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Dosage effects on health knowledge and self-efficacy amongst adolescents enrolled in a school based kidney disease prevention program

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Dosage effects on health knowledge and self-efficacy amongst adolescents enrolled in a school based kidney disease prevention program

Abstract
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Abstract

Chronic kidney disease (CKD) is a pervasive public health concern, affecting over 26 million Americans. Prevention and delayed progression of the disease is possible with early detection and treatment. School-based prevention programs are a viable option to facilitate detection and prevention of chronic diseases in at-risk youths. MIKE Program is a CKD education and prevention program that has been implemented in several schools in the Pacific Northwest. The present study aims to evaluate the effectiveness of MIKE Program in an alternative high school setting. Three groups of participants exposed to different dosages of MIKE Program (i.e., high dose, low dose, and no dose) were evaluated on measures of kidney knowledge and health self-efficacy. Results indicated that there were no significant differences for knowledge or self-efficacy between the three groups. After the high- and low-dose groups were collapsed, only one significant difference was found on a subscale of the knowledge measure. This study demonstrated that creating and evaluating positive change can be difficult, especially in an alternative school setting. Changes to program design and implementation may be necessary to effect real change in MIKE Program participants who attend a non-traditional school where there are multiple factors that affect program fidelity.

Keywords: chronic kidney disease, prevention, alternative school, health, adolescents
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Introduction

Approximately 26 million American adults suffer from chronic kidney disease (CKD) and millions more are at risk for developing CKD (National Kidney Foundation, 2012). CKD is the gradual loss of kidney functioning over time (National Kidney Foundation, 2012). It progresses through stages with the final stage being end-stage renal disease (ESRD). ESRD requires dialysis or a kidney transplant for the patient to survive, although many patients with CKD are more likely to die than to reach ESRD (Centers for Disease Control and Prevention [CDC], 2010). Risk factors for CKD include diabetes, hypertension, obesity, and high cholesterol (CDC, 2010). African Americans, Hispanics, Pacific Islanders, Native Americans, and older adults have a higher risk of developing CKD (National Kidney Foundation, 2012). Fortunately, the onset of CKD can be prevented and the progression can be delayed with early detection and treatment (National Kidney Foundation, 2012). People with multiple risk factors can make healthy lifestyle choices such as exercising, eating a healthy diet, reducing stress, and drinking more water (Lascano, Schreiber, & Nurko, 2011). The key to preventing CKD is early detection and education about the disease.

Because prevention and early intervention are critical to eliminating CKD, programs for youth that focus on the risk factors for CKD are essential. Although many federal organizations and private foundations recognize the need to prevent obesity and promote healthy lifestyle choices including improved diet and exercise, programs to address these considerations in youth vary widely (Stice, Shaw, & Marti, 2006). Noteworthy programs include “Let’s Move!,” (2010) a program funded by the USDA and other federal agencies launched by Michelle Obama in 2010, and “Just for Kids!” (Balboa Publishing Company, n.d.).
The proposed study investigates one program to prevent CKD, Multicultural Kidney Education Program (MIKE Program). This program is about 7 years old and has been used in different school settings with varying success. One of the critical components for the success of MIKE Program is the extent to which students fully participate in all aspects of the program. Thus, one of the questions being addressed in this study is the effect of program dose on measured outcomes. This study investigates the question of whether youth receive benefit from MIKE Program when they are unable to fully participate in it. Two of the targeted outcomes of MIKE Program are increased knowledge and improved health self-efficacy (HSE). HSE is considered an important precursor to healthy lifestyle change (Ajzen, 1991). In contrast, health knowledge appears to be a necessary but not sufficient condition to create change (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003). Thus, both HSE and health knowledge are a focus of the current study as a thorough understanding of these constructs is warranted.

The following literature review provides detailed information on MIKE program, its objectives, and targeted outcomes. The next section addresses the consideration of dose by reviewing studies pertaining to the question of how much of a program is necessary (i.e., how much is enough?) to effect a change. Finally, the last section of this review focuses on health knowledge and HSE.

**MIKE Program**

Multicultural Integrated Kidney Education Program (MIKE Program) is a school-based health education program designed to encourage at-risk youth to become ambassadors of kidney health within their local communities. The purpose of MIKE Program is to educate youth about kidney health, empower them to make healthy decisions in their lives and ultimately, to prevent
CKD. Participants learn about how the kidney functions, what CKD is, and what they can do to prevent CKD (MIKE Program, 2013).

MIKE Program was designed for disadvantaged youths who are at risk for developing CKD. CKD can be delayed and even prevented if at-risk individuals can be identified early enough, but at-risk populations are receiving intervention too late to see any major benefits (Schoolwerth et al., 2006). According to data from the United States Renal Data System (USRDS, 2012), advanced age is associated with CKD and prevalence rates in younger people are low; so programs are best aimed at young people whose health choices will have a more preventive impact than older people who have already developed the disease. MIKE Program is targeted to adolescents in high school who are between the ages of 14 to 22 (Li, 2010). This represents an age group that is at a critical period for making healthy lifestyle decisions (MIKE Program, 2012).

As stated above, ethnic minorities have a high risk of developing CKD. While prevalence rates of older African Americans recently began to decline, African Americans aged 20-39 are still about 3.8 times more likely to develop CKD than their Caucasian counterparts (USRDS, 2012). The largest ethnic groups represented in MIKE Program participants are Latinos and African-Americans (Li, 2010; Fancher & Soliday, n.d.; Gonzalez-Maddux, n.d.), two groups that are at increased risk for developing CKD.

MIKE Program supports Project Based Learning (PBL) that engages students in activities such as field trips, group projects, and community service to help them learn about kidney health. Research on PBL theory indicates that PBL programs are as good as or slightly better in demonstrating gains in academic achievement than traditional didactic models (Geier et al.,
2008). Thus, the emphasis on PBL in MIKE Program may increase the level of knowledge and change seen in the participating youth.

**Program Delivery.** MIKE Program is delivered in the school setting by a site-based facilitator, staff from MIKE Program, and adult mentors. Adult volunteers serve as mentors within MIKE Program who are matched with a group of students. Mentors are typically healthcare professionals or students in the healthcare field who reinforce curriculum, chaperone field trips, and model healthy behaviors. Under the direction the site-based facilitator, MIKE program is currently implemented in the health classes of two high schools (one traditional and one alternative school) and also as an after school program at an alternative high school. The duration of MIKE Program depends on how long and often students meet with mentors, which is dependent on the setting.

**Curriculum.** MIKE Program was designed to be flexible in its implementation so that it can be utilized in a variety of settings such as school health classes or within an after school program. The timeline of the program is dependent on the setting, but generally takes one high school semester (MIKE Program, 2011). The program includes nine units that include an introduction and closing, and lessons on chronic disease and prevention; healthy eating; physical activity; alcohol, tobacco, and other drugs; mental, social, and emotional health; sexual health; and violence (MIKE Program, 2011). Each unit contains a number of 50 min “sessions” (for a total of 95 sessions). The curriculum also includes essential activities, such as community service, a community project, field trips to a dialysis center, and a trip to a local grocery store to learn how to read labels and make nutritious food choices, which mentors coordinate for their groups.
Program Evaluation and Outcome Assessment. In order to evaluate MIKE Program, participants complete a series of questionnaires at the start of the program and again after they complete the program. The two main measures within this questionnaire include a health knowledge quiz and a healthy behaviors questionnaire.

Dose and Outcomes of Preventive Interventions

One of the challenges in conducting preventive interventions with low-income minority adolescents is attendance and participation. School-based health prevention programs can vary in how they are implemented, which can affect the effectiveness of the program. Since time is limited during the school day, it is important to implement programs that are time-effective and maximally impactful. An integral part of program design is to know how much of the program is needed to effect change without being overly lengthy. Dose-response can help determine this information. Dose can be operationally defined in a multitude of ways such as number of sessions attended, amount of program taught, or overall duration of the program. In this study dose is defined as attendance rates.

Many research studies support the idea that higher doses of a program are associated with better outcomes. In a meta-analysis of program implementation, Durlak and DuPre (2008) examined 59 studies that reported the relationship between dose and outcome. Results showed that in 76% of the studies, there was a significant positive relationship between higher dose and positive program outcome.

August, Egan, Realmuto, and Hektner (2003) found that higher attendance rates were associated with better program outcomes for children with aggressive behavior problems. Specifically, each week of attendance at a summer program was associated with a gain of .045 standard deviations in a measure of social competence. Increases in academic achievement and
decreases in aggressive behavior were associated with higher attendance rates, but only for children with mild to moderate levels of aggression; these findings did not extend to children with extreme levels of aggression. Similar risk group differences were found in a study of a substance abuse prevention program; dose was significantly associated with outcome measures only for low-risk students. One reason for this risk group difference may be that the intervention was started after the subjects displayed the target disease or behavior; thus, results may be different in prevention studies with subjects who have not yet displayed the target disease or behavior.

While higher doses may be associated with better outcomes, it is important to know how much of a program can affect those outcomes. Durlak and DuPre (2008) found that perfect implementation is rare and that implementation rates of 60% typically yield positive outcomes. They also found that most programs did not exceed implementation rates of 80%. It is important to note that since this was a meta-analysis, implementation was defined in a multitude of ways across studies. However, studies that measured implementation as dose, and this was defined by attendance rates, were included in the comparisons.

In summary, research suggests that greater attendance, dose, and program implementation appear to have a positive effect on program outcomes. Unfortunately, studies on health prevention programs are lacking. Health prevention programs cannot be assumed to be the same as other mental health programs, thus, school-based health prevention programs may be similar to or different from the studies reviewed.

As noted previously, targets of change in MIKE Program are many, but two constructs consistently measured in evaluations of MIKE Program include health knowledge and health self-efficacy. These factors are reviewed in detail in the following sections.
Health Knowledge

One of the outcomes of MIKE Program is students’ knowledge of kidney function and kidney disease. Knowledge is important not only because students receive high school course credit for MIKE Program as a part of a health class, but also because students need to be informed so that they can make healthy decisions, which will help prevent future kidney disease. As a part of MIKE Program, students’ kidney health knowledge is measured by the Whiz Quiz, a short multiple choice instrument taken at the beginning of the program (i.e., pre-test) and at the end (i.e., post-test). Higher scores on the post-test indicate that the student gained knowledge throughout the course of the program.

Assessment of knowledge in prevention programs is not uncommon. School-based prevention programs such as MIKE Program have been shown to be effective in increasing knowledge among participants (Muehlenkamp, Walsh, & McDade, 2010; Newton, Andrews, Teesson, & Vogl, 2009; Perry, Stigler, Arora, & Reddy, 2009; Fitzpatrick, 2011). Most programs assess knowledge as one component of an effective program.

A study of a school-based program designed to improve high school students’ knowledge of the warning signs of non-suicidal self-injury showed that the program significantly increased the students’ knowledge (Muehlenkamp et al., 2010). Another school-based program aimed at preventing substance use in adolescents was shown to be effective at increasing participants’ knowledge of alcohol and cannabis (Newton, et al., 2009). This program was also effective at decreasing participants’ alcohol and cannabis usage as compared to a control group who did not participate in the program. Similarly, a study in India showed that a school-based tobacco prevention program effectively increased participants’ knowledge of the health effects of tobacco use in both high- and low-income schools (Perry et al., 2009).
Knowledge gained and dose of a program are often linked together. Fitzpatrick (2011) found that students who received a higher dose of a cardiovascular disease prevention program showed higher increases in knowledge than students who received lower doses. In this study, high school students were randomly assigned to one of three treatment conditions based on amount of exposure to the program; students in the “minimal” group attended one 90-min session, students in the “moderate” condition attended ten 90-min sessions, and students in the “intense” condition attended twelve 90-min sessions. Students’ baseline knowledge did not differ significantly between conditions before starting the program. Overall knowledge was significantly higher in the “moderate” and “intense” conditions than in the “minimal” group after completing the program. Further, students in the “intense” condition showed higher levels of knowledge than the “moderate” and “minimal” conditions. As expected, students in the “moderate” condition also showed higher levels of knowledge than those in the “minimal” condition. Level of knowledge was determined by examining the level of difficulty of the items answered correctly. This study not only showed that school-based prevention programs can effectively increase overall knowledge, but that higher dosages are associated with higher overall knowledge gains as well as higher levels of knowledge. Thus, school-based health prevention programs appear to have a strong ability to improve student knowledge about the topics being prevented.

Knowledge and Health Behavior Change

While school-based prevention programs can be effective at increasing participants’ knowledge, it is also critical that this knowledge leads to behavioral changes. Several models of health behavior change exist in the literature. One such model is the Knowledge-Attitude-Behavior model, referred to as KAB. The basis of the KAB model is that knowledge increases
gradually which causes attitudes to slowly change which, in turn, cause behaviors to change (Baranowski et al., 2003). Many researchers have found that the relationship between knowledge and behavior change is weak (Fitzpatrick, 2011; Rimal, 2001; Baranowski et al., 2003). However, these researchers did discover that self-efficacy can serve as a mediating factor in the relationship between knowledge gains and behavior change. For this reason, health self-efficacy is an important construct to consider when evaluating relations between knowledge and health behavior change.

Self-efficacy

Self-efficacy is one’s perceived ability to perform a specific behavior (Bandura, 1982). Because self-efficacy is a perceived ability, it may not be a true reflection of actual ability and because self-efficacy varies across different behaviors, it should not be considered a global personality trait (Strecher, DeVellis, Becker, & Rosenstock, 1986). It is important to examine self-efficacy because people are more likely to change their behavior if they believe they can realistically make the change (Bandura, 2001). The primary type of self-efficacy being investigated in this study is health self-efficacy (HSE) or the perceived ability to make healthy lifestyle changes. In MIKE Program, participants self-report perceived efficacy for specific health behaviors such as eating healthy foods, exercising, and reducing stress.

Studies of adolescent HSE are relatively limited and are typically examined in the context of health behaviors and/or treatment adherence. In a study of adolescents with diabetes mellitus, lower levels of self-efficacy were related to lower levels of treatment adherence (e.g., checking glucose levels and taking insulin; Littlefield et al., 1992). Gilchrist and Schinke (as cited in Rosenthal, Moore, & Flynn, 1991) found that acquiring specific skills was associated with higher levels of self-efficacy in teenagers, following a skills-based training for contraception use.
There are four main factors that contribute to self-efficacy: performance accomplishment (i.e., learning how to perform the behavior), vicarious experience, verbal persuasion, and physiological state (Strecher et al., 1986). Performance accomplishment is the most reliable and salient predictor of self-efficacy and it is the most prominent factor addressed by MIKE Program. Performance accomplishment is embedded in MIKE Program through its emphasis on project-based service learning and skill building, such as learning how to read food labels. In one study of performance accomplishment that compared adolescents’ performance self-efficacy scores in a “process” group (i.e., they were taught how to do a task) to adolescents’ performance self-efficacy scores in a “product” group (i.e., they were told to get the work done), significant differences were found favoring youth in the process group. Youth in the process group demonstrated higher self-efficacy after completing the task (Schunk & Meece, 2006) than those in the product group. Thus, the process group increased students’ performance accomplishment, as they were taught new skills, thus increasing their self-efficacy. This is an important consideration for MIKE Program, as it follows a Project-Based Service Learning model. MIKE Program addresses performance accomplishment through mentors teaching participants how to engage in healthy behaviors such as reading food labels and creating a service project for their community (MIKE Program, 2011). Overall, it may be that MIKE Program creates change through performance enhancement and accomplishment as students learn new skills in a process model. However, the answer to this question is beyond the scope of the current study.

**Self-Efficacy and Health Behavior Change**

The theory of planned behavior (TPB) is a model of behavior change that includes self-efficacy, or perceived behavioral control, in conjunction with behavioral intention and subjective norms, that is used to predict behavior change (Ajzen, 1991). TPB is an extension of the theory
of reasoned action (TRA), which included behavioral intention, but did not take into account subjective norms and self-efficacy (Conner & Armitage, 1998). The addition of self-efficacy to this model increases its applicability to complex, goal-driven behaviors, such as the MIKE Program goals of eating nutritious food, exercising, and increasing water consumption (Conner & Armitage, 1998; MIKE Program, 2011). Marcoux and Shope (1997) found that, in a sample of adolescents, TPB accounted for 26% of the variance in alcohol use, 30% of the variance in misuse of alcohol, 38% of the variance in frequency of use of alcohol, and up to 76% of the variance in intention to use alcohol. Although MIKE Program does not measure subjective norms in its participants, and behavioral intention is not a focus of this study, HSE is a critical component measured and targeted in MIKE Program (2011). A focus on changing HSE is an important step in fostering behavior change, especially because these behaviors are more complex for at-risk youth who have less access to resources.

**Context of the Current Study and Research Hypotheses**

Traditionally, MIKE Program has been successfully implemented in a four year college preparatory high school, with participants showing improved health self-efficacy and knowledge of CKD (Li, Sage, & Neal, 2012; Sage, Li, & Neal, 2012). The program was extended to an alternative high school and an after school program, but attendance has been poor due to the program being an optional part of the curriculum (Cheryl Neal, personal communication, September 6, 2012). The current project aims to compare the effectiveness of MIKE Program between three groups of students at an alternative high school who received different doses of the program to determine if dose affects the positive outcomes of the program. Two outcomes are being compared, health knowledge and health self-efficacy. It should be noted that in the current study, no pre-test data was available from the alternative school program.
Specific research hypotheses for this study include the following:

1. It is hypothesized that the participants in the full MIKE Program (HMP; high dose) group will achieve higher self-efficacy scores than the participants in the “some MIKE Program” (SMP; low dose) and “no-MIKE Program” (NMP; no dose) groups, indicating higher self-efficacy levels for health behaviors taught in MIKE Program.

2. It is hypothesized that the participants in the SMP group will achieve higher self-efficacy scores than the participants in the NMP group, indicating higher self-efficacy levels for health behaviors taught in MIKE Program.

3. It is hypothesized that the participants in the HMP group will achieve higher knowledge scores than the participants in the SMP and NMP groups, indicating more knowledge gained from MIKE Program.

4. It is hypothesized that the participants in the SMP group will achieve higher knowledge scores than the participants in the NMP group, indicating more knowledge gained from MIKE Program.

5. It is hypothesized that the participants in the HMP group will achieve higher scores on the three subscales of the knowledge measure than the participants in the SMP and NMP groups, indicating higher levels of kidney anatomy, kidney function, and kidney disease knowledge.

6. It is hypothesized that the participants in the SMP group will achieve higher scores on the three subscales of the knowledge measure than the participants in NMP group, indicating higher levels of kidney anatomy, kidney function, and kidney disease knowledge.

**Method**
Participants

Participants included 41 students from an alternative high school in a major metropolitan city in the Pacific Northwest during the 2011-2012 academic year. No specific demographic data was collected from the sample. Therefore, demographic information from the entire school population is reported when available. At the school level, students reported the following ethnicity data: 52% of students identified as African-American, 32% identified as Latino, 14% identified as Caucasian, and 2% identified as Pacific Islander/Asian. No information regarding age or gender distribution was available.

Procedure

Through a collaborative process, MIKE Program was started at the alternative school, herein referred to as Hemlock School (pseudonym) to protect the confidentiality of participants, in the fall of 2011. Students who attended Hemlock School were given the option of participating in MIKE Program through their regular health class. These students were enrolled in MIKE Program to receive health credits. All students at Hemlock School who were taking a health class were eligible to enroll in MIKE Program, so it is assumed that the sample is most likely representative of the school population.

MIKE Program was funded by foundational grants which supported the site-based facilitator at Hemlock School, the curriculum, and the mentors. Participants enrolled in MIKE Program met two times a week for hourly sessions. Sessions were taught by two different teachers from the school. Mentors met with participants once per week during one of the sessions. Regular class attendance was expected, but many participants were employed and there were no consequences for frequent absenteeism, so there were varying levels of attendance. No pretest was given to the students attending MIKE Program; however, at the end of the
program, the students completed the post-test evaluation measures. In order to obtain some type of comparison group, students at Hemlock School who were not participating in MIKE Program also completed post-test evaluation measures.

Data was collected from all participants on one day in the spring term. All participants completed a packet of questionnaires which included a health knowledge test (the Whiz Quiz) and a health self-efficacy measure (My Health Questionnaire). The MIKE Program president and the school principal worked together to create shortened forms of the Whiz Quiz and My Health Questionnaire that would be appropriate for this population. The most salient questions from each measure were chosen based on the program president’s and school principal’s judgments of relevance and appropriateness for the participants. Shortened forms were used so students could answer all questions within one class period. The principal distributed the measures to all of the teachers in the school during one class period for all students to fill out. Teachers returned the completed forms to the principal who then returned the forms to the MIKE Program organization for analysis.

Participants were divided into three groups by the program president, based on their attendance rates. The first group included participants who attended most of the MIKE Program sessions; this group will be referred to as the HMP (high MIKE Program) group. The second group included participants who attended less frequently than HMP students, but were enrolled in the MIKE Program health class. This group will be referred to as the SMP (some MIKE Program) group. The third group included students at Hemlock School who were not enrolled in MIKE Program. This group of participants will be referred to as the NMP (no MIKE Program) group.
MIKE Program has partnered with Pacific University to evaluate its programming. The larger evaluation study was approved by the Institutional Review Board at Pacific University (IRB#170-11). The current study is included under that overarching IRB proposal.

**Measures**

**Whiz Quiz.** The Whiz Quiz was created by MIKE Program president and founder, Dr. Cheryl Neal (MIKE Program, 2011). The Whiz Quiz measures students’ knowledge of the kidney, how the kidney functions, and kidney problems. The measure has four scales: anatomy, disease, normal functioning, and prevention. The original version consists of 14 multiple choice and true/false questions and five short-answer questions. A shortened version including the most salient questions, based on the MIKE Program president’s judgment, was used in this study so that participants could complete all measures in one class period. This version consists of 14 questions—11 true or false questions (e.g., “a human kidney is about the size of a person’s fist”), one multiple choice question (i.e., “typically a human being has [blank] kidneys”), and two questions that require the participant to check all answers that apply (e.g., “normal kidneys help the body function well by: [check all that apply].” A total score is obtained by summing the number of correct responses.

**My Health Questionnaire.** The My Health Questionnaire is a modified version of the Self-Rated Abilities for Health Practices Scale created in 1993 by Becker, Stuifbergen, Oh, and Hall. The original questionnaire was developed to measure students’ self-efficacy in making healthy decisions in four areas: nutrition, well-being, exercise, and healthy practices. It consists of 28 items and participants are asked to rate how well they are able to perform each behavior on a scale from 1 (not at all) to 4 (completely). Examples of behaviors include: “eat a balanced diet” (Nutrition subscale), “change things to feel less stressed” (Well-being subscale), “do
exercises that are good for me” (Exercise subscale), and “get help from others when I need it” (Healthy practices subscale). Ratings of items are summed to produce a total scale which can range from 0 to 112. Each subscale consists of seven items and responses to these items are also summed to obtain the subscale scores, which can range from zero to 28.

According to the authors, the Self-Rated Abilities for Health Practices Scale was theoretically and empirically derived. Experts in health promotion helped to create and identify relevant questions. Factor analysis on three different populations (health fair attendees, undergraduate students, and adults with disabilities) was used to derive the four subscales.

Data among health fair attendees demonstrated the following internal consistencies: Total Scale (.94), Exercise (.92), Nutrition (.81), Psychological Well-Being (.90), and Responsible Health Practices (.86). Researchers found moderate convergent validity (.43) between the Total Scale and the General Self-Efficacy Scale (Sherer et al., 1982), which is a measure of general or global self-efficacy.

Data among undergraduates demonstrated the follow internal consistencies: Total Scale (.94), Exercise (.89), Nutrition (.81), Psychological Well-Being (.86), and Responsible Health Practices (.88). Test-retest reliabilities were conducted with a two week interval between initial testing and subsequent testing. Test-retest reliabilities were as follows: Total Scale (.70), Exercise (.69), Nutrition (.63), Psychological Well-Being (.63), and Responsible Health Practices (.73). The Self-Rated Abilities for Health Practices scale demonstrated strong convergent validity (.69) between the Total Scale and the Health-Promoting Lifestyle Profile (Walker, Sechrist, & Pender, 1987), which assesses self-reported frequency of engaging in health promoting behaviors. The Self-Rated Abilities for Health Practices scale also demonstrated
discriminant validity (.55) with the Barriers to Health-Promoting Behaviors Among Persons with Disabilities Scale (Becker, Stuifbergen, & Sands, 1991).

The first version of the My Health Questionnaire is a modified version of the Self-Rated Abilities for Health Practices scale. The MIKE Program president omitted 3 questions she judged to be less salient than the others (e.g., “brush my teeth regularly”), for a new total of 25 questions. Additionally, some of the language was modified to be more appropriate for adolescents. Subscale and total scores are calculated the same way as the Self-Rated Abilities for Health Practices scale; however, because of item omissions (all of which come from the Nutrition subscale), the Nutrition subscale has a score range of zero to 16 and the Total score has a range of zero to 100.

A second reduced version of the My Health Questionnaire was created for use in this study. For this short-form, 16 questions were omitted based on the program president’s and school principal’s judgment of the salience and relevance of the items. A short-version was created so that students could complete the measure in one class period. This second version has a total of 9 questions. Because of the small number of items, subscale scores will not be calculated and only the total score will be used. The Total score has a range of zero to 36.

Results

Preliminary Analyses

Prior to conducting the main statistical analyses, data were screened for missing data and outliers. Two cases were deleted due to missing data. One additional case was deleted because the participant circled multiple answers to some questions. Two cases were identified as outliers. Based on an inspection of the data, these cases showed no variability on one of the core measures.
(i.e., health self-efficacy). The cases were removed due to this lack of variability and due to their significant influence on the normality of the data set.

The data were screened to address the assumptions of normality, homogeneity of variance, independence, and interval level data. According to the Kolmogorov-Smirnov test, all variables were normally distributed and met the normality assumption ($D = .13$, ns and $D = .14$, ns, for My Health and Whiz Quiz respectively). According to Levene’s test, self-efficacy (i.e., the My Health Questionnaire) exhibited similar variances across groups; thus, meeting the homogeneity of variance assumption for this variable. In contrast, health knowledge (i.e., The Whiz Quiz questionnaire) did not meet the homogeneity of variances assumption based on the Levene’s test ($\sigma_{\text{HMP}} = .01$, $\sigma_{\text{SMP}} = .06$, $\sigma_{\text{NMP}} = .06$); however, the data was not transformed. The assumption of independence was met because each participant’s scores were not influential on any other participant’s scores. The interval level data assumption was met because the outcome variables were measured on continuous scales. Overall, all data, with the exception of knowledge, met all four assumptions for parametric analyses.

**Major Analyses**

Analyses of Variance (ANOVAs) were conducted to examine to test each hypothesis using the three groups identified in the methods section, HMP ($N = 10$), SMP ($N = 9$), and NMP ($N = 19$). In a second set of analyses, the low dose (SMP) and high dose (HMP) groups were collapsed to compare to the no dose (NMP) group to examine whether participants receiving any dosage level of MIKE Program had significantly different scores than participants who did not receive any MIKE Program. Both sets of results will be discussed in relation to each hypothesis.

**Hypothesis 1:** participants in the HMP group will achieve higher self-efficacy scores than participants in the SMP and NMP groups. A one-way ANOVA was conducted to
compare the self-efficacy scores across the three groups. There were no significant group differences, \( F (2, 35) = .17, p = .85 \). Groups means were as follows: HMP \( (M = 3.00, SD = .61) \), SMP \( (M = 3.11, SD = .44) \), and NMP \( (M = 2.96, SD = .66) \) groups.

A second one-way ANOVA was conducted to compare self-efficacy scores for the collapsed HMP/SMP group \( (M = 3.05, SD = .53) \) as compared to the NMP \( (M = 2.96, SD = .66) \) group. There was not a significant difference in self-efficacy scores between the two groups, \( F (1, 35) = .186, p = .67 \). Overall, there were no significant differences in self-efficacy between participants in the different dosage groups.

**Hypothesis 2: participants in the SMP group will achieve higher self-efficacy scores than participants in the NMP group.** As stated above, there were no significant differences in self-efficacy scores based on group, indicating that all groups had similar levels of self-efficacy. Although the group mean for SMP was higher than the mean for NMP, this difference was not significant.

**Hypothesis 3: participants in the HMP group will achieve higher knowledge scores than participants in the SMP and NMP groups.** A one-way ANOVA was conducted to compare the knowledge scores from the HMP \( (M = .64, SD = .09) \), SMP \( (M = .65, SD = .25) \), and NMP \( (M = .64, SD = .25) \) groups. There were no significant group differences, \( F (2, 35) = .005, p = .99 \).

A second one-way ANOVA was conducted to compare the knowledge scores for the collapsed HMP/SMP group \( (M = .64, SD = .17) \) and NMP group. There was not a significant difference in knowledge scores between the two groups, \( F (1, 35) = .001, p = .97 \). Overall, there were no significant differences in knowledge between participants in the different dosage groups.
Hypothesis 4: participants in the SMP group will achieve higher knowledge scores than participants in the NMP group. As stated above, there were no significant differences in knowledge scores based on group, indicating that all groups had similar knowledge levels.

Hypothesis 5: participants in the HMP group will achieve higher scores on the three knowledge subscales (anatomy, function, and disease) than participants in the SMP and NMP groups. A one-way ANOVA was conducted to examine score differences on the Kidney Anatomy subscale of the knowledge measure, between the HMP ($M = .58$, $SD = .24$), SMP ($M = .63$, $SD = .33$), and NMP ($M = .65$, $SD = .24$) groups. There were no significant group differences, $F (2, 35) = .23$, $p = .78$, indicating that participants in all three groups had similar levels of kidney anatomy knowledge.

A one-way ANOVA was conducted to compare the Kidney Anatomy subscale scores for the collapsed HMP/SMP group ($M = .60$, $SD = .27$) and NMP group. Again, there was not a significant difference in Kidney Anatomy subscale scores between the two groups, $F (1, 35) = .37$, $p = .57$. Overall, there were no significant differences in kidney anatomy knowledge between participants in the different dosage groups.

A one-way ANOVA was conducted to examine score differences on the Kidney Function subscale of the knowledge measure, between the HMP ($M = .58$, $SD = .21$), SMP ($M = .60$, $SD = .37$), and NMP ($M = .72$, $SD = .32$) groups. There were no significant group differences, $F (2, 35) = .81$, $p = .46$, indicating that participants in all three groups had similar levels of kidney function knowledge.

A one-way ANOVA was conducted to compare the Kidney Function subscale scores for the collapsed HMP/SMP group ($M = .59$, $SD = .28$) and NMP group. There was not a significant difference in Kidney Function subscale scores between the two groups, $F (1, 35) = 1.62$, $p = .21$. 
Overall, there were no significant differences in kidney function knowledge between participants in the different dosage groups.

A one-way ANOVA was conducted to examine score differences on the Kidney Disease subscale of the knowledge measure, between the HMP ($M = .83$, $SD = .24$), SMP ($M = .75$, $SD = .15$), and NMP ($M = .61$, $SD = .33$) groups. There were no significant group differences, $F (2, 35) = 2.24$, $p = .12$, indicating that participants in all three groups had similar levels of kidney disease knowledge.

A one-way ANOVA was conducted to compare the Kidney Disease subscale scores for the collapsed HMP/SMP group ($M = .80$, $SD = .20$) and NMP group. There was a significant difference in Kidney Disease subscale scores between the two groups, $F (1, 35) = 4.15$, $p = .05$. Overall, the participants who attended MIKE Program had higher levels of kidney disease knowledge than participants who did not attend MIKE Program.

**Hypothesis 6: Participants in the SMP group will achieve higher scores on the three knowledge subscales (anatomy, function, and disease) than participants in NMP group.** As stated above, there were no significant differences in knowledge subscale scores between the different dosage groups, indicating that all three groups had similar knowledge levels. There was a significant difference in kidney disease knowledge when the HMP and SMP groups were collapsed into one group.

**Discussion**

Chronic kidney disease (CKD) is a gradual loss of kidney function over time that affects millions of individuals in the United States. Ethnic groups including African Americans and Latinos, as well as among older individuals, are at the highest risk for developing CKD. Other risk factors, such as hypertension and obesity, can be targeted for early detection and treatment,
which can help slow the progression of CKD or prevent it altogether (National Kidney Foundation, 2012). To facilitate early intervention and prevention, school-based programs targeted for at-risk youth may be an effective option. Because time is a commodity in most schools, it is important to know the optimal dosage of a program that is needed to produce effective change. It is also important to understand that programs can vary in their effectiveness depending on the type of school setting in which they are implemented (e.g., traditional vs. alternative schools).

The purpose of the current study was to examine the dosage effects (i.e., high dose, low dose, no dose) on health knowledge gains and levels of health self-efficacy in a population of adolescents who participated in a school-based health education program (i.e. MIKE Program). We examined the effects of MIKE Program for students who received some of the program, those who participated regularly, and those who did not participate in the program. All groups completed questionnaires at the conclusion of the program.

Overall, there were few significant effects on health knowledge or self-efficacy based on the dosage group. There was one significant difference in kidney disease knowledge such that students who participated in MIKE Program, at either the high or low dosage levels, had higher kidney disease knowledge than those participants who did not attend MIKE Program.

Most of the hypotheses for the current study were not supported and thus there are many unanswered questions regarding the reasons for the nonsignificant results. These questions will be further addressed in the limitations section. The current results are thought to be due in a large part to the design and implementation of the program in this setting, rather than to the effectiveness of MIKE Program itself, as positive effects have been documented in other samples.
Summary and Implications

Dose-response studies, such as the current study, can be useful in determining how much of a prevention program is needed to effect change without being overly lengthy. There are many ways to define dose, such as number of sessions attended, amount of program taught, or overall duration of the program. This study defined dose by program attendance rates. Studies have shown that higher doses are correlated to better program outcomes (Durlak & DuPre, 2008; August et al., 2003). In this study, dose did not appear to be related to better program outcomes as the groups did not differ in health knowledge or health self-efficacy. This finding may be consistent with previous literature in that some studies have found that program outcomes do not extend to higher risk individuals (August et al., 2003). Thus, one reason for the lack of the effects in this study may have been due to characteristics of the students. Participants in this study were at-risk youth in an alternative high school, which is a different sample than has been investigated in past studies of MIKE Program effectiveness (Li, Sage, & Neal, 2012; Sage, Li, & Neal, 2012); thus, the nature of this sample may have attenuated the program effects.

School-based prevention programs like MIKE Program have been shown to be effective at increasing students’ knowledge levels of the program topic (Muehlenkamp et al., 2010; Newton et al., 2009; Perry, Stigler, Arora, & Reddy, 2009; Fitzpatrick, 2011 Sage, 2012). Further, studies have shown that higher doses of a program are correlated with higher knowledge levels (Fitzpatrick, 2011). The current study had similar results, but only for one subtype of knowledge, kidney disease. Participants who participated in MIKE Program showed higher levels of kidney disease knowledge than participants who did not participate in MIKE Program, but the two dosage levels of MIKE Program did not differ in knowledge scores. MIKE Program appears to be successful at increasing at-risk students’ knowledge of kidney disease, but did not
appear to be successful at increasing levels of other knowledge areas. This particular finding may have been due to other aspects of the program that support knowledge of kidney disease outside of the school setting including the program field trip to a dialysis center.

It is difficult to compare findings from this study to other studies of MIKE Program effectiveness as the measures used in this study were abbreviated versions of the ones used in prior studies. In comparing this study to the literature in this area, previous studies of similar programs have generally found that prevention programs are effective in improving knowledge (Muehlenkamp et al., 2010; Newton et al., 2009; Perry et al., 2009; Fitzpatrick, 2011). The difficulty teaching knowledge in this study could be due to a variety of factors including the participants having gained the knowledge from other sources. This explanation was considered due to the high levels of knowledge reported by students in the no dose category. The highest possible raw score for knowledge was 11 and seven NMP students achieved perfect scores or near perfect scores (90% of the content correct) on the knowledge measure. It is not known how much knowledge a naive sample of adolescents would be expected to have.

Self-efficacy has been found to be an important predictor of behavior change (Ajzen, 1991; Conner & Armitage, 1998; Marcoux & Shope, 1997). However, self-efficacy was not different between participants in the three groups in this study. All three groups demonstrated a high level of self-efficacy; because the NMP group had high self-efficacy without the MIKE Program intervention, there may have been a ceiling effect in which high initial levels of self-efficacy could not be raised by MIKE Program. A second explanation could be that the students who attended MIKE Program had lower initial self-efficacy that was raised by MIKE Program and the NMP group was comprised of people with high levels of self-efficacy despite not attending MIKE Program. This lack of significant findings for self-efficacy does not mean that
the participants are less likely to change their behavior. Self-efficacy is only one variable in the Theory of Planned Behavior (TPB) that is used to predict behavior change (Ajzen, 1991).

The majority of the results of this study are not consistent with past research on the effectiveness of prevention programs. This study was the first year in which MIKE Program was implemented at this particular alternative school. Program staff and school personnel have reported anecdotal evidence that there were difficulties with the implementation (Cheryl Neal, personal communication, September 6, 2012), such as poor attendance and inconsistent instruction. Therefore, the lack of significant results in this study are likely attributable to limitations of the study design and implementation, rather than to the effectiveness of MIKE Program when implemented with high program fidelity.

Limitations

There were several limitations to the current study. First, the sample size was small ($N = 36$), which may have limited the ability to detect significant group differences. The small samples size also limits the ability to generalize the results to a larger population.

The interplay between sampling method and sample characteristics is another limitation, as evidenced by the unequal variances between the three groups. The full MIKE Program group (HMP; high dose) had a significantly smaller variance than the SMP and NMP groups on the knowledge test, indicating that the HMP participants performed similarly to each other on this measure. This indicates that HMP participants had similar levels of knowledge, whereas the SMP and NMP participants’ scores were highly variable, as some scored well and some scored poorly. These differences in variance could be caused by true group differences such that participants in the high dose group may have retained the information they learned, whereas participants in the SMP may have gained some knowledge across the program and some students...
would have retained this information and some would have not. The NMP group had high
variability in knowledge, thus there may be subgroups of the NMP that had previously
experienced similar programs to MIKE Program or may have been exposed to the same content
in MIKE Program through another mechanism. Information regarding this possibility was not
available to the researchers at the time of this study. Further, the differences in variances could
be due to the non-matched nature of the groups.

Participants in the three groups were not matched on important characteristics such as
risk level, prior knowledge, or even age; inherent group differences on these factors and
important third variables such as being pre-diabetic or having a family member diagnosed with
kidney disease could significantly affect the data. The control group was not naïve and may
have had prior exposure to the type of content found in MIKE Program. It should also be noted
that the students in MIKE Program presented their capstone community project to the entire
school prior to them taking the post-test measure. Thus, any student in the school who attended
the community project given by the MIKE Program students would have been exposed to some
health knowledge and could have also experienced a change in HSE.

A related limitation is the manner by which the groups were formed. Students in the
three groups were designated as such by the subjective opinion of the MIKE Program president,
who served as the instructor of the program in this school for part of the year. She based her
judgment on how well she recognized the students’ names, rather than with an objective measure
of program attendance. Quieter youth who were not easily recognized by name may have
accidentally been classified incorrectly. To potentially address this, we re-ran the analyses
collapsing the HMP and SMP groups; however, this did not affect the results.
The shortened measures used in this study may also have limited the results. The psychometric properties of the shortened measures have not been evaluated in comparison to the full version counterparts. Because the measures were not edited based on empirical evidence, their ability to measure each phenomenon may have been reduced. Difficult questions may have been removed inadvertently during the editing process, meaning that naïve participants would have had a higher likelihood of answering the questions correctly regardless of their dosage group, which would decrease the group differences. Using the shortened measures also limits the ability to compare to participants to previous data collected regarding MIKE Program in other schools.

A limitation to the theoretical foundations of this study was the lack of sufficient variables to test the TPB model as only one of the variables of the TPB model was examined. The TPB posits that behavior change can be predicted by evaluating self-efficacy, behavioral intention, and social norms; and, this study only measured self-efficacy. Utilizing only part of this theory limits the ability to actually predict behavior change or to test the TPB model in this sample.

Finally, there is the major limitation of the actual impact that a small mentoring program can make in with high risk youth in an alternative school setting. Students in this particular school were already at risk of developing chronic kidney disease and at risk for academic failure due to their placement in an alternative school. Thus, it is possible that MIKE Program is not sufficient to create change for these youth who are at risk for negative outcomes on multiple levels.

Other factors must be considered when attempting to implement prevention programs such as MIKE Program in an alternative school setting. Students at alternative schools frequently
struggle with attendance and meeting state benchmarks for math and reading (Carrier, 2013). In fact, students must have erratic attendance rates and/or not meet state benchmarks, or meet another criterion, to become eligible to attend an alternative education program (Oregon Department of Education [ODE], 2012). Across alternative schools attendance rates can vary and are usually far below rates at traditional high schools. Given the challenges for youth at alternative schools it is highly likely that further modifications need to be made for these youth to fully benefit from MIKE Program. Having students complete questionnaires as the standard for evaluating the success of the program may be problematic given the youths’ potential struggles with traditional testing and academically-oriented tasks.

**Future Directions**

Because this was the first year that MIKE Program was implemented in this alternative school setting, there are many changes that can be made to improve program delivery. First, to increase the power to detect real group differences, it is important to compare data from multiple cohorts. These cohorts could be compromised of youths from different alternative schools, or youths from multiple years in the same school to increase the sample size and improve the ability to detect significant effects.

In addition to multiple cohorts, there is a need for a better control group. One way to create a better control group is to collect pre-intervention data, such as age, number of health classes taken, whether or not the student has a family member with a kidney disease, and utilize this information to create matched groups. Creating and comparing matched groups would increase the likelihood that any post-intervention group differences would be the result of the intervention rather than other spurious factors. Equivalent groups can be obtained through randomization; however, in community settings, random assignment is often difficult to achieve.
Another beneficial change would be to either utilize the original measures or to examine the psychometric properties of the shortened measures. It would be helpful to examine the item difficulties of the shortened version compared to the original version to examine if one version is more difficult than the other. Any of these changes would help increase the generalizability of the data collected.

Additionally, to encapsulate the TPB and thus increase the predictability of behavior change, measures of behavioral intent and social norms should be added. Other MIKE Program sites include a measure of personal goals, which could be utilized as a measure of behavioral intent, but a true measure of intent as well as a measure of social norms may be more helpful across all of MIKE Program’s school sites. Adding these measures would allow for a more accurate predictability of behavior change via the TPB in MIKE Program’s participants.

Finally, to address the difficulties of implementing a program in an alternative school, changes must be made. A dedicated site coordinator would be helpful to ensure that the program is being implemented with integrity and that data collection procedures follow a protocol. Because MIKE Program is reliant on mentors, it is necessary to recruit dedicated and knowledgeable mentors who can make the commitment for the duration of the program. To help define group membership, an objective measure of attendance should be added. MIKE Program is successful in other settings where these factors are present and there is tighter school control. Perhaps creating a protocol for all sites to follow would be helpful in ensuring that MIKE Program is successful in any setting.

**Conclusions**

Although there were no significant differences in health knowledge or self-efficacy based on group membership, this study is important in understanding program design and
implementation for community based programs that serve high risk youth. The sampling method
and sample characteristics had an impact on the results, demonstrating that it is extremely
important to choose a sampling method and examine the variables of the sample to screen for
any inherent biases. This study was the first time implementing MIKE Program, a kidney
disease education and prevention program, in an alternative school setting. Results of this study
can be used to improve the implementation of MIKE Program to increase its effectiveness with
at-risk youth in an alternative school setting.

The detection and prevention of CKD is an important goal, as it can help prevent or delay
the progression of the disease. It is also important that prevention programs are actually
effective, rather than just providing an opportunity for a “feel good” experience for
administrators and youth. Assessing positive change due to a prevention program is difficult,
especially in an alternative school setting, and assessing health knowledge and self-efficacy
through questionnaires may not be the most prudent way to evaluate program effectiveness. In
the future, it may be more helpful to assess improvements in skills (e.g., the ability to choose a
healthier food option) as a way to target behavior change.
References


