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Decision-Making Program for Rural Adolescents with Asthma: A Pilot Study

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In the United States (U.S.), the leading causes of morbidity and mortality in adolescents and young adults are associated with a variety of risk behaviors such as tobacco use, alcohol consumption, and other illicit drug use (Center for Disease Control and Prevention [CDC], 2007). It is concerning that having a chronic illness does not appear to protect vulnerable adolescents from risk behaviors. To set the stage for the current study, the following review provides brief snapshots of the overall status of risk behaviors in U.S. adolescents and adolescents with chronic illness, followed by an in-depth discussion of risk behaviors in adolescents with asthma.

Prevalence of Risk Behaviors in U.S. Adolescents

According to results from the 2005 national Youth Risk Behavior Survey (YRBS), during 30 days preceding the survey a total of 23% of high school students had smoked cigarettes, 43.3% had drunk alcohol and 20.2% had used marijuana (CDC, 2006). Rural environments do not appear to protect adolescents from risk behaviors. Substance use in rural areas has been increasing rapidly and reached rates equal to or even higher than those in urban areas (National Center on Addiction and Substance Abuse, 2000). According to Atav and Spencer (2002), rural adolescents are significantly more likely than urban or suburban youths to engage in risk behaviors such as frequent smoking (28%), alcohol use (12.3%) and use of other substances (14.4%).

Risk Behaviors in Adolescents with Chronic Illness

Risk behaviors are also a serious issue in adolescents with chronic health conditions. Contrary to the common assumption that a chronic condition may act as a protective factor against risk behavior, a growing body of literature has consistently indicated that risk behaviors are widespread among adolescents with various types of chronic illnesses (Bussing & Aro, 1996; Frey, Guthrie, Loveland-Cherry, Park, & Foster, 1997; Hollen, Hobbie, Donnangelo, Shannon, & Erickson, 2007; Miauton, Narring, & Michaud, 2003; Suris & Parera, 2005; Valencia & Cromer, 2000). Adolescents with chronic conditions perceive risk behavior as a normative behavior; thus, the use of risk behaviors by these adolescents can be a reflection of their eagerness to be normal (Suris & Parera, 2005). Risk behaviors add extra burden to an already vulnerable adolescent with a chronic illness, and may result in serious health consequences.

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Risk Behaviors in Adolescents with Asthma

Asthma is one of the most common chronic illnesses in children and adolescents. Studies in the U.S. report that about 12–13% of children and adolescents living in rural areas have an asthma diagnosis (Arif, Borders, Patterson, Rohrer, & Xu, 2004; Brunner, Lindgren, Langner, Williams, & Yawn, 2005; Chrischilles et al., 2004). Despite the common notion that asthma is less common or causes less morbidity in adolescents than in children, for many, childhood asthma remains a serious problem through adolescence and into adult life (Morgan et al., 2005). According to a CDC report (Brener et al., 2007) based on the 2005 YRBS, over 15% of high school students reported current asthma, of which 40% had experienced asthma attacks or episodes during the preceding 12 months. Asthma mortality among adolescents (4.4 per 1,000,000) is approximately twice that of younger children (Akinbami & Schoendorf, 2002). The high morbidity and mortality may be attributable to adolescents' counterproductive behaviors such as engaging in substance-use behaviors as well as non-adherence to treatment.

A desire to overcome the isolation of being different through approval of and conformity to peers can also make adolescents with asthma more vulnerable to risk behaviors (La Greca, Bearman, & Moore, 2002; Zbikowski, Klesges, Robinson, & Alfano, 2002). Adolescents with asthma tend to have more positive attitudes toward smoking, show a stronger intention to become smokers, and to have a self-image more closely linked to smoking than their non-asthmatic peers (Brook & Shiloh, 1993). In fact, studies have demonstrated that adolescents with asthma are more likely to smoke (Jones, Merkle, Wheeler, Mannino, & Crossett, 2006; Mo, Robinson, Choi, & Li, 2003; Precht, Keiding, & Madsen, 2003; Rhee, Hollen, Sutherland, & Rakes, 2007; Tercyak, 2003; Zbikowski et al., 2002) or at least as likely as their healthy counterparts to smoke (Kitsantas & Zimmerman, 2000; Otten, Engels, & van der Eijinden, 2005). In large population based studies in the U.S., 56% of adolescents with asthma reported lifetime smoking (ever smoked) (Tercyak, 2003), and 20% to 30% engaged in current smoking (Jones et al., 2006; Precht et al., 2003; Tercyak, 2003). A similar rate of current smoking (19.5%) was reported in adolescents with asthma living in rural areas (Rhee et al., 2007). It is alarming to note that those who failed to take their asthma medication, despite asthma symptoms, smoked nearly twice as much as those who adhered to asthma treatment (Precht et al., 2003).

Besides smoking, little is known about other types of substance use in adolescents with asthma. According to a recent study based on the 2003 YRBS (Jones et al., 2006), high school students with current asthma reported use of marijuana (26.5%) and inhalants (4.3%) at greater rates than their counterparts without current asthma (22.4% and 3.8%, respectively). Of those with current asthma, adolescents with asthma attacks tend to report more current marijuana use (27.6%), and current inhalant use (7%) than those without asthma attacks (25.8% and 2.7%, respectively). Substance use poses serious threats not only to the course of the disease but also to the overall well-being of individuals with asthma (Tashkin, 2001). Given the high prevalence of substance use in adolescents with asthma and its serious implications to the outcomes of asthma, there is a compelling need for an intervention to reduce risk behaviors in this population.

Decision Making as a Protecting Factor of Risk Behaviors

Quality decision making may protect adolescents from substance use risk behaviors by mitigating the negative influence of environmental factors such as peer pressure (Botvin, Malgady, Griffin, Scheier, & Epstein, 1998). An increase in decision-making skills has been associated with lower use of smoking in adolescents (Gersick, Grady, & Snow, 1988). Similarly, Hollen and Hobbie (1996) found poor decision making was linked to higher risk behaviors in a sample of cancer-surviving adolescents. Hence, an intervention fostering quality

decision making may assist adolescents with asthma in ameliorating the potential risk of substance use and, ultimately, promote better health status.

Janis and Mann (1982) proposed the conflict model of decision making that predicts decision making for consequential decisions that are emotionally laden and motivationally driven. The model postulates three preconditions including the amount of risk from consequences, hope for finding a better solution, and time pressure to make a serious decision. These precipitate various levels of stress which determine the individual's decision-making style. The model describes five different decision-making styles, including four non-quality styles and one quality. Through vigilant decision making, adolescents with asthma would understand that their health is equated to choices they make with respect to risk behavior, and vigilance may help maintain or promote desirable behavior of avoiding risk behaviors. Thus, it is expected that adolescents with asthma who adhere to quality decision making would ultimately abstain from engaging in risk behaviors.

Study Aims

The aims of this pilot study were to determine the feasibility of the decision-making program for adolescents with asthma and to conduct preliminary testing of the following hypothesis: adolescents receiving the intervention, framed within the context of engaging in risk behaviors and asthma and its treatment, would report improved quality decision making, reduced risk motivation, and reduced risk behaviors at 2, 4, and 6 months post-intervention compared with the control group. This study also examined whether intervention effects would vary by gender or race.

Methods

Study Design and Sample

A prospective, two-group randomized intervention study using a repeated measure design was conducted to test the feasibility and effectiveness of a decision-making program for rural adolescents with asthma in improving decision-making quality and reducing risk motivation and risk behaviors as outcomes. Four rural outpatient clinics and one high school located in Central Virginia were used to recruit eligible study subjects. Forty-one adolescents enrolled in the study were randomly assigned to either an intervention (n=20) or control (n=21) group using a computer generated random number list. Six subjects (attrition=15%) were lost to follow up over the 6-months course of the study. Consequently, 18 from the control group and 17 from the intervention group completed all data collection points. Eligibility criteria included (a) ages between 14 –20 years, (b) current diagnosis of asthma by healthcare providers, (c) no other major physical or emotional health problems, and (d) ability to understand spoken and written English. Asthma adolescents with learning disabilities, based on reports from healthcare providers or parents, were excluded because this cognitive challenge may have influenced the adolescent's ability to understand the content of the intervention and complete questionnaires.

Intervention

The computer-assisted decision-making program originally developed for cancer-surviving adolescents was modified for the current study (Hollen, Hobbie, & Finley, 1999). The program consisted of brief counseling and CD-ROM programs. The brief (about 10 minutes) counseling session was guided by a Risk Behavior Facts Sheet (RBFS) that was developed by the research team and validated by two panels of experts, including four asthma specialists and two pediatric nurse practitioners. The RBFS contained information about the harmful effects of risk

behaviors within the context of asthma and its treatment, and allowed the researchers to tailor their counseling based on asthma medications applicable to each individual.

The decision-making module and the adolescent risk behavior module were provided via laptop CD-ROMs. The time used for both modules was approximately 1 hour. The decision-making module discussed the basic principles of the decision-making model as the basis of understanding the consequences of poor decision making (Hollen et al, 1999). Characteristics of the CD-ROM, depicting 17 decisions (including engaging in smoking as well as alcohol and street drug use), include cultural diversity within the illustrations and live actors, diverse positive role models, appealing musical score, and digital effects to stimulate interest. In the module, five decision-making styles are presented using cartoon and real teen actors facing situations requiring difficult decisions. The risk behavior module (non-interactive) (Sunburst Technology, Elgin, IL) contained information about smoking and alcohol use.

Intervention boosters were mailed at 2- and 4-months contacts. The intervention booster at 2-months, which included the repetition of the decision-making module CD-ROM and a workbook, was to provide reinforcement and an opportunity to apply the information in real life situations. About 1.5 hours were used in watching the CD-ROM again and completing the workbook. An interactive CD-ROM booster was mailed at 4-months to practice adolescent substance use decisions ("Nights Out 2™" by Will Interactive, Inc. Potomac, MD). It took most participants about 30 minutes to complete this interactive module. In addition, the researchers conducted telephone follow-up interviews to assess and ensure compliance at the 2- and 4- months timepoints.

Variables and Instruments

Decision Making Quality Scale (DMQS), a 7-item Likert-type rating scale, assesses the degree to which adolescents adhere to seven quality decision-making criteria during consequential decisions (Hollen, 1994). Four response choices ranging from "not at all true" (0) to "very true" (3) are offered for each statement representing quality decision making. The Flesh-Kincaid readability index of this scale indicates a 7th grade level. The total scores range from 0 to 21. The higher the score, the higher tendency for quality decision making. Internal consistency coefficients of 0.76 and 0.86 have been reported for two cohorts of healthy high school sophomores (N=147 and 374, respectively). Cronbach alpha was .71 for the current sample of adolescents with asthma. There is support for content and construct validity for this measure (Hollen, 1994).

Risk Motivation Questionnaire (RMQ) is a 48-item survey that measures the level of motivation for an adolescent to engage in or abstain from three risk behaviors: cigarette smoking, drinking alcohol, and illicit drug use (Hollen et al., 1999). Each behavior is assessed by 16 items; 8 items on reasons of engaging (positive score) in each type of substance use, and 8 items on reasons of abstaining (negative score). Each reason is rated on a 4-point scale ranging from "not at all true (0)" to "very true (3)." The total motivation score of each substance use is calculated by subtracting the positive score from the negative score of the risk behavior. For instance, a smoking RMQ total score being greater than zero indicates an individual's more negative attitude toward smoking, which is considered desirable. Cronbach's alpha coefficients for the three domains of smoking, drinking, and drugs were .96, .97, and .96, respectively, in high school students, and construct and criterion-related validity of the RMQ has been supported (Hollen, Hobbie, Finley, & Hiebert, 2001). In the current sample of adolescents with asthma, Cronbach alphas for the three subdomains of smoking, alcohol drinking, and illicit drug use were .69, .74 and .62, respectively; and Cronbach alphas for positive and negative subdomains of all three risk behaviors were .84 and .93, respectively.

Periodic Assessment of Drug Use (PADU) consisted of three subscales (23 items) which captures the frequency and amount of smoking, drinking alcohol and illicit drugs (Barnes, Welte, Hoffman & Dintcheff, 1997). Smoking risk was calculated based on the number of cigarettes per day in the past 30 days. Alcohol use risk was computed by multiplying the combined frequency of all 3 types of alcohol (beer, wine and liquor) by the average quantity of drink per occasion in the past year. Illicit drug use risk was constructed by combining the average frequencies of 7 types of illicit drugs in the past year.

Family Information Form was devised by the researchers to collect sociodemographic information from parents. The following Information was collected: parent's gender, marital status, age, educational level, and family income level.

Medical Chart Review. Subjects' asthma severity, medications and years with asthma were collected through a medical chart review. Because healthcare providers often failed to indicate the asthma severity on the charts, researchers interviewed subjects and/or parents about their asthma symptoms during daytime and night time, and interference of daily activities due to asthma in the past 30 days. The 2002 National Asthma Education Prevention Program (NAEPP) guidelines were used in formulating interview questions to determine asthma severity for participants without the information in medical charts.

Teen Exit Interview Form developed by the research team was administered to evaluate the feasibility of the intervention. This form consisted of two components: Part I assessed the teen's perception of the degree of clarity with which the decision-making program (including the Risk Behavior Facts Sheet) was presented by the researcher; Part II evaluated the teen's perception of meeting eight program outcome criteria.

Procedure

This study was approved by the Institutional Review Board (IRB). Healthcare providers in each setting identified eligible subjects from patient/student databases. Invitation packets, including an introductory letter and the detailed description of the study, were mailed to the eligible families. Due to low turnout rates in the clinic settings, postcard reminders were mailed, and follow-up telephone calls were made by healthcare providers at the clinics. When contacts were made by interested parents or adolescents, the researchers confirmed the eligibility using screening questions prior to the appointment. The researchers met with adolescent-parent pairs at the clinics to obtain written informed consent and assent and to collect baseline data. For school subjects, researchers reviewed the consent forms with parents on the telephone, and the parents returned the signed consent forms and completed the Family Information Form prior to the researcher's contact with school subjects.

Enrolled subjects were randomly assigned to either the intervention or control group. Subjects were blind to their group assignment. After baseline data collection, the Research Assistant (RA), who was a Family Nurse Practitioner, conducted a 10-minute brief counseling session guided by the RBFS with those in the intervention group and provided the CD-ROM decision-making and risk behavior prevention modules via a laptop computer. Participants in the control group were provided a sham CD-ROM program featuring study skills which ran for a comparable time duration to the intervention program.

Follow-up data at 2-months, 4-months and 6-months were collected online, for which a unique username and password were assigned to each participant. A conventional paper-pencil data collection method was employed for 14 participants based on individual preference or online inaccessibility. At the 2-month contact, the decision-making module CD-ROM was mailed to the intervention group along with a workbook to provide reinforcement and an opportunity to apply the information in real life situations. The intervention group received another

intervention booster on risk behavior prevention by interactive CD-ROM at 4 months. The participants were instructed to complete the online questionnaires prior to the intervention booster. Compliance to the intervention booster was ensured through the RA's telephone follow-up interviews. The interview questions pertained to specific situations portrayed in the CD-ROM booster; thus, participants' inability to address the questions indicated noncompliance. Further encouragement, guidance and follow-ups were provided to those of suspected noncompliance. Two weeks after completion of the 6-month data collection, participants in both groups were contacted by telephone to complete the Exit Interview, which measured the feasibility of the study from the perspective of the teen participants.

At conclusion of the study, participants in the control group received a copy of the RBFS and the decision-making module CD-ROM. This procedure assured that all participants, regardless of group assignment, would be provided with the core components of the intervention.

Data Analysis

Data analyses were performed using SAS v9 (SAS Institute Inc). For attrition analysis and baseline group comparisons between the intervention and control groups, t-tests or Chi-square tests were obtained. The mixed general linear model was used for testing of the effectiveness of the decision-making program for rural adolescents with asthma. The mixed model readily accommodates repeated observations within individuals by modeling the covariance structure within subjects and handles missing and mis-timed observations. Group membership (measured by a dummy variable), time (the four measurement points), and the interaction of group membership and time (to determine whether either group shows a greater change over time) were used as predictors. Age and family income were also entered in the model as covariates. The literature has supported age and socioeconomic status (SES) as significant covariates for risk behavior status in adolescents; there is a higher likelihood of risk behavior in older adolescents (Bush et al., 2007) or in those with low SES than their counterparts (Bush et al., 2007; Droomers, Schrijvers, Casswell, & Mackenbach, 2005; Goodman & Huang, 2002). Planned contrasts were used to examine group differences at each time point. Frequency analysis was calculated to evaluate the feasibility of the intervention based on exit interviews conducted with the intervention group. A significance level was set a priori at <.05 for this pilot study.

Results

Attrition Analysis

Subjects who were lost to follow-up were compared with those who completed the study with regard to sociodemographic characteristics and asthma-related factors. Analyses revealed that subjects recruited from the clinical settings were more likely to drop out of the study than those from the school setting, 37% vs. 5%, respectively (Chi-square= 3.86, p=.05); and, those with shorter average years with asthma diagnosis were more likely to be dropouts than remainders, 6 years vs. 10 years respectively (t= −2.74, p=.02). No significant baseline differences were found in other major study variables for the attrition group and those who remained in the study.

Comparisons between the Intervention and Control Groups

Table 1 presents the summary of baseline comparison between the two groups with respect to sociodemographic characteristics, asthma related factors including asthma medications and severity, and major outcome variables. No significant differences were found between the intervention and control groups with respect to sociodemographic and asthma-related factors. None of the sample was identified as having severe persistent asthma, perhaps, because severe symptoms had been controlled with the use of medications. All study subjects were taking one

or more asthma medication. Short-acting beta agonists were the most commonly used single medication (n=19, 46.3%) or in combination with other medications (n=9, 22%). Twenty-five (61%) were on two or more medications. Eleven (27%) were on corticosteroid and long-acting beta-agonists in combination with other medications such as Leukotriene modifier, anticholinergic and short-acting beta-agonists. Two participants (4%) were on oral steroid in combination with long-acting beta agonist. Table 2 summarizes means and standard deviations of study outcome variables (decision-making quality, risk motivation, risk behavior) in the intervention and control groups at each timepoint

Decision-Making Quality

A mixed model for DMQS scores, after controlling for age and family income as covariates, did not show any significant group differences over time. However there was a marginally significant difference between girls and boys over time ($F_{3, 35} = 2.73$, $p \leq .06$); where girls showed improved mean scores over time while the boy's scores remained relatively unchanged. In addition, the analysis revealed a significant race difference in the DMQS scores after controlling for age and family income as covariates, with Non-Whites reporting higher mean DMQS scores ($F_{1, 35} = 6.86$, $p \leq .01$). Pre-planned contrasts revealed a trend toward significance for Whites at 2-months; Whites in the intervention group showed more improved DMQS scores than Whites in the control group ($F_{1, 35} = 3.76$, $p \leq .06$). There were no significant differences for Non-Whites.

Risk Motivation

There was a significant difference over time between groups for smoking motivation scores after controlling for age and family income as covariates ($F_{3, 37} = 3.75$, $p \leq .02$). Overall, the intervention group demonstrated significant improvement in smoking motivation (i.e., decreased smoking motivation) at 6 months while the control group showed increased smoking motivation (see Table 2). When comparing boys and girls, the group difference held true for girls at 6-months ($F_{1, 35} = 5.56$, $p \leq .02$) but not for boys. Even after race was added into the mixed model, interaction between group and time remained significant. Individual contrasts revealed a significant difference between the control and intervention group only for non-Whites at 6-months follow-up ($F_{1, 35} = 5.57$, $p \leq .02$), indicating that smoking motivation significantly decreased at 6-months for Non-Whites in the intervention group but not for Whites.

The intervention group did not differ from the control group with respect to changes in alcohol use motivation after controlling for age and family income. However, pre-planned contrasts showed that girls in the intervention group, showed a significant change in alcohol use motivation (decreased alcohol motivation) at 4-months ($F_{1, 35} = 5.39$, $p \leq .03$) and at 6-months ($F_{1, 35} = 5.98$, $p \leq .02$), while no significant group difference over time was found in the control group. In evaluating the effect of race on alcohol use motivation, a borderline to moderate significant group difference was found for Non-Whites at 4-months ($F_{1, 35} = 3.34$, $p \leq .08$) and 6-months ($F_{1, 35} = 4.18$, $p \leq .05$). Alcohol use motivation of the intervention group showed a more pronounced decrease at 4- and 6-months for Non-Whites but not for Whites.

For illicit drug use motivation, significant group difference over time was found after controlling for age and family income ($F_{1, 37} = 3.51$, $p \leq .02$). The control group reported worse drug motivation score over time than the intervention group (see Table 2). Pre-planned contrasts between the two groups at each time point revealed that the intervention group had significantly higher scores (decreased drug use motivation) at 2-months ($F_{1, 37} = 4.37$, $p \leq .04$) and at 6-months ($F_{1, 37} = 6.96$, $p \leq .01$). The difference was more pronounced at each follow-up point for girls than for boys and for Non-Whites than for Whites.

Risk Behaviors

There was no significant group difference by time in smoking risk (average numbers of cigarette), alcohol risk or illicit drug use risk after controlling for age and family income. In relation to the pre-planned contrasts, a group difference in alcohol risk was found at 6-months only in Non-Whites ($F_{1, 35} = 4.09$, $p \leq .05$). Decreasing alcohol risk in the intervention group was more pronounced at 6-months for Non-Whites than for Whites. Pre planned contrasts also revealed that females in the intervention group showed a more pronounced decline in the risk of illicit drug use at 4-months than controls ($F_{1, 35} = 4.43$, $p \leq .04$).

Feasibility of the Intervention

Feasibility of the decision-making program was assessed using the brief Exit Interview Form. As presented in Table 3, most subjects in the intervention group who responded to the exit interviews rated positively, over 80%, all of the 11 items of the checklist, providing evidence of the feasibility and a promising program as perceived by the adolescents.

Discussion

Decision making has been viewed as a concept pertinent to adolescent health behavior for several decades (Hammes & Duryea, 1986), and it has been demonstrated that adolescents can learn decision-making skills related to health choice (Duryea, 1986; Hollen et al., 1999). In an attempt to enhance quality decision making, this pilot study implemented a decision-making intervention to rural adolescents with asthma. As expected in this preliminary testing phase, this pilot study did not detect an overall effect for the decision-making intervention in improving participants' decision-making quality over time because it was not powered as such due to prohibitive costs. This non-significant finding is somewhat consistent with a previous study by Hollen et al. (1999) implementing a similar intervention to cancer-surviving adolescents, but which used a time interval of 12 months versus 6 months as in this current study. Even in that study, significance was reached for decision making at 1 month and 12 months, but there was only a trend (p=0.10) at 6-months. Similarly, in a study by Tyc's et al. (2003), there was no effect at 6-months and a delayed effect at 12 months for a risk-counseling program related to tobacco use for 103 teen cancer survivors. Thus, the length of time for evaluation may have been a factor affecting these findings. In addition, the failure to support the finding for the previous study targeting cancer-surviving adolescents using a similar decision-making program may have been accounted for in part by the difference in the chronic illnesses. Although cancer is now considered a chronic illness, it is considered more life-threatening than asthma. It could be reasoned that adolescents with the experience of a serious health condition such as cancer may respond more readily to the intervention and become better decision makers than those with a less serious health issue such as asthma. However, it is noteworthy that this study found a trend toward significance for Whites, alluding to the effectiveness of this decision-making, which was not the case in Non-Whites. This finding may be a reflection of a "ceiling effect" in that non-Whites' reported high decision-making skills at baseline which may have not provided much room for improvement even with the intervention. Nonetheless, the possibility of a race-specific effect of the intervention cannot be ruled out. Further research can give insight into factors pertaining to race such as cultural values or beliefs that may influence adolescents' decision making.

The most distinctive effect of the intervention was found in the risk motivation variables, particularly smoking and drug use motivation but not alcohol motivation. Similarly, a previous study (Goodstadt & Sheppard, 1983) employing a decision-making program targeting the reduction of alcohol consumption in adolescents failed to demonstrate the changes in attitudes toward alcohol after implementation of the program. This might indicate that adolescents' motivation for or attitudes toward alcohol use may be more difficult to address, as adolescents

may see this drug of choice as less risky than smoking and street drug use, and may require a different approach. In this current study, adolescents receiving the intervention reported decreased risk motivation while the control group showed increased motivation to engage in risk behavior over time. It is concerning to note that adolescents' motivation to use substances becomes stronger as they age, for both boys and girls, in the absence of intervention, a trend well documented in the literature. It is worth noting that risk motivation in the intervention group was greatly improved at the later timepoint (6-months). This may be an indication that altering adolescents' motivation is a slow process requiring long-term observation (e.g., 6-months or longer) to determine the effectiveness of an intervention intended to change motivation. It is also worth noting from the findings that the intervention was particularly effective for girls; however, this gender difference may be a mere reflection of insufficient power (small number of male participants). Another interesting finding is that non-Whites were more responsive to the intervention with respect to changing risk motivation than Whites. The race difference seems somewhat contradictory to the finding that Whites benefited from the intervention in decision-making quality. The seemingly contradictory results may imply that the two race groups respond differently to each component of the intervention; that is, Whites were more responsive to the decision-making module while non-Whites were more responsive to the risk-behavior module. Another explanation is that decision making and risk motivation are distinctively different constructs and that a change in one construct does not always translate into the change in other. The gender and race differences warrant further study not only to confirm the differences but also to identify underlying mechanisms.

Effects of the intervention are less evident in reducing actual substance use behaviors. Observing the desirable behavioral changes after a risk-behavior intervention was elusive in a classic adolescent study by Goodstadt and Sheppard (1983) as well. The lack of a behavioral effect for substance use may not indicate the ineffectiveness of an intervention itself; rather it may represent the issue of the timing of the observation. Bush et al. (2007) found that adolescents' susceptibility or motivation for smoking is a strong predictor of future smoking, and Hollen (2000) also viewed risk motivation as the antecedent of risk behavior. That is, prior to behavioral changes, changes in motivation and attitude need to take place; a premise maintained in the adolescent literature. As discussed earlier, changes in risk motivation were observed in the relatively later timepoint. Therefore, actual changes in behaviors may have occurred beyond the 6-months timeframe of this study. Likewise, Goodstadt and Sheppard (1983) argued that detecting behavioral changes after interventions with a short study duration would be an unreasonable expectation. Thus, a long-term observation beyond 6 months is required to determine the behavioral effect of risk behavior prevention programs, particularly a sustained effect which is of most interest.

Overall, the current pilot study partially supported the effectiveness of the decision-making program in promoting adolescents' decision-making quality and reducing risk motivation. Potential long-term benefit of the program in reducing actual substance using behavior was also suggested. Effectiveness of the intervention needs to be re-evaluated in a study using a larger sample and a longer follow-up schedule. In line with Snow et al.'s (1992) argument highlighting the possibility of the differential effectiveness of substance use prevention programs by subgroups, this study suggests that this decision-making program yielded different effects by gender and race. It appears that the intervention was particularly effective in changing risk motivation in girls and non-White adolescents. Although such gender and race differences warrant further research using a larger representative sample, the study suggests the possibility that gender- and race-specific approaches may be needed to take into account each group's unique developmental and circumstantial factors. In addition, a future study is indicated to examine the causal paths among decision making, risk motivation and risk behavior and to determine the effectiveness of the decision-making program in improving asthma-related

specific outcomes and quality of life as a result of reducing the risk of substance use behaviors and enhancing adherence to asthma treatment and self-management.

Caution is advised in reviewing these findings due to several study limitations. As in many pilot studies, the possibility of a Type II error due to a small sample size might have explained some of the non-significant effect of the intervention program. Specifically, limited representation of male and Non-White participants needs to be taken into consideration in understanding gender and race differences and making generalizations to adolescents in these subgroups. Also, findings cannot be generalized to adolescents who live in non-rural settings. Lack of control for some of the study procedures involving the intervention boosters (for some being administered at home and others at school) and follow-up data collection (for being offered both online or paper-pencil method) may have limited the internal validity of the study. In addition, because the decision-making scale is generic in nature which is nonspecific to situations involving risk-taking behaviors, it might have not been sensitive enough to capture the potential effect of the intervention that is specifically tailored to substance use risk behaviors. If subject burden is not an issue, the counterpart decision-making scale, Decision Making Quality Inventory, developed by Hollen (1994) should be considered for use as it has a substance use situation to set the stage for 21 questions. Also, internal consistency of the study measurements, alphas ranging from .62 to .74, was somewhat lower than what was reported in the previous studies. Lastly, having relied on self-report data, the extent of under-reporting or over-reporting of substance use cannot be determined. However, it has been found that self-report is both a reliable and valid method of assessing substance use behavior in adolescents when compared to biochemical measures (Akers, Massey, Clarke, & Lauer, 1983); moreover, self-report is used for national, state, and regional adolescent substance use surveys.

Many recent studies have revealed the high prevalence of substance use among adolescents with asthma (Jones et al., 2006; Precht et al., 2003; Rhee et al., 2007; Tercyak, 2003; Zbikowski et al., 2002). Yet, to date no attempt has been directed to prevent or reduce the risk of substance use in this vulnerable population. In that sense, this study, albeit aforementioned limitations, is of great importance. Although the overall effectiveness of the intervention needs to be determined through further investigation, this study provided strong support for the feasibility of the intervention. The overwhelmingly majority of adolescents who participated in the exit interview responded that the intervention was practical, helpful and interesting, and that they understood the major concepts of the decision-making model. Goodstadt and Shepard (1983) also observed that a decision-making program for alcohol education was effective in leading adolescents to a better understanding of the concept of decision making. This current study also espoused the feasibility of applying information technology in research with adolescents in a rural setting. The computer-assisted intervention and online data collection was successfully implemented without major setbacks and favorably accepted by the participants. The application of information technology can be particularly beneficial in rural research because of its capacity to address some of challenges in conducting research in rural settings such as high recruitment costs, geographic distance, and travel constraints (Lamb, Puskar, & Tusaie-Mumford, 2001; Mann, Hoke, & Williams, 2005). The use of the Internet and other information technology in rural research can serve to overcome some of the cost, travel and geographic challenges of rural studies. In this study, 62% of the participants submitted follow-up data online for at least one timepoint, which shows promise as an approach. The benefits of using online data collection in this study included the flexibility the data collection provided to the adolescents with regard to time and place, the reduced transportation time and costs for the researchers, the reduced printing costs, and the enhanced safety of the data by eliminating the risk of losing data in the process of mailing. Given its beneficial effects and feasibility, the application of the Internet can be considered as an alternative data collection method in conducting rural research, particularly for adolescents.

Substance use behavior in individuals with asthma is particularly serious not only because it can have a detrimental impact on the course of the disease, but also it often coincides with patients' poor adherence to a treatment regimen (Bender, 2006; Precht et al., 2003). Adolescents are specifically prone to risk behavior that is viewed as part of normal adolescence and which plays major roles in development such as providing a means to gain peer acceptance, to establish autonomy from parents, to achieve a feeling of maturity, and to cope with developmental and situational stress (Jessor, 1991). Therefore, it is imperative that clinicians periodically assess the status of and susceptibility to risk behavior in adolescents with asthma and implement specific strategies protecting those who present with the actual or potential risk of substance use. This study explored the feasibility of a decision-making program as an avenue that clinicians may consider. Duryea (1986) argued that those who spend time reflecting on alternatives in regard to costs and benefits in making decisions are more likely to reach health-related decisions that are higher in quality, less susceptible to change over time and ultimately less likely to be regretted compared to those who make hasty and impulsive decisions. In fact, the workbook exercise at home that was one of the intervention components provided participants with an opportunity to reflect on multiple alternatives in terms of pros and cons within the contexts involving substance use behavior. The home workbook method can be readily adapted for clinical practice as it does not require much time at the clinic. Adolescents' motivation to engage in risk behavior can further be altered by personalized counseling that discusses the risk of substance use within the context of their specific health situation, asthma, and specific asthma medications that they are on. This pilot study demonstrated that the RBFS was a feasible approach in delivering the tailored information in less than 5 minutes, thus suggesting its clinical adaptability. The multi-media intervention modules can also be provided to adolescent patients during their clinical appointment using the kiosk set up in the waiting room. Most importantly, it is imperative for clinicians to recognize that changing (reducing) actual substance use behavior from the implementation of an intervention is a long-term process that requires continuous monitoring and guidance from health professionals for specifics related to the chronic illness in additional to the general guidance from the school and home environments.

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Table 1

Comparisons between the Control and Intervention Groups in Subject Characteristics at Baseline

		Control Group (n = 21)	Intervention Group (n=20)
Sex (F/M)		16/5	12/8
Race (Whites/nonwhites)		15/6	11/9
Family Income < $30,000		52.7%	55.5%
Age (years)	M (SD)	16.29 (1.77)	15.80 (1.24)
Years with Asthma	M (SD)	9.05 (5.38)	9.70 (4.80)
Numbers of medication	M (SD)	1.9 (1.00)	2.3 (1.03)
Asthma severity			
Mild Intermittent		47%	39%
Mild Persistent		37%	28%
Moderate Persistent		16%	33%
DMQS	M (SD)	14.76 (3.86)	14.50 (2.95)
Risk Motivation: Smoking	M (SD)	26.23 (5.78)	26.65 (4.97)
Risk Motivation: Alcohol	M (SD)	11.38 (8.23)	14.40 (6.39)
Risk Motivation: Illicit drug	M (SD)	13.75 (7.80)	17.72 (6.88)
Total # Risk Behaviors	M (SD)	0.66 (1.02)	0.40 (0.68)
Smoking Risk, Average # of cigarette/day	M (SD)	1.26 (4.39)	1.05 (3.06)
Alcohol Use Risk	M (SD)	41.52 (161.54)	8.40 (22.40)
Illicit Drug Use Risk	M (SD)	4.05 (10.63)	2.10 (9.16)

Table 2

Means and Standard Deviations of Dependent Variables by Treatment Group

	Control Group								Intervention Group							
	T1		T2		T3		T4		T1		T2		T3		T4	
Variable	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**
DMSQ Total	14.76	3.86	14.75	4.28	14.85	5.12	14.50	5.69	14.50	2.95	14.84	4.00	15.61	4.02	15.31	4.90
RMQ - Smoking	13.95	6.20	10.80	8.43	10.25	9.25	8.78	10.36	14.85	6.45	15.32	8.09	13.56	9.13	17.25	6.95
RMQ –Alcohol	11.38	8.23	8.90	10.14	5.40	7.89	5.89	8.37	14.40	6.39	13.42	9.32	12.56	12.73	12.00	9.40
RMQ- Drug	17.81	7.30	13.90	9.23	13.75	7.78	12.33	9.15	19.90	3.89	18.79	6.30	17.72	6.88	19.44	5.05
Risk - Smoking	1.26	4.39	2.50	6.39	1.55	3.65	1.69	3.82	1.05	3.06	1.61	5.01	0.58	2.35	1.28	4.99
Risk -Alcohol	41.52	161.54	30.30	81.84	13.50	43.70	7.00	21.01	8.40	22.40	12.32	33.85	19.67	52.62	18.38	44.98
Risk- Drug	4.05	10.63	1.38	3.69	3.90	9.34	3.31	9.40	2.10	9.16	0.34	0.75	0.06	0.24	0.63	1.37

DMQS: Decision-Making Quality Scale

RMQ: Risk Motivation Questionnaire

Table 3

Frequencies of “somewhat true” and “very true” to intervention criteria (n=15)

Criteria	n	%
Clear description of possible effects of risk behaviors on my asthma	13	87
Clear description of the Risk Behavior Fact Sheet	14	93
Clear description of risk behaviors to avoid based on my asthma and medications	15	100
Understand the basic decision-making theory	15	100
Believe the decision-making theory can be useful	15	100
Can explain the decision-making theory to others	12	80
Able to take steps to make an important decision	15	100
Found role-playing helpful to practice making future decision	13	87
Perceived the decision-making CD ROM program as helpful	15	100
The decision-making program was interesting	13	87
The decision-making program was helpful	15	100