

Original Article

Predicting Malawian women's intention to adhere to antiretroviral therapy

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Significance for public health

The knowledge of the rates of adherence to antiretroviral therapy (ART) could be used to evaluate planning and project, which could lead to better outcomes predicted by treatment efficacy data. In addition, knowledge of adherence behaviour could help the development of interventions focusing on collaboration between healthcare providers and Malawian government to provide food support for patients on ART. The interventions could also focus on providing better counselling support to improve beliefs regarding control over taking the medication and perceived *versus* real side effects. It is relevant for public health professors to understand factors influencing women's ART adherence, in order to create interventions that are appropriate for increasing ART adherence, which may lead to improved outcomes among women with HIV living in endemic regions with limited treatment access.

Abstract

Background. With the increase in scaling up of antiretroviral therapy (ART), knowledge of the need for adherence to ART is pivotal for successful treatment outcomes.

Design and Methods. A cross-sectional study was carried out between October and December 2013. We administered theory of planned behaviour (TPB) and adherence questionnaires to 358 women aged 18-49 years, from a rural and urban ART-clinics in southern Malawi. Hierarchical linear regression models were used to predict intentions to adhere to ART.

Results. Regression models show that attitude ($\beta=0.47$), subjective norm ($\beta=0.31$) and perceived behavioural control ($\beta=0.12$) explain 55% of the variance in intentions to adhere to ART. The relationship between both food insecurity and perceived side effects with intentions to adhere to ART is mediated by attitude, subjective norm, and perceived behavioural control. Household ($r=0.20$) and individual ($r=0.21$) food insecurity were positively and significantly correlated with perceived behavioural control. Household food insecurity had a negative correlation with perceived side effects ($r=-0.11$). Perceived side effects were positively correlated with attitude ($r=0.25$). There was no statistically significant relationship between intentions to adhere to ART in the future and one month self-report of past month adherence. These interactions suggest that attitude predicted adherence only when food insecurity is high or perception of side effects is strong.

Conclusions. This study shows that modification might be needed when using TPB constructs in resource constraint environments.

Introduction

Malawi, one of the countries in Sub-Saharan Africa with the highest burden of HIV, is located in south central Africa, with a population of 15.9 million (85% rural) people, with an estimated HIV prevalence of 12%.^{1,2} Thyolo and Blantyre Districts have an HIV preva-

lence of 21% and 22%, respectively.² About 97% of rural women in Malawi engage in sustaining farms.³ The literacy rate for women is 67%, compared with 77% for men.⁴ The United Nations World Food Program (WFP) estimated that 60% of those in the rural region of Malawi live below poverty level and do not meet minimal nutritional needs.⁵

As of 2011, about 322,209 people living with HIV/AIDS had access to antiretroviral medication in Malawi, compared with 13,183 in 2004.⁶ Antiretroviral therapy (ART) coverage increased from 54% to 67% between 2010 and 2011.⁶ Although access to HIV medications has significantly improved over the last decade, Malawians living with HIV still struggle with the disease, in part, due to non-adherence ART medication. The range of non-adherence in adults is between 33% and 88%.⁷ Research shows that to minimize progression of HIV to AIDS, prevent drug-resistant genotypic mutations,⁸ decrease mortality, and have a long-term suppression of viral load, a minimum adherence level of 95% is required.^{9,10} Au and colleagues found that increased appetite after treatment initiation is a potential barrier to adherence.^{11,12} Other challenges impeding adherence include fear of disclosure and discrimination, staff and drug shortages, belief regarding ART, knowledge, forgetfulness, stigma, financial constraints, and religion.^{13,14} According to the Centre for Disease Control and Prevention (CDC),¹⁵ medication adherence is *the patient's conformance with the provider's recommendation with respect to timing, dosage, and frequency of medication-taking during the prescribed length of time.*

With an increase in scaling up of ART medication, Malawi now has to address some of the challenges of ART adherence. Malawian government has upheld a strong commitment to providing HIV treatment and increasing ART adherence of individuals on treatment. The government established strategies to increase adherence by having patients identify a guardian who reminds, facilitates, and supports patients' medications' intake.¹⁶ There are 449 HIV treatment clinics across Malawi, with the Central East and Northern zone having greatest access to treatment and South East zone having the lowest access.⁶ Malamulo Hospital (rural) and the Queen Elizabeth Central Hospital ART Clinics (urban), located in the southern zone, are two of the many treatment centers that provide HIV/AIDS related services to Malawian patients and make adherence very pivotal in these areas.

The theory of planned behaviour (TPB) is a useful predictor of health behaviour, including HIV/AIDS health behaviour.^{17,18} The use of this theory in other research suggests it may be applicable in the context of understanding ART adherence. We have adapted the TPB to ART adherence setting by adding additional constructs *Food Insecurity and Perceived Side Effects* as shown in Figure 1. According to the TPB, an individual's behaviour is directly predicted by the *intention* to perform the behaviour and by *actual behavioural control*. When individuals' beliefs about actual behavioural control are accurate, perceived behavioural control, (PBC) can serve as a stand-in. Intention is predicted by *attitudes* towards behaviour, *subjective norms*, and *perceived behavioural control*.¹⁹ Ajzen developed the TPB because it added a key element he felt was overlooked in the theory of reasoned action (TRA).²⁰ According to Ajzen,¹⁹ the TPB is used to

examine the relationships between individuals' behaviour, beliefs, attitudes, intentions, and perceived control over that behaviour. Under the TPB, behavioural intention and perceived behavioural control are hypothesised to be the strongest and most direct determinant of behaviour.¹⁹

The constructs *food insecurity* and perceived side effects were included in the model because we were interested in identifying factors that prevent HIV-positive Malawian women from adhering to ART. In McKinney and colleagues' study on providers' perceptions of patients' adherence to ART among Malawian sample, providers identified barriers to adherence to include medication side effects and food insecurity.¹³ The providers also stated that some of the patients believed the medication had to be taken with food and when they took their medications on empty stomach, they experienced unwanted side effects.¹³ The rationale for food insecurity influencing PBC was that individuals are likely to believe lack of food security will be a barrier to their ART adherence because lack of food will make it more likely that they will experience unwanted side effects.¹³ The rationale for side effects influencing attitude is that side effects are a negative outcome of ART and according to the theory of planned behaviour,¹⁹ beliefs that negative outcomes will result from the behaviour lead to negative attitudes toward the behaviour. In addition, researchers show that food insecurity and perceived side effects although independent of each other, have a strong association with patients' adherence behaviour.²¹⁻²³ Food insecurity has been shown to be associated with missed clinic visits, worse immunologic response, higher mortality and worse ART adherence.²³ When the provision of food for people living with HIV increased, side effects decreased.²⁴

To the best of our knowledge, no study has assessed Malawian women's intention and ART adherence behaviours using the theory of planned behaviour. Henceforth, we suggest the two additional variables and a direct association between variables, which we hypothesized to have more influence on Malawian women's adherence behaviours than intention. The objective of this study was to predict intentions to adhere to ART and determine whether the TPB constructs of attitude, subjective norms, and PBC directly predict adherence behaviours without the influence of intention. The second objective of this study was to determine whether if the additional variables (food insecurity and perceived side effects) would improve the prediction of intentions to adhere to ART.

Design and Methods

Site of study and participants

This study was conducted with 358 women on HIV treatment at two ART Clinics located in a rural and urban hospital (Malamulo and Queen Elizabeth Central Hospitals) in southern Malawi from October to December of 2013. The rural ART Clinic is operated in a faith-based hospital owned by Seventh Day Adventist (SDA) Christians while the second ART Clinic located in the urban city of Blantyre is government-owned and operated. Both ART Clinics provide inpatient and outpatients HIV/AIDS services to all individuals with HIV/AIDS regardless of age, sex, income, or religious background. Most of the patients come from primarily low-income and low educational background. The rural clinic has just five staff, the same applied to the urban clinic.¹³ The women are expected to follow-up for medication refill every 30 days, depending on their clinical status, while other women went for follow-up every 3 months.¹⁶

Reproductive age women who were on ART and visit Malamulo and Queen Elizabeth Central Hospital (QECH) ART clinics for HIV related treatment and services such as pill refill and counselling were approached and asked to be in the study on their way out of the clinics. Inclusion criteria for the participants were: i) women 18-49 years of age residing in Malawi, ii) HIV positive, iii) on ART for at least six months, iv) able to understand spoken English or Chichewa, and v) willing to participate in the study. Patients in the hospital and clinic who met all of the conditions and consented to be in the study were included, pregnant women were not excluded.

Procedures

We employed multiple procedures to recruit participants for the study. A purposeful snowball sampling method along with recruitment flyers and direct solicitation were used to obtain participants for the study. Flyers were handed out to healthcare providers to give out to their patients. A member of the study team also recruited participants through the physician's office of both health centres. Participants were told if they were interested in learning more about the study, they could contact the researcher in a private room for more information. A statement of consent was read to patients who wanted to take

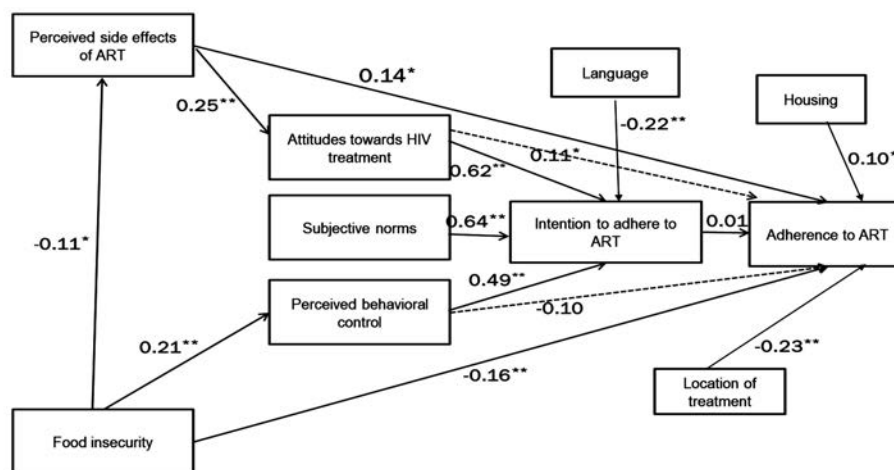


Figure 1. Summary of associations between the theory of planned behaviour constructs and other variables, basing on the proposed model of adherence by Ajzen.¹⁹ **P<0.01, *P<0.05.

part in the study and verbal consent was given. Only those who consented were included in the study.

In order to eliminate any bias and embarrassment that could arise from lack of literacy, an interview-guided questionnaire was used. Trained research assistants read the questions to all participants in participants' language preferences. Literacy was not assessed as this was outside the scope of this study.

After completing the survey, each participant was given a compensation worth up to \$3 (U.S. dollars) or Malawi Kwacha 1,004.24 for their time and travel. A gift bag full of pens, notebooks, hand sanitizers, soaps, lotions, and more (worth \$10 U.S dollars) was given to ART clerks and in-charged nurses who helped handed out flyers about the study to patients. Approval for this research was obtained from the Loma Linda University Institutional Review Board (IRB), the University of Malawi College of Medicine Research and Ethical Committee (COMREC), and the directors of both hospitals.

Instrument testing

The instruments were pilot tested prior to the collection of data for the study. Twelve subjects were recruited from a rural ART Clinic located about 31 miles (50 km) away from Malamulo Hospital. Each participant was asked to give her consent before the survey was administered. Pilot testing the questionnaires helped to identify and eliminate problems and determine which, if any, words or terminology were too difficult for participants to understand or read. After participants completed the questionnaire, they were asked to provide any feedback about their understanding of the words and terminology, questions they did not understand and questions that made them uncomfortable. Any suggestions and or comments given by participants were noted and considered when we made changes to the instrument. The responders from the pilot testing were not included in the study sample or analysis.

Instruments

The questionnaire included questions on self-reported adherence, theory of planned behaviour constructs (intention, attitude, subjective norm, and perceived behavioural control), perceived side effects, food insecurity, and demographic characteristics. All of the TPB scales were developed according to Ajzen's guidelines,²⁵ and modified to the study setting. The questionnaire took approximately 40-50 minutes to complete.

Intention to adhere to antiretroviral therapy

A four-item scale was constructed to assess intention to adhere to ART using the format for developing the theory of planned behaviour questions by Ajzen.²⁵ A five-point rating scale ranging from *disagree a lot* to *agree a lot* was used. Cronbach's alpha for the four items was 0.90.

Attitudes toward antiretroviral therapy adherence

A five-item Likert-type scale was developed to assess attitude. The scale consisted of five Likert scale responses ranging from *very difficult* to *very easy*, *very bad* to *very good*, *very worthless* to *very valuable*, *very unpleasant* to *very pleasant*. Cronbach's alpha was 0.75.

Subjective norms

A three-item five point Likert type scale ranging from *disagree a lot* to *agree a lot* questions assessing participants' perception of social pressure from people they considered important to them as relates to the respondents taking ART was used. The Cronbach's alpha was 0.95.

Perceived behavioural control

Perceived behavioural control (PBC), which is the perceived ease

of adhering or not adhering, was measured using a four-item, five-point, Likert type scale. The responses ranged from *disagree a lot* to *agree a lot*. Cronbach's alpha was 0.72.

Perceived side effects

A five-item Treatment Satisfaction Questionnaire for Medication (TSQM) scale with five-point rating scale was used to measure participants' perception of side effects when taking medication. A similar scale used by Atkinson was adapted for this study.²⁶ The first item asked patients to answer with *yes* or *no* whether they had side effects because of taking the medication. The second item is on a five point Likert scale with responses ranging from *extremely bothersome* to *not at all bothersome*. The last three items were on a five point Likert rating with responses ranging from *a great deal* to *not at all*. The Cronbach's alpha for the scale used for this study was 0.83.

Food insecurity

Food insecurity was measured using the modified version of the Radimer food insecurity scale which was used by Kendall to assess food insecurity.^{27,28} The scale assesses individual, household, and child access to food or lack thereof using an eight-item scale. The household level subscale consists of five questions with Cronbach's alpha of 0.84,²⁸ which assessed individual access to food. The individual/adult level subscale consists of four questions with Cronbach's alpha of 0.86,²⁸ which assessed family access to food. The child level subscale consists of four questions with Cronbach's alpha of 0.85 and assessed child access to healthy food.²⁸ For the purpose of this study, only the household and individual/adult level subscales with four items each were assessed. For the purpose of this study, the responses were rated on 5-point scale, *disagree a lot* to *agree a lot* assessing respondents and their household access to food. The reliability for the modified scale as indicated by Cronbach's alpha on the household level was 0.93 and 0.94 for individual level food insecurity.

Self-reported adherence

Adherence was assessed using a two-day self-report recall of how many doses of medication patients took and one-month self-report recall data using a visual analogue scale (VAS). The scale consisted of 0 to 100 with lines at increments of 10, with 0 indicating no medication was taken, 50 indicating half of the medications were taken and 100 indicating that patients took all of their medications. For the one-month self-report recall using a 10 cm long visual analogue scale,²⁹ patients were asked to indicate on the line about how much of their prescribed HIV medication they have taken in the last month. For the two-day self-report recall of adherence, patients were asked how they took their medications in the last two days. A modified version of the Medication Adherence Scale was used to assess adherence.

Data analysis

All statistical procedures were performed using Statistical Package for Social Sciences (SPSS) version 22. All data were entered using double entry and then examined for identification of possible missing data. About 12 subjects who had substantial missing information were excluded from our analysis. Frequencies, percentages, means, mediums, minimum/maximum scores, and standard deviations were calculated for the independent variables. Spearman's rho correlation analysis was performed to examine the correlations for the TPB constructs on intentions. Hierarchical multiple linear regression analysis was used to test the amount of variance explained for intentions to adhere to ART. We used Hayes' PROCESS SPSS macro to assess the mediating effect of food insecurity and perceived side effects on intentions to adhere to ART.³⁰ This approach was used to obtain information on the proportion of an association between two variables that

can be explained for by a mediator(s). For this study, attitude, subjective norm, and perceived behavioural control were treated as mediators between food insecurity and perceived side effect with intentions to adhere to ART. A 1000 sample bias-adjusted bootstrap procedure was performed to obtain upper and lower 95% confidence intervals (N=357). The total mediation effect sizes for each mediator and combined effect sizes for the three mediators were calculated. Statistical significance was set at $P < 0.05$.

Multi-collinearity tests revealed that there was no issue with collinearity because the correlations among predictors were less than 0.80 and the Variance Inflation Factor (VIF) were all below 10. The residuals of prediction were not normally distributed so transformations were conducted to normalize the skewed distributions, in spite of transformation; the residuals were still not normally distributed.

Results

Over 400 patients were invited to participate in the study, of that number, 370 (93%) agreed to take part in the study. However, 12 were discarded due to missing data, leaving us with 358 (90%) for analysis. Table 1 shows the characteristics of the patients. The majority (55.9%) were between the ages of 29-39 years old, had less than primary education (63.7%), married (64.5%), had at least 1 child (91.0%), live with husband (58.8%), owned a home (71.1%), and spoke Chichewa as a primary language (66.7%). In terms of annual income, 98.9 percent reported making less than k162, 998 (equivalent to 400 U.S dollars).

Predicting intentions to antiretroviral therapy adherence

Table 2 depicts Spearman's rho correlation coefficient of TPB constructs and other key variables in addition to self-reported adherence. All of the theories of planned behaviour constructs were significantly correlated with intentions to adhere to ART. Subjective norm ($r=0.64$, $P < 0.000$) was strongly and significantly correlated with intentions followed by attitude ($r=0.62$, $P < 0.000$) and perceived behavioural control ($r=0.49$, $P < 0.000$). All three were positively correlated with intentions to adhere to ART. Perceived side effects ($r=0.13$, $P < 0.016$) were also significantly correlated with intentions to adhere to ART. It is also notable that side effects and both food insecurity variables were correlated with both attitude and perceived behavioural control. In fact, these associations were stronger than the associations of side effects and food insecurity with intention. Additionally, subjective

Table 1. Socio-demographic characteristics of patients.

Variables	N.	%
Patients location		
Rural ART clinic	200	55.9
Urban ART clinic	158	44.1
Age range		
18-28	36	10.1
29-39	200	55.9
40-50	122	34.1
Education		
Less than primary school	228	63.7
Primary school or more	130	36.3
Marital status		
Married	231	64.5
Never married	32	8.9
Widowed	23	6.4
Others	72	21.1
Parity		
No children	32	9.0
At least one child	324	91.0
Language		
Chichewa	238	66.7
Other*	119	33.3
Living situation		
Lives with husband	210	58.8
Live with children	103	28.9
Other	44	12.3
Housing		
Rent	103	28.9
Own	254	71.1
Income level		
Less than K 162, 998	354	98.9
Greater than K 162, 998	4	1.1
Religion		
Seventh Day Adventist	75	20.9
Catholic	68	19.0
Muslims	14	3.9
Pentecostal	53	14.8
Presbyterian	40	11.2
Baptist	5	1.4
Traditional religion	15	4.2
No religion	2	0.06
Others Christians	66	18.5

ART, antiretroviral therapy. *English or other Malawian tribal languages.

Table 2. Spearman's rho correlations of key constructs.

	Intention	Attitude	SN	PBC	FI_H	FI_Ind	PSE	SRA
Intention	1.00							
Attitude	0.62*	1.00						
SN	0.64*	0.50*	1.00					
PBC	0.49*	0.39*	0.55*	1.00				
FI_H	0.09	0.15*	0.11**	0.20*	1.00			
FI_Ind	0.09	0.19*	0.10	0.21*	0.90*	1.00		
PSE	0.13**	0.25*	0.14*	0.22*	-0.11**	-0.05	1.00	
SRA	0.01	0.11**	-0.06	-0.09	-0.17*	-0.15*	0.14**	1.00

SN, subjective norm; PBC, perceived behavioural control; FI-H, food insecurity-household; FI-Ind, food insecurity-individual; PSE, perceived side effects; SRA, self-reported adherence. *Correlation is significant at the 0.01 level (2-tailed); **Correlation is significant at the 0.05 level (2-tailed).

norm was positively correlated with side effects and household food insecurity.

Household food insecurity was significantly correlated with attitude ($r=0.15$), subjective norm ($r=0.11$), and perceived behavioural control ($r=0.20$). However, it had an inverse correlation with perceived side effects ($r=-0.11$). Individual food insecurity had a significant correlation with attitude ($r=0.19$) and perceived behavioural control ($r=0.21$). Perceived side effects was correlated with attitude ($r=0.25$), subjective norm ($r=0.14$), and perceived behavioural control ($r=0.22$).

To assess the prediction of intention to adhere to ART among reproductive age women we used hierarchical regression analysis. In Step 1, demographic variables (age, education, marital status, language and location) were tested explaining 5.7% of the variance in intention to adhere to ART (R^2 change=0.06, $F(5, 351)=4.24$, $P=0.001$). In Step 2,

the TPB constructs (attitude, subjective norm, and perceived behavioural control) were tested and accounted for 55% of the variance in intentions to adhere to ART (R^2 change=0.49, $F(3, 348)=126.53$, $P=0$). In Step 3, food insecurity and perceived side effects were added into model 2 and there was a 0.01% changed in variance for intention to adhere to ART (R^2 change=0.00, $F(2, 348)=0.248$, $P=0.780$). Table 3 shows the final model. In that model, the predictors that were statistically significant were attitude ($\beta=0.47$, $P<0.000$), subjective norm ($\beta=0.31$, $P<0.000$), perceived behavioural control ($\beta=0.12$, $P<0.004$), location ($\beta=0.094$, $P<0.028$), and language ($\beta=-0.13$, $P<0.001$). The strongest predictors for intentions to adhere to ART were attitude, subjective norm, and perceived behavioural control in descending order. The relationship between intentions to adhere to ART in the future and self-reported past adherence was also tested but the correlation coefficient was not significance ($r=-0.051$, $P=0.337$). The lack of prediction

Table 3. Regression of intention to adhere to antiretroviral therapy on key variables.

Model	B	SE	β	t	Sig	LL*	UL*
Constant	1.453	0.206	7.051	0.000	1.048	1.858	
Age	0.034	0.024	0.053	1.412	0.159	-0.013	0.082
Education	-0.017	0.034	-0.021	-0.499	0.618	-0.085	0.051
Location of ART treatment	0.076	0.034	0.094	2.213	0.028	0.008	0.143
Marital status	0.015	0.017	0.034	0.887	0.376	-0.019	0.049
Language	-0.112	0.032	-0.133	-3.496	0.001	-0.176	-0.049
Attitude	0.429	0.040	0.470	10.853	0.000	0.351	0.507
Subjective norms	0.224	0.031	0.311	7.190	0.000	0.163	0.285
Perceived behavioural control	0.073	0.025	0.117	2.862	0.004	0.023	0.123
Perceived side effects	-0.008	0.017	-0.017	-0.447	0.655	-0.041	0.026
Food insecurity	-0.007	0.014	-0.021	-0.542	0.588	-0.035	0.020

SE, standard error; Sig, significance; LL, lower limit; UL, upper limit. *95% confidence interval. Dependent Variable: Intention; Adjusted $R^2=0.54$

Table 4. Test for mediating effects of theory of planned behaviour constructs on relationship between perceived side effects and food insecurity with intentions (N=357).

	Effect	95%CI	SE	t	P
Direct effects TPB variables on intentions					
Attitude	0.08	[0.008, 0.017]	0.02	3.79	0.00
Subjective norm	-0.07	[-0.019, 0.126]	0.03	2.68	0.01
Perceived behavioural control	0.10	[-0.002, 0.012]	0.03	3.38	0.00
Total	-0.04	[-0.032, 0.023]	0.01	-0.32	0.75
Indirect effects of food insecurity on intentions					
Attitude	0.03	[0.0150, 0.0550]	0.01		
Subjective norm	0.02	[0.0029, 0.0332]	0.01		
Perceived behavioural control	0.01	[0.0023, 0.0179]	0.00		
Total	0.06	[0.0276, 0.0894]	0.02		
Direct effects of TPB variables on intentions					
Attitude	0.10	[0.046, 0.146]	0.03	3.77	0.00
Subjective norm	0.09	[0.027, 0.157]	0.03	2.77	0.01
Perceived behavioural control	0.21	[0.067, 0.350]	0.07	2.92	0.00
Total	0.00	[-0.033, 0.034]	0.02	0.02	0.98
Indirect effects of PSE on intentions					
Attitude	0.04	[0.018, 0.069]	0.01		
Subjective norm	0.02	[0.007, 0.041]	0.01		
Perceived behavioural control	0.05	[0.017, 0.093]	0.02		
Total	0.07	[0.099, 0.300]	0.02		

CI, confidence interval; SE, standard error; TPB, theory of planned behaviour; PSE, perceived side effects.

may be because we were trying to predict past adherence from future intention to adhere.

Table 4 shows the results of the Hayes Process SPSS macros of mediating effect of other TPB constructs on food insecurity and perceived side effects on intentions to adhere to ART. Attitude, subjective norm, and perceived behavioural control are mediating the relationship between food insecurity and intentions to adhere to ART. In combination, attitude and subjective norm mediate the relationship between perceived side effects (PSE) and intentions to adhere. Distribution issue prevented the testing of indirect effects for PBC. However, when just whether or not participants had side effects was used as a predictor, it had an indirect effect through PBC and had a direct effect on intentions.

Discussion and Conclusions

The present study shows the applicability of the TPB constructs in predicting women's intentions to adhere to ART. The proximal variables of the theory of planned behaviour explained 49% of the variance in intentions to adhere to ART. Based on the observed standardized regression coefficients (Table 3), intentions to adhere to ART were primarily associated with attitude and subjective norm while perceived behavioural control has a lower association. This implies that women have a stronger intention to adhere to ART if they had a positive attitude toward the medication. In addition, the high beta for subjective norm indicates that women are more likely to intend to take their ART if they experienced more social pressure to adhere to ART. Food insecurity had no statistically significant direct association with intentions; however, it had an indirect effect through other TPB constructs. Perceived side effects had indirect effects on intentions through PBC and had a direct effect on intention.

This study shows that the proximal variables of the TPB with the addition of perceived side effects and food insecurity can predict behavioural intentions. This finding is similar to findings from previous study conducted in South Africa.²⁹ According to Saal and Kagee's study in South Africa, the TPB variables of attitude, subjective norms, and perceived behavioural control explained 12% of the variance in adherence to ART among HIV patients on ART.²⁹ However, no association was found between adherence and intentions to adhere to ART in the South Africa samples.²⁹ In our study, the addition of food insecurity and perceived side effects did not significantly improve the prediction of intentions to adhere to ART. However, both variables had indirect effects on intentions to adhere to ART through TPB constructs. Previous studies have indicated that the addition of other constructs to TPB constructs does improve the variance in intentions to adhere to ART. In Omer and Haidar's study,³¹ they added perceived risk to the TPB constructs and results revealed a significant improvement in the variance in intentions to use VCT services among teachers in Ethiopia. In Saal and Kagee's study,²⁹ perceived stigma was added to TPB constructs and results revealed an improvement in the variance in intentions to adhere to ART, however, it was a non-significant relationship.

Our results indicate that TPB constructs of attitude, subjective norms, and perceived behavioural control along with food insecurity and perceived side effects should be considered when planning intervention to improve adherence. The significant relationship of food insecurity and perceived side effects with attitude and PBC was not a surprise to us. Our rationale for including food insecurity was that individuals are likely to believe that lack of food security will be a barrier to their ART adherence because lack of food will make it more likely, that they will experience unwanted side effects.¹³ In McKinney and colleagues' study on providers' perspectives on patients' adher-

ence,¹³ providers reported that some patients did not take their medications if they believe they had to take the medications with food. The influence of medication side effects on attitude is likely to lead to a lack of adherence and hence, to a negative outcome of ART. According to the theory of planned behaviour, beliefs that negative outcomes will result from the behaviour lead to negative attitudes toward the behaviour.¹⁹ Our study indicates that when predicting intentions to adhere to ART, food insecurity plays no direct role in predicting intention. In Abah and colleagues' study on adherence and food insecurity,²¹ results indicated that food insecurity was negatively associated with adherence in HIV patients. But Abah *et al.*²¹ did not investigate the possibility of food insecurity predicting ART adherence via an indirect route through theory of planned behaviour variables. This is what our findings seem to suggest. Previous studies have shown that food insecurity may be more of a problem with HIV/AIDS patients in resource poor countries since patients may be forced to choose between using the little money they have on transportation to the ART facility or using the money on food.³²⁻³⁴

One of the analyses revealed no significant correlation between self-reported adherence and intentions to adhere to ART. This finding is similar to that of Saal and Kagee,²⁹ in which they found no association between self-reported adherence and intentions to adhere to ART among a South African sample. The combination of attitudes, subjective norms, and perceived behavioural control was capable of accounting for a generous, statistically significant proportion of the variance in behavioural intentions. Our results is also similar to Fincham *et al.*³⁵ study in which they found an association between PBC and attitude with self-reported dietary and fluid adherence. Kagee and van der Merwe's study on adherence to diabetes and hypertension regimens among a South African sample found that the TPB constructs accounted for 47% of the variance in adherence intentions, which corroborated our findings.³⁶ In our study, TPB constructs explained 49% of the variance in intentions to adhere to treatment with PBC being the strongest predictor of intentions to adhere to treatment. In addition, the TPB constructs (attitude, subjective norm, and PBC) explained a larger percent of variance in behavioural intentions and attitude had more influence in predicting intentions compared to PBC in Fincham's study.³⁵ While TPB variables may account for intentions, the theory breaks down when it tries to predict actual adherent behaviour.

This study had some limitations. Some explanations for the non-significant relationship between intentions and self-reported adherence in our study could be due to recall bias and social desirability bias. This indicates that the women may have forgotten their past adherence behaviour and/or are more likely to provide answers they think we wanted. Another possible explanation would be the lack of applicability of social cognitive models of health behaviours in the context of resource-constrained environments as stated in Campbell's study,³⁷ indicating TPB does not work among rural non-literate women because of possible lack of translation of Likert scale in subjects local cultures. Some possible constructs that may be relevant in predicting adherence were not discussed when using this specific framework (TPB). In addition, the lack of association between intentions and adherence could be because we assessed past adherence behaviour while intentions assessed future behaviour. This study showed that the use of TPB constructs of attitude, subjective norm, and PBC may need further revisions when considering it to develop adherence-enhancing interventions.

This study's strengths include its theory-driven approach, large sample size, and the study includes women receiving care at both urban and rural clinics (southern Malawi). The study participants consisted of all women ages 18-49 years old, with low SES at two clinics in Malawi, meaning the results can only be generalized to similar populations. Future research should assess additional ages, especially elderly aged 50 and above in higher SES levels, to see if there will be changes in the findings with different demographics. Although self-reported

adherence measurements have been shown to correlate with other, more *objective* measurements of adherence,^{38,39} there is still a possibility that the women over-estimated adherence. Self-selecting those who adhere better to follow-up visits is likely to lead to selecting women who also adhere better to medication.

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