Exploring Additional Intention Predictors within Dietary Behavior among Type 2 Diabetes

D. O. Omondi, M. K. Walingo, G. M. Mbagaya

***Abstract*—**Objective: This study explored the possibility of integrating Health Belief Concepts as additional predictors of intention to adopt a recommended diet-category within the Theory of Planned Behavior (TPB). Methods: The study adopted a Sequential Exploratory Mixed Methods approach. Qualitative data were generated on attitude, subjective norm, perceived behavioral control and perceptions on predetermined diet-categories including perceived susceptibility, perceived benefits, perceived severity and cues to action. Synthesis of qualitative data was done using constant comparative approach during phase 1. A survey tool developed from qualitative results was used to collect information on the same concepts across 237 legible Type 2 diabetics. Data analysis included use of Structural Equation Modeling in Analysis of Moment Structures to explore the possibility of including perceived susceptibility, perceived benefits, perceived severity and cues to action as additional intention predictors in a single nested model. Results: Two models-one nested based on the traditional TPB model {$\chi2$=223.3, *df* = 77, *p* = .02, $\chi2/df$ = 2.9; *TLI* = .93; *CFI* =.91; *RMSEA (90CI)* = .090(.039, .146)} and the newly proposed *Planned Behavior Health Belief Model* (PBHB) {$\chi2$ = 743.47, *df* = 301, *p* = .019; *TLI* = .90; *CFI*=.91; *RMSEA* (90CI) = .079(.031, .14)} passed the goodness of fit tests based on common fit indicators used. Conclusion: The newly developed PBHB Model ranked higher than the traditional TPB model with reference made to chi-square ratios (PBHB: χ^2/df = 2.47; p=0.19 against TPB: χ^2/df = 2.9, p=0.02). The integrated model can be used to motivate Type 2 diabetics towards healthy eating.

***Keywords*—**Theory, intention, predictors, mixed methods design.

I. Introduction

TYPE 2 diabetes remains one of the leading health problems highly prevalent in many nations both in the developing and developed world. This condition has negative impact on individual health status and if not detected and prevented early could lead to serious health complications such as blurred vision, amputation, fatigue and death. The burden of disease stemming from Type 2 diabetes now calls for multidisciplinary interventional approaches for effective management. Successful management of this condition can be enhanced through lifestyle change interventions. Healthy dietary behavior is one intervention that has had promising results. Five randomized trials have shown a healthy diet can reduce both the incidence and progression of Type 2 diabetes [1]-[4]. However, a major challenge is identifying the best approaches to effectively promote a healthy diet among people with Type 2 diabetes.

The current communication methodologies used to motivate Type 2 diabetics towards healthy eating in most clinics in Kenya neglect patient's cognitive related factors [5]. Most approaches focus on patients as passive players in the decision making process with regard to healthy food choice. Cognitive related theories such as the Theory of Planned Behavior [6] and the Health Belief Model [7] have great potential to identify key intrinsic modifiable patient-related factors that influence healthy dietary practices among Type 2 diabetics. The Theory of Planned Behavior (TPB) puts emphasis on attitudes, subjective norms and perceived behavioral control as immediate predictors of behavioral intentions. Behavioral intention in turn predicts behavior. The Health Belief Model, on the other hand, identifies perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self efficacy as key predictors of behavior.

Previous empirical evidence found out that attitude, subjective norm and perceived behavioral control only accounted for 58% of the variance on intention [8]. This lack of full accountability of intention by key variables within the TBP is shared in work of Blue et al. [9]. It therefore implies that some additional proxy factors not specified in the model may be important drivers of behavioral intentions. The Health Belief Model outlines five key factors as direct and immediate predictors of behavior and excludes the mediating role of intention within the framework. It relates largely to the cognitive factors predisposing a person to health behavior, concluding with a belief in one's self-efficacy for the behavior. We noted that the model leaves a gap to be explained by factors enabling and reinforcing one's behavior, in this case intention. These factors become increasingly important when the model is used to explain and predict more complex lifestyle behaviors that need to be maintained over a lifetime.

A systematic, quantitative review of studies that had applied the Health Belief Model among adults into the late 1980s found it lacking in consistent predictive power for many kinds of health behavior, probably because its scope is limited to predisposing factors [10]. One study that specifically compared its predictive power with other models found that it accounted for a smaller proportion of the variance in diet, exercise, and smoking behaviors than did the Theory of Planned Behavior [11]. Based on these two parallel weaknesses concerning performance of the two theories applicable to individual cases, we test the utility of the

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Planned Behavior Health Belief Theory which builds on two theories with an aim of closing the pre-intention gap within the TPB*.* The proposed theory is a hybrid generation of the Theory of Planned Behavior with traditional health belief concepts integrated as competing predictors of intention. Emphasis was put on quantitative assessment of a model built on the newly formulated theory based on a hypothesis that: "a nested model structured from *planned behavior health belief theory* fits the data on dietary behavior acceptably among Type 2 diabetics".

II. Methods

A. Setting of the Study

The study was conducted at Kisii Level-V Hospital between June and November, 2009. This is a provincial referral hospital and the largest in Kisii County in Kenya. Until the period of data collection the clinic was operated by one consultant doctor who was not a residence of the Hospital, five residence doctors, six clinical officers, four nurses and one nutritionist. Diabetic management clinic are held every Tuesdays and Fridays. During each clinic patients arrive at 8.30 am. Health education sessions are conducted by a health professional as patients wait for clinical processes to begin. The patients then undergo various medical tests including blood to determine sugar levels, followed by receipt of medical prescriptions. After receiving their prescriptions, the patients undergo counseling conducted by the nurse in charge then proceed to collect drug and other supplies from the pharmacy. This means that our interviews were ethically scheduled one hour before 9.00 am and after the all the clinical processes following initial identification of the patient to be interviewed.

B. Research Design

This study used a three-phase sequential exploratory mixed methods approach. We first gathered qualitative data during Phase 1 using Focus Group Discussions (FGDs). Transcripts of the FGDs were analyzed using constant comparative approach in grounded theory analysis. The approach involved collecting data using FGD guide and analyzing the transcripts collected, then collecting more data and analyzing. In each case attempts were made to identify main categories measuring key concepts in the original and proposed theories until saturation. The techniques used included open, axial and selective coding process. The findings from the qualitative component were then used to develop a quantitative survey tool during Phase 2. The survey tool developed was then used to collect relevant data for an exploratory study during Phase 3 [12], [13]. In this article we only focus on the results of the quantitative survey.

C. Study Population and Sampling

The desired sample size was computed using the Creative Research Systems [14] formula, which has been used in several studies [15], [16]. A sample of 217 participants was computed as the minimum sample size given a finite population of 400 patients forming the sampling frame for the entire dietary behavior cohort. Simple random sampling technique was used to select individual participants out of 400 legible participants using a table of random numbers. We ensured that this group of patients was the one involved during the past two month of qualitative study to ensure homogeneity and consistency.

D. Data Collection Tools and Measurement

The survey instruments detail focused on measuring the key concepts intended to be nested into models as key latent variables. The latent variables from the traditional concepts in the TPB model includes attitude towards dietary behavior, subjective norm towards dietary behavior, perceived behavioral control towards dietary behavior, intention towards dietary behavior and dietary behavior itself. Latent variables from the Health Belief Model intended to be included in the newly developed model includes perceived susceptibility, perceived benefits, perceived severity and cues to action. Measurements of these variables were done using a 7-point likert scale and more details are in Table I.

TABLE I
MEASUREMENT OF KEY CONCEPTS

Concepts	Measurement criteria
Dietary behavior	Measured on the by the number of times in a week a patient consumes foods in *high fat diet* (Beef, chicken with skin, egg yolk, fried potato chips, roast meat, fatty meats, chapatti, and cream) , *high sugar diet* (Sweet potato, Irish potato, white rice, white rice, white sugar, soda and sweet soft drinks, cakes, ice cream, chocolate, sugared beverage, jam, glucose, honey, arrow roots and boiled maize) and *recommended diet* (Whole grain rice, green vegetables, low fat milk, chicken without skin, fish, beans, green grams, carrots, minnow fish (*omena*), sweet banana, pineapple and mangoes) categories as identified during FGDs. A score of 8 was given to patients who consumed food from recommended diet category, no foods from high fat diet and high sugar diet. (e.g. *How frequently do you consume foods from high fat diet (Diet class-1) category*)
Attitude	Computed by summing up the product of five salient belief strengths and corresponding evaluation weights for attitude towards “high fat diet” (attitude-1), “high sugar diet” (attitude-1) and “recommended diet” (attitude-3). (e.g. *Consuming class 1 foods make you go into a comma*-1=Strongly disagree, 7=strongly agree)
Subjective norm	Computed by summing up the product of five normative belief strengths and corresponding motivation to comply weights for subjective norm towards “high fat diet” (subjective norm-1), “high sugar diet” (subjective norm-2) and “recommended diet” (subjective norm-3). (e.g. *My doctor/nurse/nutritionist think that ________________ consume of fruits and vegetables, fish, poultry without skin, whole wheat flour, maize flour and unpolished rice grain when diabetic*- 1=I should, 7=I should not)
Perceived behavior control	Computed by finding the product between control belief strength (barriers) and control power weight, for perceived behavioral control towards “high sugar diet” (Perceived behavioral control-1), “high sugar diet” (perceived behavioral control-2) and “recommended diet” (perceived behavioral control-3). In this study only barriers emerged as factors which hinder following appropriate dietary recommendation. (e.g. *How often do you encounter factors such as social influence, unavailability of foods, conveniences among others that prevent you from reducing consumption of food items rich in fat such as red meat, fried potatoes among others?*-1=very rarely, 2=very frequently)
Intention	Measured by the degree of willingness to reduce fat and sugar intake or increase consumption of recommended diet (vegetables and fruits) by half. (e.g *Intend to reduce the intake of foods including red meat, fried potatoes among others by half*.-1=not at all, 7=very much)
Perceived susceptibility	Measured the perceived level of risk the participants attached to negative outcome of their conditions in relation to the three diet categories. Risk indicators included elevated blood sugar, blurred vision and loss of strength. (e.g. *Failure to reduce intake of diet rich in fats increases the chances of experiencing elevated blood sugar levels* (hyperglycemia), blurred vision and loss of strength-1=totally disagree, 7=totally agree)
Perceived severity	Measured the participants’ perception of how severe their conditions could be if they failed to follow dietary recommendations. Severity indicators included amputation, going into a comma and skin irritation. (e.g. *Adhering to the recommended diet consistently maintains blood sugar level within normal range*-1=totally disagree, 7=totally agree)
Perceived benefits	Measured the participants’ perception of the benefits they could get if they followed appropriate or recommended diet. Benefit indicators included improved strength and work productivity, risk avoiding risks and severe levels of disease and maintenance of blood sugar level. (e.g. *If I don’t reduce intake of diet rich in fats I risk being amputated, going into a comma and suffering from skin irritation*.-1=totally disagree, 7=totally disagree)
Cues to action	Focused on whether the participants were aware of materials and processes that promote appropriate dietary practice. Cues to action indicators included reading materials (booklets, magazines among others), visual materials (posters, television among others) and diabetic education day. (e.g. *There are enough reading materials (booklets, magazine among others) explaining the relationship between diet and Type 2 diabetes in this clinic*.-1=totally disagree, 7=totally agree)

E. Data Collection Tools and Measurement

Preliminary analysis was done to statistically test for the reliability of the survey tool using Cronbach’s alpha as a measure for internal consistency. Descriptive statistics were also reported to show the range of measurements and test for normality of data since we intended to use Structural Equation Modelling (SEM). SEM is based on the assumption that well fitting data should be normally distributed. Finally we performed SEM in AMOS 7.0 using Maximum Likelihood (ML) estimation during final analysis to test for the godness of fit of the models nested. During SEM analysis we included Confirmatoty Fit Index (CFI), Turkey Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), Chi-square P-Value, Relative Chi-square and Hoelter’s critical N as fit parameters. CFI and TLI values greater than 0.90 were considered satisfactory [17]. RMSEA less than 0.08 was also considered satisfactory [18]. Relative chi-square was considered fit under 3:1 range [19] and more accuate when closer but not less than 1. Hoelter’s critical N was considered low below 75 cases and bootsrap samples were set at 200 (Garson, 2009). ALL presentations were made in tables and nested model.

III. RESULTS

Reliability analyses: It is a common practice that survey items measuring same concept need to be reliable before nesting a model for SEM. We assessed the internal consistency of the questionnaire using *Cronbach’s alpha* reliability coefficient. *Cronbach’s alpha* reliability coefficient normally ranges between 0 and 1. The closer *Cronbach’s alpha* coefficient is to 1.0 the greater the internal consistency of the items in the scale. George and Mallery [20] rules of thumb was used to classify the *Cronbach’s alpha* coefficients generated. These rules of thumb provide the following: “> .9 – Excellent, > .8 – Good, > .7 – Acceptable, > .6 – Questionable, > .5 – Poor, and < .5 – Unacceptable” (p. 231). All the *Cronbach’s alpha* exceeded the 0.5 threshold criteria we set except for dietary behavior. Lower *Cronbach’s alpha* level for dietary behavior suggested the possibility of varied dietary practice being displayed and these categories were mutually exclusive. Table II shows internal consistency reliability coefficients for all the grouped factors measuring each concept within the questionnaire.

TABLE II
RELIABILITY TEST FOR DIETARY QUESTIONNAIRE

Concepts	Number of measurement items	Cronbach's alpha (main survey, (n=237)
Dietary behavior measures	3	0.387
Indirect attitude	3	0.570
Indirect subjective norm	3	0.940
Indirect Perceived Behavioral Control	3	0.590
Dietary intention	3	0.587
Pre-intention moderators		
Perceived susceptibility	3	0.514
Perceived severity	3	0.688
Perceived benefits	3	0.844
Cues to action	3	0.713

Exploring models using SEM: In order to address the core objective of this study, we intended to dwell more on the newly generated model and do a comparison with the traditional TPB model outcome. To perform this structural analysis, we tested the hypothesis that including *perceived susceptibility, perceived severity, perceived benefits* and *cues to action* as additional intention predictors within the TPB model applied to dietary behavior (the hybrid *planned behavior health belief theory*), would enhance the variance accounted for in predicting dietary behavioral *intentions*. All items in the model were accepted following the initial Confirmatory Factor Analysis (CFA). CFA is a measurement model whose purpose is to obtain factor loading estimates of the parameters of the model, the variances and covariance of the factors and the residual error variances of the observed variables. Usually it helps in exclusion of observed variables that load poorly into a model. Both item measurements analysis and measurement model analysis were performed using observed/unobserved endogenous and unobserved exogenous variables (Table III).

All variable cases were subjected to both univariate and multivariate screening to test for the normality of the data for each variable observed before fitting the model. The means and standard deviations for all the measures within model are displayed (Table IV). All the measures were subjected to skewness tests and based on the recommended ±2 range for normal distribution measures of dietary behavior were negatively skewed except for diet class-1 which appeared to be normally distributed. Measures of intention were all negatively skewed. All measures of cues to action and perceived behavioral control were normally distributed, while subjective norm measures, perceived benefits, perceived severity appeared to be negatively skewed. Perceived susceptibility measures were negatively skewed except for perceived susceptibility-1 which was normally distributed. Attitude measures were all normally distributed. On the overall data violated normality assumption based on skewness. Kurtosis also indicated that all measures were outside the ±2 range for normal distribution except for diet class-1, and perceived behavioral control measures, attitude-1 and perceived susceptibility-3.

TABLE III
ENDOGENOUS AND EXOGENOUS VARIABLES

Endogenous Variables	Exogenous Variables (*Unobserved*)
Observed	Perceived Benefits
Attitude-1 (A1)	Cues to Action
Attitude-2 (A2)	Perceived Susceptibility
Attitude-3 (A3)	Perceived Severity
Perceived susceptibility-1 (PS1)	PBC
Perceived susceptibility-2 (PS2)	Attitude
Perceived susceptibility-3 (PS3)	e3
Perceived severity-1 (SE1)	e2
Perceived severity-2 (SE2)	e1
Perceived severity-3(SE3)	c6
Subjective norm-1 (SN1)	c5
Subjective norm-2 (SN2)	c4
Subjective norm-3 (SN3)	c3
PBC-1 (PC1)	c2
PBC-2 (PC2)	c1
PBC-3 (PC3)	Subjective Norm
Intention-1 (IN1)	e6
Intention -2 (IN2)	e5
Intention -3 (IN3)	e4
Cues to action-1 (CA1)	e13
Cues to action-2 (CA2)	e14
Cues to action-3 (CA3)	e15
Perceived benefits-1 (PB1)	c12
Perceived benefits-2 (PB2)	c11
Perceived benefits-3 (PB3)	c10
Diet class-1 (D1)	c9
Diet class-2 (D2)	c8
Diet class-3 (D3)	c7
Unobserved	e9
Intention	e8
Dietary Behavior	e7
	other1
	other2
	e10
	e11
	e12

e/c= error; other=other factors 1=High fat diet 2=High sugar diet 3=Recommended diet

TABLE IV
MEASUREMENT LEVEL DESCRIPTIVE STATISTICS, UNIVARIATE AND MULTIVARIATE NORMALITY FOR THE MODEL (N= 237)

Variable	skew	c.r.	kurtosis	c.r.
IN3	-3.071	-19.298	11.485	36.091
IN2	-4.636	-29.136	28.659	90.058
IN1	-3.097	-19.467	10.696	33.613
PC1	.279	1.754	-1.617	-5.082
PC2	.045	.285	-1.777	-5.583
PC3	1.070	6.722	-.489	-1.537
PB1	-5.248	-32.984	27.635	86.840
PB2	-4.549	-28.591	21.067	66.203
PB3	-3.558	-22.362	11.422	35.895
CA1	.362	2.276	-1.710	-5.373
CA2	.629	3.953	-1.420	-4.463
CA3	-1.367	-8.589	.255	.800
D3	-3.242	-20.378	9.942	31.242
D2	-2.799	-17.594	10.447	32.829
D1	-.970	-6.093	.815	2.562
SN1	-1.728	-10.859	2.637	8.286
SN2	-2.079	-13.064	4.348	13.663
SN3	-2.098	-13.184	4.978	15.642
PSE1	-2.810	-17.661	6.981	21.938
PSE2	-3.915	-24.607	15.352	48.244
PSE3	-2.205	-13.858	3.416	10.733
PS1	-3.049	-19.166	8.468	26.610
PS2	-5.202	-32.694	28.998	91.124
PS3	-1.867	-11.732	1.858	5.837
A1	-.847	-5.324	.365	1.147
A2	-1.837	-11.548	5.800	18.225
A3	-1.688	-10.612	8.288	26.045
Multivariate			425.543	82.774

Item level measurements were then performed for the model due to the difference in the measurement scales. The model was recursive with a *df*=301. Standardized regression weights for the endogenous variables were determined and screened. Items defining attitudes, subjective norms, perceived behavioral control, perceived susceptibility, perceived severity, perceived benefits, cues to action, intention, and dietary behavior had very high regression weights close to 1.00. The squared multiple correlation indicated that predictors of subscales accounted for >90 percent except for *perceived behavioral control* (PBC-3) for the recommended diet and cues to action-3 where the predictors accounted for 44 percent and 77.8 percent of the variances respectively. Correlations between variables in the model were strong ($p<0.001$) and positive except PBC3 which registered lower but significant positive correlation coefficient ($p<0.01$). Modification indices suggested specifying relationships among items within and between the scales, which suggest multicolinearity.

The goodness of fit statistics were statistically non-significant at the .01 level but the model should be rejected at the .05 level ($\chi^2 = 743.47$, $df = 301$, $p = .019$, $\chi^2/df = 2.47$). However, the relative chi-square was under the recommended 3:1 range indicating acceptable fit after significant modification indices were uncorrelated. Modification Index was set at the customary cutoff value of 4.00. Other fit indices {*TLI* = .90; *CFI* =.91; *RMSEA* (90CI) = .079(.031, .14)} also demonstrated a good model fit. Hoelter's critical N values suggest that the model would have been accepted at the .05 significance level with 161 cases and the upper limit of *N* for the .01 significance level is 197. Because the data violated the normality assumption, bootstrapped chi-square values were also calculated and the model fits better in 200 bootstrapped samples. The Bollen-Stine $p = 0.02$ provided further reassurance about the model fit. Based on the goodness of fit statistics an attempt was made to advance the *planned behavior health belief theory* using structural model.

Standardized regression weights indicated that attitude was a better predictor of knowledge (β=0.56, $p<0.0$), followed subjective norm (β=0.38, $p<0.05$). Perceived behavioral control showed very minimal negative change on (β=-0.01, $p>0.05$) intention and minimal positive change on dietary behavior (β=0.01, $p>0.05$). Perceived susceptibility (β=0.03, $p>0.05$), perceived severity (β=0.02, $p>0.05$), perceived benefits (β=0.07, $p>0.05$) and cues to action (β=0.06, $p>0.05$) poorly predicted intention while intention still had a strong prediction for dietary behavior (β=1.00, $p<0.001$).

IV. DISCUSSION

This study put to test the four concepts drawn from the Health Belief Model [7]. These concepts were included in the original Theory of Planned Behavior [6] in order to build a new behavior model for the Type 2 diabetics. The concepts included *perceived susceptibility, perceived severity, perceived benefits* and *cues to action*. These concepts were incorporated into the TPB model to advance a new theory labeled *planned behavior health belief theory* (PBHB). Goodness of fit comparisons (based on relative chi-squares and *p*-values) between the *planned behavior health belief theory* and the traditional Theory of Planned Behavior ranked the new theory higher within dietary behavior (PBHB: χ^2/df = 2.47; p=0.19 against TPB: χ^2/df = 2.9, p=0.02 under similar conditions). Chi-square ratio is usually the most commonly used index for model comparison and the closer value is to 2 the better the performance. There were also considerable reduction (-0.24) in the prediction power of attitude [21] implying these variables were possible moderators. This goodness of fit comparison leads us to the next phase of discussion where we now take a critical analysis of the contribution each of the additional intention proposed predictors made in the model.

Health belief concepts performed rather well as predictors of intention within dietary behavior domain. However, the variance of intention accounted for by each of the four concepts was not significant but gain larger than zero. The relationship between *perceived susceptibility* and health related behavior is well researched [22] but puts more emphasis on the direct link with health behavior. However, in this study we examined *perceived susceptibility* as an indirect determinant of dietary behavior. *Perceived susceptibility* focused on how Type 2 diabetic patients' view the risks related to dietary practices and explained up to 3 percent of the variance in dietary intention. This shows that Type 2 diabetic patients always had intention whenever they perceived themselves to be at high risk. Perceived susceptibility is one of the motivator for people to adopt healthier behaviors. When perceived risk is high, individuals tend adopt healthier behaviors to decrease the risk [23], [24]. In close ties with our results, Type 2 diabetics would become more likely to follow recommended diet whenever they feel more are at risk to worse outcomes of their condition. On the on the contrary, when the patients believe that they are not at risk at all or minor risk, they tend to resort to unhealthy dietary practices. Among people whose parents had or have the Type 2 diabetes, the perception of risk of developing the condition was predictive of more heath-enhancing behaviors and were more likely than others to engage in behaviors to control their weight [25], since weight is a known risk factor to Type 2 diabetes.

The construct of *perceived severity* also referred to as perceived seriousness in some studies also showed elements of accountability for Type 2 diabetics' dietary intentions. It appeared that perceived severity positively accounted for 2 percent of the variance in dietary intention. This study revealed that while the perception of severity of a disease is often based on medical information or knowledge, it may also come from beliefs a patient has about the difficulties a disease would create or the effects it would have on his or her life in general [26]. For instance, some Type 2 diabetics view their condition as relatively minor ailment during initial stages. When they are diagnosed with the condition, they simply walk to the clinic get medication and get better. However, when their conditions worsen, they realize the seriousness of the disease and seek serious medical help.

The construct of *perceived benefits* focused on the patients' opinions on the value or usefulness of a new behavior in decreasing the risk of developing severe conditions of Type 2 diabetes. Perceived benefits performed better than other concepts in the planned behavior health belief model by explaining up to 7 percent of the variance in dietary intention. This implies that Type 2 diabetics tend to develop high intentions to follow recommended diet when they realize the benefits of healthy eating. Perceived benefit plays a greater role in the adoption of secondary prevention behaviors. For example, Graham [27] discovered that the earlier breast cancer is found, the greater the chance of survival and when a breast self exam (BSE) is done regularly early detection early is guaranteed. However, not all women do BSE regularly and somehow they have to believe there is a benefit in adopting this behavior. Similarly in this study Type 2 diabetics must know there are benefits before they make decision to adopt a prescribed dietary prescription.

Cues to actions are events, people, or even things that move people to change their behavior. For example, illness of a family member, media reports [27], mass media campaigns, and reminder postcards from health care provider or warning labels on a food product. This study focused on three categories of cues to action, including posters and materials, television or radios and weekly education program as elements of cues to action. The study has shown that cues to action negatively accounted for 6 percent of the variance in dietary intention. The average mean score (μ=4.08±0.16) indicates that most patients were undecided on whether enough materials exist to explain relationship between diet and Type 2 diabetes. To some extent some patients disagreed if TVs and posters were relevant to their conditions. Watching and hearing TV or radio news stories about food borne illness and reading the safe handling instructions on packages of new meat and poultry are cues to action associated with safer food-handling behaviors [28]. Similarly having posters and showing patients TV pictures relevant to Type 2 diabetes are cues to action associated with prevention of severe conditions of the disease.

Conclusion and international health relevance of the study: This study has revealed that health belief concepts such as *perceived susceptibility, perceived benefits, perceived severity* and *cues to action* when combined with *attitude, subjective norm* and *perceived behavioral control* as *intention* predictors within the original theory of planned behavior improves the model's competitive power. This was arrived at after considering improved performance of a model nested based on the concepts within *planned behavior health belief theory* compared to a model nested based on the traditional concepts of the Theory of Planned Behavior. Even though the contributions of *attitude* and *subjective norm* were still on the lead as predictors of intention, their prediction power were much reduced when concepts such as *perceived susceptibility, perceived severity*, *perceived benefit* and *cues to action* were loaded into the model. This suggests that researchers need to re-focus on the pre-intention phase of the TPB model, otherwise users of the TBP would assume that it is only attitude, subjective norm and perceived behavioral control that are key intention predictors yet this may not be the case. The newly integrated model in addition to being patients' centered and marries key concepts from two theory and can be used educate Type 2 diabetics at individual level. We believe that implementation of this model may have a remarkable impact on positive dietary behavior change and opens up a window for debate in the scientific world.

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