



Predicting safe sex: Assessment of autoregressive and cross-lagged effects within the Theory of Planned Behavior

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Abstract

Despite its popularity, few studies have assessed the temporal stability and cross-lagged effects of the Theory of Planned Behavior factors: Attitude, subjective norms and self-efficacy. For this study, 298 adolescent learners from KwaZulu-Natal, South Africa, filled out a Theory of Planned Behavior questionnaire on teenage pregnancy at baseline and after 6 months. Structural equation modeling showed that there were considerable cross-lagged effects between attitude and subjective norms. Temporal stability was moderate with test–retest correlations ranging from 0.37 to 0.51 and the model was able to predict intentions to have safe sex ($R^2 = 0.69$) Implications for practice and future research are discussed.

Keywords

cross-lagged effects, KwaZulu-Natal, teenage pregnancy, temporal stability, Theory of Planned Behavior

Introduction

Sub-Saharan Africa has the highest prevalence rate of sexual violence, HIV, and teenage pregnancy (TP) in the world (UNAIDS, 2012). In South Africa, for example, it is estimated that 12 percent of the young females (aged 15–24 years) are HIV positive (UNAIDS, 2012), and 7 percent of the female high-school learners have been pregnant (Reddy et al., 2010). In South Africa, early childbearing has been the norm for decades and is associated with problems such as increased school dropout, in utero HIV transmission, inadequate mothering, intimate-partner violence, and economic dependence on older partners (Macleod and Tracey, 2010; Rutenberg et al., 2003). In the province of KwaZulu-Natal especially, there is a strong

need for interventions, as 37 percent of the high-school students report having had sex, but more than half of them have never used a condom. Use of other types of contraception is generally low with approximately 20 percent of the sexually active students reporting no type of contraception whatsoever (Reddy et al.,

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2010). This makes sexual and reproductive health education a top priority for the region.

A study by Kirby et al. (2007) showed that worldwide, 29 percent of the sex education programs used the Theory of Planned Behavior (TPB; Ajzen, 1991), or its predecessor the Theory of Reasoned Action, to develop or evaluate their program. In short, the TPB states that intention is the most important predictor of behavior and that intention stems from three important factors, namely, attitudes toward executing the behavior, subjective norms with regard to executing the behavior, and the self-efficacy to execute the behavior. Even though the TPB is undoubtedly one of the most popular theoretical models in the scientific field of behavior change, few studies have assessed the temporal stability and cross-lagged effects (the causal effects between factors) of its factors: attitude, subjective norms, and self-efficacy. If these factors are stable over time, interventions that manipulate them can have long-lasting effects. If, however, they fluctuate, achieving stable long-term effects will be difficult and reminders or booster sessions should be used to stimulate retention. This question of temporal stability is especially relevant for interventions that target young adolescents, since they often experience rapid shifts in their concept of self, their beliefs, and their goals, due to puberty (Montemayor et al., 1990). In addition, it would be interesting to assess to what extent fluctuations within factors are caused by the interdependency between factors. Although the factors attitude, subjective norms, and self-efficacy are assumed to be independent (Ajzen, 1991), it is quite plausible that subjective norms, for example, could influence one's attitude toward a certain behavior. Or vice versa, that one's attitude will influence the perception about others. Confirmation of these reciprocal or cross-lagged effects could also prove beneficial for intervention development, since it would imply that addressing one or two factors in an intervention would be cost-efficient by causing "spillover" effects to other factors.

Thus, this study aims to assess the temporal stability over 6 months of attitude, subjective

norms, and self-efficacy beliefs with regard to the prevention of TP and to assess whether they can be prospectively predicted by autoregressive effects or cross-lagged effects. First, it is expected that the TPB factors have relatively high levels of temporal stability. Second, if the factors are stable over time, it would be intuitive to expect minor cross-lagged effects and relatively large autoregressive effects. Third, in order to validate the theory, associations of attitudes, subjective norms, and self-efficacy with intention will be assessed.

Method

Sample and procedure

In KwaZulu-Natal, South Africa, a stratified random sample of 16 government funded high schools was approached to participate in a teenage prevention program developed by the University of KwaZulu-Natal and Maastricht University (Taylor et al., 2012). Using the lists provided by the provincial KwaZulu-Natal Department of Education, half of the schools were selected from Ugu District (which is a predominantly rural area), and the other half were from the urban area of eThekweni district. Data for this study came exclusively from the control group (eight schools with equal numbers in both urban and rural districts) of this randomized controlled trial and comprised 298 students, 152 boys (51%) and 146 girls between the age of 12 and 16 years ($M = 14.08$ years; standard deviation (SD) = 1.36 years), who had completed a baseline self-report questionnaire (T1) and a follow-up measurement after 6 months (T2). Questionnaires were translated into isiZulu (the predominant language in KwaZulu-Natal) and back-translated for validation. Informed consent forms were signed by parents, and students provided written assent before filling out the questionnaires during classroom sessions. Ethical approval was obtained from the Biomedical Research Ethical Committee of the University of KwaZulu-Natal and the KwaZulu-Natal Department of Education, and schools gave permission.

Measurements

The questionnaire was developed based on six focus-group discussions with the target group in each district, at schools not included in the study. Two single-sex groups of 10 randomly selected students from grades 9 to 11 at each school participated after providing parental informed consent and participant assent. Four research assistants were trained to undertake the focus groups. The moderator of each of the groups was a young but experienced first language isi-Zulu-speaking research assistant of the same gender as the group, and each group had an observer of the same gender who monitored nonverbal communication. The focus-group discussions were held in private, audio-recorded, transcribed by the group's moderator, and translated. The interview schedule used was theory based and explored students' perceptions about TP and the results were used to develop the items for the questionnaire. Using this local information the questionnaire assessed attitudes, subjective norms, self-efficacy, intention and behavior. Demographic factors assessed include gender, age and socioeconomic status (SES). Attitude, subjective norms, self-efficacy, and intention were all measured by using a 5-point Likert scale ranging from 1 = "Strongly disagree" to 5 = "Strongly agree."

SES. We used a short family affluence scale to assess SES. Students were asked whether their household had a television and/or a mobile phone. Having none of these items was coded as "0," 1 item as "1," and both items as "2."

Attitude. Attitude was assessed by the positive and negative beliefs surrounding TP, following principles outlined by Velicer et al. (1985). The positive beliefs consisted of four statements: "When I get pregnant or make someone pregnant: This means I get a child support grant; I don't need to go to school anymore; I will be regarded as an adult; I can have sex more often without worrying" (Cronbach's alpha = 0.70). The negative beliefs consisted of eight statements: "When I get pregnant or make someone

pregnant: I will lose my friends; I risk losing my partner; I will be ashamed; I will get rude comments; I will not be able to finish school; my parents will be angry with me; my teachers will be angry with me" (Cronbach's alpha = 0.90).

Subjective norms. Subjective norms were assessed by four statements asking students whether their parents, their friends, their teachers, or their peers believed that they should not become pregnant (Cronbach's alpha = 0.89).

Self-efficacy. Self-efficacy was assessed by four statements asking students whether they felt confident to "prevent falling pregnant or causing pregnancy; go to a clinic for contraception; use a condom when having sex; use contraception" (Cronbach's alpha = 0.84).

Intention. Intention was assessed by two statements asking students whether they were intending to prevent themselves from falling pregnant or causing a pregnancy and whether they were intending to use contraception (Cronbach's alpha = 0.59).

Sexual experience. In order to adjust for the sexual experience of students, students were also asked "Have you ever had sex?" (0 = No, 1 = Yes).

Analysis

Preparation and descriptive analyses were done using SPSS 19. Confirmatory factor analysis and structural equation modeling were done in Mplus 6. Modification indices (10+) were used to identify missing paths, but none were detected. The Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA) were used to assess model fit. A CFI value higher than 0.95 indicates good model fit, in accordance with a value below 0.06 for the RMSEA (Hu and Bentler, 1999). The nesting of students within schools was accounted for by using the cluster option available in Mplus, and all items assumed to reflect latent factors were

defined as categorical. The default estimator for categorical data in Mplus was used (weighted least squares with mean and variance adjustment (WLSMV)), and all presented coefficients are standardized and considered significant when $p < 0.05$.

Results

Confirmatory factor analysis indicated that all items loaded significantly on their corresponding latent factor (all loadings > 0.40 ; all $p < 0.05$; measurement model fit: $\chi^2 = 892.9$; $df = 783$; $p < 0.05$; CFI = 0.95; Tucker–Lewis Index (TLI) = 0.95; RMSEA = 0.02). The students ($N = 298$) had access to an average of 1.78 household items ($SD = 0.42$; maximum = 2), and 50 of them (of which 41 boys) had sexual experience (16.8%). In all, 15 of the sexual-experienced boys (39.5%) and 3 of the sexual-experienced girls (33.3%) reported using contraception. The observed distribution of the intention factor was slightly skewed (adjusted Fisher–Pearson skewness = -0.50) with 58 percent agreeing or strongly agreeing to prevent TP.

Bivariate correlations based on latent factor estimates (see Table 1) showed that intention at T2 was weakly correlated with positive beliefs about TP at T2 ($r = 0.15$), moderately with subjective norms ($r = 0.41$) and the negative beliefs about TP at T2 ($r = 0.28$), and strongly with self-efficacy at T2 ($r = 0.61$). Positive beliefs, negative beliefs, subjective norms, and self-efficacy were all intercorrelated at T2.

Temporal stability of the factors over the 6-month period was moderate. Test–retest correlations were 0.51 for the positive beliefs, 0.48 for the negative beliefs, 0.41 for subjective norms, and 0.37 for self-efficacy.

To assess the hypothesized pathways of the TPB, structural equation modeling was used to regress intention at T2 on positive beliefs, negative beliefs, subjective norms, and self-efficacy at T2. In addition, intention at T2 was regressed on age, gender, SES, and sexual experience at T2 to adjust for their potential influence. Subsequently, positive beliefs, negative beliefs,

subjective norms, and self-efficacy at T2 were regressed on their baseline counterparts and each other (basic cross-lagged panel model). Results showed that model fit was adequate ($\chi^2 = 1062.9$; $df = 951$; $p < 0.05$; CFI = 0.95; TLI = 0.94; RMSEA = 0.02) and that self-efficacy was the main predictor of intention ($\beta = 0.68$), followed by the positive beliefs ($\beta = 0.41$), sexual experience ($\beta = 0.40$), and subjective norms ($\beta = 0.32$). Factors that were not significantly related to intention were age ($\beta = -0.12$), gender ($\beta = 0.20$), SES ($\beta = -0.08$), and negative beliefs about TP ($\beta = 0.09$; total $R^2 = 0.77$). Without the inclusion of the covariates age, gender, SES, and sexual experience, the model was able to explain 69 percent of the variance in intentions to have safe sex.

Next, nonsignificant pathways were cut out and a final cross-lagged model was established (see Figure 1). Results showed that the autoregressive pathways of the factors positive beliefs, negative beliefs, subjective norms, and self-efficacy were weak to moderate (ranging from 0.20 for subjective norms to 0.43 for negative beliefs about TP). Cross-lagged effects were found for all factors except self-efficacy, implying that self-efficacy does not predict attitude or subjective norms over time. First, higher positive beliefs about TP at baseline were associated with lower negative beliefs and lower subjective norms at follow-up. Second, higher negative beliefs about TP at baseline were associated with lower positive beliefs and higher subjective norms at follow-up. Third, higher subjective norms at baseline were associated with lower positive beliefs and higher levels of self-efficacy at follow-up.

Discussion

This study aimed to assess to what extent the TPB factors are stable over a period of 6 months and whether cross-lagged effects would be present. Few studies have assessed the temporal stability of attitude, subjective norms, and self-efficacy, while many studies target them for behavior-change purposes (Kirby et al., 2007).

Table 1. Means and correlations of the factors and demographic variables.

	Mean (SD)	Bivariate correlations																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Baseline (T1)																		
1. Age	14.10 (1.37)																	
2. Gender ^a	51.0% (152)	-0.34*																
3. SES	2.23 (0.48)	0.29*	-0.07															
4. Sexual experience ^b	12.3% (36)	0.56*	-0.55*	0.24*														
5. Positive attitudes	2.19 (0.95)	0.26*	-0.13	0.16	0.24*													
6. Negative attitudes	3.87 (0.96)	-0.17*	0.26*	-0.06	-0.26*	-0.28*												
7. Subjective norms	3.96 (1.07)	-0.22*	0.29*	-0.04	-0.12	-0.30*	0.49*											
8. Self-efficacy	4.02 (0.93)	-0.01	-0.02	0.02	0.11	-0.04	0.13*	0.34*										
9. Intention	3.58 (0.94)	0.13	0.11	-0.14	-0.16	-0.28*	0.50*	0.68*	0.61*									
Follow-up (T2)																		
10. Age	14.37 (1.43)	0.83*	-0.30*	0.25*	0.64*	0.25*	-0.20*	-0.18*	0.02	-0.15								
11. Gender ^a	51.0% (152)	-0.32*	1.00*	-0.07	-0.55*	-0.21	0.36*	0.35*	-0.09	0.15	-0.30*							
12. SES	2.21 (0.42)	0.34*	-0.18*	0.61*	0.26*	0.14	-0.11	-0.17*	0.02	-0.01	0.33*	-0.19*						
13. Sexual experience ^b	16.8% (50)	0.53*	-0.53*	0.12	0.89*	0.15*	-0.15*	-0.09	0.24*	-0.33*	0.61*	-0.58*	0.11					
14. Positive attitudes	2.21 (0.90)	0.32*	-0.31*	0.11	0.32*	0.51*	-0.43*	-0.41*	-0.09	-0.23*	0.30*	-0.33*	0.28*	0.31*				
15. Negative attitudes	3.83 (0.94)	-0.16*	0.21*	-0.13	-0.28*	-0.30*	0.48*	0.30*	0.12	0.56*	-0.19*	0.24*	-0.13	-0.27*	-0.30*			
16. Subjective norms	4.18 (0.92)	-0.25*	0.14*	-0.14	-0.22*	-0.39*	0.42*	0.41*	0.17*	0.45*	-0.25*	0.16*	-0.20*	-0.17*	-0.44*	0.46*		
17. Self-efficacy	4.02 (0.74)	-0.04	0.13	0.08	-0.20*	-0.24*	0.28*	0.41*	0.37*	0.22*	0.22*	0.14	0.17*	-0.18	-0.25*	0.32*	0.42*	
18. Intention	3.82 (0.87)	-0.03	0.08	-0.12	0.12	0.02	0.26*	0.32*	0.36*	0.54*	-0.06	0.05	-0.08	0.22*	0.15*	0.28*	0.41*	0.61*

SD: standard deviation; SES: socioeconomic status.

^aPercentage of females (coding: males = 0, females = 1).

^bPercentage who have had sex.

*p < 0.05.

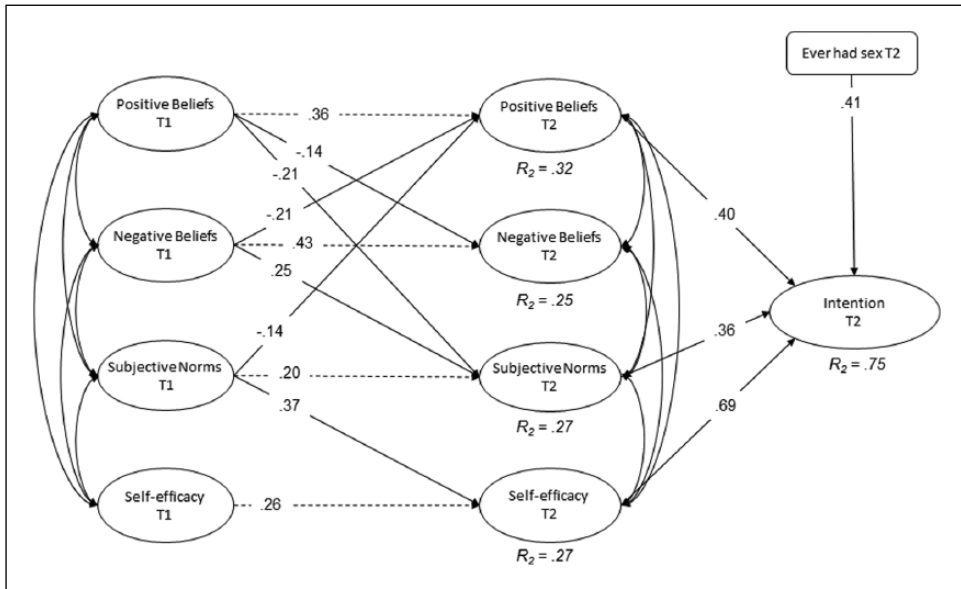


Figure 1. Cross-lagged longitudinal TPB model ($N = 298$; $\chi^2 = 945.2$; $df = 834$; $p < 0.05$; CFI = 0.95; TLI = 0.94; RMSEA = 0.02) with positive beliefs, negative beliefs, subjective norms, and self-efficacy predicting intention.

Dotted pathways represent autoregressive effects. Ellipses are latent factors, and rectangles represent single-item indicators. Only significant pathways ($p < 0.05$) are shown and all coefficients are standardized. All factors were intercorrelated.

First, the results show that the factors were able to predict intention ($R^2 = 0.69$), but that temporal stability was modest. Although it is hard to pinpoint exact test-retest qualifications (e.g. weak, moderate, strong) due to its dependence on time span, good test-retest reliability can generally be assumed when values exceed 0.70 (Aiken, 2003; Anastasi and Urbina, 1997). In our study, within-subjects test-retest correlations over a relatively long period of 6 months ranged from 0.37 to 0.51. This temporal instability most likely reflects actual changes in norms and beliefs instead of measurement error, considering the age of our participants (age = 12–16 years), and the rapid development that takes place during puberty (Montemayor et al., 1990). These findings are also strengthened by the fact that latent variables were used to estimate the coefficients. Using latent variables allows including the factor structure in the estimation process and thereby accounts for unreliability in the measurement.

Only a few studies specifically mention test-retest correlations of attitude, subjective norms, and self-efficacy. A study by Hagger et al. (2001), for example, showed that test-retest correlations of attitude and perceived behavioral control, which is similar to self-efficacy, were 0.74 and 0.67, respectively, over a 5-week period. The behavior in question, however, was physical activity among adolescents and subjective norms were not assessed. Similarly, Plotnikoff et al. (2012) assessed TPB variables in relation to physical activity among adults over a 15-year period. Their results indicated that test-retest correlations were 0.07 for perceived behavioral control and 0.23 for attitude over these 15 years. A study on sugar intake, with follow-up measurements after 3 months, showed test-retest correlations of 0.45, 0.47, and 0.39 for attitudes, subjective norms, and perceived behavioral control, respectively (Ästrom and Okullo, 2004). Although these estimates can be considered moderate at best,

the authors limit their discussion to the predictive effects of the variables on intention and behavior. Likewise, other studies have focused on the temporal stability of intention only and in particular on its moderating effects (Doll and Ajzen, 1992; Sheeran et al., 2000). More research is therefore needed to be able to draw decisive conclusions about when temporal stability declines and which factors are active in this process.

With regard to cross-lagged effects, there was considerable cross-lag exchange between the attitude factors and subjective norms in our study. Interestingly, self-efficacy toward preventing TP at baseline was not longitudinally associated with any of these factors. This would imply that at least for certain target groups, changes in, for example subjective norms, could potentially trigger changes in attitude and self-efficacy. Especially, in resource-limited situations or confined time periods, these cross-lag or spillover effects could be helpful to achieve cost-efficient impact. In addition, the results about temporal stability suggest that booster sessions that re-emphasize certain beliefs after an intervention is completed could be needed, as retention and stability of attitude, subjective norms, and self-efficacy beliefs over periods of 6 months and longer may not be guaranteed.

This study is subject to certain limitations. First, the behavior in question (i.e. preventing TP) was not well specified. In fact, it consists of at least three different sub-behaviors, namely, contraception use, abstinence, and specific sexual practices (e.g. anal sex). As a consequence, it is impossible to unravel which of these behaviors students were actually thinking of when filling out the questionnaire. Second, even though a prospective cross-lagged structural equation model was used, no strong inferences about causal relationships can be made, since experimental manipulation was absent. Alternatively, replication in future research with three or more measurement waves would allow for stronger inferences about causality. Third, how to conceptualize socio-cognitive constructs has been an ongoing debate for many

years, with some authors arguing for integration of constructs (Noar and Zimmerman, 2005). In this study we used items that reflected beliefs surrounding TP based on focus-group discussions with the target group. It is important to note that these beliefs differ per region and per target group and that generalizability is therefore limited. Furthermore, attitude was divided into positive and negative beliefs about TP and self-efficacy was measured instead of perceived behavioral control. It is possible that different methods of operationalization could lead to different results.

Conclusion

The temporal stability of attitude, subjective norms, and self-efficacy was considered moderate. This implies that interventions that seek long-term changes in beliefs surrounding TP could benefit from booster sessions or other ways of retention enhancement. Furthermore, the factors attitude and subjective norms seem to have a reciprocal relationship, meaning that changes in personal beliefs such as attitudes can lead to a change in the perception of social norms and vice versa. Knowing the size of these “spillover” effects can lead to the development of more cost-efficient interventions. Future studies are therefore recommended to use experimental manipulations to investigate to what extent changes in one factor would be able to cause changes in other TPB factors.

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