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The Role of Attitude, Control and Intention to Explain Fruit and Vegetable Intake among Racial/Ethnic Minority Women with Low Socioeconomic Status

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Abstract

Objective: Fruit and Vegetable (FV) intake-a modifiable risk factor for chronic diseases-is lower among racial/ethnic minorities and low Socio-Economic Status (SES) groups when compared to other populations. The Theory of Planned Behavior (TPB) is one theoretical model studied to explain and influence individual health behaviors, including FV intake, in middle class populations, but not exclusively in diverse, low SES groups. This cross-sectional study evaluated the utility of select TPB variables to explain intention to consume and intake of FV in this population.

Design: Demographics, BMI, select TPB variables, and FV intake were measured *via* survey. Bivariate analyses were conducted to explore relationships between variables. Hierarchical regression analyses were used to fit two models: one to explain intention and one to explain behavior with regard to FV vegetable intake.

Results: Participants (n=114) age 25-69 years and were mostly African American/Black and Hispanic (21.9% and 73%, respectively). The TPB variable perceived behavioral control was the only significant predictor of intention to consume FV (OR=2.55, 95% CI OR: 1.23, 5.27), and with BMI, FV intake (R^2=0.08; F [2,130] =5.72, p=0.0042).

Conclusion: Perceived behavioral control and BMI are the most significant predictors of FV intake but explain only 8% of the variability in intake in our cohort. Our results support prior research which suggests an attenuation of the intention-behavior relationship by SES, and may question the utility of the TPB as it is currently operationalized as a foundational model for future health behavior change research and programs in low SES racial/ethnic minorities.

Keywords: Theory of planned behavior; Fruit and vegetable intake; Racial/ethnic minorities; Low socioeconomic status; Public housing

Introduction

Increased consumption of fruit and vegetables is associated with decreased risk of cardiovascular disease, some cancers, and obesity [1,2]. Although the US government has suggested that American's increase their intake of fruit and vegetables to five servings per day, epidemiologic data suggest that most Americans have not attained intake levels which meet these guidelines [3,4]. The strongest disparity in intake is seen in racial/ethnic minorities of low Socio-Economic Status (SES) compared to those of higher levels of income with 32.2% *versus* 32.9% consuming ≥ 2 servings per day of fruit and 22.0% *versus* 29.4% consuming ≥3 servings of vegetables per day, respectively [5-7]. Differences in fruit and vegetable intake between racial/ethnic and socioeconomic groups are thought to contribute to the higher incidence of cardiovascular disease and obesity that is seen in these vulnerable populations [8-11].

Under-consumption of fruit and vegetables is thought to be the result of both individual and environmental factors [12-14]. Theoretical models of behavior seek to understand individual-level factors which shape health behavior including diet [15,16]. One theoretical model that was developed and is being studied to explain health behaviors is Ajzen's Theory of Planned Behavior (TPB) [17-20]. The TPB is a model which extends the Theory of Reasoned Action (TRA) [21]. The TPB posits that intention (and ultimately behavior) can be predicted effectively by a person's attitude (personal judgement about the behavior), subjective norms (other's judgement about the behavior), and perceived behavioral control (the individual's perceptions about whether or not he/she has the skills and means necessary to bring about successful performance of a goal intention). Perceived behavioral control has influence on both goal intention and behavior and its influence depends upon the type of behavior and the nature of the goal intention. In instances where attitudes are strong, or where subjective norms are powerful, perceived behavioral control may be less predictive of goal intentions. But, when these factors are reduced, perceived behavioral control may play a more powerful role in goal intention strength, and performance of behavior.

The TPB has been studied as a model to explain health behaviors in a number of groups, but not exclusively in racial/ethnic minority

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Table 1: Socio-demographic and behavioral variables of participants.

	Total[a] *n*=144
Age, Years, Mean (SD), Range	38.7 (7.85) 25-69
Race/Ethnicity[b]:	
Asian	2 (1.5)
Black or African American	30 (21.9)
Hispanic/Latino	100 (73.0)
White	5 (3.7)
Other	10 (6.9)
More than one	0 (0)
Highest level of education:	
< High school	46 (32.0)
High school graduate/GED	48 (33.3)
Some college or technical college	33 (22.9)
College graduate	17 (11.8)
Other	0 (0)
Adult BMI, kg/m^2	31.1 (7.7)
BMI classification[c]:	
Underweight BMI <18.5	6 (4.2)
Normal weight 18.5-24.9	24 (16.7)
Overweight 25-29.9	41 (28.5)
Obese >30	73 (50.7)
Attitudes about fruit and vegetable intake (median IQR)	7.00 (2.00)
Perceived behavioral control (median IQR)	6.00 (3.00)
Goal intention strength (median IQR)	6.00 (3.00)
Fruits & vegetables, servings/day[d](mean(sd))	3.28 (2.05)
Fruits & vegetables, servings/day[e](mean(sd))	3.49 (2.16)

[a]Numbers represent n (% unless otherwise noted)
[b]Subjects were able to choose multiple answers
[c]Classifications based upon CDC guidelines (CDC.gov)
[d]BRFSS FVM, no potatoes
[e]BRFSS FVM

women of low SES. If the TPB could be used to explain health behaviors in this vulnerable population, we could then use the TPB as a foundation to develop interventions to improve health behaviors (like fruit and vegetable intake) which we know are performed with less frequency in racial/ethnic minorities and low SES groups. Although the TPB has been used to understand fruit and vegetable intake specifically in multi-ethnic and overweight/obese groups, to date we know of no study investigating how TPB variables explain fruit and vegetable intake exclusively in racial/ethnic minority women of low SES [22,23]. The goal of this cross-sectional study was to evaluate whether the TPB variables attitude, perceived behavioral control, and goal intention strength explain fruit and vegetable intake in a group of racial/ethnic minority women of low SES. We hypothesized that attitude and perceived behavioral control would be significantly associated with goal intention strength, and goal intention strength would be significantly associated with fruit and vegetable intake, consistent with the TPB. Testing these hypotheses will provide insight into some of the constructs of the Theory of Planned Behavior in racial/ethnic minority women of low SES; information we hope can then be used to guide the development of effective strategies to increase fruit and vegetable intake in these often-marginalized groups.

Methods

Participants and data collection

Participants for this ancillary study were the mothers from the evaluation cohort of a parent study ("Healthy Families"). Details of this study design have been published elsewhere [24]. For the current cross-sectional study, data were collected as part of the one year follow up survey for the Healthy Families study (May through November, 2014). In addition to a re-assessment of height and weight, attitude, perceived behavioral control, goal intention strength and fruit and vegetable intake were measured at this time. The study was approved by the Boston Medical Center Investigational Review Board.

Demographic measures

Age, education level, and race/ethnicity were collected *via* survey. Height was measured using a standard measuring tape, and weight was obtained using a digital scale.

Theory of planned behavior measures

Attitude, perceived behavioral control and goal intention strength were measured using 1 question each with a bipolar semantic differential scale for response as informed by the literature [25]. As a recent meta-analysis by Armitage and Connor (2001) as well as studies by Conner & Sparks (2005), Louis *et al.* (2009) and Emmanuel *et al.* (2012) indicate that subjective norms is the weakest predictor of intention in the TPB, and we were cognizant of the significant participant burden associated with our survey (over 125 questions) we decided to only included questions that we felt were essential to the study [26-29]. As such, we did not measure the TPB construct subjective norms.

Attitude was measured using the question: *"For me, increasing my daily intake of fruit or vegetables by one serving every day over the next month is…"* to which subjects could respond on a scale between 1 and 7 anchored with *"foolish"* or *"wise"*. Perceived behavioral control was measured using the question: *"For me, increasing my daily intake of fruit or vegetables by one serving every day over the next month would be"* to which subjects could respond on a scale between 1 and 7 anchored with *"difficult"* and *"easy"*. Goal intention strength was measured using the question: *"I intend to increase my daily intake of fruit or vegetables by one serving every day for the next month."* Subjects could respond to this statement on a scale between 1 and 7 anchored with *"disagree strongly"* and *"agree strongly"*.

Fruit and vegetable intake measures

Fruit and vegetable intake was measured using the Behavioral Risk Factor Surveillance Survey Fruit and Vegetable Module (BRFSS FVM), a 6-item self-reported questionnaire measuring frequency of fruit and vegetables usually eaten during the past 30 days [30]. This measure has been validated in a similar population with a correlation between the BRFSS FVM and multiple 24-hour diet recalls of 0.46 [31]. The module includes an item designed to assess intake of potatoes excluding fried potatoes (e.g. French fries, potato chips) as well as an item to assess intake of green salad. A pictorial reference for serving size was added to the screener to improve its validity [31-33].

Analysis plan

Sample size was calculated based upon a medium effect size, 1-β=.80. α=.05, and 4 predictor variables to be 84 subjects. Bivariate correlational analyses were conducted to assess the strength and direction of relationships among demographic and TPB variables for addition into the multivariable models. Pearson product-moment correlation testing was used for normally-distributed continuous, and Spearmen's rank correlation coefficient was used for categorical and ordinal measures. Cochran-Mantel-Haenszel testing was conducted

Table 2: Logistic regression analyses for outcome highly positive goal intention strength using demographic, TPB and Healthy Family development predictor variables.

Predicting *"highly positive"* goal intention strength	*β*	*SE β*	Wald's χ^2	*df*	*p*	e^{β} (OR)	95% CI OR
Constant	0.44	0.34	1.65	1	0.20		
PBC	0.94	0.37	6.39	1	0.0115*	2.55	1.23, 5.27
Education	-0.74	0.30	6.23	1	0.0125*	0.29	0.09, 1.00
Development	-0.79	0.38	4.37	1	0.0367*	0.46	0.22, 1.00
Model evaluation							
Global Test (attitude, PBC, development, BMI, education, race/ethnicity)			χ^2	*df*	*p*		
Likelihood ratio test			19.40	5	0.0016**		
Score test			18.46	5	0.0024**		
Wald test			16.61	5	0.0053**		

*p<.05; **p<.01; ***p<.0001
PBC = Perceived Behavioral Control

Table 3: Linear regression analyses to predict FVI using demographics, TPB and Healthy Family development predictor variables.

VARIABLE (*n*=144)	R^2	F (*df*)	*p*	*β*
Predicting behavior (Fruit and Vegetable intake)				
Attitude, PBC, goal intention strength, BMI, Development, education, race/ethnicity	0.0809	5.72 (2,130)	0.0042**	
PBC	0.0371		0.0235*	0.30
BMI	0.0438		0.0174*	- 0.02

*p<.05; **p<.01; ***p<.0001
PBC = Perceived Behavioral Control

to test for associations between education and TPB variable scores, and ANOVA was used to test for associations between education and mean fruit and vegetable intake. Strength of associations was assessed as suggested by Dancey & Reidy (2004) [34].

Following the bivariate analyses, hierarchical regression analyses were conducted to examine the utility of the TPB to explain both goal intention strength (intention) and intake of fruit and vegetables (behavior). Covariate additions to these models were guided by the aforementioned bivariate correlational analyses as well as the tenants of the TPB.

In the first series of hierarchical regression models, goal intention strength (dependent variable) was dichotomized into those who scored a *"7"* (most positive) for goal intention strength, and those who scored less positive (*"1"* through *"6"*). At step 1, demographic variables and BMI were entered. In addition, an indicator variable for housing development residence was entered to control for potential influence of the parent study. At step 2, attitude and perceived behavioral control were entered.

Prior to performing the second series of hierarchical regression analyses, model assumptions were checked. As it was determined that both the linearity and homoscedasticity assumptions were violated, fruit and vegetable intake was transformed using the natural log, and TPB predictor variables were dichotomized with score 1 through 6 assigned the value zero (0) and score 7 assigned the value one (1). At step 1, demographic variables, BMI and an indicator variable for housing development residence was entered. At step 2, goal intention strength and perceived behavioral control were entered.

For all tests, significance was set at $\alpha = 0.05$. Data were analyzed using SAS 9.3© [35].

Results

Participant characteristics

Participants who completed the 1-year follow up survey for the parent study were included in this analysis (n=144; 68% of the total sample) (Table 1). Participants had a mean age of 38.7 (±7.85), and ranged from 25-69 years of age. Hispanic/Latina subjects comprised the majority race/ethnicity (73%), followed by Black/African American (21.9%), White (5%) and Asian (1.5%). Most of the participants had a less than high school education (32%) or were high school/GED educated (33.3%). More than three quarters of subjects had a BMI which classified them as either overweight or obese (79%). The mean servings per day of fruit and vegetables for the group was 3.49 (SD=2.16).

Multivariable modeling

In the final logistic regression model (Table 2), perceived behavioral control was significantly associated with highly positive goal intention strength (χ^2 model [5] =19.40, p=.0016; β = 0.94, p=.0115) with an odds ratio of 2.55 (95% CI OR 1.23, 5.27). No other variables reached statistical significance.

For the final linear regression model (Table 3), perceived behavioral control and BMI were the only significant predictors of fruit and vegetable intake (F [2,130] =5.72, p=0.0042; βPBC=0.30, p=0.0.0235; βBMI= -0.02, p=0.0174) and explained 8% of the variability in fruit and vegetable intake (Table 3).

Discussion

Analysis of our cross-sectional survey of demographic, select TPB variables and fruit and vegetable intake in a group of racial/ethnic minority women of low SES yielded a number of interesting findings. Contrary to our hypothesis, perceived behavioral control

rather than attitude toward consuming fruit and vegetables was the main predictor variable associated with highly positive goal intention strength in our group. Similarly, perceived behavioral control and not goal intention strength was significantly associated with fruit and vegetable intake (with BMI included in the model). As perceived behavioral control is thought to play a greater role in driving non-volitional behavior (i.e. not under a person's control), this finding suggests that for our study cohort, fruit and vegetable intake may be driven more by their assessment of their control over the behavior rather than how strongly they intend to perform that behavior. In other words, attitude toward consuming fruit and vegetables is not sufficient to influence their intention, which, in turn, is not sufficient to drive their intake behavior.

One possible reason for our finding of a limited role of intention to explain fruit and vegetable intake may be our study population; racial/ethnic minority women of low SES who classify as overweight/obese. These population characteristics differ significantly from those of other groups studied using the TPB. We are aware of only one study applying the TPB to a multi-ethnic group. Blanchard *et al*., (2009) conducted a study to assess if ethnicity and gender "matter" when the TPB is used to understand fruit and vegetable consumption [22]. Their results were similar to ours as they demonstrate perceived behavioral control as a significant predictor of intention, but inconsistent with our results, their results point to intention as a significant predictor of behavior to consume fruit and vegetables.

To explore the disparity between our findings and that of others further, we subjectively compared our scores for the TPB variables attitude, goal intention strength, and perceived behavioral control with scores obtained from the literature where the TPB was used as a theoretical foundation to explain fruit and vegetable intake in populations not including individuals of low SES [36-39]. In general, our subjects scored as high if not higher than subjects in the comparator studies for the variables attitude (mean±sd: 6.06±1.47 *vs*. 6.23±0.60, 5.69±1.11, 5.06±1.14, 6.01±1.26, respectively), goal intention strength (mean±sd: 5.90±1.64 *vs*. 5.72±0.88, 4.79±1.49, 5.06±1.14, 5.39±1.50, respectively), and perceived behavioral control mean±sd: 5.37±1.90 *vs*. 5.53±1.28, 5.40±1.78, 4.80±0.97, 5.43±1.28, respectively). These results suggest that there may be some difference(s) when the TPB is applied as currently operationalized or in the adequacy of attitude, perceived behavioral control and/or goal intention strength to explain fruit and vegetable intake in our group.

Studies using the TPB model to explain health behaviors in overweight and obese populations and have reported inconsistent results with regard to the strength of the intention – behavior relationship. For example, Gardner and Hausenblas (2004) examined the utility of the TPB to explain diet and exercise behavior in a group of overweight women enrolled in a 4-week weight loss program [23]. They determined that intention was the sole predictor of participants' diet adherence (behavior); consistent with the TPB model, but inconsistent with our findings. In their study, neither attitude, subjective norm, nor perceived behavioral controls was significant predictors of intention to adhere to a diet, which is inconsistent with our results. Boudreau and Godin (2007) studied the TPB as a framework to understand intention to be physically active in a group of obese adults [40]. Their results demonstrated the variability in intention was explained by attitude and perceived behavioral control. This is consistent with our results which suggest a significant role for perceived behavioral control in explaining the variance in goal intention.

The results of the aforementioned studies help to explain our results in terms of inconsistencies in significant predictors of intention and behavior when using the TPB to explain health behaviors in multi-ethnic, overweight and obese subjects. However, they do not help to explain the relatively small percentage of variance in behavior explained by the TPB found in our analyses. Blanchard *et al*. (2009) reported intention as a predictor to consume 5-A-Day with an R^2 of .17 to .22 in a sample of college-aged, white and black men and women [22]. Gardner and Hausenblas (2004) report intention as a predictor of behavior (positive dietary behaviors and exercise) with an R^2 of .10 in a sample of middle-class Caucasian women [23]. Other research using the TPB to explain and predict health behaviors has demonstrated that the theory variables account for more than 25% of the variability in the health-related behavior under study [41]. Studies that explored the TPB to explain fruit and vegetable intake produced similar numbers (above 25%) [36,37]. We were unable to demonstrate similar values, which suggest to us that for our study group there appear to be variables not accounted for by our research of the TPB (e.g., subjective norms, and/or other variables not included in the TPB) that play a greater role in explaining intake behavior.

This conclusion may be explained by the low socioeconomic status that characterized our study population and differentiates ours from the aforementioned research. Conner *et al*, (2013) suggested that the intention-health behavior relationship may be attenuated in lower SES samples [42]. Our findings are consistent with this assertion as we found the intention – behavior relationship was reduced, and the "self-efficacy-behavior" relationship (self-efficacy often used as a proxy for perceived behavioral control) was maintained, although our R^2 value was 30% lower than the valued Conner *et al*. (2013) reported [42].

The results from our cross-sectional survey have a number of implications for dietary behavior change interventions targeting racial/ethnic minority, low SES, overweight or obese groups. As our results suggest that perceived behavioral control is significantly associated with dietary behavior in this population, our results support the assertion by Conner *et al*. (2013) that the standard practice of targeting health behavior intentions (through programs which provide information on healthy eating, etc.) may not be effective [42]. We suggest that it may be more efficacious to target barriers to perceived behavioral control in racial/ethnic minority, low SES women. Planning, such as asking individuals to identify specific actions before opportunities to enact behavior arise, has been suggested by a number of researchers as a helpful intervention to increase perceived behavioral control [42,43]. Two recent meta-analyses (including one of the obesity literature) suggest that "action planning" (i.e. detailed planning where the individual determines the when, where and how a behavior is going to be performed) increases self-efficacy scores [44,45]. As such, interventions which assist individuals in planning health behavior change activities as a way of improving their perceived control over the behavior may be useful here. Another intervention which may be effective for low

SES groups, was proposed by Connor *et al.* (2013), who suggest that helping individuals overcome their inability to act on their health behavior intentions may be needed [42]. Specifically, Connor *et al.* (2013) suggest implementation intentions (which specifically target the *'intention-behavior gap'*) may prove useful in this population [43].

Limitations to this study include the self-reported nature of the TPB variables and dietary intake measures. We chose the assessment methods used in this study specifically to balance the use of validated instruments with the need for brief measurements that would not be overly burdensome. In addition, we did not include measurement of subjective norms in our participants. As our results point to a low predictive value for the TPB variables we did include in this study, future study of the TPB in this population should include measurement of subjective norm to determine its contribution to explaining dietary health behaviors. Finally, it is also possible that the low-income racial/ethnic minority female residents of public housing who participated in this study may not be representative of other public housing residents or low-income populations in urban areas. In particular, our study cohort was drawn from individuals who agreed to participate in a larger parent study with diet-related outcomes. Additionally, our cohort was small and be overrepresented by individuals who identify as Hispanic/Latina. Thus, caution should be taken when generalizing our outcomes.

Conclusion

In summary, the TPB was used as a framework to evaluate a number of cognitive processes associated with fruit and vegetable intake in a group of racial/ethnic minority women with low SES. Our results show that perceived behavioral control and BMI are significant predictors of the variability in fruit and vegetable intake in our study population. Results also support the attenuation of the intention-behavior relationship by SES which has been demonstrated in prior research. Future research which examines interventions which target perceived behavioral control and the *"intention-behavior gap"* (e.g. implementation intentions) in low income, minority racial/ethnic populations is needed to improve health behaviors in these often-marginalized groups.

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