

Examining the Predictive Value of the Theory of Planned Behavior and Stages of Change on Fruit and Vegetable Intake

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Abstract

Objective: Most research examining the Theory of Planned Behavior (TPB) and the Transtheoretical model's stages of change (SOC) in predicting fruit and vegetable (FV) intake has been cross-sectional in nature. The aim of this study was to investigate the strength of these variables in predicting FV consumption and SOC after one year.

Methods: A random-digit dial phone panel survey was administered in spring of 2006 (T1) and followed up in fall of 2007 (T2). Participants were English-speaking adults residing in the state of Hawai'i. Data included the 722 participants who were not meeting the 5-a-day recommendation at baseline. TPB variables (attitudes, perceived behavioral control (PBC), and social norms) were assessed, with stage of change (SOC), substituted for intention. Self efficacy, barriers, and dietary behavior were also measured. Various analyses were run investigating the predictive value of these variables on future FV intake.

Results: Without accounting for baseline FV intake, self efficacy and PBC significantly predicted whether or not the 5-a-day recommendation was reached, and self efficacy and barriers significantly predicted the number of servings consumed at follow up. However, when previous FV intake was accounted for, this variable explained most of the variance in behavior, rendering all other variables non-significant predictors. Some evidence was found supporting the temporal notion inherent in the SOC construct, namely that more people progressed forward through the stages than regressed backward. However, the majority of people in both the precontemplation and preparation stages tended to remain in that stage at T2.

Conclusion: After controlling for potential confounding variables, the TPB constructs and stages of change were not significant predictors of future FV intake. Some support was seen for SOC progression.

Implications: Results indicate that these constructs may not be the best option for the implementation of a long-term intervention, and more research is necessary in order to determine which theoretical constructs are strong predictors over time.

Introduction

One of the greatest challenges faced by public health today is the task of reducing chronic disease prevalence by shifting individuals toward healthy behaviors. Eating sufficient quantities of fruits and vegetables is one of these behaviors, with abundant research suggesting that increasing intake reduces the risk of cancer, diabetes, obesity and cardiovascular diseases¹⁻³. High prevalence rates for these chronic conditions have prompted multiple health organizations to set minimum recommendations for daily fruit and vegetable consumption. A minimum of five servings daily has been recommended for health benefits with more recent recommendations for even larger amounts⁴. However, according to the Behavioral Risk Factor Surveillance System's (BRFSS) 2000 data, only 24.6% of U.S. adults meet this recommendation, with the average number of servings eaten daily amounting to only 3.4⁵.

Theoretical Framework

A number of different theoretical models have been proposed which seek to explain the mediating variables contributing to behavior change. The Theory of Planned Behavior⁶ has arguably been one of the most extensively researched of these models, and has been useful in predicting a wide range of behaviors, including fruit and vegetable consumption⁷⁻¹⁰. The key premise of this model is that behavior is determined based on an individual's intention to perform or not perform an action. Intention is subsequently influenced by three theoretical constructs: 1) attitude (the combined set of beliefs one holds about the behavior), 2) subjective norm (an assessment of the amount of social pressure one feels regarding the behavior), and 3) perceived behavioral control (PBC –the degree one feels that they can control their behavior). Fundamentally, the TPB attempts to understand the "why" of an individual's behavior, and can be helpful in tailoring an intervention that addresses these specific variables^{11,12}.

Most research using the TPB can be categorized in two ways. Intervention-based TPB studies are designed to influence the variables through motivation and education¹²⁻¹⁴, and cross-sectional validation studies assess whether the four psychosocial variables predict fruit and vegetable consumption^{15,16}. Very little research has examined the predictive value of the model over time. Kvaavik and others¹⁷ found strong evidence

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supporting the model's predictive power over a period of eight years. However, most research usually operated in a relatively short time frame (i.e. ≤ 6 months)^{8,18}. In a review of the literature, Baranowski, Cullen and Baranowski¹⁰ conclude that "the relationship of intention to behavior needs to be tested prospectively, rather than cross-sectionally, because intention refers to future behavior."

In addition, a magnitude of research has sought to explain behaviors by using a stage model¹¹. The most commonly used is the Stage of Change Construct (SOC) from the Transtheoretical Model, which consists of 5 stages of change: pre-contemplation (no intention of changing behavior) contemplation (considering a change) preparation (planning to change and may have made small attempts), action (actively involved in changing behavior) and maintenance (behavior change sustained over time)¹⁹. Although the model was initially designed to describe the progression toward smoking cessation²⁰, it has been adapted to numerous other health behaviors, including fruit and vegetable consumption^{21,22}. This model provides information on "when" behavior change is to occur. SOC is a construct of the larger Transtheoretical model, which, like the TPB, also facilitates assessment of certain "why" variables. These variables, which include decisional balance, self efficacy, and various "processes of change," are conceptually similar to the TPB constructs of attitudes and PBC, but do not include an assessment of subjective norms. Therefore, it is feasible and perhaps even advantageous to examine SOC in terms of the TPB. This can be accomplished by thinking of an individual's stage as the temporal distance from the present time to the time that the individual *intends* to change their behavior. Thus, intention becomes a *progression* to behavior, rather than a dichotomous outcome variable. Previous research has suggested that these two models suitably compliment each other^{11,23,24}, although Courneya (1998) "questioned the utility of including both intention and stage as predictors... over time." This suggests that stage of change may provide an appropriate substitute for intention in the TPB, and perhaps even a more inclusive measure. The purpose of this study is to examine the efficacy of a combined TPB-SOC in predicting future fruit and vegetable intake. Stage progression is also explored.

Methods

Selection and procedure

Participants were selected from a target population of the entire state of Hawai'i, and were contacted by a random-digit dial telephone survey conducted in spring of 2006 (n=3495). Stratified random selection of participants assured that the sample reflected the correct percentage of the state's population living in

each county. This longitudinal study used survey data from a larger intervention project, known as the Healthy Hawai'i Initiative. The survey covered demographic data and various health behavior questions. A follow up was conducted the following year, utilizing the same cohort (n=1554). Alternative contacts were collected and contacted in the instance that a participant had moved or changed phone numbers. Follow up data was compared to baseline data in order to investigate changes that may have taken place over time. Participants were included if they responded to both of the following questions: "how many servings of fruits do you eat each day?" and "how many servings of vegetables do you eat each day?" at both time points. For the purpose of this study, only at-risk participants (those not meeting the 5-a-day recommendation at recruitment), were included in the analysis. Permission to conduct this survey was granted by the University of Hawai'i at Mānoa institutional review board, and consent was obtained verbally from participants before the start of the survey.

Measures

This study focused specifically on a subset of survey questions regarding a modified Theory of Planned Behavior (TPB) and stages of change (SOC) as they relate to fruit and vegetable (FV) intake. Attitudes and subjective norms were both measured on 5 point Likert scales, with 1 being "not at all important," and 5 being "extremely important." *Attitude* was measured by two items: "How important is it to you..." 1) "that eating more fruits and vegetables would provide more vitamins and minerals?" and 2) "...that you would feel good about looking after your health by eating more fruits and vegetables?" and *subjective norm* was measured with a single item, "How important is it that your family would be pleased if you ate more fruits and vegetables?" *Perceived behavioral control* was measured with two items: 1) "On a scale of 1 to 10, how much control do you have over the number of servings of F&V you eat per day?" 1 being "very little control" and 10 being "complete control," and 2) "On a scale of 1 to 10, how would you rate your ability to eat 5-a-day on a regular basis?" 1 being "extremely difficult" and 10 being "extremely easy."

In addition, self efficacy and barriers were assessed. Both were measured with three items, each employing a 5-point Likert scale. *Self efficacy* was assessed by the questions, "How confident are you that you can eat five or more servings of fruit and vegetables... on the weekends?" "...during the week?" and "...when you are on vacation?" Scores could range from 1 ("not at all confident") to 5 ("completely confident"). *Barriers* were assessed with the question, "How important is it that...eating more fruits and vegetables would be expensive?" "...preparing and cooking vegetables would be time consuming?" and

“...cooking more vegetables would make meal planning more difficult for my family?” These scores could range from 1 (“not at all important”) to 5 (“extremely important”). These items were designed in accordance with psychosocial evidence brought to light in focus groups²⁵⁻²⁷. Answers to each subset of questions were averaged to yield a single number representing the strength of that construct for each participant.

Intention was not measured as a dichotomous variable; instead, we substituted SOC as a representation of different levels of intention. This variable was measured using the following criteria: “not intending to eat 5 a day within the next six months” (precontemplation), “intending to start eating 5 a day in the next six months” (contemplation phase), “intending to eat 5 a day in the next 30 days” (preparation phase), “already eating 5 a day” (action) or “have been eating 5 a day for at least six months” (maintenance). Responses were initially coded either “yes” or “no,” and then assembled into a single categorical variable in order to assess SOC.

Previous behavior was defined as the number of servings of fruits and vegetables eaten daily at baseline (<5). The outcome variable, behavior at time 2 (T2), was evaluated on a continuous scale (number of servings of FV consumed daily), and also as a dichotomized variable (ate <5 a day/ate ?5 a day). Cronbach’s alpha was computed in order to assess the reliability of the constructs.

Data analysis

The Statistical Package for Social Sciences (SPSS), version 16.0, was used for data analysis. To assess differential dropout, independent-sample t-tests were run to compare psychosocial and demographic variables between those who completed both time points and those who did not. Correlations between all variables were analyzed. In order to investigate the strength of the psychosocial variables in predicting whether or not participants met 5 a day at follow up (a dichotomous outcome), a logistic regression was performed. We also assessed the predictive power of these variables on the number of servings of fruits and vegetables eaten daily (a continuous outcome) using multiple linear regression. Finally, progression through the stages of change was explored using a cross tabulation of stage at each time point.

Results

Participants

Of the initial 3451 participants recruited into the study, 1700(49.3%) were not included in the analysis because they already met the 5-a-day recommendation at baseline. This left an at-risk population of 1751 at baseline(T1). Of these, 1029(58.8%) could not be contacted at follow up(T2), leaving a final study

Table 1. Descriptive statistics and assessment of differential dropout

| Variable (range) | # of items | .a | Completed both time points n=722 | | Completed T1 only n=1029 | |
|--|------------|-------|----------------------------------|-----------|--------------------------|-----------|
| | | | Mean | Std. Dev. | Mean | Std. Dev. |
| Attitude (Likert: 1-5) | 2 | 0.799 | 3.74 | 0.90 | 3.85* | 0.83 |
| Subjective Norm (Likert: 1-5) | 1 | na | 3.29 | 1.31 | 3.42* | 1.27 |
| PBC (Likert: 1-10) | 2 | 0.455 | 7.06 | 2.01 | 7.01 | 2.21 |
| Barriers (Likert: 1-5) | 3 | 0.639 | 2.12 | 1.00 | 2.27** | 1.08 |
| Self Efficacy (Likert: 1-5) | 3 | 0.782 | 2.86 | 1.03 | 2.90 | 1.07 |
| Baseline Fruit consumption (Self-report: 0-4) | 1 | na | 1.39 | 0.77 | 1.39 | 0.73 |
| Baseline Vegetable consumption (Self-report: 0-4) | 1 | na | 1.57 | 0.68 | 1.57 | 0.70 |
| Years of education (1-22) | 1 | na | 14.89 | 3.09 | 14.2*** | 3.1 |
| Age (18-102) | 1 | na | 53.69 | 15.44 | 49.5*** | 18 |
| BMI (15-67) | 2 | na | 27.16 | 6.02 | 26.7 | 5.70 |
| Gender | | | | | | |
| Male | | | 42.2% | | 46.6% | |
| Female | | | 57.8% | | 53.4% | |
| Ethnicity | | | | | | |
| Caucasian | | | 34.1% | | 31.1% | |
| Asian | | | 32.5% | | 23.0% | |
| Hawaiian/Pacific Islander | | | 27.0% | | 35.3% | |
| Other | | | 6.4% | | 10.3% | |

^a Cronbach’s alpha

*Significantly different at $p < 0.05$ (independent samples t-test)

**Significantly different at $p < 0.01$ (independent samples t-test)

***Significantly different at $p < 0.001$ (independent samples t-test)

population of 722. Despite the high attrition rate, there were no significant differences between those who completed the study and those who did not in terms of self efficacy, perceived behavioral control, or fruit and vegetable consumption at T1. Slight differences were seen in education level, age, barriers, subjective norms and attitudes between the two groups(See table 1). Descriptive statistics of demographics, attitudes, self-efficacy, behavioral control, and daily fruit and

vegetable intake of the 722 participants who completed the study are presented.

This sample was 42% male and 58% female. This discrepancy was also seen in the larger sample (n=3451: 40% male, 60% female). The mean age of the participants was 53.7 years(SD 15.4). Mean BMI was 27.2(SD 6.0), which is above the cutoff of 25 for being considered overweight. This is consistent with BRFSS data that suggest that more than half of Hawai'i's population is overweight or obese²⁸. Sixty three percent were either married or living with their partner, only 5% did not complete high school, and most (65%) had some college(≥ 1 year).

Predicting fruit and vegetable intake

When Pearson's correlation coefficients were examined, all four of the continuous psychosocial variables (attitudes, self efficacy, barriers and perceived

behavioral control) were significantly correlated with future behavior. Correlation coefficients are seen in Table 2.

A stepwise linear regression that controlled for age, gender, education level, BMI, and ethnicity then found that perceived behavioral control (RR=0.895; 95% CI: 0.808-0.991, p<0.05), self efficacy (RR=0.799; 95% CI: 0.648-0.984, p<0.05) and barriers (RR=1.220; 95% CI: 1.001-1.487, p<0.05) significantly predicted future behavior. This further analysis found that attitudes, subjective norms and stage were insignificant predictors follow up FV intake. However, this model predicted only 5.7% of the variance in behavior. When previous behavior (number of daily servings of FV at recruitment) was entered, this variable explained most of the variance (RR=0.451, 95% CI: 0.353-0.575, p<0.001), and increased the predictive power of the

Table 2. Pearson correlation coefficients between psychosocial and demographic variables

| | | Attitude | Subjective Norm | PBC | Self Efficacy | Barriers | BMI | Age | Education | Baseline FV intake | Follow-Up FV intake |
|----------------------------|---------------------|----------|-----------------|---------------|---------------|----------------|----------------|----------------|----------------|--------------------|---------------------|
| Attitude | Pearson Correlation | 1 | .454** | .103** | .371** | .129** | .003 | -.044 | .001 | .150** | .073* |
| | N | 719 | 711 | 712 | 710 | 719 | 695 | 719 | 717 | 719 | 719 |
| Subj. Norm | Pearson Correlation | | 1 | -.002 | .215** | .148** | .073 | -.102** | -.081* | -.024 | -.037 |
| | N | | 713 | 707 | 704 | 713 | 689 | 713 | 711 | 713 | 713 |
| PBC | Pearson Correlation | | | 1 | .238** | -.133** | -.102** | -.007 | .097** | .218** | .123** |
| | N | | | 715 | 707 | 715 | 691 | 715 | 713 | 715 | 715 |
| Self Efficacy | Pearson Correlation | | | | 1 | .080* | -.048 | .017 | -.012 | .193** | .151** |
| | N | | | | 713 | 713 | 690 | 713 | 711 | 713 | 713 |
| Barriers | Pearson Correlation | | | | | 1 | .058 | -.015 | -.176** | -.078* | -.103** |
| | N | | | | | 722 | 698 | 722 | 720 | 722 | 722 |
| BMI | Pearson Correlation | | | | | | 1 | -.054 | -.062 | -.069 | -.033 |
| | N | | | | | | 698 | 698 | 697 | 698 | 698 |
| Age | Pearson Correlation | | | | | | | 1 | -.058 | .040 | .025 |
| | N | | | | | | | 722 | 720 | 722 | 722 |
| Education | Pearson Correlation | | | | | | | | 1 | .059 | .077* |
| | N | | | | | | | | 720 | 720 | 720 |
| Baseline FV intake | Pearson Correlation | | | | | | | | | 1 | .385** |
| | N | | | | | | | | | 722 | 722 |
| Follow-Up FV intake | Pearson Correlation | | | | | | | | | | 1 |
| | N | | | | | | | | | | 722 |

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

Table 3. Stages of change cross tabulation (T1 & T2)

| | | Stage at T2 | | | | | |
|--------------------|--------------------------|-------------------|---------------|--------------|--------------|-------------|-------|
| | | Pre-contemplation | contemplation | preparation | action | maintenance | |
| Stage at T1 | Pre-contemplation | Count | 213 | 11 | 52 | 40 | 44 |
| | | % | 59.2% | 3.1% | 14.4% | 11.1% | 12.2% |
| | Contemplation | Count | 16 | 6 | 17 | 6 | 8 |
| | | % | 30.2% | 11.3% | 32.1% | 11.3% | 15.1% |
| | Preparation | Count | 65 | 12 | 100 | 33 | 45 |
| | | % | 25.5% | 4.7% | 39.2% | 12.9% | 17.6% |

²(8)=89.1, $p<0.001$

model to 12.6%. This model predicted 76.9% correct classification.

Similar results were seen when we changed the dependent variable from a continuous (number of servings eaten daily) to a dichotomous (met 5 a day/did not meet 5 a day) outcome variable with a logistic regression. Without accounting for previous intake (T1), two of the constructs predicted future behavior: self efficacy (RR=0.116; $p<0.01$), and barriers (RR=-0.105, $p<0.01$). This model explained only 5.5% of the variance. However, when previous daily intake was included in the analysis, this variable accounted for most of the variance in behavior (RR=0.364; $p<0.001$) and the prediction of the variance increased to 17.1%. In this analysis, attitudes, subjective norms, PCB, and stage were not significant, even without accounting for previous behavior.

Progression through stages of change

Over half (53.3%) of participants were in the precontemplation phase at recruitment. Only 8.3% were in the contemplation phase, and 38.4% claimed to be in the preparation phase. Since the sample was limited to those that did not meet the 5 a day recommendation, no one was in action or maintenance. One year later, the percentage of precontemplators decreased to 42.7. Contemplation and preparation had both decreased, to 4.3% of the sample and 26.8% of the sample, correspondingly. However, 11.5% had moved into the action phase and 14.8 into maintenance. Contemplation accounted for the smallest proportion of the population in both time points, and precontemplation accounted for the largest. These results are outlined in Table 3.

Overall, 47.8% of the sample remained in the same stage that they had been in at T1. Thirty eight percent moved forward one or more stages, and only 12.9% regressed through the stages.

Discussion

By implementing a longitudinal design and controlling for sociodemographic variables as well as FV intake at baseline, our results strongly suggest that attitudes, subjective norms, and stage of change are not significant predictors of future FV intake. Although

some evidence was found for the predictive value of barriers, self-efficacy, and PBC over one year, this evidence was confounded by previous intake. These results are consistent with other findings suggesting that increased time intervals between assessments can decrease associations between thoughts and behaviors²⁹. However, the literature on this phenomenon shows mixed results, with some studies reporting strong correlations^{11,17}.

Our finding that stage does not predict future behavior is revealing in that it may suggest that stage of change is not an appropriate substitute for intention in the TPB. Since intention was not measured as a distinct variable in this study, further research examining the comparative predictability of both of these variables is recommended.

Our study also found that people moved through the stages of change over the time period. Though the study could not define whether SOC occurs in a series for example, from pre-contemplation to contemplation and contemplation to preparation and so on, it was identified that overall, most people remained in the same stage over a one year period. About a third moved forward one or more stages, and only 13% regressed one or more stages. This is consistent with findings by Prochaska¹⁹, in which people either remain in the same stage for longer periods of time than indicated (hence the term “chronic contemplation”), or slip backward from the action phase after a short time. Our findings may actually indicate a more aggressive progression through the stages than other studies, due to simultaneous social marketing campaigns at the population level.

Limitations

The high attrition rate seen in this study was due to the difficulty in tracking individuals whom had moved or changed phone numbers over the course of the study. However, no significant differences were seen between those who completed the study and those who did not in terms of baseline self efficacy, perceived behavioral control, or FV consumption. Significant differences were seen with regard to age, education, and attitudes, but, as shown in table 1, these differences are miniscule

and unlikely to have any great confounding effect on study results.

Subjective norms are typically measured by a single item in the literature¹¹. However, in a meta-analysis of TPB studies, Armitage and Conner⁷ assert that this is a limiting factor and potentially the reason why subjective norms seem to be the weakest predictor of intention, and therefore behavior^{16,30,31}. Although this could, in theory, threaten the study's internal validity, it is doubtful since none of the other variables were found significant either.

This study examined the stages of change over a one year time period. Since SOC is usually defined in six-month increments^{19,22,32}, we were unable to track whether or not the stages were followed explicitly as defined by Prochaska¹⁹. In addition, simultaneous interventions regarding fruit and vegetable intake could have potentially contributed to this progression through stages. Future studies will directly assess the impact that these large scale interventions may have had in relation to the stages of change as well as the other psychosocial variables analyzed in this study.

Conclusion

The results of this longitudinal study suggest that, although people do tend to progress chronologically through the stages of change, the psychological variables of the TPB, self-efficacy and SOC may not be sufficient predictors of future behavior change among populations already at-risk. Previous behavior was the only true predictor over time, and this is a variable that cannot be targeted through interventions.

Since empirical studies regarding this phenomenon are rare and show mixed results^{10,17}, further exploration is recommended. Future research should focus on the development of an appropriate survey tool based upon the Theory of Planned Behavior while incorporating stage of change and intention as distinguishable variables.

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