Obese	7 (7) [a]	14 (21.5) [b]
Beverage Category[c]		
Water,[d] fl. oz. (SE)	28 (2)	32 (2)
Sugar-sweetened beverage,[e] fl. oz. (SE)	9 (2)	12 (2)
Sugar-sweetened beverage,[e] kcal (SE)	118 (11)	118 (16)
Total beverage, fl. oz. (SE)	50 (2)	63 (3)
Total beverage, kcal (SE)	291 (21)	285 (27)
Theory of Planned Behavior[f]		
Attitude (SE)	3.44 (0.06)	4.85 (0.16)
Subjective norm (SE)	3.59 (0.07)	4.56 (0.15)
Perceived behavioral control (SE)	4.48 (0.06)	6.52 (0.08)
Intention (SE)	3.45 (0.84)	5.69 (0.22)

[a] Adolescent BMI-for-age categories: Underweight: <5th percentile, Normal weight: 5th percentile to the 85th percentile, Overweight: 85th to less than 95th percentile, Obese: Equal to or greater than the 95th percentile.

[b] Parent BMI=body mass index; calculated as kg/m^2. Underweight: <18.5, Normal weight: 18.5-24.9, Overweight: 25-29.9, Obese≥30.

[c] Adolescent beverage intake was determined using the average of four interviewer-administered 24-hour recalls; parent beverage intake was determined using the beverage intake questionnaire (BEVQ-15).[30]

[d] Water included drinking water from the tap, bottles, and fountains, not water found in foods.

[e] Sugar-sweetened beverages include regular soft drinks, juice drinks, sweetened tea, coffee/tea with cream and/or sugar, mixed alcoholic drinks, and energy and sports drinks.[30]

[f] Responses to the Theory of Planned Behavior questionnaire were scored using a seven-point semantic differential scale in parents (i.e. "1" to "7") and a five-point semantic differential scale in adolescents (i.e. "1" to "5").

Table 2

Intercorrelations (*r*-values) for adolescent (A, *N*=100) and parent (B, *N*=65) Theory of Planned Behavior constructs from a Mixed Methods Analysis of Beverage Choices in Adolescents and Parents using the Theory of Planned Behavior.

A.

Variables	1 Behavior (SSB[a] kcal)	2 Intention	3 Perceived behavioral control	4 Subjective norm	5 Attitude
1. Behavior (SSB kcal)	---	−0.36***	−0.01	−0.30***	−0.11
2. Intention		---	0.32***	0.52***	0.21*
3. Perceived behavioral control			---	0.09	0.18*
4. Subjective norm				---	0.34***
5. Attitude					---

B.

Variables	1 Behavior (SSB[a] kcal)	2 Intention	3 Perceived behavioral control	4 Subjective norm	5 Attitude
1. Behavior (SSB kcal)	---	−0.58***	−0.27*	−0.04	−0.03
2. Intention		---	0.55***	0.25*	0.21*
3. Perceived behavioral control			---	0.24*	0.14
4. Subjective norm				---	0.106
5. Attitude					---

[a]Sugar-sweetened beverage; includes regular soft drinks, juice drinks, sweetened tea, coffee/tea with cream and/or sugar, mixed alcoholic drinks, and energy and sports drinks.[30]

*$p<0.05$

***$p\leq0.001$

Table 3

Linear models for predictors of sugar-sweetened beverage[a] (SSB) consumption from the Theory of Planned Behavior (TPB) constructs in adolescents (panel A) and parents (panel B) with 95% bias corrected and accelerated confidence intervals (95% BCa) and statistically significant interactions from the moderator analysis of the Parent Response to Beverage Choice Questionnaire on adolescent TPB constructs and SSB[a] intake (panel C). Confidence intervals and standard errors for linear models are based on 1000 bootstrap samples.

A. Adolescents					
Predictor Variable	R^2 (Adj R^2)	Final Model *b* (95% BCa)	Final Model *SE* B	Final Model β	*F*
Step 1 Intention	0.13	−37*	16	−0.27	14.65***
	(0.12)	(−70, −7)			
Step 2 Perceived behavioral control	0.14	16	20	0.09	7.99***
	(0.12)	(−24, 57)			
Step 3 Subjective norms	0.16	−15	20	−0.10	4.43**
	(0.12)	(−52, 28)			
Step 3 Attitude	0.16	−3	18	−0.01	4.43**
	(0.12)	(−36, 35)			
Step 4 Gender	0.22	−49*	22	−0.22	3.77***
	(0.16)	(−90, −10)			
Step 4 Age	0.22	9	6	−.15	3.77***
	(0.16)	(−4, 21)			
Step 4 BMI percentile	0.22	0	0	0.02	3.77***
	(0.16)	(−1, 1)			
B. Parents					
Predictor Variable	R^2 (Adj R^2)	Final Model *b* (95% CI)	Final Model *SE* B	Final Model β	*F*
Step 1 Intention	0.33	−49**	14	−0.63	31.43***
	(0.32)	(−75, −17)			
Step 2 Perceived behavioral control	0.34	17	31	0.08	15.72**
	(0.32)	(−47, 68)			
Step 3 Subjective norms	0.36	−7	12	0.06	8.25**
	(0.31)	(−14, 30)			
Step 3 Attitude	0.36	11	10	0.10	8.25**
	(0.31)	(−11, 31)			
Step 4 Gender	0.38	−41	56	−0.11	5.03***

A. Adolescents					
Predictor Variable	**R^2 (Adj R^2)**	**Final Model *b* (95% BCa)**	**Final Model *SE* B**	**Final Model β**	***F***
	(0.31)	(−154, 60)			
Step 4 Age	0.38	−1	2	−0.02	5.03***
	(0.31)	(−6, 7)			
Step 4 BMI[b]	0.38	3	4	0.13	5.03***
	(0.31)	(−4, 7)			
C. Moderation Analysis	**R^2**	***b*** **(95% CI)**	***SE* B**	***F***	
Main effect: Adolescent intention	---	−80**	16		
		(−112, −48)			
Main effect: Parent encouragement of SSB[a] overall	---	17	16		
		(−14, 48)			
Interaction: Parent encouragement of SSB[a] overall X adolescent intention	0.34	−43*	18	10.98**	
		(−80, −7)			
Main effect: Adolescent intention	---	-81**	14		
		(−109, −54)			
Main effect: Parent encouragement of SSB[a] outside of home	---	26*	13		
		(−0, 51)			
Interaction: Parent encouragement of SSB[a] outside the home X adolescent intention	0.40	−55**	14	14.22**	
		(−83, −28)			

[a] Sugar-sweetened beverages include regular soft drinks, juice drinks, sweetened tea, coffee/tea with cream and/or sugar, mixed alcoholic drinks, and energy and sports drinks.[30]

[b] Body mass index

* $p \leq 0.05$

** $p \leq 0.01$

*** $p \leq 0.001$

Table 4

Means and standard errors of parent response to beverage choice questionnaire (Par-B-Q) subscales for sugar-sweetened beverages[a] (A) and non-sugar-sweetened beverages (B) in and out of the home.

A. Par-B-Q Subscale for Sugar-sweetened Beverages	*M*[b]	SE
At Home		
Encouraging intake	2.26	0.09
Discouraging intake	3.17	0.13
Out of Home		
Encouraging intake	2.62	0.10
Discouraging intake	2.49	0.13
Overall encouraging intake	2.58	0.10
Overall discouraging intake	3.19	0.13
B. Par-B-Q Subscale for Non-Sugar-sweetened Beverages	*M*	SE
At Home		
Encouraging intake	2.53	0.11
Discouraging intake	2.40	0.12
Out of Home		
Encouraging intake	2.95	0.10
Discouraging intake	2.06	0.13
Overall encouraging intake	2.95	0.10
Overall discouraging intake	2.39	0.15

[a] Sugar-sweetened beverages include regular soft drinks, juice drinks, sweetened tea, coffee/tea with cream and/or sugar, mixed alcoholic drinks, and energy and sports drinks.[30]

[b] Responses to the Par-B-Q are scaled from "1"= very unlikely to "7"=very likely.