

**COMPARING THREE THEORIES IN PREDICTING REPRODUCTIVE HEALTH
BEHAVIOR IN ADOLESCENT WOMEN WITH DIABETES**

by

Shiaw-Ling Wang

Bachelor of Science in Nursing, Chung Sang Medical College, 1984

Master of Science in Nursing, University of Wisconsin-Madison, 1991

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SCHOOL OF NURSING

This dissertation was presented

by

Shiaw-Ling Wang

It was defended on

April, 5, 2005

and approved by

Denise Charron-Prochownik, RN, PhD, School of Nursing and Graduate School of Public Health

Susan M. Sereika, PhD, School of Nursing and Graduate School of Public Health

Yookyung Kim, PhD, School of Nursing and Graduate School of Public Health

Linda Siminerio, RN, PhD, Schools of Medicine and Nursing

Dissertation Director: Denise Charron-Prochownik, RN, PhD, and
Susan M. Sereika, PhD, School of Nursing and Graduate School of Public Health

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Background: Understanding factors that affect decision-making in using preconception planning is important in order to reduce the rate of unplanned pregnancies and pregnancy-related complications in all women with type 1 diabetes (T1D). Previously, there were no studies of reproductive health-related beliefs, attitudes, or behaviors of adolescent women with diabetes. Constructs from social cognitive models, such as, the Health Belief Model (HBM), Theory of Reasoned Action (TRA), and Social Cognitive Theory (SCT), are factors that can influence these behavioral outcomes.

Objective: Three theories were each tested in terms of goodness of fit with respect to decision-making with reproductive health behaviors in female teens with diabetes; and to identify a composite model of the most significant predictors across all three theories.

Method: Secondary analysis was conducted from a data set from a cross-sectional study. Data were collected from a telephone interview by same-gender research assistants on a sample of 87 female adolescents with T1D from four medical centers using the “Reproductive Health Attitudes and Behavior” (RHAB) Questionnaire. Measures represent demographic, psychosocial, constructs of the three theories, and behavioral outcomes. Logistic regression analyses were used

to examine the prediction of the three theories in the outcome variable (birth control use in the future).

Results: Good model-fit were found for both the HBM (Nagelkerke $R^2 = .66$) and TRA (Nagelkerke $R^2 = .47$). The composite model consisted of perceived barriers, cues to action, personal attitude, intention, and age, which were statistically reliable in predicting the future use of birth control in the female teens with diabetes. Perceived barriers (OR= .56, 95% CI= 0.32-0.97), cues to action (OR= .25, 95% CI= 0.10-0.61), personal attitude (OR= .72, 95% CI= 0.59-0.87) and intention (OR= .70, 95% CI= 0.50-0.97) were the strongest predictors among all constructs.

Conclusion: Perceived barriers, cues to action, personal attitude, and intention appear to predict birth control use in the future in this sample of adolescent females with T1D. Intervention studies to prevent future unplanned pregnancies in this high-risk population could focus on strategies to target these factors that are amenable to change.

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1. INTRODUCTION

1.1. SIGNIFICANCE

Women with diabetes have a higher prevalence of perinatal morbidity and mortality. Compared with the general population, a mother with diabetes has 5 times greater risk for having a stillbirth and 10 times greater risk for having a baby with congenital malformation (Casson, et al., 1997). As reported by clinical studies, the anomalies most affected are cardiovascular, gastrointestinal, genitourinary musculoskeletal and central nervous systems (Casson, et al., 1997; Martinez-Frias, 1994; Schaefer, et al., 1997). Many malformations involve multi-organ systems (Martinez-Frias, 1994; Schaefer, et al., 1997). High incidence of macrosomic babies with increased risk of shoulder dystocia delivery are also related to mothers with diabetes (Casson, et al., 1997; Gold, Reilly, Little, & Walker, 1998). As a result, greater medical resources and higher cost are necessary throughout the pregnancy and continue to after childbirth.

Reducing the rate of perinatal morbidity and mortality is achievable. What is required is a tight glycaemic control before and around conception, and throughout the pregnancy. Many investigators reported that mothers of babies with anomalies had significantly higher glycohemoglobin levels in the first trimester than did mothers with diabetes having no affected babies (Lucas, Leveno, Williams, Raskin, & Whalley, 1989; Reid, Hadden, Harley, Halliday & McClure, 1984). Subsequently, it is believed that the congenital malformation indicated a teratogenic effect related to the degree of metabolic disturbance very early in gestation (by the stage of organogenesis) (Lowy, Beard, & Goldschmidt, 1986; Towner et al., 1995). For the

multiplicities of malformation, Mills, Baker, and Goldman (1979) suggested that it might occur as early as the stage of embryologic development. Undoubtedly, good glycemic control needs to be established as early as possible, before conception. Women with diabetes must have preparation and planning for their pregnancy. The American Diabetes Association (ADA) (2004) emphasized the importance of counseling on reproductive health behavior and pre-conception care for all women with diabetes of child-bearing potential to avoid the risk of unplanned pregnancy.

Unfortunately, many women with diabetes are not likely to plan their pregnancy (Holding, Beyer, Brown & Connell, 1998). Especially, adolescent women with diabetes may be more vulnerable than others due to their risk-taking behaviors. Although adolescent birth rate has declined slowly from 1991 to 2001, the United States still has the highest rates in the western industrialized world (Ventura, Hamilton, & Sutton, 2003). Contraceptive use among sexually active adolescents has increased but remains inconsistent (Terry & Manlove, 2000). Alan Guttmacher Institute reported (www.agi-usa.org/pubs/fb_teen_sex.html#8, 1999) that a sexually active adolescent who does not use contraception has a 90% chance of pregnancy within one year. As high as 71% of pregnancies are unintended in the population of adolescent women (Henshaw, 1998). Moreover, Carson (2000) revealed that some girls with diabetes might not be alert in measuring blood glucose, administering insulin and monitoring diet. Consequently, adolescent women with diabetes may have the highest risk for unplanned pregnancy with perinatal complications.

Therefore, it is imperative to understand the factors affecting the decision-making in performing reproductive health behaviors of this high-risk group with the purpose of preventing unplanned diabetic pregnancy. Demographic, psychological, behavioral, and social

characteristics of adolescents with diabetes may interact with each other and impact the decision-making process of reproductive health behavior (Holding et al., 1998; St. James, Younger, Hamilton & Waisbren, 1993). It is believed that theory-based predictors would provide a systemic basis for explaining the determinants of reproductive health behavior and behavioral change. Three established theories, the Health Belief Model (HBM) (Becker, 1974), the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980), and the Social Cognitive Theory (SCT) (Bandura, 1977a) are used frequently in predicting health-related behaviors of adolescents. These theories postulate that the decision-making of a behavior depends on the adolescent's social cognitive characteristics and their interrelationships. The model depicting the blending of these three theories is presented in Figure 1. Although empirical literatures have demonstrated good predictive utility in this context (Adler, Kegeles, Irwin & Wibbelsman, 1990; Eisen, Zellman, & McAlister, 1985; Heinrich, 1993; Hester & Macrina, 1985; Levinson, 1995; Volk & Koopman, 2001), there is still no consensus that any certain model is more accurate than the others, or that certain variables (across models) are more influential than others. To date, most studies have examined the ability of predicting reproductive health behavior by using a single theory in one study. None have compared the efficacy in predicting reproductive health behavior across these three theories.

1.2. PROBLEM STATEMENT

1.2.1. Purpose

The purpose of this study was to compare the relative strength of these three theories and to identify composite models in predicting reproductive health behavior of adolescent women with type 1 diabetes (T1D).

1.2.2. Specific Aims

The specific aims of this secondary analysis were to: 1) conduct a comparative analysis of the influence of these three theories in predicting reproductive health behaviors in teens with diabetes; 2) determine the influential predictors of reproductive health behaviors of each theory; and 3) identify reliable composite model to predict reproductive health behaviors among constructs from three theories.

1.2.3. Research Questions

This study examined the following research questions:

1. Which theory was a significantly predictive model for future birth control use in adolescent women with T1D?
2. What constructs of the HBM, TRA and SCT, respectively, were the most predictive of future birth control use of adolescent women with T1D?
3. What were the statistically significant composite models to predict future birth control use of adolescent women with T1D from constructs of the HBM, TRA and SCT?

1.3. DEFINITIONS OF TERMS

Adolescent – Young women between aged of 16 to 21 years as defined in the parent study.

Cues to action – a construct of the HBM, strategies to activate a person's motivation to perform a certain health behavior. Operational definition: messages or information related to birth control

use and preconception counseling received by the teen with diabetes, which encourage her to perform birth control.

Participant information– descriptive information includes age, ethnic background, religion, socioeconomic status based on income and education.

Reproductive health behavior – activities of women involve preventing unplanned pregnancy (e.g. using birth control, seeking preconception care). Operational definition: the teen's planned behavior; plan to use birth control in the future.

Intention – a construct of the TRA; the motivation of a person to conduct a certain behavior. Operational definition: situation specific attitudes of the teen's willingness to use a birth control method that gives full protection against an unplanned pregnancy.

Outcome expectations – a construct of the SCT; a person's estimate on the outcomes resulted from her own performances of a certain behavior. Operational definition: the teen assesses the level of her beliefs that outcomes are the results of her own decisions regarding using birth control and performing preconception care.

Perceived barrier – a construct of the HBM; a person may perceive the negative aspects in performing a health behavior. Operational definition: the teen's belief in the difficulties related to conduct birth control.

Perceived benefit – a construct of the HBM; a person's belief referring to the sense of effectiveness on taking a particular behavior to prevent a health threat. Operational definition: the teen's belief referring to the sense of effectiveness on using birth control to prevent an unplanned pregnancy and pregnancy-related complications.

Perceived severity – a construct of the HBM; a person's subjective feelings concerning the seriousness of contracting a health problem. Operational definition: the teen's perception about

seriousness of having an unplanned pregnancy and pregnancy-related complications.

Perceived susceptibility – a construct of the HBM; a person has his/her own perception of the likelihood of contracting an adverse condition. Operational definition: the teen's perception of her vulnerability to an unplanned pregnancy and pregnancy-related complications.

Personal attitude – a construct of the TRA; a person's positive or negative beliefs toward a certain behavior. Operational definition: the teen's positive or negative beliefs regarding birth control and preconception counseling.

Self-efficacy – a construct of the SCT; a person's belief about his/her ability to execute a certain behavior required to attain a desired outcome. Operational definition: the teen's confidence in her own abilities to perform effective birth control and preconception counseling.

Subjective norm – a construct of the TRA; the influence of social pressure that is perceived by a person to perform or not perform a particular behavior. Operational definition: the teen's perceptions of social pressure of significant referents regarding whether or not to perform birth control and preconception counseling.

Type 1 Diabetes (T1D) – Type 1 diabetes, also known as insulin-dependent diabetes mellitus (IDDM) diagnosed during childhood or adolescence.

1.4. CONCEPTUAL FRAMEWORK

The conceptual framework for this study was based on three established Social Cognitive Models (SCM), the HBM, TRA, and SCT, to explain the decision-making process of reproductive health behavior of adolescent women with diabetes. These three theories focus on describing the important social/cognitive variables and their interrelationships underlying

behaviors, used in predicting reproductive health or other health behaviors in various chronic illnesses and different population. These theories and their key constructs will be described in the section of literature review. Other variables included in this framework are demographic factors, which consists of age, SES, races, and religion and covariates, which are duration of diabetes in years and metabolic control.

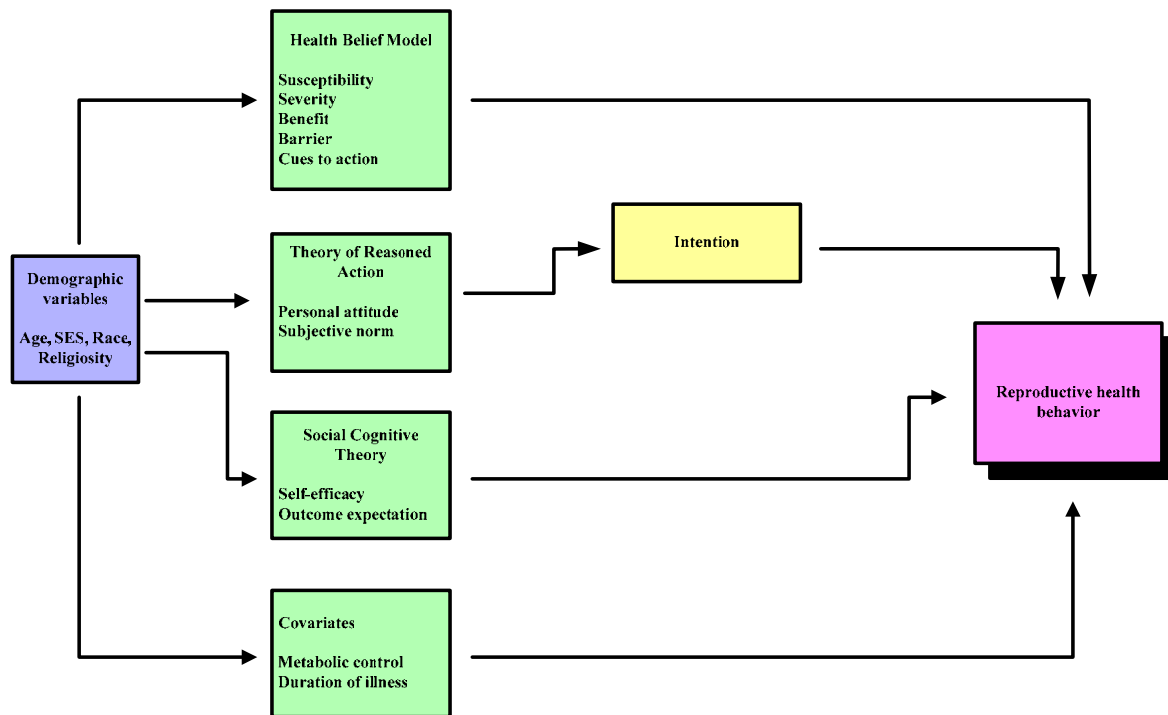


Figure 1 Conceptual framework

2. REVIEW OF LITERATURE

2.1. INTRODUCTION

The following three conceptual models will be presented in this chapter: the Health Belief Model, the Theory of Reasoned Action, and the Social Cognitive Theory. These three models will be discussed in relation to their theoretical origins, constructs and propositions, and efficacy in studies. Beliefs and attitudes are cognitive factors, and are the major constructs of each of these models. The theory underlying all three models has been attributed to SCM (Conner & Norman, 1995), which views an individual as a thinking organism and emphasizes the role of cognitive factors in influencing his/her health relevant decision-making. An individual's behavior is a deliberative decision-making process and determined by a dynamic interaction of the individual's subjective thought and available stimuli from the environment. These theories are all linear direction models.

2.2. THREE THEORIES

2.2.1. Health Belief Model

2.2.1.1. Theoretical origins

Among the various theoretical orientations related to health behaviors, the HBM is one of the most frequently-used models. As early as in the 1950s, the HBM was originally developed by a group of social psychologists and tested in a study as a systematic method to explain the failure of the people to obtain a chest x-ray for the early detection of tuberculosis (TB) (Hochbaum, 1958). Since then, in addition to the prediction of preventive behaviors, the model has been extended to apply to sick role behaviors, health-risk behaviors, and health services use (Sheeran & Abraham, 1995). In response to diverse health settings and populations, the model has been revised, expanded, and broken down into different grouping of components in studies and still effectively emphasized the relationship between health beliefs and health-related behaviors (Becker, 1974; Janz & Becker, 1984).

The HBM provides a theoretical basis from which health-related behavior might be predicted and changed. Rosenstock (1974) proposed that the HBM has roots in value-expectancy approach. This approach predicts behavior based on two elements: 1) the subjective value of the individual concerning a particular outcome, and 2) the individual's estimate of the probability of a behavior being associated with that outcome. From this perspective, the HBM suggests that the individual's motivation to avoid an unpleasant health outcome is based on his/her subjective thought (value) toward the outcome and his/her belief of the likelihood that a specific action would prevent that outcome (expectancy).

2.2.1.2. Constructs and proposition of the HBM

Specifically, for developing a new behavior or changing an existing behavior of an individual, the HBM suggests the following unique and subjective beliefs of the person (Janz & Becker, 1984; Rosenstock, 1974) would be involved in the decision-making process:

Perceived susceptibility: In response to health threat, an individual would have his/her own perception of the likelihood of contracting this adverse condition. Rosenstock (1974) recommended that the acceptance of susceptibility to a risk condition is wildly varied among peoples. Sheeran and Abraham (1995) stressed that threat perception plays an important role to trigger an individual's motivation to engage in a health behavior to avoid the adverse condition. Threat perception consists of both the beliefs of susceptibility and severity. The individual at higher level of susceptibility would experience a sense of fear and have high possibility to adopt a protective action.

Perceived severity: Severity belief is one of threat perceptions regarding an individual's subjective feelings concerning the seriousness of contracting a health problem (Rosenstock, 1974). The degree of seriousness of the consequence may be determined by the emotional arousal from the appraisal of the health problem and its consequence. This personal cognitive appraisal might include medical complications and the effects of the health problem on the individual's family life, financial burdens and social relations (Rosenstock, 1974). An individual would likely follow a particular preventive action to avoid the negative consequence when he/she believes the level of severity of the health problem is high.

Perceived benefits: Conner and Norman (1995) acknowledged that two sets of factors influence the individual's presentations of health behaviors: threat perceptions and behavioral evaluation. Perception of benefits, an aspect of behavioral evaluation, is a personal belief referring to the

sense of effectiveness on taking a particular behavior to prevent a health threat (Strecher & Rosenstock, 1996). Therefore, the preventive action may not be executed unless the individual perceived great benefits for taking the action.

Perceived barriers: Perceived barriers is the other component of behavioral evaluation. Even though a given action will be beneficial for avoiding a health problem, the individual may perceive difficulties in performing the behavior. The negative aspects for carrying out the health behavior are viewed as barriers. Barriers relate to the essences of a health behavior that may be inconvenient, time consuming, expensive, unpleasant, painful, or upsetting (Rosenstock, 1974). These barriers may interfere with the motivation to perform the health behavior.

Cues to action: Events experienced by the individual during the period of decision-making, either internal or external, which encourage him/her to perform the health behavior, are cues to action. This so-called “cues to action” serves as trigger mechanisms to activate behavior and may include physical symptoms, mass media communications, interpersonal interactions, advice from others, health education campaigns, and reminder postcard from physician (Janz & Becker, 1984; Rosenstock, 1974).

The HBM posits the greatest likelihood that an individual will perform a health behavior to avoid a health problem is under the following conditions. First, the individual needs to believe he/she is personally susceptible to the health problem. Second, he/she needs to perceive the threat of severity of the health problem. Third, the individual must believe that the benefits of performing the behavior outweigh the barriers. Finally, internal and/or external cues must trigger the health behavior. A diagram of the HBM is presented Figure 2. Accordingly, the high degree of perceived susceptibility, severity, and benefit will strengthen the possibility of the individual to perform the health behavior, while a stronger degree of perceived barriers lessens the

possibility that health behavior would occur. In addition, threat perception, the combination of perceived susceptibility and severity (susceptibility x severity = threat perception) will provoke the desirability to perform the health behavior (Rosenstock, 1974); and the comparison between perceived benefits and barriers (benefits – barriers = behavioral evaluation) will provide the behavioral evaluation of evaluation on the means to action (Conner & Norman, 1995).

The mechanism of the HBM could be presented mathematically as:

Likelihood of an action = (*Susceptibilities* × *Severities*) W_1 + (*Benefits-Barriers*) W_2 + (*Cues to action*) W_3 , where W_1 , W_2 , and W_3 are the weights of each component respectively in equation)

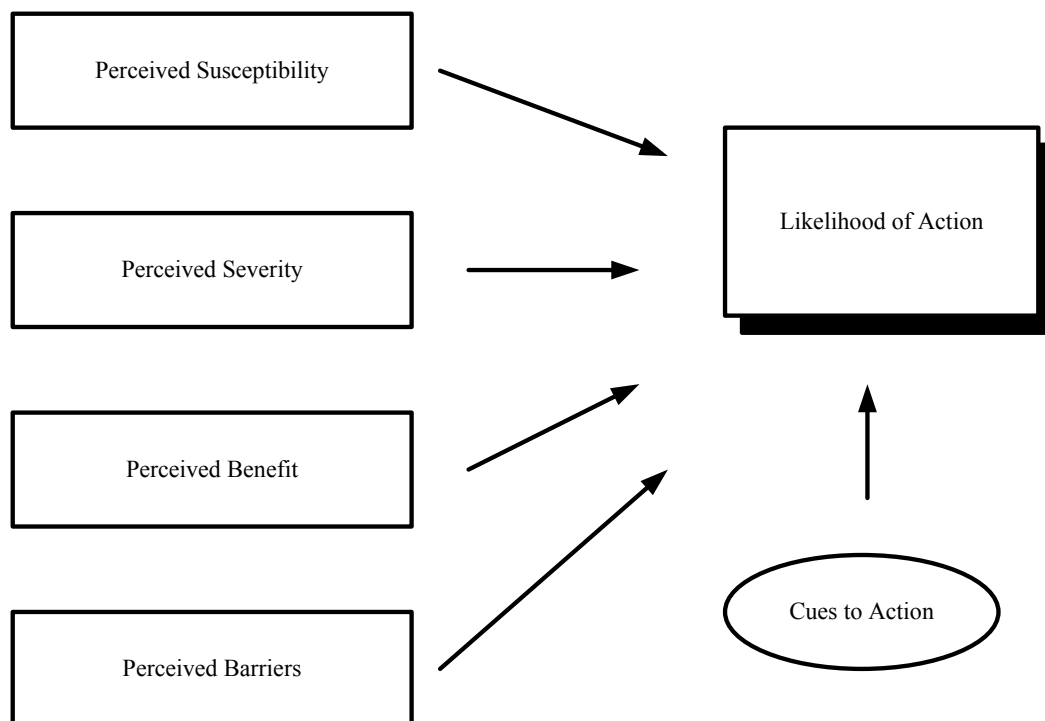


Figure 2 The Health Belief Model

2.2.1.3. Efficacy of the HBM in studies

Apparently, each construct of the HBM presents different strengths in predicting various health-related behaviors, even though most of studies use the complete HBM as a framework to conduct research. Janz and Becker (1984) reviewed all HBM studies published from 1974 to 1984 and provided a quantitative evaluation of the results of those studies. In this study, they created a “significant ratio” in which the numbers of positive and statistically significant findings for a HBM construct was divided by the total number of studies that reported high significance levels for that construct. Across various study designs, populations, and health-related behaviors, the authors revealed the following significant ratio ordering among constructs of HBM: perceived barriers (91%), benefit (81%), susceptibility (77%), and severity (59%). Seventeen published studies prior to 1974 (Becker, 1974; Janz & Becker, 1984) were also examined by using the same approach, and reported that perceived susceptibility had the highest ratio (91%), followed by severity (80%), barriers (80%), and benefits (73%). Results of these two review studies suggested that: each construct of the HBM was proven to be a significant predictor for health-related behavior; and the power of prediction of each construct varied depending on the characteristics of the health behavior. Prior to 1974, perceived susceptibility was found to be the most powerful predictive construct, because most studies that used the HBM before 1974, focused on preventative health behaviors. While many studies after 1974 focused on sick role behavior, perceived benefits showed higher predictive power than for preventive health behaviors.

In general, across all types of studies, perceived severity had the lowest predictive power among the HBM constructs and perceived barriers was the most powerful single predictor. These same results were also reported in a meta-analytic review paper that examined 16 published

studies (Harrison, Mullen & Green, 1992). These 16 studies examined on only four dimensions of the HBM, susceptibility, severity, benefits and barriers and mean effect sizes were computed for all the dimensions. Harrison et al. (1992) reported the ordering of effect sizes as follows: perceived barriers (-0.21), susceptibility (0.15), benefits (0.13), and severity (0.08).

Cues to action were not included in the above analysis. Most studies did not examine the role of “cues to action” empirically due to the difficulty in developing its operational definition (Sheeran & Abraham, 1995). However, Janz and Becker (1984) emphasized the importance for including cues to action into the HBM in order to promote predictive power. Some studies, however, had successfully identified significant cues to action as triggering the desired health behavior, such as physicians’ advice to smoking cessation (Stacy & Lloyd, 1990), and postcard reminders for flu vaccination (Larson, Bergman & Heidrich, 1982).

Since 1977 the HBM has been proposed as a useful framework for explaining family planning behavior because of its conceptual strength (Katatsky, 1977). However, only a few studies focused solely on explaining family planning behavior of young women based on the HBM. Hester and Macrina (1985) tried to examine the contraceptive behavior of 213 college women in an attempt to discriminate the characteristics between adequate contraceptive users and inadequate users. Those adequate contraceptive users reported that they felt significantly more susceptible to pregnancy and showed higher score on the ratio of perceived benefit to contraceptive use over cost than did inadequate users. However, both groups displayed no difference on the perception of pregnancy as a serious situation. Four constructs of the HBM, perceived barriers, benefits, susceptibility and severity, were used to develop a predictive model for risky sexual practices in college students. Their results revealed that these constructs significantly explained 18% of variance in total number of risk behaviors, and 22% of variance

in multiple sexual partnerships, but failed to predict condom usage in college women (Lollis, Johnson, & Antoni, 1997). Eisen, Zellman, and McAlister (1985) effectively enhanced contraceptive usage of an adolescent group by using an educational program based on the HBM. Consequently, the HBM was shown to be a potentially useful theoretical framework for family planning behavior.

2.2.2. Theory of Reasoned Action

2.2.2.1. Theoretic origins

Developed in 1967, the TRA originated in the area of social psychology. During the 1970s social psychologists put their emphasis on studying the term “attitude” and tried to identify the relationship between attitude and behavior. The developers of the TRA, Ajzen and Fishbein (1980), examined the low empirical relationship between attitude and behavior and suggested that the term “attitude” should be limited to a person’s evaluation of any psychological object and identified a person’s intention as the immediate determinant of behavior. They confirmed the clear distinction between beliefs, attitudes, intentions and behaviors. Moreover, they highlighted that there is a principle of compatibility among belief, attitude, intention and behavior and each of these elements share an important role to influence performance of behaviors (Ajzen & Fishbein, 1980).

2.2.2.2. Constructs and proposition of the TRA

The TRA provides a framework to study attitude toward behaviors with the ultimate goal being to predict and understand an individual’s behavior. Rooted in value expectancy theories,

the TRA assumes that humans are rational and make decisions for their action by contemplating all the information available to them and possible implications of the action (Conner & Sparks, 1995). Based on these assumptions, the TRA attempts to explain how intention converts into behavior and what specific beliefs, attitudes, and subjective norm influence this transition.

The TRA is composed of the following main constructs:

Behavior: the behavior must be specific, volitional and performed in a given situation. Based on the analyses of behavioral criteria, Ajzen and Fishbein (1977) defined behavior as being comprised of four elements: the action, the target at which the action is directed, the context in which it occurs, and the time at which it is performed.

Intention: the likelihood of doing something. Intention is interpreted as a transition between the cognitive and evaluative compositions of attitude and behavior (Ajzen & Fishbein, 1980). According to Ajzen and Fishbein (1977), intention is the primary determinant of behavior. It is believed that the stronger an individual's intention toward a particular behavior, the more successful he/she are expected to perform the behavior.

Personal attitude: an individual's positive or negative beliefs in relation to a specific behavior. In addition, it is the degree to which an individual has a favorable or unfavorable outcome evaluation of the specific behavior (Ajzen & Fishbein, 1977).

Subjective norm: the influence of social pressure that is perceived by an individual to perform or not perform a particular behavior. The social pressures are mainly from the significant others or groups from the individual's environment (Ajzen & Fishbein, 1980).

The other constructs (normative beliefs and salient beliefs, outcome evaluation and motivation to comply) are described below. The dimensions of the TRA are diagrammed in

Figure 3. There are three equations that could be used to demonstrate the relationships among the above constructs in the TRA (Poss, 2001). First of all, the theory can be represented algebraically as:

$$\text{Behavior} = (\text{Intention}) W_1 = (\text{Personal attitude}) W_2 + (\text{Subjective norm}) W_3$$

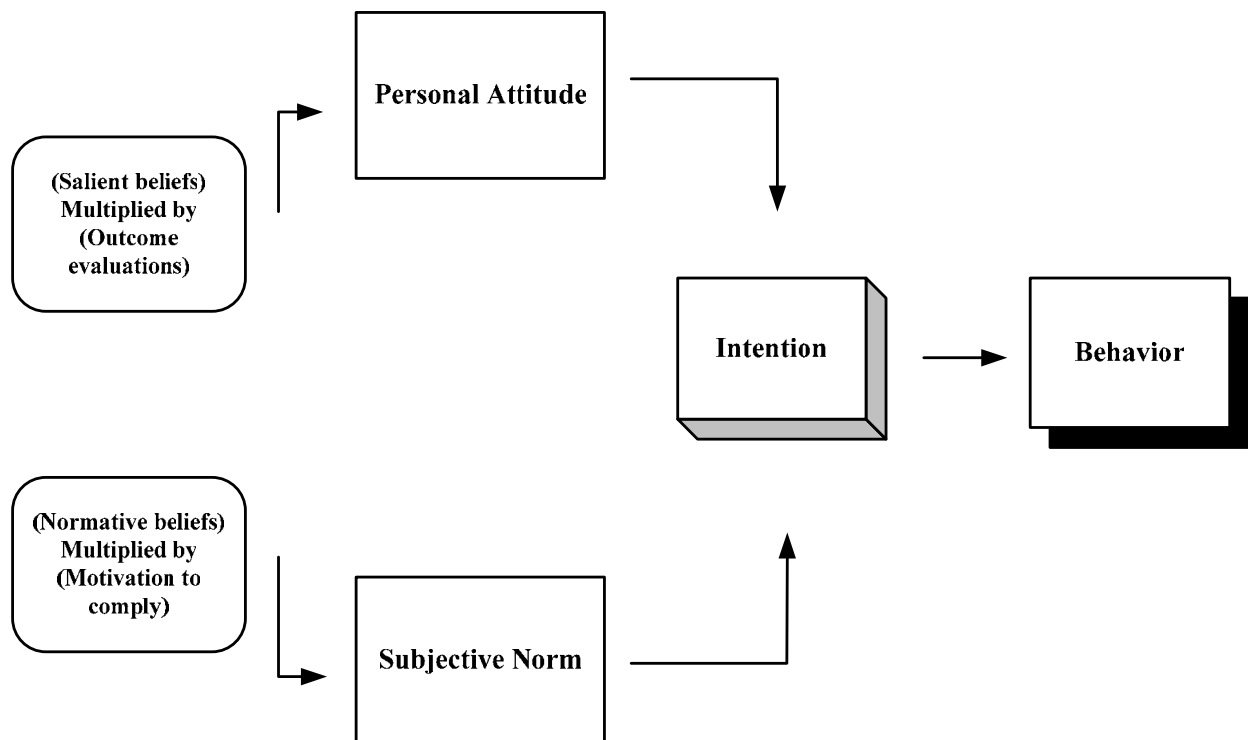


Figure 3 Theory of Reasoned Action

According to the TRA, behavioral intention is the best predictor of behavior and intention is a linear regression function of the person's attitude toward the behavior and the subjective norm. W_1 and W_2 are empirically determined weights showing differences of the effect on intention from attitude and subjective norm upon the behavior. For some behaviors the construct of

attitude may share more weight in shaping intention, whereas for other behaviors weight of the subjective norm may be more noticeable (Ajzen & Fishbein, 1980). Consequently, the weights of W_1 and W_2 should be inter-situational and inter-individual differences.

Antecedents to attitude are salient beliefs and outcome evaluation toward the behavior. Algebraically, this relationship can be expressed as:

$$Attitude = \sum (Salient\ belief \times Outcome\ evaluation)$$

According to the TRA, attitude of an individual is quantified as the summed product of salient beliefs and outcome evaluation (Conner & Spark, 1995). Salient beliefs are the beliefs toward a certain behavior that is topmost in the individual's mind. An individual may hold many beliefs toward a given behavior, but it is believed that he/she can only handle a small number of beliefs (salient beliefs) at any certain situation. According to the theory, these salient beliefs are the immediate determinants of the individual's attitude. The second component of attitude is personal evaluation of the corresponding anticipated consequences. In other words, an individual is more motivated to perform a behavior that will result in an outcome that is highly valued by the individual.

The subjective norm is a function of normative beliefs about what significant others or groups think he/she should or should not perform the behavior, weighted by the motivation to comply with each of these groups. Thus, this relationship can be expressed as an equation:

$$Subjective\ norm = \sum Normative\ beliefs \times Motivation\ to\ comply$$

Normative beliefs involve an individual's perception regarding other people's generalized opinions about a certain behavior. In addition, the individual's motivation to comply with each of the significant others should be taken into consideration. As a result, each normative belief may

be attenuated by the corresponding motivation to comply in the process of forming a subjective norm (Godin, 1994).

2.2.2.3. Efficacy of the TRA in studies

The TRA has explained and predicted a variety of human behavior with varying degree of achievement. Meta-analytic studies indicate that attitude and subjective norm were medium to strong predictors of intention to perform behavior (Sheeran & Taylor, 1999; Sutton, 1998). Correspondingly, evidence suggested that intention was a reliable predictor (correlation 0.44 to 0.62) for behavior and explained variance ranging between 19% to 38% (Sutton, 1998). In studying contraceptive behavior of adolescents, Adler et al. (1990) revealed that attitudes toward contraceptive methods were significantly correlated with the multiplicative composites of their beliefs and outcome evaluations upon the contraceptive methods. Similarly, significant association was found between subjective norms and the multiplicative composites of normative beliefs and motivation to comply in their study. In regards to intention to use contraceptive method, the previous study (Adler et al., 1990) showed both attitudes and subjective norms were significant determinants. Fishbein et al. (1980) also found the intention to use birth control pill among college women was accurately predicted by its antecedents: attitudes ($r = .81$) and subjective norms ($r = .68$), whereas college women put more weight on the component of attitude than subjective norms. When behavior was predicted from intention only, Adler et al. (1990) found that the intention to use contraception among adolescent females' was significantly correlated with frequency of use in the following year ($r = 0.20-0.42$). Taken together, attitude and subjective norm were effective factors for explaining family behaviors and intention was proved to be the strongest predictor in performing family planning behavior in young women.

2.2.3. The Social Cognitive Theory

2.2.3.1. Theoretical origins

Developed from the field of Social Learning Theory (renamed as Social Cognitive Theory in 1986), self-efficacy was first introduced by Bandura (1977a) to explain behavioral change. Besides traditional learning theory, Bandura (1977a) believed the thoughts of expectancy complicated the process of behavioral change. Individuals can develop anticipatory responses to the stimuli arising from certain personal experiences or associated mastery performances. As a result, Bandura confirmed this cognitive mechanism termed self-efficacy as an important mediator of behavioral change. After reviewing a vast body of research, Bandura (1986) instituted the concept of self-efficacy into the social cognition domain.

2.2.3.2. Constructs and proposition of the SCT

Through SCT, it is believed that individuals are governed by their own self system. This self system possesses a self-referent mechanism to provide meaning and value on environmental events that serves as a regulation function to shape the way the individual feels, thinks, and acts (Bandura, 1992). These cognitive self-evaluations influence all kinds of human experiences, including the goals for which people endeavor, the amount of energy expended toward goal achievement, and likelihood of attaining particular levels of behavioral performance. Additionally, through this process, individuals are able to evaluate their experiences and thoughts, and develop the sense of self-beliefs. As such, individuals' behaviors are mediated by their self-beliefs. Higher levels of positive self-belief are accompanied by higher sense of control, and therefore higher performance attainments. In sum, the SCT presents one general mechanism through which individuals implement influence over their own motivation and behavior.

The SCT postulates that behavioral change is determined by an anticipatory mechanism which includes outcome expectancy and expectancy of self-efficacy.

Outcome expectancy: Outcome expectancy is an individual's estimate that a given behavior will lead to certain outcomes in a given situation, and assume them to occur when the situation emerges again. In this way, the individual will be likely to conduct a behavior that maximizes a positive outcome or minimizes a negative outcome (Schwarzer & Fuchs, 1995).

Self-efficacy: An individual's belief about his/her ability (confidence) to organize and execute the course of action required to attain a given outcome. The dimensions of self-efficacy include magnitude, strength, and generality (Bandura, 1977a). Magnitude refers to the individual's perception on the degree of difficulty of a given task. Self-efficacy strength expresses the confidence the individual has that he/she can achieve the anticipated level of the task. The dimension of generality concerns the extent to which efficacy expectancy generalizes to other situations. Bandura (1977a, 1986) identified self-efficacy as the most important determinant for behavioral change because it can influence the selection an individual makes, the courses of action he/she pursues, how much effort if he/she will spend on the action, and how long he/she will persevere despite barriers.

A model of the SCT is depicted in Figure 4. Bandura (1977a) outlines that both outcome and efficacy expectancies reflect an individual's beliefs about capabilities along with the process from behavior to outcome. On the other hand, he has emphasized that the roles of self-efficacy and outcome expectancy on influencing both motivation and action phase of behavioral change are different (Bandura, 1992). Outcome expectancy tends to display greater influence on the phase of motivation formation than action control (Schwarzer, 1992). Conversely, self-efficacy seems to be vital in both phases of behavioral change. During the motivation phase, a new

behavior is possibly initiated by a desired outcome with high value and a judgment of personal competence. Once the behavior has been adopted, it has to be maintained by exerting the appropriate self-belief on competence, especially when confronting difficulties. At this phase, self-efficacy becomes the dominant determinant of behavior.

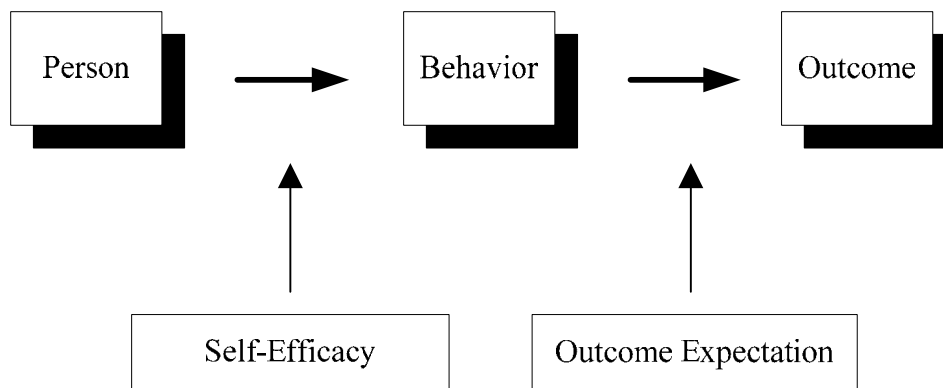


Figure 4 Social Cognitive Theory

2.2.3.3. Efficacy of the SCT in studies

Social Cognitive theory has been applied to diverse domains of health-related behaviors, such as self-management of chronic disease, smoking cessation, alcohol use, eating disorders, exercise, and safe sex behavior. In consideration of the SCT, it would be an important model to explain and predict family planning behavior because contraception always involves “effective use” as a set of skills. Although the SCT addresses both outcome and efficacy expectancy, most studies examined only self-efficacy construct, particularly in the area of family planning behavior of adolescent women. Levinson (1986, 1995) assessed the strength of adolescent

women's self-beliefs on practicing safe sex and suggested that the adolescents with high self-efficacy tended to think that they should and could be responsible for their sexual activities, with high motivation to use contraceptives. Likewise, in another study by Heinrich (1993) contraceptive use was highly correlated with high scores on self-efficacy in 250 college women. Gilchrist and Schinke (1983) designed an intervention to train the adolescents with birth control skills to establish their efficacy on contraception. Those adolescents with significant improvement in efficacy displayed higher level of intention to use contraception at next intercourse compared to the group not receiving the intervention. The results of these studies presented that self-efficacy was highly predictive of contraceptive behavior in the population of young women.

2.3. COMPLEMENTARY AND/OR COMPETING THEORIES

All three theories have been adopted in studies to explain and predict reproductive health behavior or sex-related behaviors and proved be useful in many empirical studies. To date only a few studies have tested these theories against one another in predicting general sexual behaviors. None, however, have compared the full models of the three theories (HBM, TRA, and SCT). Thus, there is still no agreement to which theory is the most effective model to predict outcome behavior of interest (reproductive health behavior), or which constructs of these complete theories are the strongest predictors. On the other hand, composite models, derived by combining some of the constructs from two or three of the theories, were used in studies (Charron-Prochownik et al., 2001; Janz, et al., 1995; Selvan, Ross, Kapadia, Mathai & Hira, 2001; Wulfert & Wan, 1993; Wulfert, Wan, & Backus, 1996). These studies will be discussed

below. Composite models consolidate variables and enhance the predictive power of the model. Combining theories incorporates the best features from different theories and appears to be a constructive approach (Shewarzer, 1992; Poss, 2001). Regardless of whether these theories should be complementary or competing, it is necessary to conduct a comparison among these theories in their entirety.

2.3.1. Similarities of the three theories

All three theories provide a clear theoretical framework which presents a map to guide research in selecting, defining, and measuring variables and interpreting results. They also share a similar conceptual approach, expectancy-value theory, which assumes an individual is apt to initiate the behaviors that are associated with high value expectancy. Additionally, these theories are rooted in SCM (Baranowski, Perry & Parcel, 2002), with a strong emphasis on the role of cognitive operation upon decision-making processes that underlies and precedes the behavior. For example, if the risk of unplanned pregnancy for an adolescent woman with diabetes is viewed as a negative outcome, according to her value appraisals, she would strongly tend to avoid this situation. The value appraisal on a situation, such as an ‘unplanned pregnancy’, is the cognitive operation involving perceived severity and susceptibility (threat) in the HBM; salient beliefs and outcome evaluations in the TRA; and outcome expectancy in the SCT. Under the conceptual rationale, these core constructs share the same fundamental meaning, although they may have different definitions, and be given different names. Moreover, these constructs play a similar role as an active force to influence the formation of motivation to perform a behavior in each theory.

2.3.2. The role of beliefs and attitudes

Beliefs are the important essentials in three theories. According to the SCM, an individual's self-beliefs about him/herself are critical elements to exercise the control of his/her feeling, thinking, and action (Bandura, 1992). In the SCT, self-efficacy is an individual's self-beliefs of his/her capability in performing an action. Salient and normative beliefs are explicitly included in the TRA. Salient beliefs refer to the individual's personal beliefs about a specific behavior lead to certain outcomes and his/her evaluations of these outcomes. Normative beliefs are the individual's personal beliefs about what specific social groups think whether he/she should or should not perform the behavior and his/her motivation to comply with the specific referents (Conner & Spark, 1995). In the TRA, both beliefs are the determinants of attitude and subjective norms. The HBM emphasizes the role of beliefs in explaining behavior. Behavioral motivation is operationalized by 2 groups of beliefs: 1) threat-avoidances (susceptibility x severity) and 2) expectancy of success of the behavior (benefits – barriers) (Maiman & Becker, 1974).

Among three theories, attitude is explicitly presented in the TRA only. The TRA is the most widely applied models of attitude-behavior relationships within the expectancy-value approach (Godin et al., 1996). According to the TRA, one of the determinants of the intention to adopt a specific action is the individual's attitude toward performing the action. Attitudes are viewed as evaluative appraisals which included personal beliefs regarding the perceived consequences of performing a specific action and personal evaluations of each of these consequences. Similar to behavior, Ajzen and Fishbein (1977) stressed that attitude should also be viewed as consisting of four elements: target, context, time, and action. A significant relationship between attitude and behavior can only be obtained at least when there is at minimum a correspondence with both target and action element of the attitudinal and behavioral entities.

2.3.3. The role of intention

The TRA argues that attitude, composed of a set of beliefs, does not directly explain behavioral change. Rather, intention is the immediate determinant of behavior, and serves as the mediator between attitudes and behavior (Ajzen & Fishbein, 1980). The TRA emphasizes a strong correlation between behavior and intention, thus making intention the strongest immediate predictor of behavior. Therefore, to assure the predictive validity of the construct intention and given its relationship with attitudes and behavior, it must be measured in relation to the four elements (action, target, context, and time frame) (Ajzen & Fishbein, 1977, 1980).

Intention is explicitly found in the TRA and implicit through “likelihood of action” in the HBM. Likelihood of action refers to “disposition to act” (Maiman & Becker, 1974), the potentiality of an action in any given situation. This construct can be seen as being very similar to intention to take action. Likelihood of action in the HBM has been viewed as an outcome or terminal variable rather than a predictor in explaining behavior. Several studies, however, that explained health-related behaviors based on the HBM added behavioral intention as likelihood of action, and served as a mediator in their research framework (Bodenheimer, Fulton & Kramer, 1986; Charron-Prochownik et al., 2001; Cummings, Jette, Brock & Haefner, 1979; Wurtele, Roberts & Leeper, 1982). Behavioral intention was found to be a powerful predictor to actual behavior in these studies. Moreover, intention demonstrated higher correlation with behavior than the original constructs of the HBM (Bodenheimer, Fulton & Kramer, 1986; Cummings, et al., 1979; Wurtele, Roberts & Leeper, 1982). The relationship between intention and the HBM constructs was also examined, and researchers found that the HBM constructs were better predictors of behavioral intention than direct predictors to the actual behavior (Cummings, et al.,

1979; Norman, 1995). Consequently, Cummings et al. suggested that the effect of the HBM constructs might be mediated via their effect on behavioral intention. The focuses of recent studies have been shifted to specifying constructs which can distinguish between those who intend and carry out a behavior with those who intend and do not (Schwarzer, 1992).

Intention is not explicitly found in the SCT. Therefore, it is believed that self-efficacy beliefs can affect the intention to initiate or change a behavior. In regards to the relationship between self-efficacy with intention, studies have reported positive associations (Wulfert, Wan, & Backus, 1996; Charron-Prochownik et al., 2001). Wulfert, Wan, and Backus (1996) found that higher levels of self-efficacy resulted in stronger intention to engage in the behavior of condom use.

2.3.4. The role of self-efficacy

Self-efficacy belief results from a cognitive appraisal, and is a key determinant of initiation and maintenance of a behavior. Having originated in the Social Learning Theory (Bandura, 1977a), it has become an extensively applied theoretical construct in studies concerning health-related behaviors. It is explicit in the SCT, but not in the original HBM or TRA. It is believed that an individual will expend more effort to implement and complete a behavior when he/she perceives a high degree of self-efficacy upon this behavior (Bandura, 1992). According to Schwarzer (1992), behavioral performance depends equally on both motivation and action phases. During the motivational phase, the sense of threat (“severity x susceptibility” from the HBM) and outcome expectancy (“benefit - barrier” from the HBM) in a given situation is needed to initiate a particular behavior. Self-efficacy, however, can affect the effort and persistence to continue the behavior and to attain the desired outcome.

Self-efficacy is not explicitly included in the HBM. However, it can be viewed as being related to perceived barriers (Janz, & Becker, 1984), because lack of confidence in one's ability to undertake an action would be one of barriers to take the action. In 1988, Rosentock, Strecher, and Becker started to expand the HBM by adding self-efficacy into model to enhance the explained variance, especially for complex, long-term, and difficult behaviors. They proposed that self-efficacy is a determinant of behavior along with perceptions of susceptibility, severity, barrier and benefit, and cues to action. After a comprehensive review, Schwarzer (1992) concluded that self-efficacy was a powerful predictor and its total effects on behaviors, both direct and indirect, are significantly higher than other variables.

Wulfert, Wan, and Backus (1996) studied safe sex behaviors by comparing the different theories (HBM, TRA and SCM). By using structural equation modeling, the HBM was found to fit the data, but only explain 28% of the variances in estimated risk behavior. After adding self-efficacy into the HBM as the fifth predictor, the explained variance of this model improved to 84%, and self-efficacy became the only significant factor for risky sex behavior in the expanded model.

The concept of perceived behavioral control in TRA has considerable overlap with self-efficacy (Ajzen & Madden, 1986; Conner, & Norman, 1994); it is described as an evaluation of the degree to which the behavior is perceived to be under control of an individual. Ajzen and Madden (1986) posited the perceived behavioral control at the same level as personal attitude and subjective norms, and suggested that this construct will predict both behavioral intention and behavior itself. Research has shown that the TRA with self-efficacy has stronger predictive power for both intention and behavior, than the original TRA (Leone, Perugini, & Ercolani, 1999, Wulfert, Wan, & Backus, 1996). Godin et al. (1996) compared the cross-cultural validity of the

TRA and the combined of TRA with perceived behavioral control (self-efficacy) on intention of condom use, and found that the later (included variables: attitude, subjective norm, and perceived behavioral control) explained more of the variance in intention across three different ethnocultural communities. In particular, Wulfert, Wan, and Backus (1996) revealed that adding self-efficacy in the TRA improved the explaining efficacy of full model on the intention to condom use, at the same time, impeded the effects of attitude and subjective norms on behavior.

2.3.5. The role of social and environmental factors

It is suggested that a range of factors, including individual, sociocultural, and environmental characteristics, potentially account for some of the variance of health-related behaviors. Not all of these factors are included explicitly in the three models. The three theories emphasize cognitive variables, and explain only as much of the variance in health behaviors as can be explained by attitudes and beliefs. Other factors are assumed related to health behavior only through their impact on the core constructs specified in the theories.

One of main criticisms of the HBM and SCT is the failure to incorporate explicitly the concepts of social and environmental influences. In the context of the HBM, both individual characteristics, and social factors (such as social support, social pressure, media, advice) are include as moderators; whereby the influence of these factors are directed toward either ‘perceptions of threat’ or ‘cues to action’, instead of toward the behavior itself. However, Schwarzer (1992) customized the HBM and added external barriers and resources in his stage model, such as situational barriers, social support, and social network in the action phase. He addressed that both stages of plan and implementation of behavior are strongly determined by self-efficacy, but also by the perceptions of situational barriers and supports.

Social outcome expectancies, one component of outcome expectancies, refers to an individual who is more likely to behave in a certain way due to a sense of social pressures to do so (Schwarzer, 1992). Additionally, self-efficacy is influenced by social modeling, whereby others' experiences are learned via observation and persuasion (Bandura, 1977b). Hence, in the SCT, social and situational factors serve as distal antecedents that help to stimulate the expectancies of outcome and self-efficacy which further influence behavior.

Peer norms, another social factor, has been found to be extremely important for understanding sexual behavior of young group (Adler et al., 1990; Selven et al., 2001; Sutton, McVey, & Glanz, 1999; Wulfert, & Wan, 1993; Vanlandingham, Suprasert, Grandjean & Sittitrai, 1995). Peer norm is explicit in the TRA, under subjective norm, but it is not explicit in the HBM or SCT. In the study conducted by Adler et al. (1990), subjective norms were shown to be significantly associated with intention to use contraceptive methods in female adolescents. According to Vanlandingham et al., peer group effects have been also observed by a way of comparing the HBM and TRA in predicting sexual behaviors. In this study, the HBM was operationalized by including perceptions of susceptibility, severity, barriers, benefits, and self-efficacy, whereas, the TRA shared the same attitudinal constructs of severity, barriers, and benefits but also added peer group norms (subjective norms). Based on the Bayes Information Criterion, the TRA was robustly shown to be the better model over the HBM, and its high predictive power was attributed to the unique effect of peer norms.

2.3.6. Causal relationship among constructs

One major difference among the three theories is that the HBM did not suggest a clear causal ordering among constructs, while the TRA and SCT did. Every construct in the HBM is assumed

to be an independent variable, and share in explaining the variance in a given behavior. Although the original model suggests the multiplicative effect of perceived susceptibility and severity as the perception of threat (since they are both viewed as positive incentive values of success regarding a given action) (Rosentock, 1974), few researchers have operationalized this construct for analyses. Sheeran and Abraham, (1995), however, have proposed adding severity with susceptibility scores into a composite score for analysis based on its expectancy-value structure of the HBM. Similarly, it is suggested that perceived benefits should be weighted against perceived barriers in original model (Becker, 1977a). Benefits minus barriers is the behavioral evaluation. A given action may be influenced by the conflict between perceived benefits and barriers, and must be calculated psychologically. Weinstein (1988) argued that there are distinct conceptual differences between perceived benefits and barriers, and that these two constructs should be treated as separate components. The relationship between perceived benefits and barriers to be viewed as a ratio relationship or separated constructs remains questionable given the lack of specification of a casual ordering among constructs and of clearly defined the mathematical formula for an overall behavioral estimation in the HBM. As a result, the problems on varied operationalizations and measurements regarding the utility of the HBM across studies.

In the SCT, there is an obvious causal ordering between outcome expectancy and self-efficacy; but no mathematical relationship. The effects of outcome expectancy upon behaviors are mediated by self-efficacy (Schwarzer & Fuchs, 1995). Basically, outcome expectancy is assumed to be the precursor of self-efficacy (Schwarzer, 1992). On the other hand, not enough empirical evidence supports the relationship because most of studies did not test the associations between these two constructs in the SCT.

The TRA attempts to build a quantified pathway in organizing the constructs, in which behavioral intention is a linear regression function of attitude and subjective norms. Attitude is a product composed of the multiplicative sum of the salient beliefs and outcome evaluations, as are the subjective norms from normative beliefs and motivation to comply. Although according to Evans (1991) this distinct causal ordering would require sophisticated statistical procedures (such as hierarchical regression) test the full model precisely. Note that the appropriate procedures would make enormous requirements on sample size and often caused further misinterpretations. Sutton, McVey, and Glanz (1999) tried to simplify the TRA by replacing the multiplicative assumption underlying attitude and subjective norms with additive term. The analysis revealed that the predictive power of additive term was almost identical with product-sum term and suggested this way could reduce the scaling problems concerning use multiplicative assumptions.

2.3.7. Studies of combined theories for sex-related behaviors

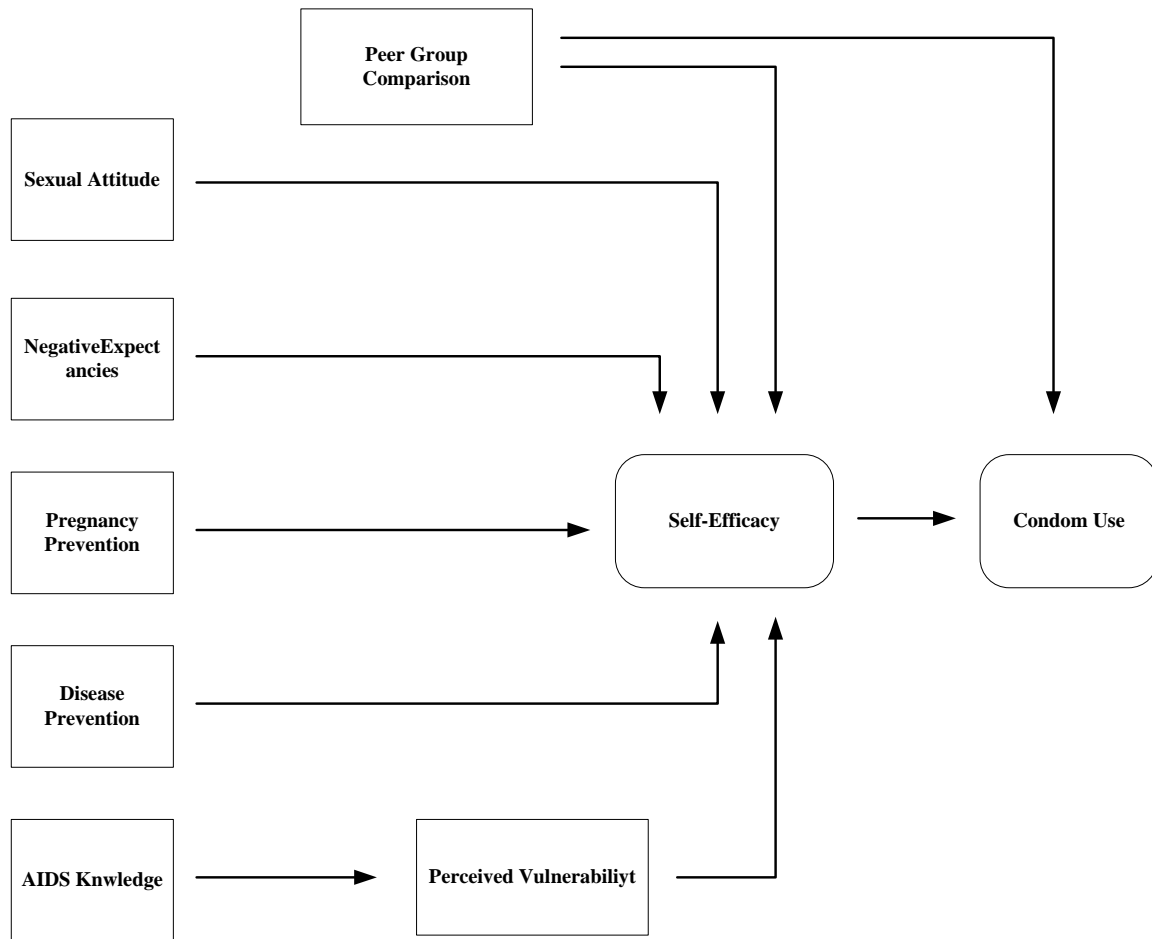
Individually, each of the three theories has been used to predict sex-related behaviors. Given the above discussion regarding the importance of individual constructs, it seems reasonable to integrate the constructs of these theories into a parsimonious model in order to improve the predictive power when studying sexual behaviors. There are various ways to combine theories. The parsimonious model adopts only the crucial constructs (Selvan, et al., 2001; Wulfert & Wan 1993), while the comprehensive model includes all potential constructs into the model (Wulfert, Wan, & Backus, 1996). Both methods will be discussed below.

For the purpose of understanding the intended sexual behavior, a total of 1260 Indian teenagers were included in the study conducted by Selvan et al. (2001). Based on the importance

of peer groups on the adolescents' sexual behaviors, Selvan et al. (2001) developed their integrative model by having perceived peer group norms as the main theme and clustering other constructs, including intention to perform sexual behaviors, perceived opinion of chance (risk) of getting sexual diseases, risk behavior, and knowing infected people. Note that perceived peer norms (subjective norms) and intention are from the TRA; perceived risk of getting sexual diseases, and knowing infected people are analogous to perceived susceptibility and cues to action in the HBM. This model explained approximately 26% of the variance in the intention to perform sexual behaviors, and 15% in actual sexual behaviors of the adolescents in India. Although the predictive power of the composite model was not exceedingly strong, it was in accordance with the theoretical definitions of the TRA and HBM. In the regression model, perceived peer norms was a significant predictor for both intention and actual behavior, whereas risk of getting sexual diseases, and knowing infected people were only significantly associated with intention. Perceived severity, barriers, and benefits were missing in this model. Sociodemographic factors, such as parents' education, and type of family, were added into the analyses, but did not enhance the predictive power of the model.

The SCT was the framework adopted by Wulfert and Wan (1993), who assigned the pivotal role to self-efficacy in their first path model, while other social-cognitive factors were less dominant in their prediction of condom use of sexually active undergraduate students. The social cognitive variables were related to concepts within the TRA and HBM, including sexual attitude, condom use expectancies, peer group comparison, and perceived vulnerability. This integrated model served the purpose of examining psychological factors associated with condom use of the group of 212 undergraduate students who were single, heterosexual and currently sexually active. Overall fit of the model based on based on path analyses was adjusted by examining the direct

linear relationship between peer group comparison and condom use. The new model of this study is depicted in Figure 5. This new path model was shown to have an excellent model fit with strong Comparative Fit Index and accounted for 53% of variances in self-efficacy and 46% of variances in condom use. The SCT was supported in this study, outcome expectancies were significantly directly related to self-efficacy, and indirectly to condom use. Conversely, perceived vulnerability similar to susceptibility of the HBM, and general sexual attitude, similar to attitude of the TRA, had no significant effects on either self-efficacy or condom use. By these results, it is suggested that general sexual attitudes should be replaced by condom-specific attitudes (Wulfert & Wan, 1993), as well as, using perceived risk of getting pregnant instead of contracting AIDS, which might be the major concern for using condoms in this population. It is worth noting that the effects of peer group comparison not only impacted self-efficacy, but also impacted condom use directly. Moreover, the link between peer group comparison and condom use was even stronger than the one between self-efficacy and condom use based on an exogenous variables effect test. In summary, this model successfully explained the variance of self-report condom use behavior. Intention, a strong predictor of behavior, was noticeably missing from their model. It would seem worthwhile to include it into this model and test its relationship with other variables.

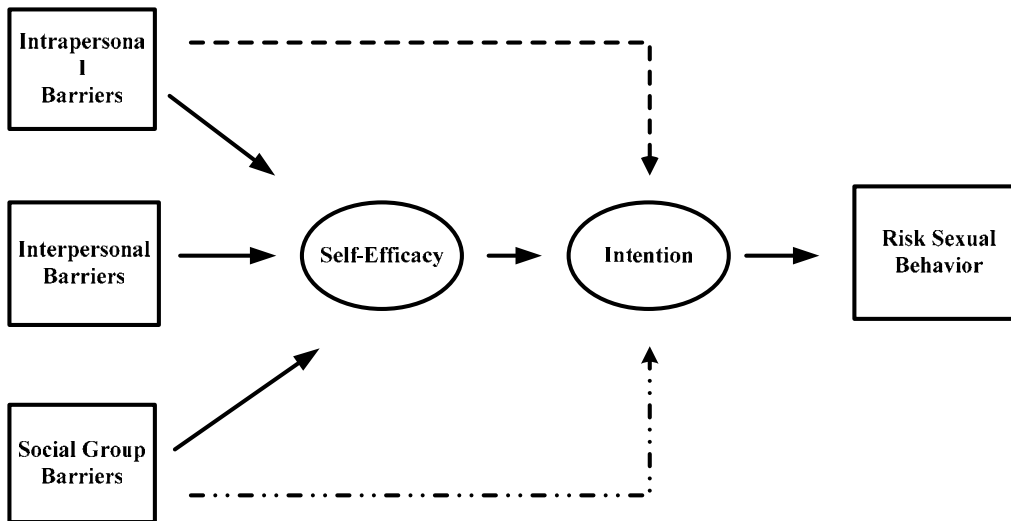


Source: Wulfert, E. & Wan C. K. (1993). Condom use: a Self-Efficacy model. *Health Psychology*, 12(5), 346-353.

Figure 5 Model of Wulfert and Wan (1993)

In a subsequent study, Wulfert Wan, and Backus (1996) conducted preliminary model tests, separately for 3 theories, the HBM, TRA, and SCM; and later combined the potential variables across these theories. Perceived susceptibility, severity, and benefit were excluded from this model because they failed to predict condom use in the preliminary analyses. Attitude from the TRA, outcome expectancies from the SCM and perceived barriers from the HBM were viewed as conceptually analogous variables and shared the same measurements in this integrative model.

Subjective norms was replaced by the conceptually similar variables, perceived social group barriers. Self-efficacy was the central mediator, and incorporated the effects of both perceived barriers and social group barriers to predict the behavioral intention. Intention was the only predictor directly linked to the occurrences of sexual risk behavior. In this cross-sectional study, the model depicted in Figure 6 was used to predict sexual risk behavior of 153 sexually active gay men and effectively explained 81% of the variance in self-efficacy, 89% of the variance in the intention to use condom, and 85% of the variance in self-reported sexual behaviors. In addition to self-efficacy, two additional direct paths from attitudes and social group barriers to intention, were tested but not supported in the analyses. Therefore, self-efficacy was found to be the important mediator in this model, unlike Wulfter's previous study (1993), in which the function of intention was significantly confirmed and located in between self-efficacy and behavior. To summarize, the original HBM (without self-efficacy) was the least effective individual model among models in terms of explaining the variance in sexual behavior, whereas the integrative model was the highest. Both self-efficacy and intention were crucial in predicting sexual behavior.



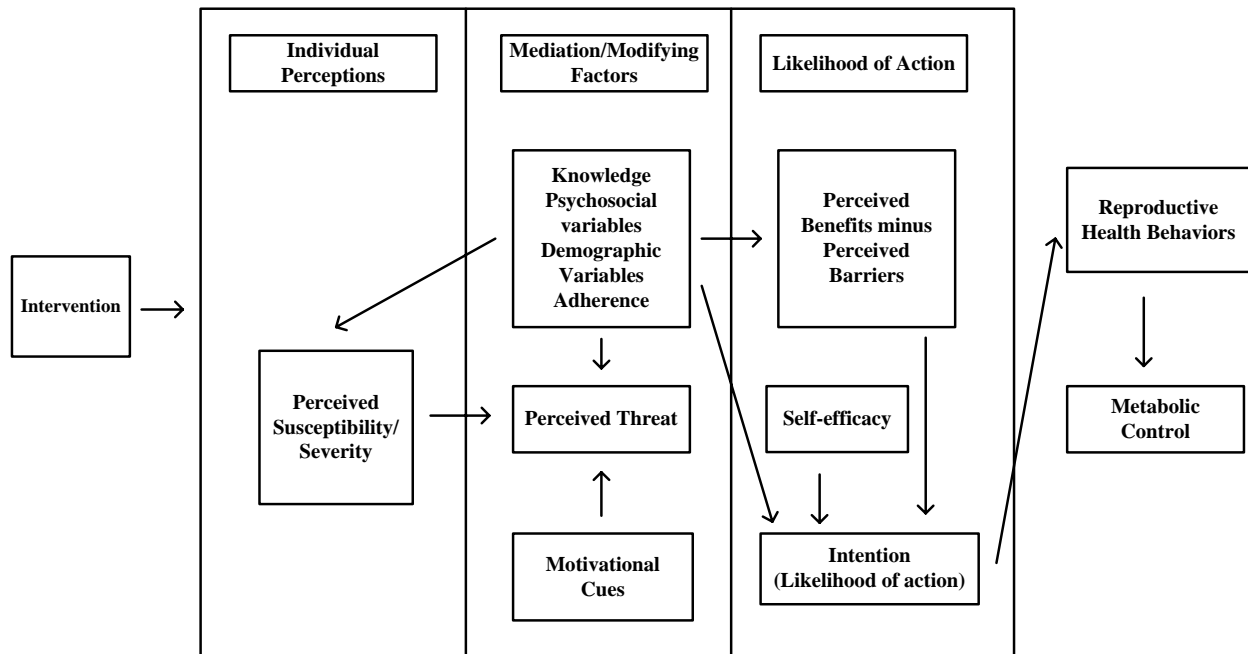
Source: Wulfert, E. W., Wan, C. K., & Backus, C. A. (1996). Gay men's safer sex behavior: and integration of three models. *Journal of Behavioral Medicine*, 19(4), 345-366.

Figure 6 Model of Wulfter, Wan, and Backus (1996)

Janz et al. (1995) conducted the first study that employed concepts across different theories to identify the characteristics of women with diabetes who sought preconception care. Fifty-seven women with diabetes making their first preconception visit and 97 women with diabetes without having received preconception care were included in this case-control study. The measurements of beliefs and attitudes regarding diabetes and pregnancy were derived from three theories, the HBM, TRA, and SCT. The variables included: perceived susceptibility, severity, benefits, barriers and cues to action from the HBM, intention and subjective norm from the TRA and self-efficacy from the SCT. Among the constructs of these three theories, perceived benefits of preconception care for mother and baby, and cues to action were the only significant characteristics of women who sought preconception care. However, perceived benefits made no significant contribution to the decision-making in further model testing, whereas, high adherence

to diabetic regimen and reported encouragement to get preconception care by a health care provider (cues to action) were more likely to influence the behavior of seeking preconception care. It is not surprising that the TRA and SCT showed no evident impact on the behavior of seeking preconception care because only one variable from each of the TRA and SCT were analyzed, these theories were not considered to have been tested in this study.

The only study having reported examining predictors of family planning behaviors of adolescent women with diabetes, based in a theoretical framework, was conducted by Charron-Prochownik et al. (2001). Using the Expanded Health Belief Model (EHBM), the relationships of family planning behaviors and 6 cognitive constructs: perceived susceptibility, severity, benefit, barrier, cues to action, and self-efficacy, were examined with a sample size of 80 adolescent women with diabetes in a case-control design study. Intention was also included in the model, and defined as the “likelihood of behavior change” to perform family planning behaviors. The full model underlying this study is presented in Figure 7. Teens with diabetes were interviewed by phone to examine their awareness, attitudes, knowledge and behaviors related to diabetes and reproductive health. Correlational analyses showed that self-efficacy was inversely associated with perceived barriers and positively related to intention. In addition, social support, an important predictor of seeking pre-conception care (Janz et al., 1995), was positively associated with self-efficacy. In terms of behavioral outcomes, it appeared that the sexually active adolescent women with high levels of self-efficacy tended to have higher effectiveness of contraceptive use, and greater percentage of time using some type of contraception to prevent a pregnancy. The effectiveness of contraceptive use was also negatively related to perceived susceptibility and barriers. Intention was significantly positively associated with the percentage of time that some type of contraception was used.



Source: Charron-Prochownik, D, Sereika, S. M., Becker, D., Jacober, S., Mansfield, J. White, N. H., Hughes, S, Eean-McElhinny, T., & Trail, L. (2001). Reproductive health beliefs and behaviors in teens with diabetes: application of the Expanded Health Belief Model, *Pediatric Diabetes*, 2(), 30-39.

Figure 7 Model of Charron-Prochownik et al. (2001)

As expected, the role of self-efficacy was essential as proposed by EHBM. The above analyses also supported that many of the major constructs were significantly associated to either the likelihood of action or the behavioral outcomes. Although this study only reported on analyses of constructs that were found in the EHBM, the researchers measured all of the major constructs in the TRA and SCT as well.

Therefore, testing and comparing all three models would be helpful to further verify the structure of each model, examine the path coefficients of the interactions among constructs, and finally identify the predictive power of the full model.

2.4. DEVELOPMENT TRAJECTORY OF ADOLESCENTS

Adolescence is a time of major transitions; the developmental trajectory involving biological, psychosocial, and cognitive changes are most significant and extraordinary during this period of development. Biological development in adolescents, the main focus is hormonal and pubertal changes (Rice, 1999), thus sexual maturation and sexual behaviors become the evident concerns in their life. Overall, sexual development of adolescent women with diabetes is usually normal given that the metabolic control is reasonable.

Psychosocially, adolescents are faced with large tasks of establishing a new sense of identity, autonomy and intimacy (McCarthy, 2000). By establishing identity, they eventual have a clear sense of their values and beliefs, occupational goals, and relationship expectations. Through the exercising on autonomy, the adolescents become independent and enhance their ability to make and follow through with their decisions. During adolescence, young people begin to form intimate relationships and to take different social roles outside the family (e.g., peer relationship).

In addition, the adolescent's mind and thinking system begin to change as well. According to the Piaget (1979), the final stage of cognitive development, characterized as formal operations and abstract reasoning ability, begins at about age 12 years, and is consolidated during adolescence. Having reached this stage, the adolescent can generate hypotheses, deal with contradictory view, imagine possibilities, and understand others' perspectives.

For adolescents, they are likely to have their own beliefs and values regarding a particular behavior (e.g., reproductive health behavior), different hypothetical consequences toward a specific event (e.g., unplanned pregnancy), and have their own decision-making process. Moreover, as a social being, they are capable to realize significant others' perspectives. Piaget suggests (1979) that even the typical adolescent of the formal operations stage does not always

practice all or some of the formal operations in every situations. Often cognitive development for adolescent lags behind biological maturation, placing the younger adolescent at risk for undesired consequences, such as an unplanned pregnancy.

3. METHODS

3.1. STUDY DESIGN

In this study, a secondary data analysis was conducted utilizing data were collected in an exploratory case-control study, “Family Planning Decision and Behaviors in Adolescents with IDDM”, conducted by Dr. Denise Charron-Prochownik (NIH/NINR P30 NR 03942 CRCDC pilot, CMRF, and STT- Alpha Chi) in 1996. Secondary analysis is a research method that involves using an existing dataset by other researchers to answer new research questions or employ a different statistical analysis approach. It allows an investigator to explore new interpretations, conclusions or knowledge in addition to, or different from, those presented in the initial study. In using data for secondary analysis, researchers need to be aware of theoretical concerns, the issues of variable conceptualization, and operation, and problems involving sampling, measurement, and external and ecological validity in primary study design. Advantages of secondary analysis include its potential for resource savings and cost-effectiveness. However, it can impose difficulties: the lack of control in collecting the data set, and data availability (Rew, Koniak-Griffin, Lewis, Miles & O’Sullivan, 2000).

3.2. PROCEDURES

Data were collected by using a structured questionnaire during a one-hour telephone interview with a standardized interview manual. A trained and same-gender research assistant conducted

the phone calls from the research office in University of Pittsburgh. All completed questionnaires were entered and verified in using Teleform (version 6.0, Cardiff Software, Inc, San Marcos CA, 1996) and managed using Paradox (Borland International Inc., Scotts Valley, CA, 1992)

3.3. SUBJECTS AND SETTINGS

The 87 adolescent women with T1D were recruited from four major university-based pediatric diabetes clinics located in Pittsburgh, Pennsylvania; St. Louis, Missouri; Boston, Massachusetts; and Detroit, Michigan. Subjects were eligible if they: 1) were between the ages of 16 to 21 years ; 2) had no other chronic illnesses or mental retardation; 3) were not pregnant; and 4) had T1D for at least 1 year. The confidentiality of subjects was assured and written informed consent of every participant was obtained. Moreover, the study was approved by the Institutional Review Board at each participating institution.

The mean age of subjects was 17.9 years (SD= 1.26, range= 16 to 21 years) of age. All of subjects were female and never married, but 36 (41.4%) reported having a current boyfriend or sexual partner. Most of subjects were unemployed ($n= 72$, 82.8%). Consistent with the prevalence of T1D by ethnicity (La Porte, Matsushima & Chang, 1995), the majority of subjects were Caucasian ($n= 76$, 87.4%). Fifty-eight subjects (66.7%) were in high school between grades 9th to 12th. Subjects tended to come from households that were at annual income level above \$ 20,000 ($n=45$, 51.7%). Forty-six subjects (52.9%) identified themselves as Roman Catholic and 20 (23%) were Protestant. The average duration of diabetes was 8.5 year (SD=0.46, range= 1 to 17 years). Based on a 4- point ordinal scale (rating from poor to excellent control),

47 of 87 (54%) rated their diabetes control as “good”, 29.9% (n = 26) reported fair control, and only 3.4% (n =3) reported poor control on their diabetic condition. The demographic information of the subjects is presented Table1.

Table 1 Description of Study Subjects (n=87)

Age (years)	Mean= 17.86 SD= 1.26
Ethnic Background	
Caucasian	87.4% (n=76)
African-American	5.7% (n=5)
Asian-American	1.1% (n=1)
Hispanic	1.1% (n=1)
Native American	1.1% (n=1)
Other	2.3% (n=2)
Current Occupation	
Unemployed	82.8% (n=72)
Unskilled workers	9.2% (n=8)
Semi-skilled workers	4.6% (n=4)
Skilled workers	2.3% (n=2)
Highest Grade Completed in School	
9 th -12 th grade, did not graduate	66.7% (n=58)
High school graduate	20.7% (n=18)
College/University/Trade school	12.6% (n=11)
Income	
> \$20,000	51.7% (n=45)
\$12,000-\$20,000	11.5% (n=10)
\$6,000-\$11,999	2.3% (n=2)
≤ \$5,999	2.3% (n=2)
Religion	
None	6.9% (n=6)
Roman Catholic	52.9% (n=46)
Protestant	23.0% (n=20)
Other	17.2% (n=15)
Current Boyfriend or Sexual Partner	
Yes	41.4% (n=36)
No	58.6% (n=51)
Duration of Diabetes (years)	Mean 8.51 SD 4.33
Diabetic Control	
Poor	3.4% (n=3)
Fair	29.9% (n=26)
Good	54.0% (n=47)
Excellent	12.6% (n=11)

3.4. MEASUREMENT

The Scales for Reproductive Health Attitudes and Behavior (RHAB) were developed from the item pool of the Family Planning Behavior and Diabetes Study Questionnaire, a multidimensional instrument in assessing family planning decisions and behaviors in female adolescents with diabetes (Charron- Prochownik et al., 2001). The Scales for RHAB consisted of ten scales (representing the major constructs of the three models: HBM, TRA, and SCT) with a total of 49 items. All items and response scales were modeled from the original theorist's instrument (Ajzen & Fishbein, 1980; Bandura, 1977a; Becker, 1974). A composite score is computed for each scale. In addition, separate subscale scores for specifically birth control and preconception care can be determined for most measures. The scales used in this study are reported in the Appendix A.

3.4.1. Scales of the Health Belief Model

Higher composite scores reflected stronger level of the beliefs. For the cues to action, higher scores indicated more cues regarding an unplanned pregnancy and family planning.

- 1) Perceived susceptibility to complications of pregnancy and to becoming pregnant. This scale was measured by four items using a 5-point Likert-type scale ranking responses from “not at all” (scored as 1) to “a lot” (scored as 5). Possible score ranged from 4 to 20. In this study, the internal consistency reliability of this scale was .73.

- 2) Perceived severity of complications of pregnancy and of becoming pregnant. This scale was evaluated by three items using a 5-point Likert-type scale, ranking responses from “not at all” (scored as 1) to “a lot” (scored as 5). Possible score ranged from 3 to 15. In this study, the internal consistency reliability of this scale was .77.
- 3) Perceived benefits of birth control and preconception care. This scale was evaluated by four items using a 5-point Likert-type scale, ranking responses from “not at all” (scored as 1) to “a lot” (scored as 5). Possible score ranged from 4 to 20. In this study, the internal consistency reliability of this scale was .65.
- 4) Perceived barriers to using birth control and to preconception care. This scale was evaluated by five items using a 5-point scale, ranking responses from “no problem at all” (scored as 1) to “a big problem” (scored as 5). Possible score ranged from 5 to 25. In this study, the internal consistency reliability of this scale was .72.
- 5) Cues to action are triggers to performing family planning behaviors. Cues to action were examined by five items scored dichotomously yes (scored as 1) and no (scored as 2). Possible ranged from 5 to 10. In this study, the internal consistency reliability of this scale was .57.

3.4.2. Scales of the Theory of Reasoned Action

Higher summative scores reflect high positive anchor of the constructs.

- 1) Personal attitudes: the individual’s attitudes toward birth control and preconception care. This construct was measured by three items using a semantic differential scale, ranking each anchor from “slightly” to “extremely” with an item score ranging from 1 (negative

attitude) to 7 (positive attitude). Possible score ranged from 3 to 21. In this study, the internal consistency reliability of this scale was .60.

- 2) Subjective norm: the individual's perceptions of significant referent's preferences regarding whether or not to use birth control and preconception care. This construct was assessed by six multiplicative composite scores (normative belief x motivation to comply) from the items of normative beliefs and corresponding items of motivations to comply (e.g., normative belief: "Would you say that your parents think you should use birth control when preventing a pregnancy" the corresponding motivation to comply: "When it comes to using birth control, do you want to do what your parents think you should do"). Three different referents were evaluated: partner/boyfriend, parents, and friends. Normative beliefs and motivations to comply were measured respectively by 6 items on a Likert-type scale, ranking each from "not at all" (scored as 1) to "all of the time" (scored as 5). Each subscale possible score ranged from 6 to 30. In this study, the internal consistency reliability of this scale was .83.
- 3) Intention: the individual's intent to always use a birth control method when having sex, and to always seek medical care and advice when planning a pregnancy. Each of the two items is ranked on a scale from one to seven, where one is "unlikely" and seven is "likely". Possible score ranged from 2 to 14. In this study, the internal consistency reliability of this scale was .67.

3.4.3. Scales of the Social Cognitive Theory

Higher scores represented strong and positive attitude toward birth control and preconception care.

- 1) Self-efficacy: A 6-items scale where items were ranked from zero (not at all confident) to ten (absolutely confident), and were used to rate the level of the adolescent's confidence in her own abilities to use birth control and to perform preconception care. Possible score ranged from 0 to 60. In this study, the internal consistency reliability of this scale was .65.
- 2) Outcome expectations: This measure consisted of four items, scored on a 5-point Likert-type scale; responses ranged from "not at all" (scored as 1) to "a lot" (scored as 5), and assessed the level of the individual's belief that outcomes are the results of her own decisions regarding using birth control and performing preconception care. Possible score ranged from 4 to 20. In this study, the internal consistency reliability of this scale was .46.

3.4.4. Reproductive health behavior

Reproductive health behavior was operationalized as a general planned behavior variable, namely, "do you plan to use birth control in the future?" and the effectiveness of using birth control. A dichotomous scale (yes/no) was used to measure the teens' planning to use birth control.

3.4.5. Reliability and validity

For this study, internal consistency reliability and criterion-related validity were conducted. The results of these analyses indicated that, overall, the RHAB had acceptable reliability except cues to action and outcome expectation. The likelihood to use birth control in the future was significantly associated with perceived barriers (OR = .56, 95% CI = 0.32-0.97), cues to action (OR = .25, 95% CI=0.10-0.61), personal attitude (OR = .72, 95% CI = 0.59-0.87), and intention

(OR = .70, 95% CI = 0.50-0.97). See Appendix B for complete manuscript on the “A theory-based reproductive health and diabetes instrument” (Charron-Prochownik, Wang, Sereika, Kim & Janz, 2005, paper under review).

3.5. DATA ANALYSIS

All statistic analyses were performed using SPSS for Window (Version 12.0, SPSS, Inc., Chicago, IL). Evaluation of data accuracy, including outlier screening and missing data examination, was conducted before main data analyses. No specific pattern of missing data and influential outliers were found. Composite score for each scale (construct) were computed. Descriptive statistics and graphical assessment were used to examine central tendency, variability, and distribution of study variables and composite scores.

Research question 1: To determine the significant model in predicting future birth control use for adolescent women with T1D.

Binary logistic regression was used to assess the goodness-of-fit of three theories. Logistic regression allows one to predict a dichotomous outcome from a set of predictors that may be continuous or discrete, or a mix of these. Given that the level of measurement of the three sets of predictors are all continuous variables and the measurement level of the outcome variable is dichotomous, binary logistic regression was conducted to build predictive models for future birth control use in terms of the three sets of predictor variables.

Logistic regression makes no assumption about the distribution of the independent variable. Moreover, predictor variables do not have to be normally distributed, linearly related or of equal variance within each outcome group. The relationship between the predictor and outcome

variable need not be a linear function but it does assume a linear relationship between the logit transform of the outcome variable and continuous predictor. The procedure of orthogonal polynomial contrasts was conducted to examine the assumption of linearity in the logit among continuous independent variables. The assumption of multicollinearity was also examined given that if one independent variable is a linear function of at least one independent variable, the values and the standard errors of the regression coefficient could be inflated. Influential outliers in the solution were detected by computing standardized residuals.

Sample size justification was evaluated by using PASS (NCSS, 2000). The results showed that binary logistic regression with a sample size of 90 achieved 80% of power at a 0.05 significance level to detect an odds ratio (OR) of 1.9 ($R^2=0$).

Direct logistic regression (all constructs were entered simultaneously) was conducted for the HBM and SCT because there is no specific theoretical sequence or importance of constructs in both models. Hierarchical logistic regression was used in the TRA, given that intention is theoretically defined as a mediator between attitudinal and behavioral constructs. Personal attitude and subjective norm were simultaneously entered into the equation first, followed by intention in the second step. To assess the goodness-of-fit of each model, -2 Log Likelihood, model chi-square, Hosmer-Lemeshow test, and classification tables were examined. Nagelkerke R^2 , a re-scaled generalized R^2 , was used to evaluate the predictive power (i.e., how well a predict outcome variable based on the values of a set of constructs in a model). The level of statistical significance was set at 0.05.

Research question 2: To identify the influential constructs of the three theories respectively for future birth control use of adolescent women with T1D.

Univariate logistic regressions were used to identify the influential predictors. Univariate logistic regressions were conducted for each construct of the three theories and the key demographic variables (age and duration of diabetes). In addition, the Wald statistics, unstandardized regression coefficients (b), odds ratios, and their 95% confidence intervals (CI) were used to evaluate the relative importance of the constructs of each theory in terms of impact on the outcome variable. Evaluation of underlying statistical assumptions and sample justification were the same with research question 1.

Correlation coefficients were computed to examine the relationships among constructs. The Pearson product-moment correlation coefficient was used between two continuous variables with normal distributions and Spearman's rank-order correlations were used with non-normally distributed variables.

Research question 3: To determine the significant composite model to predict future birth control use of adolescent women with diabetes among constructs of three theories.

Direct logistic regression analysis was used to examine the efficacy of composite model which included the significant variables (with significant OR) identified by univariate logistic regressions from question 2. The values of -2 Log Likelihood, model chi-square, Hosmer-Lemeshow test, and Nagelkerke R^2 were used to evaluate the goodness-of-fit of composite models. Evaluation of assumptions and sample justification were the same with research question 1.

4. RESULTS

The result section was presented as the following manuscript with the title of “Comparing three theories in predicting reproductive health behavior in adolescent women with diabetes”.

4.1. MANUSCRIPT

4.1.1. Abstract

Background: Understanding factors that affect decision-making in using preconception planning is important in order to reduce the rate of unplanned pregnancies and pregnancy-related complications in all women with type 1 diabetes (T1D). Previously, there were no studies of reproductive health-related beliefs, attitudes, or behaviors of adolescent women with diabetes. Constructs from social cognitive models, such as, the Health Belief Model (HBM), the Theory of Reasoned Action (TRA), and the Social Cognitive Theory (SCT), are factors that can influence these behavioral outcomes.

Objective: Three theories were each assessed in terms of goodness-of-fit in regards to decision-making with reproductive health behaviors in teens with diabetes. Additionally, a composite model of the most significant predictors across all three theories was developed.

Method: Secondary analysis was conducted from a data set from a cross-sectional study. Data were collected from a telephone interview by same-gender research assistants on a sample of 87 female adolescents with T1D from four medical centers using the “Reproductive Health Attitudes and Behavior” (RHAB) Questionnaire. Measures represent demographic, psychosocial,

constructs of the three theories, and behavioral outcomes. Logistic regression analyses were used to examine the prediction of the three theories in the outcome variable (birth control use in the future).

Results: The sets of constructs for HBM (Nagelkerke $R^2 = .66$) and TRA (Nagelkerke $R^2 = .47$) both demonstrated adequate goodness-of-fit. The composite model consisted of perceived barriers, cues to action, personal attitude, intention, and age (as a demographic covariate), which were statistically reliable in predicting the use of birth control in the teens with diabetes. Perceived barriers (OR= .56, 95% CI= 0.32-0.97), cues to action (OR= .25, 95% CI= 0.10-0.61), personal attitude (OR= .72, 95% CI= 0.59-0.87) and intention (OR= .70, 95% CI= 0.50-0.97) were the strongest predictors among all constructs.

Conclusion: Perceived barriers, cues to action, personal attitude, and intention appear to predict birth control use in the future in this sample of adolescent females with T1D. Intervention studies to prevent future unplanned pregnancies in this high-risk population could focus on strategies to target these factors that are amenable to change.

Keywords: adolescent, diabetes, birth control, Health Belief Model, Theory of Reasoned Action, Social Cognitive Theory

4.1.2. Introduction

Adolescent women with diabetes are at high risk for an unplanned pregnancy with perinatal complications (Charron-Prochownik et al., 2001). Therefore, it is imperative to understand the factors affecting their decision-making in performing effective family planning behaviors with the purpose of preventing unplanned diabetic pregnancies. Demographic, psychosocial, and cognitive characteristics of adolescents with diabetes may interact with each other and impact the decision-making process of family planning behaviors (Holding et al., 1998; St James et al.,

1993). It is believed that theory-based predictors, especially cognitive factors, would provide a systematic basis for explaining the determinants of reproductive health behavior and behavioral change (Conner & Norman, 1995). Three established Social Cognitive Models (SCM) (Conner & Norman, 1995), the Health Belief Model (HBM) (Becker, 1974), The Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980), and the Social Cognitive Theory (Bandura, 1977a) are used frequently in predicting health-related behaviors of adolescents. These theories postulate that the decision-making of a behavior depends on the adolescent's social cognitive characteristics and their interrelationships. All three theories provide a clear theoretical framework which presents a map to guide research in selecting, defining, and measuring variables and interpreting results. They also share a similar conceptual approach, expectancy-value theory, which assumes an individual is apt to initiate the behaviors that are associated with high value expectancy. Additionally, these theories are rooted in SCM (Baranowski, Perry & Parcel, 2002), with a strong emphasis on the role of cognitive operation upon decision-making processes that underlies and precedes the behavior. Although empirical literature has demonstrated good predictive utility in this context (Adler et al., 1990; Eisen, Zellmen & McAlister, 1985; Heinrich, 1993; Hester & Macrina, 1985; Levinson, 1995; Volk & Koopman, 2001), there is still no consensus that any certain model is more precise than the others, or that certain variables (across models) are more influential than others. To date, most studies (Adler et al., 1990; Hester & Macrina, 1985; Heinrich, 1993) have examined the ability of predicting family planning by using a single theory in one study. None have compared the efficacy in predicting family planning behavior in adolescents across these three theories.

According to the HBM, the probability of a person performing a particular health-related behavior depends on his/her perceptions of susceptibility to the health threat, the severity of the

threat, the benefit to behavioral outcomes, and the cost of the behavior (Becker, 1974). In addition, these perceptions are influenced by internal or external cues to action (Janz & Becker, 1984).

The TRA postulates that intentions represent a person's motivation to perform a behavior. Furthermore, intention to perform an action is influenced by two forces: 1) the person's own attitude toward taking the action, and 2) the person's view of the social expectations of specific significant others with regard to the behavior (subjective norm) (Ajzen & Fishbein, 1980).

Bandura's SCT (Bandura, 1977a) suggests that behavior change and maintenance are functions of a set of anticipatory mechanisms. These include: 1) outcome expectation: the expectations regarding a given behavior which may lead to a given outcome; and 2) self-efficacy: the expectation of a given behavior leading to a particular outcome is based on a person's perceptions of the confidence to carry out the performance of the behavior.

Each theory provides a unique perspective of the decision-making process carried out by adolescents with DM who are or will be performing reproductive health behaviors. Individually, all three theories have been found to be useful in explaining and predicting family planning or sex related-behaviors in the general population (Adler et al., 1990; Hester & Macrina, 1985; Heinrich, 1993). To date, only a few studies have tested these theories against one another in predicting general sexual behaviors (Wulfert, Wan & Backus, 1996). Together these theories incorporate several cognitive variables which have been found to be highly predictive of sex-related behavior, such as family planning behaviors (Conner & Norman, 1995). Composite models consolidate variables and enhance the predictive power of the model. Therefore, combining theories incorporates the best feature from different theories and appears to be a constructive approach (Poss, 2001; Schwarzer, 1992). Some studies (Janz et al., 1995; St. James,

et al., 1993) combined constructs from two or three theories to examine reproductive health behaviors in adult women with diabetes. No studies, however, have compared the full models of the three theories, nor have they combined constructs to predict reproductive behaviors in teens with diabetes.

The purpose of this study was to conduct a comparative analysis of the relative strength of these three theories in predicting decision-making with reproductive health behaviors in female teens with diabetes; and to identify the best composite model to predict reproductive health behaviors among the strongest constructs across all three theories.

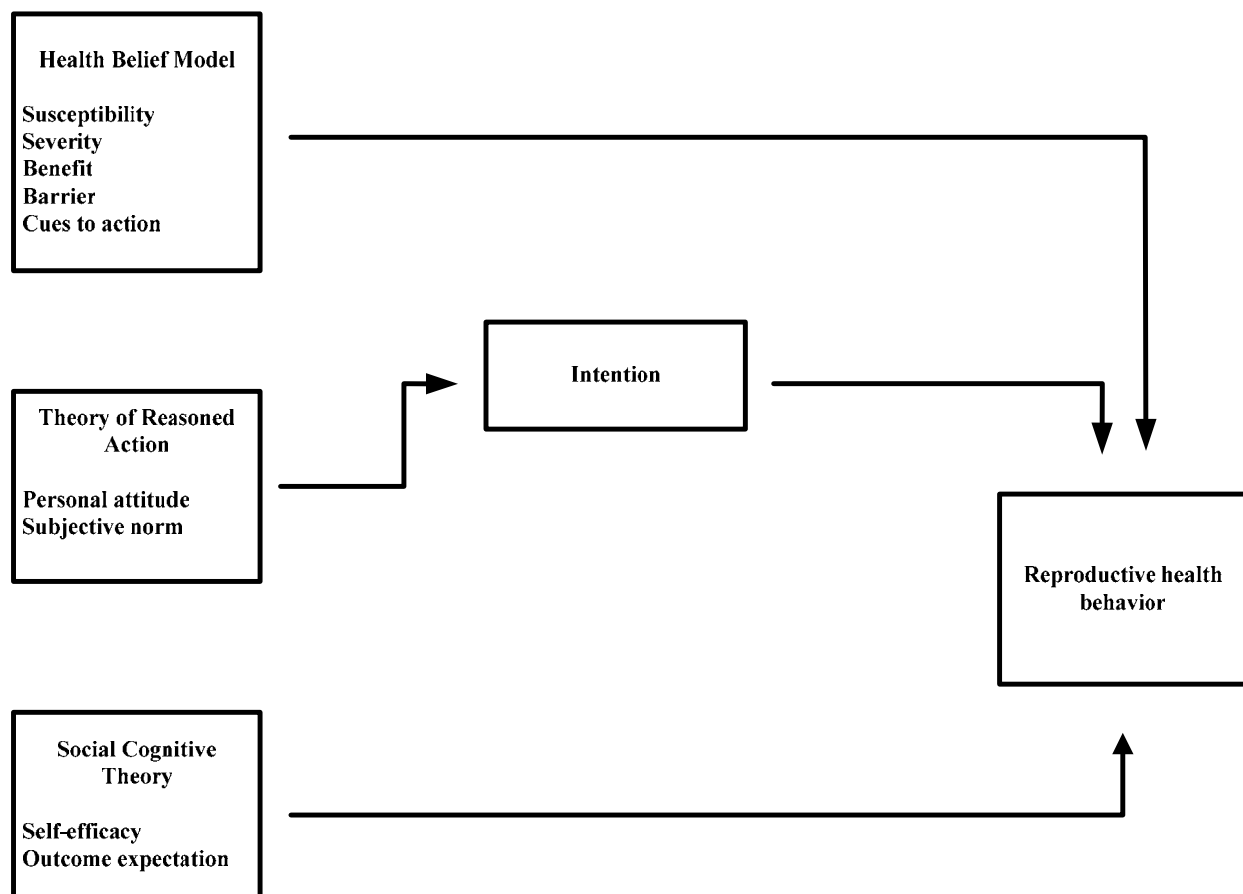


Figure 8 Conceptual model for reproductive health behavior

4.1.3. Methods

4.1.3.1. Design

This secondary analysis was conducted on cross-sectional data that were collected using an exploratory case-control design, (design described detail in Charron-Prochownik et al., 2001) from a study called, “Family Planning Decisions and Behaviors in Adolescents with IDDM”. Data were collected during a one-hour structured telephone interview. Interviews were conducted by trained, same-gender research assistants from the main project office at the University of Pittsburgh. Approval from each Institutional Review Board was obtained (Charron-Prochownik et al., 2001).

4.1.3.2. Sample

Subjects consisted of 87 adolescent women with type 1 diabetes (T1D), recruited from four major university-based pediatric diabetes clinics located in Pittsburgh, Pennsylvania; St. Louis, Missouri; Boston, Massachusetts; and Detroit, Michigan. Eligibility included 1) female patients, 2) age between 16 to 21 years, 3) no other chronic illnesses or mental retardation, 4) not pregnant; and 5) T1D for at least 1 year.

Subjects had a mean age of 17.9 years (SD= 1.26, range= 16 to 21). All were single females, and 36 (41.4%) reported having a current boyfriend/sexual partner. The majority were Caucasian ($n = 76$, 87.4%). Fifty-eight (66.7%) were attending high school, 18 (20.7%) had only a high school diploma, and 11 (12.6%) were in college or technical school. The subject’s households tended to have incomes of >\$20,000 per year ($n = 45$, 51.7%). Forty-six (52.9%) were Roman Catholic and twenty (23%) were Protestant. The average duration of illness was 8.51 years (SD= 0.46, range= 1 to 17).

4.1.3.3. Measurement

Reproductive Health Attitudes and Behavior (RHAB) had items and scales representing the theories described above. These items for current study were directly taken or modified from the validated “Pregnancy and Diabetes Interview Schedule”, a theory-based questionnaire developed by Janz, et al. (1995). This questionnaire was used to define sociodemographic characteristics, medical factors, knowledge, attitudes, and health-related behaviors that distinguish women with diabetes who seek preconception care from those who seek care only after conception. For women with diabetes, reproductive health behavior should include preconception counseling and care (PC). Because birth control (BC) can be discussed and could be obtained during PC visits, the items in the questionnaire refer to both BC and PC.

The RHAB consists of ten scales (constructs from three major theories), with a total of forty-nine items. All items and response scale were modeled from the original theorist’s instrument. **Health Belief Model** included five scales: susceptibility (4 items), severity (3 items), benefits (4 items), barriers (5 items), and cues to action (5 items). Three scales are in **Theory of Reasoned Action**: personal attitudes (4 items), subjective norms (12 items) and situation specific intention (2 items). **Social Cognitive Theory** has two scales: outcome expectations (4 items) and self-efficacy (6 items). Most of items yield ordinal data, scored on a Likert-type scale, except cues to action, which used dichotomous scale (yes/ no). Each construct has a composite score, whereby higher summative scores reflect greater levels of the constructs. **Behavioral outcome variable**: reproductive health behavior was operationalized as a dichotomous variable (yes/no), namely, “do you plan to use birth control in the future?”. Covariates included the following continuous variables: age and duration of diabetes.

The original theorists confirmed content validity of the original instrument (19): HBM (M. Becker, PhD), TRA (Fishbein, PhD), and SCT (Bandura, PhD). Each reviewed the items and provided feedback (19). The internal consistency reliability for preliminary estimates from the pilot study were obtained from the scales [Cronbach's α coefficients: HBM (.57- .77), TRA (.60- .83), and SCT (.46- .65)] (Charron-Prochownik, Wang, Sereika, Kim & Janz, 2005, paper under review). Overall, the RHAB had acceptable reliability except cues to action and outcome expectation. The likelihood to use birth control in the future was significantly associated with perceived barriers (OR = .56, 95% CI = 0.32-0.97), cues to action (OR = .25, 95% CI=0.10-0.61), personal attitude (OR = .72, 95% CI = 0.59-0.87), and intention (OR = .70, 95% CI = 0.50-0.97). Complete questionnaire can be seen in the paper of Charron-Prochownik et al. (2005, paper under review).

4.1.3.4. Data management and statistical analysis

Questionnaire data were processed and scanned by trained research assistants using Teleform (Cardiff Software Inc., San Marcos, CA, 1996) and Paradox Data Management System (Borland International Inc., Scotts Valley, CA, 1992). All statistic analyses were performed using SPSS for Window (Version 12.0, SPSS, Inc., Chicago, IL).

Correlation coefficients were computed to examine the relationships among constructs. The Pearson product-moment correlation coefficient was used between two continuous variables with normal distributions and Spearman's rank-order correlations were used with non-normally distributed variables.

Logistic regression was used to test the goodness-of-fit of each theory and the relative contribution of the constructs of these theories in predicting the future use of birth control by female teens with diabetes. Direct logistic regression analyses were conducted for the HBM and

SCT because the theories did not identify a specific sequence or importance of constructs in the models. Hierarchical logistic regression was used in the TRA, since intention is theoretically defined as a mediator between the attitudinal and behavioral constructs. To test the goodness-of-fit of each model, -2 Log Likelihood, model chi-square test, Hosmer-Lemeshow test, and classification tables were examined. Nagelkerke R^2 was used to assess the predictive power of the set of constructs of a model for the behavioral outcome.

Univariate logistic regressions were conducted to identify the significant predictors. The Wald test statistics, unstandardized regression coefficients (b), odds ratios (OR), and 95% confidence intervals (CI) were used to evaluate the relative importance of the constructs of each theory in terms of the effect on the outcome variable. In addition, the impacts of demographic variables (age and duration of diabetes) on behavioral outcome were also evaluated by using univariate logistic regression.

The composite models were built by including the variable that was significant in univariate logistic regressions. The predictive power of the composite model on behavioral outcome was also assessed by using direct logistic regression analysis. The level of statistical significance was set at 0.05 with two-tailed testing being employed.

4.1.4. Results

4.1.4.1. Inter-correlations among the constructs from the three theories

Results of the correlational analyses revealed several significant inter-relationships among constructs of the three theories (Table 2). Perceived susceptibility had significant positive relationship with perceived severity ($r = .33$, $p < .01$), barriers ($r = .30$, $p < .01$) and cues to action ($r = .23$, $p < .05$). Perceived benefit of using birth control was significantly related with positive

personal attitude about using birth control ($r = .29, p < .01$). Perceived barriers had several significant correlations across the three theories, including positive association with cues to action ($r = .25, p < .05$) and subjective norm ($r = .25, p < .05$), but a negative association with self-efficacy ($r = -.28, p < .01$). Subjective norm had a positive relationship with outcome expectation ($r = .25, p < .05$). Greater intention was found to be associated with higher levels of self-efficacy ($r = .22, p < .05$) and positive outcome expectations ($r = .24, p < .05$).

Table 2 Inter-correlations among the constructs of the three theories

	susceptibility	severity	benefit	barrier	cues to action	personal attitude	subjective norm	intention	self-efficacy	outcome expectation
susceptibility	—									
severity	.33**	—								
benefit	.16	.17	—							
barrier	.26*	.18	.17	—						
cues to action	.23*	-.00	.10	.25*	—					
personal attitude	.18	.19	.29**	-.01	.27*	—				
subjective norm	.13	.20	.19	.25*	.32**	.11	—			
intention	-.06	-.10	-.10	-.15	.44**	.14	.11	—		
self-efficacy	-.08	.10	-.02	-.28**	-.09	.02	-.07	.22*	—	
outcome expectation	.02	-.08	.15	-.10	.12	.19	.25*	.24*	.12	—

* $p < .05$, ** $p < .01$ (2-tailed)

4.1.4.2. Predictive power of the three theories for reproductive health behavior

As a set, the constructs of HBM was statistically reliable in predicting the use birth control in the female teens with diabetes. In the direct logistic regression analysis, the initial -2 Log

Likelihood value for a constant-only model was 43.23. After the HBM constructs were added to the equation, the -2 Log Likelihood was reduced to 17.15, and this change was significant, $\chi^2 = 26.08$ (df = 5), $p < .001$. The goodness-of-fit was also evaluated using the Hosmer-Lemeshow test and a non-significant chi-square was found, indicating that HBM was an adequate model for these data. ($\chi^2 = 1.41$, $p = .94$). Overall, the model of HBM had moderately high predictive power for the behavioral outcome (Nagelkerke $R^2 = .66$). More specifically, HBM correctly classified 94.9% of the female teens who would plan to use birth control in the future and 66.7% of the teens who would not. According to the results of the Wald test statistics, only cues to action (OR= 0.11, 95% CI= 0.02-0.57) reliably predicted future birth control use of this sample. Results are summarized in Table 3.

Using hierarchical logistic regression for the modeling of TRA, personal attitude and subjective norm were first entered into the regression equation simultaneously [-2 Log Likelihood= 27.86, $\chi^2 = 15.66$ (df= 2)], followed by intention at the second step [-2 Log Likelihood= 25.65, $\chi^2 = 17.88$ (df= 3)]. Although, adding intention did not result in a significant improvement in prediction ($\chi^2 = 2.21$, $p = .14$) in the second step, there was still a good model fit of the final model of TRA [-2 Log Likelihood= 25.65, $\chi^2 = 17.88$ (df= 3), $p < .001$, Nagelkerke $R^2 = .47$]. Similarly, the result of Hosmer-Lemeshow test ($\chi^2 = 4.86$, $p = .68$) confirmed a good model fit for the TRA. According to the classification table, correct classification rates were 93.8% for the teens who would plan to use birth control in the future and 66.7% of teens who would not. The results also revealed that personal attitude (OR= 0.72, 95% CI= 0.58-0.88) was the only significant predictor of future birth control use from the TRA. Results are summarized in Table 2. In this sample, the mediator role of intention was not supported since no significant effects were found for personal attitude and subjective norms on intention ($F=1.81$, $p = .17$).

Comparing the predictive power of the three models under consideration, the SCT appeared to be the least predictive model of the three theories. Compared to the constant-only model (-2 Log Likelihood= 43.52), its constructs failed to significantly improve the prediction of future birth control use [-2 Log Likelihood= 43.04, $\chi^2 = 0.48$ (df= 2), $p = .79$, Nagelkerke $R^2 = .01$]. In conclusion, in this data set the HBM was the best predictive model among the three theories according to the value of Nagelkerke R^2 .

Table 3 Summary of multivariate logistic regression models of HBM, TRA, and SCT constructs on future use of birth control

Theory	Construct	b	Wald	p	OR	95% CI
HBM	Susceptibility	-0.07	0.11	0.74	0.93	0.62-1.41
	Severity	-0.39	2.14	0.14	0.68	0.40-1.14
	Benefit	0.40	0.86	0.35	1.50	0.64-3.52
	Barrier	-0.85	2.55	0.11	0.43	0.15-1.21
	Cues to action	-2.21	6.87	<0.01	0.11	0.02-0.57
TRA	Personal attitude	-0.33	9.75	<0.01	0.72	0.58-0.88
	Subjective norm	-0.01	0.65	0.42	0.99	0.95-1.02
	Intention	-0.31	2.18	0.14	0.74	0.49-1.11
SCT	Self-efficacy	-0.00	0.00	0.96	0.99	0.85-1.16
	Outcome expectation	-0.15	0.48	0.49	0.86	0.56-1.32

4.1.4.3. Predictive power of the constructs of the three theories for behavioral outcome

For the HBM, perceived barriers (OR= .56, 95% CI= 0.32-0.97) was a significant predictor for future use of birth control, indicating that more perceived barriers to using birth control was related to a greater likelihood of using birth control in the future. Cues to action was also significantly related to future use of birth control (OR= .25, 95% CI= 0.10-0.61), whereby more cues about birth control were significantly associated with greater likelihood to use birth control in the future.

From the TRA, greater likelihood to using birth control in the future was positively related to stronger personal attitude (OR= .72, 95% CI= 0.59-0.87), and higher levels of situation specific intention in using birth control (OR= .70, 95% CI= 0.50-0.97). However, none of the constructs from SCT were found to be the significant predictors for the behavioral outcome variable. The results are presented in Table 4. The relationships of covariates and the behavioral outcome variable were also evaluated, and only age was significantly associated with the behavioral outcome (OR= .21, 95% CI= 0.05-0.91).

Table 4 Summary of univariate logistic regressions of the constructs on future use of birth control

Theory	Consturct	b	OR	95% CI
Health Belief Model	Susceptibility	-0.18	0.83	0.67-1.04
	Severity	-0.15	0.86	0.64-1.17
	Benefit	-0.01	1.00	0.70-1.42
	Barrier	-0.59	0.56*	0.32-0.97
	Cues to action	-1.37	0.25**	0.10-0.61
Theory of Reasoned Action	Personal attitude	-0.34	0.72**	0.59-0.87
	Subjective norm	-0.02	0.98	0.95-1.01
	Intention	-0.36	0.70*	0.50-0.97
Social Cognitive Theory	Self-efficacy	-0.01	0.99	0.85-1.15
	Outcome expectation	-0.16	0.86	0.56-1.32

* OR significant at the level .05 level

4.1.4.4. The composite model

From the previous regression analyses in Table 4, the variables with significant OR were selected (perceived barriers, cues to action, personal attitude, intention and age) into the composite model. Together these variables made a reliable predictive model for using birth control in teens with diabetes [-2 Log Likelihood= 10.15, $\chi^2= 33.25$ (df= 5), $p< .001$]. Table 5 lists the results of goodness-of-fit for the composite model.

Table 5 Summary of multivariate logistic regression for composite model

Model	-2 Log Likelihood	χ^2 (df)	p	Nagelkerke R^2	Hosmer-Lemeshow χ^2 (p)
	10.15	33.23(5)	.00	.81	.11 (NS)
	B	Wald	p	OR	95% CI
Age	-1.66	1.06	.30	.19	.00-4.50
Barriers	-1.43	1.48	.22	.24	.020-2.40
Cues to action	-5.48	1.54	.22	.00	.00-23.96
Personal attitude	-0.76	1.67	.20	.47	.15-1.48
Intention	0.77	0.84	.36	2.16	.42-11.16

4.1.5. Discussion

Given the risk of an unplanned pregnancy and the seriousness of pregnancy-related complications of teens with diabetes, the effectiveness of a theoretical model in predicting reproductive health behavior is important. The major goal of this study was to compare the three SCM theories, and to identify a composite model of their main constructs regarding the predictive efficacy on future reproductive health decision-making of female teens with diabetes. Based on the results of this study, it appears that the HBM and TRA provide the strongest determinants of future reproductive health behavior of female teens with diabetes. Perceived barriers, cues to action, personal attitude, and intention were the most influential factors in predicting future birth control use in this sample.

4.1.5.1. Comparing prediction of the three theories

The findings of our present study showed that both the TRA and HBM were significantly reliable in predicting reproductive health behaviors of the teens with diabetes. While no studies compared 2 or 3 of these three theories in sex-related behaviors with this particular population, one study compared the same theories in a sample of gay men (Wulfert, Wan & Backus, 1996), showing that the TRA accounted for the highest amount of the variance in sexual behaviors compared to the HBM and SCT. Similarly, in another study comparing young men's condom use, the TRA was better than the HBM model (Vanlandingham, et al., 1995).

Similar to other studies, the TRA and HBM were effective in predicting sex-related behaviors (Adler et al., 1990; Hester & Macrina, 1985; Rannie & Craig, 1997); however, the SCT was not. One issue may be the role of self-efficacy in the model. It is assumed that the impact of outcome expectations on health behavior might be mediated through self-efficacy because perceived self-efficacy implicitly includes some degree of outcome expectations (Schwarzer, 1995). Self-efficacy has been treated as a mediator or moderator conceptually and statistically (Levinson, 1986; Wulfert & Wan, 1993; Wulfert, Wan & Backus, 1996) rather than a main factor, as was the case in our study. The small sample size of this study restricted our use of statistical analyses, such as, multivariate analyses with interaction terms, or path analyses and structural equation modeling. In the future, studies with larger sample sizes should examine the role of self-efficacy as a mediator and/or moderator. Perhaps, self-efficacy interacts with sexual experience, whereby, sexually active teens would have higher levels of self-efficacy regarding birth control use.

4.1.5.2. Predictive power of the constructs of the three theories for behavior outcome

As expected, the bivariate relationships among the constructs are according to the hypothesized directions of the theories. For example, in the HBM, higher levels of susceptibility were associated with both higher levels of perceived severity to complications of pregnancy, and to perceived barriers to using birth control. Furthermore, the teens who perceived greater benefit of using birth control tended to have more cues related to birth control use.

In regards to the outcome variable, consistent with previous studies of reproductive health behaviors in youth (Adih & Alexander, 1999; Basen-Engquist & Parcel, 1992), these results also found perceived barriers to be significantly associated with birth control use. Although, this relationship was positive in our study, due to the cross-sectional nature of this data, perhaps teens, who perceive greater current barriers, could overcome them and still intend to use birth control in the future. Our study also confirmed Fisher's (1977) suggestion that teens receiving a cue to action were more likely to perform family planning behavior than those not receiving such a cue. For the population of women with diabetes, similar findings were found in Janz et al.'s study (1995), namely, that receiving cues to action was one of the most significant characteristics of women who sought preconception care. Additionally, these current findings support previous studies having reported that personal attitude and intention were associated with using birth control (Adler et al., 1990; Albarracin, Johnson, Fishbein & Muellerleile, 2001; Krahe & Reiss, 1995; Rannie & Craig, 1997; St. James et al., 1993). These results underscore the social-cognitive perspective in this research area.

Although in this study, the constructs of SCT were not found to be significantly related to the outcome variable, some were significantly related to the constructs of the HBM and TRA.

Teens with diabetes who perceived more barriers about using birth control were likely to have lower levels of self-efficacy. Moreover, those who had greater intention to use birth control tended to report higher levels of self-efficacy and outcome expectations. Surprisingly, however, unlike other studies that found self-efficacy to be significantly related to the behavioral outcome (Heinrich, 1993; Levinson, 1986; Wulfert & Wan, 1993, Wulfert, Wan & Backus, 1996), our study did not. This may be due to the fact that most of the teens (57.5%) had no sexual experience and felt perplexed about the skills of using birth control.

4.1.5.3. The composite model

In this study, the composite model using logistic regression analyses suggested that including the variables (perceived barriers, cues to action, personal attitude, intention and age) improved the models from a statistical standpoint. Only a few studies have used a composite model to examine the prediction in sex-related behaviors (Selvan et al., 2001; Wulfert & Wan, 1993; Wulfert, Wan & Backus, 1996). None, however, have explicitly focused on female teens with diabetes. Consistent with previous reports, perceived barriers, attitude, and intention were identified as effective factors and selected into their composite models. A major difference was that none of the other studies measured cues to action, and therefore never included it in their composite model.

4.1.5.4. Limitations

Due to the limitations of this study, caution in the interpretation is warranted. This study is a secondary analysis, and thus the data were not collected for the major focus of this paper. Studies with larger sample sizes are recommended to conduct multivariate logistic regression analyses. In addition, the original study had a cross-sectional design rather than a longitudinal

design, and lacked follow-up measures of behavior, making it impossible to determine cause and effect.

In this current study, in order to use a larger sample, “plan to use birth control in the future” (a general planned behavior), was selected as the outcome variable. An issue has been raised that this “plan to use...” variable is similar to the construct “intention”. Intention is an attitude and a direct predictor of behavior that is theoretically defined in the TRA. In our data set, intention reflects a situation-specific attitude, namely, the intent to always use birth control to prevent unplanned pregnancy; and to use a birth control method that gives full protection against an unplanned pregnancy. Moreover, these two variables, intention and behavior outcome, had less than moderate correlation ($r = .26$, $p < .05$), indicating that teens in the sample were able to distinguish between these two variables. However, for future analysis, given that the variable “intention” has a mediating role in TRA, and is similar to the “likelihood of action” (outcome variable for HBM), and it could be used as an outcome variable. Furthermore, instead of a dichotomous variable, intention is measured as a continuous variable with possible score range 2-14.

Due to the level of cognitive development of the subjects, for some scales, perhaps younger teens may not have been able to comprehend the compounded structure of items of outcome expectations (“if you do this, you can expect this...”), or the dual nature of the items of subjective norms (subjective norm were treated as multiplicative composite scores = normative belief x motivation to comply in this study). Some scales such as outcome expectations, perceived severity and the outcome variable were evaluated with relatively few items, whereas, many researchers have suggested that scales with multiple items would lead to substantially better results.

4.1.5.5. Conclusions

In this sample of adolescent females with T1D, the strongest predictors from the three theories of birth control use in the future appeared to be perceived barriers, cues to action, personal attitude, and intention. Intervention studies to decrease future unplanned pregnancies in this high-risk population should focus on strategies to target these factors that are amenable to change.

5. SUMMARY AND CONCLUSION

5.1. Summary of the results

The main purpose of this study was to compare the ability of the three theories, the HBM, TRA and SCT, to predict future birth-control use behavior of adolescent women with diabetes. Overall, the present findings indicate that both the HBM and TRA are effective theoretic models for studying the future reproductive health behavior of teens with diabetes. Similar to other studies, the TRA and HBM were effective in predicting sex-related behaviors (Alder et al., 1990; Hester & Macrina, 1985; Krahe & Reiss, 1995; Rannie & Craig, 1997; Wulfert, Wan & Backus, 1996).

This study identified perceived barriers, cues to action, personal attitude and intention as important factors in the prediction of future birth control use. For the HBM, the results of current study cast further light on previous studies (Schwarzer & Fuchs 1995; Rannie & Craig, 1997) that perceived barriers is a strong predictor in explaining behavioral change across different populations and different healthy behaviors. Cues to action appeared to be an influential factor especially for the population of women with diabetes, similar findings were also found in the study of Janz et al. (1995). In TRA, like other studies, both personal attitude and intention were consistently found as the significant predictor in explaining sex-related behavior of teens (Adih WK, Alexander, 1999; Adler et al., 1990; Basen-Engquist & Parcel, 1992; St. James et al., 1993; Wulfert & Wan, 1993). A composite model included the factors perceived barriers, cues to action, personal attitude and intention and age, and proved to be a reliable model with satisfactory

goodness-of-fit for explaining reproductive health behavior of female teens with diabetes. Given that these three theories are conceptually analogous, it seemed useful to integrate these constructs into a model that is both, parsimonious and does not violate the theoretical consideration of original theory. In this way these theories can complement the utility of each other, and thereby, improve the prediction of reproductive health behavior of female teens with diabetes.

5.2. Additional model analyses

Direct logistic regression was conducted to test the comprehensive model with all ten constructs of the three theories. This model was significant [-2 Log Likelihood= 7.81, $\chi^2= 31.26$ (df= 10), $p < .001$, Nagelkerke $R^2 = 0.87$, Hosmer-Lemeshow test: $\chi^2= 0.07$, $p = .998$] in predicting future birth control use of female teens with diabetes. However, a problem of overfitting occurred because there were too many predictors relative to the small number of cases with the outcome variable. Four competing composite models were developed and examined.

The composite models were developed by including the variables that were either significant in the multivariate logistic regression analyses or had significant correlation with the outcome variable. The full composite model included perceived barrier, cues to action, personal attitude, intention and age. Three nested models were compared with the full model by using likelihood ratio statistics in logistic regression. In the analyses, age as a covariate was entered into model in the first step and then followed by the rest of constructs under consideration. All composite models were reliable based on the resulting -2 Log Likelihood and Hosmer-Lemeshow tests. The results are presented in Table 6. With the significant changes in -2 Log Likelihood, the first model fitted better than the other models. Age was not a reliable

covariate for this sample, given that the deletion of age from the composite model did not significantly change the log-likelihood of the model. In addition, cues to action and personal attitude were significant constructs in predicting future birth control use in models 3 and 4.

Perceived barriers, cues to action, personal attitude and intention predictive constructs of future birth control use were further evaluated by using stepwise logistic regression. In Table 7, perceived barriers, cues to action and personal attitude were the reliable predictors based on significant improvement of model Log Likelihood in forward stepwise regression based on a p-value for entry of .20. In this analysis, intention was not a significant factor.

Table 6 Summary of goodness-of-fit tests for additional composite models

Model	-2 Log Likelihood	χ^2 (df)	p	Nagelkerke R^2	Hosmer-Lemeshow χ^2 (p)
Model 1	10.15	33.23(5)	.00	.81	.11 (NS)
	b	Wald	p	OR	95% CI
Age	-1.66	1.06	.30	.19	.00-4.50
Barriers	-1.43	1.48	.22	.24	.020-2.40
Cues to action	-5.48	1.54	.22	.00	.00-23.96
Personal attitude	-0.76	1.67	.20	.47	.15-1.48
Intention	0.77	0.84	.36	2.16	.42-11.16
Model 2	12.12	31.26(4)	.00	.77	.34 (NS)
	b	Wald	p	OR	95% CI
Barriers	-.87	1.87	.17	.42	.12-1.46
Cues to action	-3.07	1.99	.16	.00	.00-3.30
Personal attitude	-0.5	2.81	.09	.34	.34-1.09
Intention	0.16	0.11	.74	.47	.47-2.89
Model 3	16.78	26.60(3)	.00	.67	1.41 (NS)
	b	Wald	p	OR	95% CI
Age	-.79	1.29	.26	.45	.12-1.77
Cues to action	-1.58	5.04	.03	.21	.05-.82
Personal attitude	-0.28	4.78	.03	.76	.59-.97
Model 4	18.63	24.75(2)	.00	.63	.94 (NS)
	b	Wald	p	OR	95% CI
Cues to action	-1.54	5.90	.02	.22	.06-.74
Personal attitude	-.32	6.74	.00	.72	.58-.92

Table 7 Models test if construct removed in stepwise logistic regression

	Construct	Model Log Likelihood	Change in -2 Log Likelihood	df	Sig. of the Change
Step 1	Personal attitude	-21.688	14.117	1	.000
Step 2	Cues to action	-14.630	10.632	1	.001
	Personal attitude	-14.025	9.422	1	.002
Step 3	Barriers	-9.314	6.384	1	.012
	Cues to action	-12.074	11.905	1	.001
	Personal attitude	-10.760	9.277	1	.002

5.3. Implications

A better understanding of factors which influence decision toward future birth control use is a necessary prerequisite for designing effective strategies to decrease unplanned pregnancy, especially for teens with diabetes. According the findings of this study, it is appropriate to propose that the HBM and TRA provide an effective framework for empirically identifying factors on which intervention efforts should focus.

Furthermore, health education interventions should be targeted to the specific factors (perceived barriers, cues to action, personal attitude, and intention) which are significantly associated with birth control use in present study. Health care professionals will need to explore the barriers that the female teens with diabetes believe they will encounter and provide them the ways to reduce such difficulty. Given the more cues (e.g. online information, informational campaign, reminder in clinic visit) related to reproductive health behaviors female teens with

diabetes should increase their likelihood to perform family planning behavior. Strengthening positive attitude toward family planning and promoting the value of using birth control as a general practice in this population would increase the likelihood of female adolescents with diabetes to adopt healthy reproductive behaviors.

5.4. Limitations

While there are obvious benefits to research involving existing data, there are some inherent limitations of secondary data analyses. These may include misfit between available data and the new perspectives and research questions, lack of accuracy in data documentation, and lack of control in research design and data collection. According to Elder, Pavaldo and Clipp (1993), an intensive process of understanding the data set would facilitate the researcher to reshape the existing data to reflect the new questions. In the current study, a comprehensive understanding was obtained fully in the beginning phase of study, for example, sampling, data collection methods, time points of assessment, design issues, codebook, measures, scaling, note of missing data, statistical concerns, theoretical perspectives, and operational definitions of variables. Lack of accuracy in documentation was also not found in the primary data set, given that strict guidelines were followed in the parent study, along with the procedures in data collection, data entry, and coding.

Similar to that of the present study, the purpose of original study was to understand the reproductive health beliefs of teens with diabetes from the perspective of SCM, and how they predicted behaviors. The original study used actual birth control use and seeking preconception counseling as behavioral outcomes, but this limited the use of the total sample given that less

than half of the sample had been sexually active. Therefore, in this current study, in order to use a larger sample, “plan to use birth control in the future” (a general planned behavior), was selected as the outcome variable. An issue has been raised that this “plan to use...” variable is similar to the construct “intention”. Intention is an attitude and a direct predictor of behavior that is theoretically defined in the TRA. In our data set, intention reflects a situation specific attitude, namely, intent to always use birth control to prevent unplanned pregnancy; and to use a birth control method that gives full protection against an unplanned pregnancy. Moreover, these two variables had less than moderate correlation ($r = .26$, $p < .05$), indicating that teens in the sample were able to distinguish between these two variables.

However, for future analysis, given that the variable “intention” has a mediating role in TRA, is similar to the “likelihood of action” (outcome variable for HBM), and the motivational stage (intention) of behavior in SCT, it could be used as an outcome variable. Furthermore, instead of a dichotomous variable used in current study, intention is a continuous variable with possible score range 2-14. Therefore, a new manuscript was written with intention as the outcome variable (see Appendix C).

Lack of control in research design and type of data was a concern in this study. The original study had a cross-sectional design rather than a longitudinal design, and lacked follow-up measures of behavior, making it impossible to determine cause and effect. Birth control use was collected through the teens’ self-report. The teens may have been uncomfortable discussing their sexual behavior and therefore underreported this behavior. Another limitation from the original data set is the sample size. Studies with larger sample sizes are recommended to conduct multivariate logistic regressions.

One limitation related to the measurement of the present study should be acknowledged.

Due to the level of cognitive development of the subjects, for some scales, younger teens may not have been able to comprehend the compounded structure of items of outcome expectations (“if you do this, you can expect this...”), or the dual nature of the items of subjective norms (subjective norm were treated as multiplicative composite scores = normative belief x motivation to comply in this study). Some scales such as outcome expectations, perceived severity and the outcome variable were evaluated with relatively few items, whereas, many researchers suggested that multi-item would lead to substantially better results. The outcome expectation defined in this study was the teen’s perception of beliefs on outcomes resulted from her own decisions regarding using birth control and performing preconception care. Given that the outcome variable (planned behavior) for this study was not an actual behavior, the scale of outcome expectation would need to be modified or eliminated for future studies.

5.5. Future study

In understanding reproductive health behavior of teens with diabetes, it is important to evaluate the unique contribution of the constructs of social cognitive theories and also to consider the complement among theories. Future research has to confirm not only what theory or what construct may be imperative, also what combination of the constructs can be targeted to this population to enhance the understanding of behavioral change. Further studies in developing and evaluating theory-driven interventions aimed at female teens with diabetes based on this study are needed. It is also important to note that these theories can be applied in combination with each other to design and deliver behavioral change interventions.

Given that age was significantly associated with birth control use in this study, developmental level could be an important factor to consider in studying reproductive health behavior of female teens with diabetes. In this sample, self-efficacy, surprisingly, was not identified as important predictor like other studies (Albarracin et al., 2001; Heinrich, 1993; Fisher, 1977; Wulfert, Wan & Backus, 1996). Therefore, this construct need to be re-evaluated in future studies.

In this study, teens had a chronic illness, which may mediate or moderate their reproductive health behavior. The parent study did not include a physiological measure (not self-report) of their metabolic control (e.g., HbA1C); nor did it include an objective measure of self-management of their diabetes. Using theories similar to those used in this study, previous studies (Grossman, Brink & Hauser, 1987; Woolridge, Wallston, Graber, Brown & Davidson, 1992) have found that social cognitive variables (e.g., self-efficacy, perceived benefits) influenced adherence and metabolic control. Given the potential influence of chronic illness on reproductive health behaviors, future studies should consider measuring HbA1C and the teen's adherence to the diabetes treatment regimen.

In conclusion, in this sample of adolescent females with T1D, the important predictors from the three theories of birth control use in the future appeared to be perceived barriers, cues to action, personal attitude, and intention. The findings of the study can be used to enhance the development of health education program. Intervention studies to decrease future unplanned pregnancies in this high-risk population could focus on strategies to target these factors that are amenable to change.

APPENDIX A. THE SCALES FOR REPRODUCTIVE HEALTH ATTITUDES AND BEHAVIOR (RHAB)

The Health Belief Model

Susceptibility

Responding scores: 1 ☐ not at all 2 ☐ a little 3 ☐ somewhat
4 ☐ a moderate amount 5 ☐ a lot

1. How much do you worry that you could become pregnant?
2. How much do you worry that you could catch a sexually transmitted disease (e.g. AIDS, venereal disease, etc.)?
3. How much do you worry that you could develop health problems during pregnancy?
4. How much do you worry that your baby could develop health problems during your pregnancy?

Severity

Responding scores: 1 ☐ not serious at all 2 ☐ a little serious
3 ☐ somewhat serious 4 ☐ moderately serious
5 ☐ very serious

5. If you developed health problems during pregnancy, do you think that those problems would be:
6. If your baby developed health problems during pregnancy, do you think that the problems would be:
7. If you had an unplanned pregnancy, do you think that this problem would be:

Benefit

Responding scores: 1 ☐ not at all 2 ☐ a little 3 ☐ somewhat
4 ☐ a moderate amount 5 ☐ a lot

8. Would having blood sugar levels in the normal range before becoming pregnant improve your chances of having a healthy baby?
9. Would using birth control prevent an unplanned pregnancy?
10. Would seeking preconception counseling (special medical care and advice) when planning a pregnancy improve your chances of having a healthy baby?
11. Would getting preconception counseling (special medical care and advice) improve your chances of having a healthy pregnancy?

Barrier

Responding scores: 0 ☐ does not apply 1 ☐ no problem at all
2 ☐ a little problem 3 ☐ somewhat of a problem
4 ☐ a moderate problem 5 ☐ a big problem

12. How much of a problem for you is the cost of birth control?
13. How much of a problem for you is getting birth control?
14. How much of a problem for you is using birth control on a regular basis?
15. How difficult would it be to seek preconception counseling (special medical care and advice) when planning a pregnancy?
16. How difficult would it be, to follow the preconception counseling advice given by health professional (e.g. keeping blood sugar levels in normal range, taking more insulin injections, etc.)?

Cues to action

Responding scores: 1 ☐ Yes 2 ☐ No

17. Have you ever discussed how diabetes affects pregnancy with your regular diabetes health care provider?
18. Has a health care professional (doctor, nurse, etc.) ever told you that you should get special medical care and advice before you become pregnant or plan for a pregnancy? This is called preconception counseling or prepregnancy planning.
19. Has anyone else (boyfriend, parent, friend, etc.) told you that you should get preconception counseling (special medical care and advice) before you become pregnant or plan for a pregnancy?
20. Has a healthcare professional (doctor, nurse, etc.) told you that you should use some type of birth control when preventing a pregnancy?
21. Has anyone else (boyfriend, parent, friend, etc.) told you that you should use some type of birth control when preventing a pregnancy?

Theory of Reasoned Action

Personal Attitude

22. My getting preconception counseling (special medical care and advice) when planning pregnancy is (will be):

<input type="checkbox"/> Unnecessary	<input type="checkbox"/> Necessary	4 <input type="checkbox"/> Neither
1 <input type="checkbox"/> extremely unnecessary	7 <input type="checkbox"/> extremely necessary	
2 <input type="checkbox"/> quite unnecessary	6 <input type="checkbox"/> quite necessary	
3 <input type="checkbox"/> slightly unnecessary	5 <input type="checkbox"/> slightly necessary	
23. My using birth control is (will be):

<input type="checkbox"/> Difficult	<input type="checkbox"/> Easy	4 <input type="checkbox"/> Neither
1 <input type="checkbox"/> extremely difficult	7 <input type="checkbox"/> extremely easy	
2 <input type="checkbox"/> quite difficult	6 <input type="checkbox"/> quite easy	
3 <input type="checkbox"/> slightly difficult	5 <input type="checkbox"/> slightly easy	

24. My using birth control is (will be):

- | | | |
|--|---|------------------------------------|
| <input type="checkbox"/> Dangerous | <input type="checkbox"/> Safe | 4 <input type="checkbox"/> Neither |
| 1 <input type="checkbox"/> extremely dangerous | 7 <input type="checkbox"/> extremely safe | |
| 2 <input type="checkbox"/> quite dangerous | 6 <input type="checkbox"/> quite safe | |
| 3 <input type="checkbox"/> slightly dangerous | 5 <input type="checkbox"/> slightly safe | |

Subjective norm

Responding scores: 1 ☐ not at all 2 ☐ a little of the time
3 ☐ a moderate amount of the time
4 ☐ a lot of the time 5 ☐ all of the time

- 25. Would you say that your husband/partner/boyfriend thinks you should use birth control when preventing a pregnancy?
- 26. When it comes to using birth control, do you want to do what your husband/partner/boyfriend thinks you should do?
- 27. Would you say that your husband/partner/boyfriend thinks you should seek preconception counseling (special medical care and advice) when planning a pregnancy.
- 28. When it comes to preconception counseling do you want to do what your husband/partner/boyfriend thinks you should do?
- 29. Would you say that your parents think you should use birth control when preventing a pregnancy?
- 30. When it comes to using birth control, do you want to do what your parents think you should do?
- 31. Would you say that your parents think that you should seek preconception counseling (special medical care and advice) when planning a pregnancy?
- 32. When it comes to preconception counseling, do you want to do what your parents think you should do?
- 33. Would you say that most of your friends think that you should use birth control when preventing a pregnancy?
- 34. When it comes to using birth control, do you want to do what most of your friends think that you should do?
- 35. Would you say that most of your friends think that you should seek preconception counseling (special medical care and advice) when planning a pregnancy?
- 36. When it comes to preconception counseling, do you want to do what most of your friends think that you should do?

Intention

Responding scores: Unlikely 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ Likely

- 37. When I have sex, I intend to always use some type of birth control to prevent an unplanned pregnancy.
- 38. When I have sex, I intend to use a birth control method that gives me full protection against unplanned pregnancy.

Social Cognitive Theory

Self-Efficacy

On a scale of 0 to 10, rate how confident you are, that you could regularly do each activity for at least 6 months. Choose the number from 0 to 10 that best describes your level of confidence, where 0 is not at all confident and 10 is absolutely confident.

How confident am I that I could:

39. Get preconception counseling before I get pregnant.
40. Convince my husband/partner/boyfriend that it is necessary for me to use birth control, even if he does not want me to use it.
41. Change my insulin and diet to keep my blood sugar levels in normal range, even if I am not yet pregnant, but planning a pregnancy.
42. Delay sex with my husband/partner/boyfriend if birth control is not available.
43. Wait on becoming pregnant until my blood sugar levels are within the normal range.
44. Use birth control each time I have sex when preventing a pregnancy.

Outcome Expectation

Responding scores: 1 ☐ not at all 2 ☐ a little 3 ☐ some
4 ☐ a moderate amount 5 ☐ a lot

Would you say that getting preconception counseling?

45. Would help you get normal blood sugars:
46. Would help you understand how diabetes affects pregnancy:
47. Would help you decide what birth control method to use:
48. Would you say that using birth control would help you prevent an unplanned pregnancy:

APPENDIX B. A THEORY-BASED REPRODUCTIVE HEALTH AND DIABETES INSTRUMENT

Denise Charron-Prochownik, PhD, RN
Associate Professor
440 Victoria Bldg
Health Promotion & Development
School of Nursing (P) 412-624-6953
University of Pittsburgh (F) 412-624-8521
Pittsburgh, PA 15261 dcpro@pitt.edu

Shiaw-Ling Wang, PhD, RN
Health Promotion & Development
School of Nursing
University of Pittsburgh
Pittsburgh, PA 15261

Susan M. Sereika, PhD
Associate Professor
Center for Research and Evaluation
School of Nursing
University of Pittsburgh
Pittsburgh, PA 15261

Yookyung Kim, PhD
Assistant Professor
Center for Research and Evaluation
School of Nursing
University of Pittsburgh
Pittsburgh, PA 15261

Nancy K. Janz, PhD, RN
Associate Professor
Health Behavior & Health Education
School of Public Health
University of Michigan
Ann Arbor, MI 48109

Keywords: adolescent, diabetes, birth control and preconception counseling, psychometrics, social cognitive model

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ABSTRACT

Objectives: To determine psychometric properties of scales within the theoretically-based “Reproductive Health Attitudes and Behavior” (RHAB) instrument for examining preconception planning of young women with diabetes (DM). Scales represented constructs from three social cognition models that can influence reproductive health behavior. *Methods:* Data were collected from a phone interview by same-gender research assistants. Psychometrics (validity: content, concurrent, construct; and reliability) were examined on this 48-item instrument using a sample of 87 female adolescents with DM from 4 medical centers. *Results:* Overall, the major factors (scales) clustered according to theoretical underpinning. Cronbach’s alphas were moderate to high (0.62-0.83), except cues to action and outcome expectations. *Conclusions:* RHAB appears to have acceptable levels of validity and reliability for use with female adolescent with type 1 diabetes..

Both maternal and infant perinatal problems have been associated with higher glucose levels from diabetes¹. To reduce pregnancy-related complications in women with diabetes, planned pregnancy and preconception counseling (PC) are recommended by the American Diabetes Association² (ADA). Planned pregnancies with PC improve metabolic control by tightening blood glucose levels, thus increasing the chances of a healthy pregnancy and offspring.³ Despite the high risk for complications, many diabetic women are not aware of PC, nor do they seek it, and therefore, many have unplanned pregnancies.⁴ This is especially true for adolescents with diabetes.⁵

In the general population, the rate of using any contraception by sexually active adolescents during the first intercourse is only 67%.⁶ Given the seriousness of pregnancy-related complications, the adolescent female's susceptibility to having an unplanned pregnancy, and the benefits of preconception counseling and care, the research emphasis must be on adolescents with diabetes, preferably, prior to becoming sexually active. Thus, a developmentally-appropriate, reliable and valid measurement of factors related to decision-making regarding reproductive health and preconception planning behaviors in adolescent women with diabetes is imperative.

Previous studies^{7,8,9} in the general population, have provided empirical evidence to support the predictive value of social cognition models (collection of psychosocial-cognitive-behavioral theories)¹⁰ regarding family planning behaviors. However, none of these studies used the same measurement, or focused on a comprehensive psychometric analysis. Moreover, there were no published studies that ever examined reproductive health issues or family (preconception) planning behaviors of adolescent women with diabetes, or least of which, the existence of a validated and reliable instrument that could be used to predict such outcomes.

Therefore, this study is significant in developing a theory-based instrument; conducting psychometric analyses; and examining the validity of the constructs of three social cognition models [Health Belief Model (HBM), Theory of Reasoned Action (TRA), and Social Cognitive Theory (SCT)] on preconception planning behavior of adolescent women with diabetes. The original questionnaire developed for this research was the “Pregnancy and Diabetes Interview Schedule”.^{4,13} This questionnaire is a theory-based multi-dimensional instrument containing items related to knowledge, beliefs/attitudes, social factors, and reproductive health behaviors for assessing family planning decisions and behaviors in adult pregnant women with diabetes (e.g., whether to seek preconception care). For this current study, the interview schedule was slightly modified for female adolescents, who may or may not be sexually active. The interview schedule for the teen study was called, “Family Planning Behavior and Diabetes Study Questionnaire”. For the purpose of this paper, only those items that are related to the constructs of the three theories in regards to preconception planning behavior (this term refers to a broad definition of family planning behavior, including the use of effective birth control and preconception counseling), were selected in generating a purely theory-based instrument. We named this final instrument, “*Reproductive Health Attitudes and Behavior*” (*RHAB*), which is the focus of this paper. The main research questions discussed in this paper include: 1) What is the content validity of the scales of the instrument? 2) What is the criterion-related validity of each construct (scale) of three theories on preconception planning behavior of adolescent women with diabetes? 3) What is the underlying structure within the scales of the instrument? 4) What is the internal consistency within each scale of the instrument?

THEORETICAL GROUNDING

An unplanned diabetic pregnancy is a complex problem. An interconnected set of circumstances that may contribute to the poor planning of a pregnancy in a diabetic woman; include demographic, psychological, behavioral, and social characteristics.^{11, 12}

Family planning is a behavior¹³ that can best be explained by social cognition models.¹⁰ The Health Belief Model,¹⁴ the Theory of Reasoned Action,¹⁵ and the Social Cognitive Theory¹⁶ (SCT) provide the conceptual frameworks used in this study to explain and predict the family planning behaviors of adolescents with diabetes. These three theories focus on describing the important social/cognitive variables and their interrelationships underlying health behaviors, used in predicting family planning or other health behaviors in various chronic illnesses. Because of the unique increased risk of pregnancy-related complications among women with diabetes, and the benefit of preconception counseling and care to decrease that risk, for this population, as previously mentioned, family planning will be referred to as preconception planning behavior.

The Health Belief Model postulates that the probability of a person performing a particular health-related behavior depends on his or her perceptions of susceptibility to the health threat, the severity of the threat, the benefit to action, and the cost of the behavior.¹⁴ In addition; these perceptions are influenced by a variety of internal or external cues to action. These cues include individual perception of symptoms, social influence, and health education campaigns.¹⁷ The HBM is limited, however, because it fails to incorporate several cognitive variables which have been found to be highly predictive of behavior in other social cognitive models.¹⁰ For example, the importance of intention formation or the influence of the approval of a significant other may impact an individual's behavior,^{12,15} especially as it relates to adolescents and family planning.⁸

Intention to perform a behavior and social pressure are key components of the Theory of Reasoned Action. The TRA hypothesizes that all behaviors are based on intentions.¹⁵ The TRA suggested that intentions represent a person's motivation (her or his conscious plan) to perform a behavior. Furthermore, intention to perform an action is influenced by two forces: 1) the person's own "general attitude" toward taking the action, and 2) the person's view of the social expectations with regard to the behavior ("subjective norm"). "Personal attitude" is operationalized as a function of a set of the person's beliefs regarding the various consequences of taking family planning behavior. "Subjective norm" is operationalized as a function of normative beliefs, which represent the person's perception of specific significant others' preferences regarding whether one should or should not perform family planning behavior; and the motivation to comply with that person's opinion.

The other potentially important variable that is missing from both the HBM and TRA is self-efficacy. This powerful predictor of behavior can be found in Social Cognitive Theory (SCT).¹⁶ Bandura¹⁶ suggested that behavior change and maintenance are functions of a set of expectations which include: "action-outcome": the expectations regarding a given behavior (personal action) which may lead to a given outcome; and "self-efficacy": the expectation of a given behavior leading to a particular outcome is based on a person's perceptions of the confidence and control over the performance of the behavior. Action-outcome expectations impact on behavior via their influence on intent to engage in the behavior, and on self-efficacy expectations. Self-efficacy expectations have a direct effect on behavior, and indirectly effect intentions.¹⁰

The HBM provides a framework to evaluate the impact of specific factors (e.g., susceptibility, severity) on the intention (likelihood) to perform preconception planning

behaviors. The TRA proposes that intention and subjective norms have a crucial, direct impact on conducting preconception planning behavior. The SCT¹⁶ states that self-efficacy influences not only the preconception planning behavior itself but also the amount of effort that will be expended on the action as well as the length of time that individual will persist, in the face of adversity, to achieve a particular outcome

Each theory contributes a unique construct in describing the decision-making processes carried out by adolescents with DM. The instrument described in this paper contains the major constructs of these three theories, and was developed specifically for adolescent females with DM. Psychometric properties will be reported in order to establish the adequacy of the instrument.

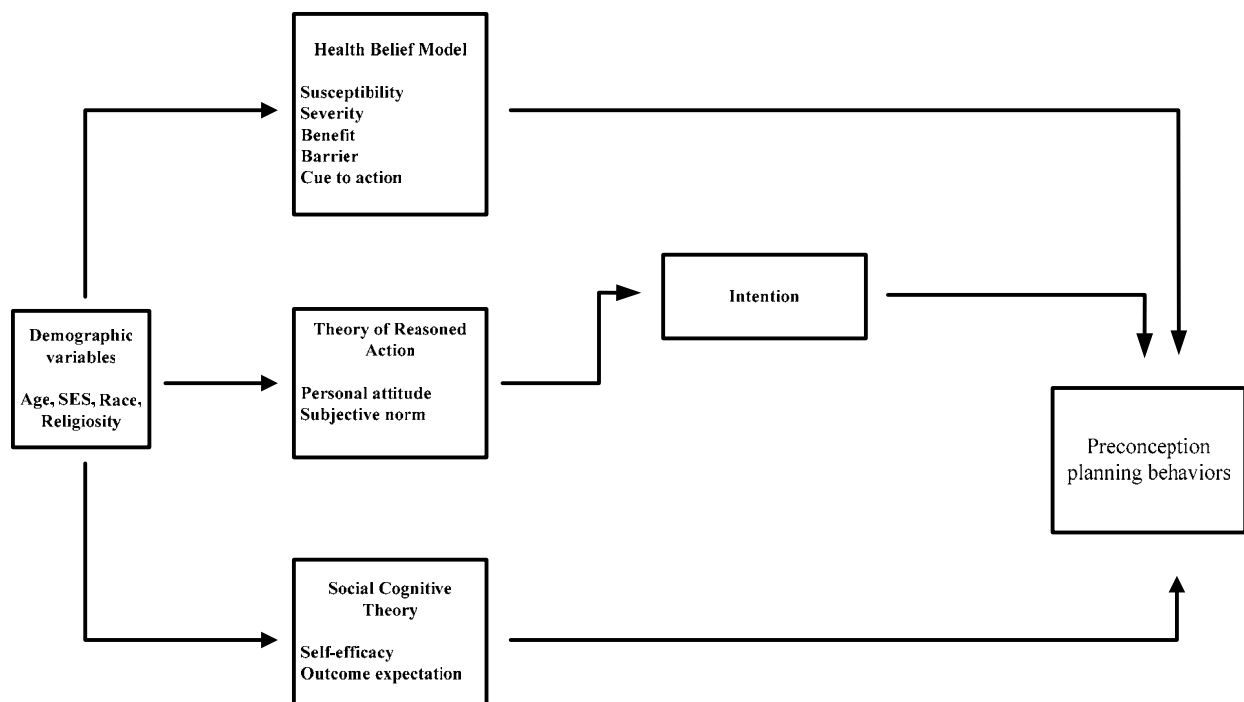


Figure B 1 Three model diagram for predicting preconception planning behavior

METHODS

Design

This study used cross-sectional data that were collected in an exploratory study, “Family Planning Decisions and Behaviors in Adolescents with IDDM” (conducted by Charron-Prochownik and colleagues).⁵ Data were collected during a one-hour structured telephone interview using the questionnaire. A trained, same-gender research assistant conducted the interview from the project office at the University of Pittsburgh. This study was approved by the Internal Review Board (IRB) at each participating institution.

Sample

Eighty-seven adolescent women with type 1 diabetes (T1D) were recruited from four major university-based medical centers with pediatric diabetes clinics, located in Pittsburgh, PA; St. Louis, MO; Boston, MA; and Detroit, MI. Subjects were considered to be eligible if they were between 16 to ≤ 22 years of age; had no other chronic illnesses or mental retardation; were not pregnant; and had type 1 diabetes for at least 1 year.

The mean age of subjects was 17.9 years (SD= 1.26, range=16.1 to 22.0 years). All subjects were female and had never been married; 36 (41.4%) reported having a current boyfriend or sexual partner. Most subjects were Caucasian ($n=76$, 87.4%). Fifty-eight (66.7%) were attending high school, 18 (20.7%) had only a high school diploma, and 11 (12.6%) were in college or technical school. Subjects tended to come from households that were at income levels $> \$20,000$ per year ($n=45$, 51.7%). Forty-six (52.9%) of the subjects identified themselves as Roman Catholic and twenty (23%) were Protestant. The average duration of illness was 8.51 years (SD=0.46, range= 1 to 17 years).

Instrument Development

Items from the ‘Family Planning Behavior and Diabetes Study Questionnaire’ formed scales for *Reproductive Health Attitudes and Behavior (RHAB)* (see Appendix for instrument), to measure the constructs from the three theories. As mentioned, these items were directly taken or modified from the validated, “Pregnancy and Diabetes Interview Schedule”, a theory-based questionnaire developed by Janz, et al..¹³ Because birth control (BC) is discussed and could be obtained during preconception counseling (PC) visits, we included BC and PC items.

Preliminary estimates from the pilot study of the predictive validity for effective use of birth control of individual scales in the RHAB Questionnaire were: 1) susceptibility = 0.69, 2) severity = 0.78, 3) benefit = 0.57, 4) barriers = 0.66, and self-efficacy = 0.68⁵. The instrument consists of three major models, ten scales (constructs), and a total of forty-eight items.

Health Belief Model included five scales. Higher summative scores reflected stronger level of the beliefs. For the cues to action, higher scores indicated more cues. The items and response scale were modeled from the original theorist’s instrument¹⁴.

- 1) Perceived susceptibility to complications of pregnancy and to becoming pregnant (e.g., “How much do you worry...”). This scale is evaluated by four items using a 5-point Likert-type scale ranking responses from “a lot” (5) to “not at all” (1). (See Table B1 for possible range scores).
- 2) Perceived severity of complications of pregnancy and of becoming pregnant (e.g., “...how serious of a problem do you think it would be...”). This scale is evaluated by three items using a 5-point Likert-type scale, ranking responses from “a lot” (5) to “not at all” (1).

- 3) Perceived benefits of birth control and preconception counseling (e.g., “Would...improve your chances of...”). This scale is evaluated by 4 items using a 5-point Likert-type scale, ranking responses from “a lot” (5) to “not at all” (1).
- 4) Perceived barriers to using birth control and to preconception counseling [e.g., “How much of a problem (difficult) would it be...”]. This scale is evaluated by 5 items using a 5-point scale, ranking responses from “a big problem” (5) to “no problem at all” (1).
- 5) Cues to action are triggers to performing preconception planning behaviors (e.g., “Has ... ever told you...”). Cues to action were examined by 5 items scored dichotomously (yes/no).

Theory of Reasoned Action includes three scales. Higher summative scores reflect higher positive anchor of the constructs. The items and response scale were modeled from the original theorist’s instrument¹⁵.

- 1) Personal attitudes: the individual’s attitudes toward birth control and preconception counseling (e.g., “My using birth control is...”). This variable is measured by three items using a semantic differential scale, ranking each anchor from “slightly” to “extremely”, with an item score ranging from 1 (negative attitude) to 7 (positive attitude).
- 2) Subjective norm: the individual’s perceptions of significant referent’s preferences regarding whether or not to use birth control and preconception counseling. This construct was assessed by six multiplicative composite scores (normative belief × motivation to comply) from the items of normative beliefs and corresponding items of motivations to comply (e.g., normative belief: “Would you say that your parents think you should use birth control when preventing a pregnancy”, and the corresponding motivation to comply: “When it comes to using birth control, do you want to do what

your parents think you should do”). Three different referents were evaluated: partner/boyfriend, parents, and friends. Normative beliefs and motivations to comply were measured respectively by 6 items on a Likert-type scale, ranking each from “all of the time” (5) to “not at all” (1).

- 3) Intention: the individual’s intent to always use a full protection birth control method when having sex, and to always seek preconception counseling when planning a pregnancy. This construct consists of two items, whereby each is ranked on a scale from one to seven, “unlikely”(1) and “likely” (7).

Social Cognitive Theory includes two scales. Higher summative scores reflect higher positive levels of the constructs. The items and response scale were modeled from the original theorist’s instrument¹⁶.

- 1) Self-efficacy: A 6-items scale where items were ranked from zero (not at all confident) to ten (absolutely confident), and were used to rate the level of the adolescent’s confidence in her own abilities to use birth control and to seek preconception counseling (e.g., “How confident am I that I could...”).
- 2) Outcome expectations: This scale consisted of four items, scored on a 5-point Likert-type scale; responses ranged from “a lot” (5) to “not at all” (1), and assessed the level of the individual’s belief that outcomes are the results of her own decisions regarding using birth control and seeking preconception counseling (e.g., “Would you say that PC/BC would help you...”).

See Table B1 for the descriptive statistics of the continuous variables from the three theories. Possible range scores are also included.

Table B 1 Descriptive statistics for constructs of three theories

Theory	Scale	Mean	SD	Median	Range (possible range)
Health Belief Model	Susceptibility	13.1	4.0	12.0	4-20 (4-20)
	Severity	12.2	2.4	13.0	4-15 (3-15)
	Benefit	18.0	2.3	18.5	8-20 (4-20)
	Barrier	6.8	3.8	6.0	2-19 (5-25)
	Cues to action	8.0	1.4	8.0	5-10 (5-10)
Theory of Reasoned Action	Personal attitude	17.3	4.0	19.0	5-21 (3-21)
	Subjective norm	93.2	33.6	92.0	35-150 (6-150)
	Intention	13.1	1.8	14.0	6-14 (2-14)
Social Cognitive Theory	Self-efficacy	54.5	5.2	56.0	36-60 (0-60)
	Outcome expectation	18.0	1.8	18.0	13-20 (4-20)

Outcome variables: Preconception planning requires effective family planning, including, birth control or abstinence. Sexually active subjects were asked to check a list of BC methods and respond to, “Please tell me which BC method you have used in the past.” Effectiveness of using birth control was a composite score by calculating $\{1 - (\text{Probabilities of failure of contraception})\}$. The probabilities of failure of contraception, which ranged from 0 to 1, were derived from the annual failure rates for methods of contraception reported in Trussel.¹⁸ For the subjects who used contraceptive methods in combination, the probability of failure was computed as the product of the failure probabilities of the each method used jointly. For the subjects identifying multiple methods, but used singly, the probability of failure was computed as the average of the failure probabilities. The subjects who were never sexually

active, yet currently had a boyfriend, were given a failure probability of zero for abstinence. Finally, the subjects who had never been sexually active and did not currently have a boyfriend were omitted from the analyses concerning birth control use.

Data Management

The completed questionnaires were examined, coded with a code book by trained research assistants, and processed using Teleform (Cardiff Software Inc., San Marcos, CA, 1996) and Paradox (Borland International Inc., Scotts Valley, CA, 1992) software. This data entry system scans raw data from the actual questionnaire and enters it into a user-defined data file in the computer.

Statistical Analysis

All statistic analyses were performed using SPSS for Window (Version 12.0, SPSS, Inc., Chicago, IL). Bivariate correlations (Pearson product moment correlation, Spearman rank-order correlations, and point-biserial correlation coefficients) were computed to assess the associations among scales and with the outcome variable to establish concurrent validity. Criterion-related validity for the effectiveness of using birth control was also determined by standard regression analysis.

Factor analysis was conducted to understand the underlying factor structure of the three theories. Factor structure was evaluated using principle components analyses (PCA) by examining the patterns of correlations and explaining variations among items and scales. The criterion of eigenvalues greater than 1 was used to select the number of factors to retain/extract. After extraction, varimax rotation was adopted to enhance interpretation of factors by maximizing the variance of factor loadings by making high loadings higher and low ones lower

for each other.¹⁹ The size of the loadings reflects the extent of relationship between each item and each factor.

Internal consistency reliability was estimated using Cronbach's coefficient alpha for ordinal and interval items and the Kuder-Richardson formula 20 (KR-20) was used for dichotomous items.

RESULTS

Content Validity

The items in the Scales for Reproductive Health Attitudes and Behavior (RHAB) were directly taken or modified from the validated "Pregnancy and Diabetes Interview Schedule", a theory-based questionnaire developed by Janz, et al.¹³ The theoretical items were developed to measure the primary constructs of the three theories patterned after standard items of those theories. The original theorists confirmed content validity of the original instrument.^{4,13} Direct contact was made with experts involved in the development of the three theories: HBM (M. Becker, PhD), TRA (M. Fishbein, PhD), and SCT (A. Bandura, PhD), who reviewed the items representing their individual model constructs and provided feedback. Changes were made according to their recommendations.

Results from the descriptive analyses of the scales from the three theories revealed that most scale scores had mid to high ranges, indicating moderate to high levels of the underlying beliefs/attitudes the constructs represented in the theories' hypothesized directions. In particular, intention was highly skewed in a positive direction. (See Table B1 for the descriptive statistics of continuous variables from the three theories).

Criterion-related Validity

“Effectiveness of using birth control” was used as the criterion variable to evaluate the validity of all the constructs in the three theories. It was tested only in the subgroup of adolescent women who had ever been sexually active or who were dating (potential for sexual activity) ($n = 47$). Among all the constructs, only perceived benefit (standardized regression coefficient $\beta = -.03$, $p < .05$) and barriers ($\beta = -.01$, $p < .05$) were significantly related to effectiveness of using birth control. Both barriers and benefit were negatively related to the outcome variable. Although perceived barriers was in the hypothesized direction, perceived benefit was not.

Concurrent validity was also determined by the correlation of all the constructs with the criterion (outcome) variable. The significant correlations were consistent with the results from the above multivariate analysis. Perceived benefit ($r = -.29$, $p < .05$) and barriers ($r = -.31$, $p < .05$) were significantly related to effectiveness of using birth control.

Factor Analysis

Each item related to either birth control or preconception counseling. However, most constructs combined both BC and PC items together.

Based on factor extraction and eigenvalues, 7 factors were identified from the 21 items of the HBM (see Appendix for all items). These seven factors were labeled: barriers for birth control, barriers for preconception counseling, benefits, susceptibility, severity, cues to action for birth control, cues to action for preconception counseling. The percentage of the explained variance indicated that the 7 factors substantially accounted for the relationships among items in the model (66.58% of the total item variance).

Using PCA, four factors from TRA’s 11 items were extracted. The first three factors were well clustered according to the theoretical definition: subjective norm, personal attitude, and

intention, and accounted for 65.75% of the total variance. However, there was a remaining factor with an eigenvalue of 1.03 accounting for 9.39% variance and containing only one item of subjective norm (“Would you say that your boyfriend/ partner thinks you should use birth control when preventing a pregnancy; and when it comes to using birth control, do you want to do what your boyfriend/partner thinks you should do?”). One explanation as to why this item is separate is because using BC is a shared responsibility and behavior with one’s partner. This behavior must include the partner’s attitude, and therefore, is not completely under the control of the young woman.

From the 10 items of the SCT, three factors with an eigenvalue greater than 1 were identified. Most items of self-efficacy clustered into the first factor and explained the total variance of 25.13%. All preconception counseling items of outcome expectations were grouped into the second factor accounting for 17.65% of the total variance. The third factor contained only the items of birth control from both self-efficacy and outcome expectations respectively. In brief, the factor structure of SCT confirmed the theoretical underpinning.

Reliability

The results of internal consistency reliability are presented in Table B2. Acceptable levels of reliability for early instrument development were obtained from the scales ($\alpha = .60- .83$): perceived susceptibility, severity, benefit, and barriers of the HBM; personal attitude, subjective norm, and intention of the TRA; and self-efficacy of the SCT. Cues to action had a marginally acceptable level of internal consistency; however, outcome expectation was less than desired.²⁰ Overall, there was evidence of sufficient reliability for most of the scales, especially for a preliminary instrument.

Table B 2 Internal consistency reliability of scales of RHAB

Theory	Scale	Internal consistency reliability
Health Belief Model	Susceptibility	0.73
	Severity	0.77
	Benefit	0.65
	Barrier	0.72
	Cues to action	0.57
Theory of Reasoned Action	Personal attitude	0.60
	Subjective norm	0.83
	Intention	0.67
Social Cognitive Theory	Self-efficacy	0.65
	Outcome expectation	0.46

DISCUSSION

Understanding factors that affect decision-making for preconception planning is imperative to reduce the rate of unplanned pregnancies and pregnancy-related complications in women of all ages with diabetes. Previously, there were no studies or measures of preconception planning or reproductive health-related beliefs, attitudes, or behaviors of adolescent women with diabetes. Constructs from social cognition models, such as, the Health Belief Model, Theory of Reasoned Action, and Social Cognitive Theory are factors that can influence these behavioral outcomes.

Therefore, these constructs became scales of the RHAB (an adolescent-focused instrument based on a composite model from the three theories). Although this instrument is unique for adolescent women with diabetes, with minor modifications, it can have broader implications. This paper attempted to describe the theoretical underpinnings of the RHAB; identify the psychometric profile, reliability, validity, and factor structure of the instrument. Overall, RHAB appears to have sufficient validity and acceptable levels of reliability.

Given the level of expertise of the panel (developers of the three theories), the RHAB has strong content validity. The measures represented the general domains of the construct. Overall, the teens in this study selected moderate to high response scores for the constructs of the three theories.

Criterion-related validity was based on the effectiveness of using BC. Perceived barriers and benefits were significantly related to the outcome variable. These and other variables from social cognition models were found to be robust in previous studies predicting the use of BC^{5,7,8} and predicting seeking PC.⁴ In regards to barriers, future interventions should consider strategies to eliminate barriers to receiving preconception planning. However, in this study, perceived benefit was negatively associated with effective use of BC; which according to the HBM, is not in the hypothesized direction. Perceived benefit was measured as benefit to using BC and seeking PC. There was only 1 BC item and 3 PC items. Perhaps future studies could conduct analyses on these subscales separately.

Overall, the factor structure of each model represented the theoretical constructs. However, some differences were noted based on preconception care or birth control (BC and PC) items. Five factors were expected for the HBM, but 7 were identified. Perceived barriers and cues to action in the HBM were sub-clustered according to BC or PC items. These subscales should be

used to measure these constructs. Furthermore, given that barriers and cues to action differ on an individual basis, analyzing the items in each of these scales, collectively, could potentially create problems. Individuals may experience different barriers or be exposed to different cues. Therefore, analysis of single items could offer more relevant information than a general clustered construct.²¹

Three factors were expected from TRA, yet an additional isolated subjective norm item (regarding her boyfriend/ partner's opinion about using birth control) was identified. It will be retained in the subjective norm scale for theoretical purposes.

Although two factors were expected from SCT, three were identified. The third factor contained BC items from both self-efficacy and outcome expectation. This subscale can be analyzed separately or items can be added to their respective construct to form the two original construct scales.

Overall, most scales had sufficient reliability ($\alpha = >0.65$) for early stage of instrument development,²⁰ showing the unidimensionality of the scales. However, further evaluation using a larger sample and modifications based on item analyses should be conducted for “outcome expectation”. The scope of content of these items was considerably wide. Additionally, outcome expectation was composed of compounded structures, such items as, “if you do this, then you can expect that...”. Based on their level of cognitive development, some teens may not yet be capable of fully comprehending these items. For scales with borderline Cronbach coefficients alphas, problematic items were eliminated and the analyses were rerun. Our results reflect these changes, while maintaining a strong content validity.

This current study chose to measure “cues to action”. This variable can be subcategorized as internal or external cues, giving rise to diversified items. Studies⁴ have found “cues to action” to

be a significant predictor. Although this construct is rarely formally measured or analyzed, future research in this area should consider measuring “cues to action”.

This study had limitations, the first of which was the sample size. Because the population of adolescent women with T1D is relatively small, subjects were recruited from multiple sites. Despite a successful recruitment of approximately 90% of the eligible population, the sample size was small for psychometric analyses. Future testing of the instrument with larger more diverse samples of adolescents with diabetes is warranted. The second is directed to scale characteristics. Some constructs were represented by a small number of items. Cronbach’s α coefficients factor into the equation the number of items in the scales. Future modifications to the scales could be to increase the number of items per domain of each construct. Lastly, test-retest was not conducted in this study. This analysis should be considered in future research.

Because the elements of the HBM, TRA, and SCT are alterable, health professionals could individualize interventions based on a patient’s responses; and use the instrument to evaluate the effectiveness of the intervention on altering health beliefs and behaviors. As part of their patient assessment, health professionals could use scales from this instrument as pretests and posttests or to segment participants for tailored interventions. With demonstrated reliability and validity, this instrument will contribute to further understanding of the factors contributing to the decision-making process of preconception planning behavior, and evaluating interventions to improve future preconception care in young women with diabetes.

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APPENDIX

The Scales for Reproductive Health Attitudes and Behavior (RHAB)

The Health Belief Model

Susceptibility

Responding scores: 1 ☐ not at all 2 ☐ a little 3 ☐ somewhat
4 ☐ a moderate amount 5 ☐ a lot

Assuming you were sexually active:

1. How much do you worry that you could become pregnant?
2. How much do you worry that you could catch a sexually transmitted disease (e.g. AIDS, venereal disease, etc.)?
3. How much do you worry that you could develop health problems during pregnancy?
4. How much do you worry that your baby could develop health problems during your pregnancy?

Severity

Responding scores: 1 ☐ not serious at all 2 ☐ a little serious
3 ☐ somewhat serious 4 ☐ moderately serious
5 ☐ very serious

5. If you developed health problems during pregnancy, do you think that those problems would be:
6. If your baby developed health problems during pregnancy, do you think that the problems would be:
7. If you had an unplanned pregnancy, do you think that this problem would be:

Benefit

Responding scores: 1 ☐ not at all 2 ☐ a little 3 ☐ somewhat
4 ☐ a moderate amount 5 ☐ a lot

8. Would having blood sugar levels in the normal range before becoming pregnant improve your chances of having a healthy baby?
9. Would using birth control prevent an unplanned pregnancy?
10. Would seeking preconception counseling (special medical care and advice) when planning a pregnancy improve your chances of having a healthy baby?
11. Would getting preconception counseling (special medical care and advice) improve your chances of having a healthy pregnancy?

Barrier

Responding scores: 0 ☐ does not apply 1 ☐ no problem at all
2 ☐ a little problem 3 ☐ somewhat of a problem
4 ☐ a moderate problem 5 ☐ a big problem

12. How much of a problem for you is the cost of birth control?
13. How much of a problem for you is getting birth control?
14. How much of a problem for you is using birth control on a regular basis?
15. How difficult would it be to seek preconception counseling (special medical care and advice) when planning a pregnancy?
16. How difficult would it be, to follow the preconception counseling advice given by health professional (e.g. keeping blood sugar levels in normal range, taking more insulin injections, etc.)?

Cues to action

Responding scores: 1 ☐ Yes 2 ☐ No

17. Have you ever discussed how diabetes affects pregnancy with your regular diabetes health care provider?
18. Has a health care professional (doctor, nurse, etc.) ever told you that you should get special medical care and advice before you become pregnant or plan for a pregnancy? This is called preconception counseling or prepregnancy planning.
19. Has anyone else (boyfriend, parent, friend, etc.) told you that you should get preconception counseling (special medical care and advice) before you become pregnant or plan for a pregnancy?
20. Has a healthcare professional (doctor, nurse, etc.) told you that you should use some type of birth control when preventing a pregnancy?
21. Has anyone else (boyfriend, parent, friend, etc.) told you that you should use some type of birth control when preventing a pregnancy?

Theory of Reasoned Action

Personal Attitude

22. My getting preconception counseling (special medical care and advice) when planning pregnancy is (will be):

<input type="checkbox"/> Unnecessary	<input type="checkbox"/> Necessary	4 <input type="checkbox"/> Neither
1 <input type="checkbox"/> extremely unnecessary	7 <input type="checkbox"/> extremely necessary	
2 <input type="checkbox"/> quite unnecessary	6 <input type="checkbox"/> quite necessary	
3 <input type="checkbox"/> slightly unnecessary	5 <input type="checkbox"/> slightly necessary	
23. My using birth control is (will be):

<input type="checkbox"/> Difficult	<input type="checkbox"/> Easy	4 <input type="checkbox"/> Neither
1 <input type="checkbox"/> extremely difficult	7 <input type="checkbox"/> extremely easy	
2 <input type="checkbox"/> quite difficult	6 <input type="checkbox"/> quite easy	
3 <input type="checkbox"/> slightly difficult	5 <input type="checkbox"/> slightly easy	
24. My using birth control is (will be):

<input type="checkbox"/> Dangerous	<input type="checkbox"/> Safe	4 <input type="checkbox"/> Neither
1 <input type="checkbox"/> extremely dangerous	7 <input type="checkbox"/> extremely safe	
2 <input type="checkbox"/> quite dangerous	6 <input type="checkbox"/> quite safe	
3 <input type="checkbox"/> slightly dangerous	5 <input type="checkbox"/> slightly safe	

Subjective norm

Responding scores: 0 ☐ does not apply

1 ☐ not at all 2 ☐ a little of the time

3 ☐ a moderate amount of the time

4 ☐ a lot of the time

5 ☐ all of the time

25. Would you say that your husband/partner/boyfriend thinks you should use birth control when preventing a pregnancy?
26. When it comes to using birth control, do you want to do what your husband/partner/boyfriend thinks you should do?
27. Would you say that your husband/partner/boyfriend thinks you should seek preconception counseling (special medical care and advice) when planning a pregnancy.
28. When it comes to preconception counseling do you want to do what your husband/partner/boyfriend thinks you should do?
29. Would you say that your parents think you should use birth control when preventing a pregnancy?
30. When it comes to using birth control, do you want to do what your parents think you should do?
31. Would you say that your parents think that you should seek preconception counseling (special medical care and advice) when planning a pregnancy?
32. When it comes to preconception counseling, do you want to do what your parents think you should do?
33. Would you say that most of your friends think that you should use birth control when preventing a pregnancy?
34. When it comes to using birth control, do you want to do what most of your friends think that you should do?
35. Would you say that most of your friends think that you should seek preconception counseling (special medical care and advice) when planning a pregnancy?
36. When it comes to preconception counseling, do you want to do what most of your friends think that you should do?

Intention

Responding scores: Unlikely 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ Likely

37. When I have sex, I intend to always use some type of birth control to prevent an unplanned pregnancy.
38. When I have sex, I intend to use a birth control method that gives me full protection against unplanned pregnancy.

Social Cognitive Theory

Self-Efficacy

On a scale of 0 to 10, rate how confident you are, that you could regularly do each activity for at least 6 months. Choose the number from 0 to 10 that best describes your level of confidence, where 0 is not at all confident and 10 is absolutely confident.

How confident am I that I could:

- 39. Get preconception counseling before I get pregnant.
- 40. Convince my husband/partner/boyfriend that it is necessary for me to use birth control, even if he does not want me to use it.
- 41. Change my insulin and diet to keep my blood sugar levels in normal range, even if I am not yet pregnant, but planning a pregnancy.
- 42. Delay sex with my husband/partner/boyfriend if birth control is not available.
- 43. Wait on becoming pregnant until my blood sugar levels are within the normal range.
- 44. Use birth control each time I have sex when preventing a pregnancy.

Outcome Expectation

Responding scores: 1 ☐ not at all 2 ☐ a little 3 ☐ some

4 ☐ a moderate amount 5 ☐ a lot

Would you say that getting preconception counseling?

- 45. Would help you get normal blood sugars:
- 46. Would help you understand how diabetes affects pregnancy:
- 47. Would help you decide what birth control method to use:
- 48. Would you say that using birth control would help you prevent an unplanned pregnancy:

APPENDIX C. COMPARING THEORIES IN PREDICTING REPRODUCTIVE HEALTH BEHAVIOR IN ADOLESCENT WOMEN WITH DIABETES

Shiaw-Ling Wang, Doctoral Candidate, PhD, RN
Health Promotion & Development
School of Nursing
University of Pittsburgh
Pittsburgh, PA 15261

Denise Charron-Prochownik, PhD, RN
Associate Professor
Health Promotion & Development
School of Nursing
440 Victoria Bldg (P) 412-624-6953
University of Pittsburgh (F) 412-624-8521
Pittsburgh, PA 15261 dcpro@pitt.edu

Susan M. Sereika, PhD
Associate Professor
Center for Research and Evaluation
School of Nursing
University of Pittsburgh
Pittsburgh, PA 15261

Linda Siminerio, PhD, RN, CDE
Assistant Professor
Schools of Medicine and Nursing
Director
University of Pittsburgh Diabetes Institute.
601 Kaufmann Medical Building
Pittsburgh, PA 15261

Yookyung Kim, PhD
Assistant Professor
Center for Research and Evaluation
School of Nursing
University of Pittsburgh
Pittsburgh, PA 15261

Sources of support: Competitive Medical Research Fund, University of Pittsburgh; Center for Research in Chronic Disorders (NIH/NINR - # 5P30NR03924), Pilot study; and Sigma Theta Tau - Alpha Chi.

ABSTRACT

Background: Understanding factors that affect decision-making in using preconception planning is important in order to reduce the rate of unplanned pregnancies and pregnancy-related complications in all women with diabetes. Previously, there were no studies of reproductive health-related beliefs, attitudes, or behaviors of adolescent women with diabetes. Constructs from social cognitive models, such as, the Health Belief Model, Theory of Reasoned Action, and Social Cognitive Theory, are factors that can influence these behavioral outcomes.

Objective: To compare the predictive powers of these three theories in regards to decision-making with reproductive health behaviors in teens with diabetes; and to identify a composite model of the strongest predictors across all three theories.

Method: Data were collected from a telephone interview by same-gender research assistants on a sample of 87 female adolescents with type 1 diabetes (T1D) from four medical centers using the “Reproductive Health Attitudes and Behavior” (RHAB) Questionnaire. Measures represent demographic, psychosocial, constructs of the three theories, and behavioral outcomes. Standard multiple regression analyses were used to examine the prediction of the three theories in the outcome variable (intention for using birth control).

Results: Among the three theories considered, HBM had the overall highest variance explained (24.4%) in the intention to using birth control. The best composite model consisted of perceived barriers, cues to action, and self-efficacy (26.1% of the variance in intention explained). Perceived barriers, cues to action and self-efficacy were also the strongest predictors among all constructs considered.

Conclusion: In this sample of adolescent females with T1D, the strongest predictors from the three theories in intention to using birth control appeared to be perceived barriers, cues to action,

and self-efficacy. Intervention studies to decrease future unplanned pregnancies in this high-risk population could focus on strategies to target these factors that are amenable to change.

Keywords: adolescent, diabetes, birth control, Health Belief Model, Theory of Reasoned Action, Social Cognitive Theory

Introduction

Adolescent women with diabetes are at high risk for an unplanned pregnancy with perinatal complications (1). Therefore, it is imperative to understand the factors affecting their decision-making in performing effective reproductive health behaviors with the purpose of preventing unplanned diabetic pregnancies. Demographic, psychosocial, and cognitive characteristics of adolescents with diabetes may interact with each other and impact the decision-making process of family planning behaviors (2, 3). It is believed that theory-based predictors, especially cognitive factors, would provide a systematic basis for explaining the determinants of reproductive health behavior and behavioral change (4). Three established social cognitive models (SCM: the collections of psychosocial cognitive behavioral theories) (4), the Health Belief Model (HBM) (5), Theory of Reasoned Action (TRA) (6), and Social Cognitive Theory (SCT) (7) are used frequently in predicting health-related behaviors of adolescents. These theories postulate that the decision-making of a behavior depends on the adolescent's social cognitive characteristics and their interrelationships. All three theories provide a clear theoretical framework which presents a map to guide research in selecting, defining, and measuring variables and interpreting results. They also share a similar conceptual approach, expectancy-value theory, which assumes an individual is apt to initiate the behaviors that are associated with high value expectancy. Additionally, these theories are rooted in SCM (8), with a strong emphasis on the role of cognitive operation upon decision-making processes that underlies and precedes the behavior. Although empirical literature has demonstrated good predictive utility in this context (9, 10, 11, 12, 13, 14), there is still no consensus that any certain model is more precise than the others, or that certain variables (across models) are more influential than others. To date, most studies (11, 12, 14) have examined the ability of predicting family planning by

using a single theory in one study. None have compared the efficacy in predicting family planning behavior in adolescents across these three theories.

According to the HBM, the probability of a person performing a particular health-related behavior depends on his/her perceptions of susceptibility to the health threat, the severity of the threat, the benefit to action, and the cost of the behavior (5). In addition, these perceptions are influenced by internal or external cues to action (15). The TRA postulates that intentions represent a person's motivation to perform a behavior. Furthermore, intention to perform an action is influenced by two forces: 1) the person's own attitude toward taking the action, and 2) the person's view of the social expectations of specific significant others with regard to the behavior (subjective norm) (6). Bandura's SCT (7) defines self-efficacy as the person's self-belief in performing a particular behavior and in overcoming obstacles to that behavior. Bandura's SCT (7) suggests that the intention to engage in a certain behavior is associated with the strength of confident belief in one's personal efficacy. Self-efficacy is assumed to have crucial impacts on both stages of motivation and action control in behavioral change, and therefore, the only construct from this theory chosen for this study.

Each theory provides a unique perspective of the decision-making process carried out by adolescents with diabetes who are or will be performing reproductive health behaviors. Individually, all three theories have been found to be useful in explaining and predicting family planning or sex related-behaviors in the general population (11, 12, 14). To date, only a few studies have tested these theories against one another in predicting general sexual behaviors (16). Together these theories incorporate several cognitive variables which have been found to be highly predictive of sex-related behaviors, such as reproductive health behaviors (4). Composite models consolidate variables and enhance the predictive power of the model. Therefore,

combining theories incorporates the best feature from different theories and appears to be a constructive approach (17, 18). Some studies (2, 19) combined constructs from two or three theories to examine reproductive health behaviors in adult women with diabetes. No studies, however, have compared the full models of the three theories, nor have they combined constructs to predict reproductive behaviors in teens with diabetes.

For the purpose of this study, we chose intention as the outcome variable. Less than half of the subjects in this study had not yet been sexually active; and had no experience with the actual outcome behaviors (reproductive health or sex related-behaviors). Therefore, to include as many subjects as possible in the analyses, intention was the terminal outcome. This selection was also supported theoretically. For the HBM, “likelihood to action”, the model’s outcome variable, has been operationalized as intention. In the TRA, intention is an important mediator between attitude and behavior. Lastly, in SCT, self-efficacy impacts the motivational stage (intention) of behavior.

The purpose of this study was to conduct a comparative analysis of the relative strength of these three theories in predicting decision-making with the intention for reproductive health behaviors in teens with diabetes; and to identify the best composite model to predict reproductive health behaviors among the strongest constructs across all three theories. The research questions were: 1) What theory was the best predictive model in explaining the intention of performing reproductive health behaviors?, 2) What constructs of the three theories were the strongest predictors for the intention of performing reproductive health behaviors?, and 3) What is the best composite model to predict the intention of performing reproductive health behaviors among constructs from the three theories?

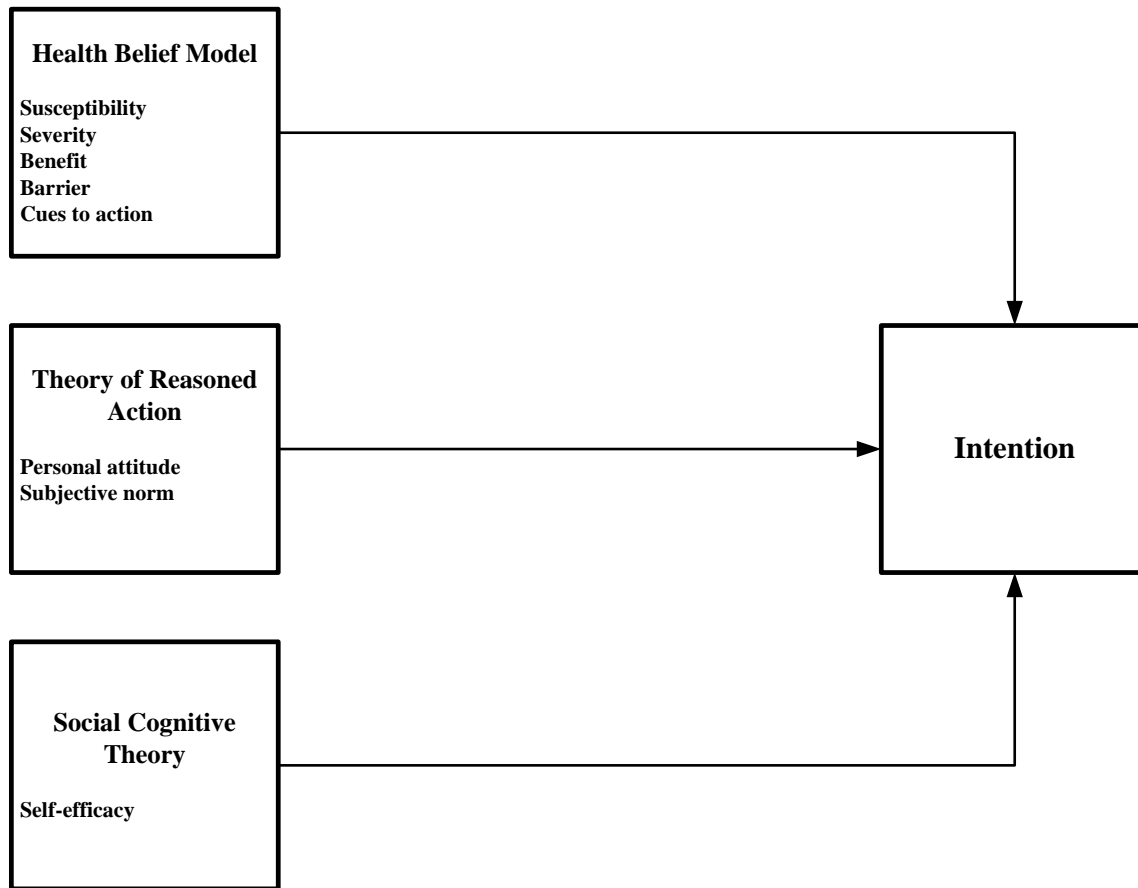


Figure C 1 Conceptual model of intention for reproductive health behavior

Methods

Design

This secondary analysis was conducted on cross-sectional data that were collected in an exploratory case-control design, (design described detail in Charron-Prochownik, 2001) (1) from a study called, “Family Planning Decisions and Behaviors in Adolescents with IDDM”. Data were collected during a one-hour structured telephone interview. Interviews were conducted by trained, same-gender research assistants from the main project office at the University of Pittsburgh. Approval from each Institutional Review Board was obtained (1).

Sample

Subjects consisted of 87 adolescent women with T1D, recruited from four major university-based pediatric diabetes clinics located in Pittsburgh, Pennsylvania; St. Louis, Missouri; Boston, Massachusetts; and Detroit, Michigan. Eligibility included female patients between 16 to 22 years of age; who had no other chronic illnesses or mental retardation; were not pregnant; and had T1D for at least 1 year.

Subjects had a mean age of 17.9 years ($SD = 1.26$, range=16.1 to 21.4 years). All were single females, and 36 (41.4%) reported having a current boyfriend/sexual partner. Consistent with the prevalence of type 1 diabetes (20), the majority of subjects were Caucasian ($n = 76$, 87.4%). Fifty-eight (66.7%) were attending high school, 18 (20.7%) had only a high school diploma, and 11 (12.6%) were in college or technical school. Subject households tended to have incomes of $>\$20,000$ per year ($n = 45$, 51.7%). Forty-six (52.9%) subjects were Roman Catholic and twenty (23%) were Protestant. The average duration of illness was 8.51 years ($SD = .46$, range= 1 to 17 years).

Measurement

Reproductive Health Attitudes and Behavior (RHAB) had items and scales representing the theories. These items were directly taken or modified from the validated “Pregnancy and Diabetes Interview Schedule”, a theory-based questionnaire developed by Janz, et al. (19). This questionnaire was used to define socio-demographic characteristics, medical factors, knowledge, attitudes, and health-related behaviors that distinguish women with diabetes who seek preconception care from those who seek care only after conception. For women with diabetes, reproductive health behavior should include preconception counseling and care (PC). Because birth control (BC) can be discussed and could be obtained during PC visits, the items in the questionnaire refer to both BC and PC.

The RHAB consists of nine scales (constructs from three major theories), with a total of forty-four items. All items and response scale were modeled from the original theorist’s instrument. **Health Belief Model** included five scales: susceptibility (4 items), severity (3 items), benefits (4 items), barriers (5 items), and cues to action (5 items). Two scales are in **Theory of Reasoned Action**: personal attitudes (3 items) and subjective norms (12 items). The scale in **Social Cognitive Theory** used in this study is self-efficacy (6 items). Most of the items are ordinal data, scored on a Likert-type scale, except cues to action, which used a dichotomous scale (yes/ no). Each construct has a composite score and higher summative scores reflect higher positive anchor of the constructs. **Outcome variable**: intention (2 items), intention was operationalized as a composite score from 2 items, namely, the individual’s intent to always use a birth control method when having sex, and to always seek medical care and advice when planning a pregnancy. Covariates included the following continuous variables: age and duration of diabetes.

Content validity was obtained by direct contact with the developers of the original theorists: HBM (M. Becker, PhD), TRA (Fishbein, PhD), and SCT (Bandura, PhD). Each reviewed the items and provided feedback (19). Acceptable levels of reliability for preliminary estimates from the pilot study were obtained from the scales (Cronbach's α coefficients = 0.56-0.83), except cues to action (21). The questionnaire can be seen in its entirety in the paper of Charron-Prochownik et al. (21).

Data Management and Statistical Analysis

Questionnaires were processed by trained research assistants using Teleform (version 6.0, Cardiff Software, Inc, San Marcos CA, 1996) and Paradox Data Management System (Borland International Inc., Scotts Valley, CA, 1992). All statistic analyses were performed using SPSS for Window (Version 12.0, SPSS, Inc., Chicago, IL).

Correlation coefficients were computed to test the relationships among constructs and outcome variable. In addition, the correlations of demographic variables (age and duration of diabetes) and outcome variable were also evaluated. The Pearson product-moment correlation coefficient was used between two continuous variables with normal distributions and Spearman's rank-order correlations were used with non-normally distributed variables. Correlations were used to confirm the selection of variables used in the composite model.

Standard regression analyses were conducted to examine the predictive utility of the three theories and the relative contribution of the constructs of these theories with respect to intention to use birth control of the teens with diabetes. In this analysis, all variables were entered into the regression simultaneously. Adjusted R^2 was used in describing the prediction of each theory. Evaluation of the effect of each construct: the indices of regression coefficients were used. To

meet the assumption of normality of the linear regression model, a square root transformation was performed on the scale of perceived barriers. No multicollinearity was found by examining the indices of variance-inflation factor (VIF), tolerance and condition indices. The composite model was built by including the variables that were significant in regression analyses. Lastly, the efficacy of the composite model was also assessed by using standard regression analysis.

Results

Inter-correlations among Constructs of Theories

Results of the inter-correlational analyses revealed several significant inter-relationships among constructs of the three theories. Perceived susceptibility had a significantly positive relationship with perceived severity ($r = .33, p < .01$), barriers ($r = .30, p < .01$) and cues to action ($r = .23, p < .05$). Perceived benefit of using birth control was significantly related to positive personal attitude about using birth control ($r = .29, p < .01$). Perceived barriers had several significant correlations across the three theories, including a positive association with cues to action ($r = .26, p < .05$) and subjective norm ($r = .27, p < .05$), but a negative association with self-efficacy ($r = -.29, p < .01$). Cues to action had a positive association with personal attitude ($r = .27, p < .05$) and subjective norm ($r = .32, p < .01$). The results are presented in Table C1.

Table C 1 Inter-correlations among constructs of theories

	susceptibility	severity	benefit	barrier	cues to action	personal attitude	subjective norm	self-efficacy
susceptibility	—							
severity	.33**	—						
benefit	.16	.17	—					
barrier	.30**	.20	.18	—				
cues to action	.23*	-.00	.10	.26*	—			
personal attitude	.18	.19	.29**	.03	.27*	—		
subjective norm	.13	.20	.20	.27*	.32**	.11	—	
self-efficacy	-.08	.10	-.02	-.29**	-.10	.02	-.07	—

* $p < 0.05$, ** $p < 0.01$ (2-tailed)

Correlations between Constructs and Outcome Variable

For the HBM, cues to action was significantly related to intention to perform reproductive health behaviors ($r = .44$, $p < .01$), whereby, more cues about reproductive health behavior were correlated with greater intention to use it. From the SCT, greater intention was positively correlated with higher levels of self-efficacy ($r = .22$, $p < .05$). However, none of the constructs from the TRA and demographic variables were found to have significant relationships with the outcome variable. The results are presented in Table C2.

Table C 2 Inter-correlations of constructs of three theories with intention

Theory	Constructs	Correlation coefficient
Health Belief Model	Susceptibility	-.06
	Severity	-.10
	Benefit	-.10
	Barriers	-.15
	Cues to action	.44**
Theory of Reasoned Action	Personal attitude	.14
	Subjective norm	.11
Social Cognitive Theory	Self-efficacy	.22*

* $p < 0.05$, ** $p < 0.01$ (2-tailed)

Prediction of the Three Theories

The regression model of HBM was significant [$F = 6.43$ (5, 84), $p < .001$] for explaining 24.4 % of variance (adjusted $R^2 = .244$) of intention to perform reproductive health behaviors in teens with diabetes. Only two constructs of HBM contributed significantly to the prediction of the model. According to standardized regression coefficients (β), the adolescent who perceived lower barriers ($\beta = -.22$, $p < .05$) and had more cues to action ($\beta = .54$, $p < .001$) was more likely to perform reproductive health behaviors. These results coincide with the hypothesized direction of the theory. The results presented in Table C3.

Although only 5.5% of the total variance of intention to perform reproductive health behaviors was explained by the SCT construct, the model was significant [$F = 5.96$, $p < .05$], and resulted in an adjusted R^2 of .055. Significant beta coefficient was obtained for self-efficacy ($\beta = .26$, $p < .05$). As expected, teens with greater self-efficacy had stronger intentions to

performing reproductive health behaviors. Results are summarized in Table C3. In evaluating the three theories, TRA appeared to be the least predictive model. TRA constructs were unable to significantly account for the variance in the outcome variable.

Table C 3 Regression analyses of HBM and SCT for intention to use birth control

Constructs	b	Std. Error	β	t	p
Susceptibility	-0.05	0.05	-0.12	-1.11	.27
Severity	0.00	0.08	0.01	0.09	.93
Benefit	-0.08	0.08	-0.10	-1.00	.32
Barriers	-0.57	0.27	-0.22	-2.14	.04*
Cues to action	0.68	0.13	0.54	5.38	.00**
Self-efficacy	-0.08	0.03	0.26	2.44	.02*

b = Unstandardized coefficient, β = Standardized coefficient

* $p < .05$, ** $p < .001$

The Composite Model

From the previous regression analyses in Table C3, the variables with significant beta coefficients were selected (perceived barriers, cues to action, and self-efficacy) into the composite model. The model accounted for 26.1% of the variance (adjusted $R^2 = 0.261$) in the teens' intention to perform reproductive health behaviors. In this model, perceived barriers, cues to action and self-efficacy were still the significant predictors in terms of effect on the outcome variable. Table C4 displays the results.

Table C 4 Regression and analysis of composite model for intention to use birth control

Constructs	b	Std. Error	β	t	p
Barriers	-0.58	0.24	-0.25	-2.49	.02*
Cues to action	0.55	0.11	0.47	4.84	.00**
Self-efficacy	0.07	0.03	0.22	2.29	.03*

b = Unstandardized coefficient, β = Standardized coefficient

* $p < .05$, ** $p < .001$

Discussion

Given the risk of an unplanned pregnancy and the seriousness of pregnancy-related complications of teens with diabetes, evaluating the effectiveness of a theoretical model in explaining reproductive health behavior is important. The major goal of this study was to compare the three SCM theories (HBM, TRA, SCT), and identify a composite model of their main constructs regarding the predictive efficacy on reproductive health decision-making of teens with diabetes. Based on the results of this study, it appears that the HBM and SCT provide the strongest determinants of reproductive health behaviors in this population. Perceived barriers, cues to action, and self-efficacy are the most influential factors in predicting intention to using birth control in this sample.

Prediction of the Three Theories

No previous studies had compared these three theories in sex-related behaviors with this particular population. The findings of our present study show that both the HBM and SCT were robust in explaining a significant portion of variance in intention to perform reproductive health

behaviors of the teens with diabetes. Furthermore, based on our results, the HBM had the highest total variance explained (24.4%) among these theories.

Our findings were similar to other studies, in that the HBM and SCT were effective in predicting sex-related behaviors of youth (11, 14, 22, 23). However, unlike some studies (12, 16), TRA was not found to be significant. One reason may be due to the complex measuring scheme of the construct personal attitude. The theoretical definition of personal attitude has two components, the evaluation of an attitude toward each behavioral outcome multiplied by the strength with which each belief is held. The resulting scores of these multiplicative components are summed up as a direct measure of the personal attitude toward the intention. However, personal attitude, for our study, was operationalized as general attitudes toward reproductive health behaviors, and were not measured as multiplicative scores. In future studies, personal attitude could be measured by the multiplicative products of behavior-specific belief and its corresponding strength.

Prediction of Constructs of Three Theories

Correlational analysis indicated that adolescent women with diabetes who had more cues and higher levels of self-efficacy tend to have greater behavioral intention. By using regression analyses, perceived barriers, cues to action, and self-efficacy were identified as jointly significant predictors for intention to using birth control for female teens with diabetes.

Our findings were consistent with previous studies of reproductive health behaviors in youth (24, 25); whereby, these results also found perceived barriers to be significantly associated with behavioral intention and birth control use. Our study also confirmed Fisher's (26) suggestion, that teens receiving a cue to action were more likely to perform reproductive health behaviors than those not receiving such a cue. For the population of women with diabetes,

similar findings were found in Janz et al.'s study (19), namely, that receiving cues to action was one of the most significant characteristics of women who sought pre-conception care. Lastly, similar to other studies (11, 16, 22, 27) (Levinson, 1986; Heinrich, 1993; Wulfert, & Wan 1993; Wulfert, Wan, & Backus 1996), our findings highlight the importance of self-efficacy in predicting sex-related behaviors.

The Composite Model

Only a few studies have used a composite model to examine the prediction in sex-related behaviors (16, 22, 28). None have explicitly focused on female teens with diabetes. Both the HBM and SCT were statistically significant in explaining behavioral intentions, suggesting that at least some of these constructs were significant predictors. A composite model, that incorporated the best features of both models, did improve prediction. The composite model included perceived barriers, cues to action, and self-efficacy. This model was the most effective in predicting intention to perform reproductive health behaviors, with slightly higher percent of explained variance than the HBM.

Although our composite model was significant, less than a third of the variance in our outcome variable was explained. This suggests that other important variables may have been overlooked, which may need to be added to the model.

Limitations

Due to the limitations of this study, caution in the interpretation is warranted. This study is a secondary analysis, and thus the data were not collected as the major focus of this paper. Studies with larger sample sizes are recommended to conduct analyses in this area of research. In addition, the original study had a cross-sectional design rather than a longitudinal design, and lacked follow-up measures of behavior, making it more difficult to determine cause and effect.

For some scales, given the level of cognitive development, perhaps younger teens may not have been able to comprehend the dual nature of some items, such as, subjective norms (subjective norm were treated as multiplicative composite scores = normative belief x motivation to comply in this study). Perhaps more simple and directive instruction should be included on the questionnaire.

For other scales, such as, perceived severity and intention, they had relatively few items. It has been suggested (29) that scales with multiple items would reduce measurement error and lead to substantially better results and. Furthermore, most of the scales consisted of both preconception care (PC) and birth control (BC) items. Therefore, items could be separated (e.g., BC items only) for future study in terms of the interests of the research area.

In this study, teens had a chronic illness, which may mediate or moderate their decisions regarding reproductive health behaviors. The parent study did not include a measure to reflect their chronic illness, such as, a physiological measure of their metabolic control (e.g., HbA1C); nor did it include an objective measure of their self management of their diabetes. Using theories similar to those presented in this study previous studies (30, 31) have found that social cognitive variables (e.g., self-efficacy, perceived benefits) influenced adherence and metabolic control. Given the potential influence of chronic illness on reproductive health behaviors, future studies should consider measuring HbA1C and the teen's adherence to their diabetes treatment regimen.

Conclusions

In this sample of adolescent females with T1D, the strongest predictors of intention to performing reproductive health behaviors, from the three theories, appeared to be perceived barriers, cues to action, and self-efficacy. Intervention studies to decrease future unplanned

pregnancies in this high-risk population could focus on strategies to target these factors that are amenable to change.

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