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Cover Page Footnote

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Abstract

Education for preventing type 2 diabetes in adolescents should be a high priority among school officials and healthcare providers. The purpose of this research study was to educate adolescents on type 2 diabetes and to increase awareness about this disease. The Health Promotion Model developed by Nola Pender was used as the theoretical framework for this study. A quasi-experimental before-after design was used. The seventh and eighth-grade students enrolled in physical education classes at a local school were recruited. Of the 57 students recruited, 47 completed the study. A diabetes education program geared towards kindergarten through eighth grade was used. The program was developed by a Girl Scout troop as a community outreach program. The students received a pretest, watched an informational session, experienced a live performance by a high school theatre group on type 2 diabetes, and completed a posttest. The main goal of this study was to address the research question, "Can theatre be used to raise awareness about Type 2 Diabetes among seventh and eighth grade students?" This awareness was demonstrated by an increase in the student's post-test scores. The average pre-test score among the 47 participants was 78%. After the informational session and play, the average post-test scores were 84%. This was a 6% increase from baseline. Peer education and engaging activities can play a role in enhancing knowledge and awareness among adolescents.

Keywords: *Type 2 Diabetes, awareness, education, adolescents, theatre*

Background

Type 2 diabetes continues to be a health challenge in the United States. According to the Centers for Disease Control and Prevention (CDC, 2023b), over 29.7 million people have been diagnosed with diabetes, while 8.7 million have undiagnosed diabetes. The estimated total cost for this disease in 2023 was 412.9 billion dollars, according to the American Diabetes Association (ADA, 2023). Diabetes and its complications are seen in people of all age groups; therefore, healthcare professionals must be prepared to care for and educate individuals across the lifespan. The CDC (2023b) noted that 5,293 children and adolescents between the ages of 10 and 19 years developed type 2 diabetes, and this was reported to be a significant increase. Although rare, the prevalence of type 2 diabetes in adolescents needs more attention. Between 2002 and 2018, the CDC (2023b) reported an increased incidence of type 2 diabetes in children between the ages of 10 and 19. They are at risk if they are obese, insulin-resistant, and have a family history of this disease. The increased incidence of type 2 diabetes in adolescents requires education with a focus on prevention. Adolescents must be instructed on this disease and their risk of developing diabetes (CDC, 2021). Early education may prevent or reduce the incidence of type 2 diabetes (Mangione et al., 2022). The CDC (2023a) reported that if type 2 diabetes in young people continues at its current rate of incidence between 2017 and 2060, the number of cases will increase by 70%. This study aimed to examine the effect of an educational intervention on adolescents' knowledge of type 2 diabetes.

Literature Review

A review of the literature has shown an increased incidence of type 2 diabetes in the adolescent population. Bendor et al. (2020) identified several risk factors for type 2 diabetes in children, including comorbidities such as hypertension and dyslipidemia. Early detection of

this disease (Mangione et al., 2022; Xie et al., 2022) and diet education was a successful intervention with high-risk adolescents (Bonsembiante et al., 2021). It is essential to instruct students who may be at high risk for developing this disease equally with lower-risk students. Bendor et al. (2020) reported on the increased incidence of severely obese children, described as a body mass index of 120%, and the need to address and treat their multiple cardiac risk factors such as type 2 diabetes. The authors noted that, according to the United States Preventive Services Task Force (USPSTF), the evidence for screening adolescents and children for type 2 diabetes is insufficient. It is still imperative that healthcare professionals and educators seek to prevent type 2 diabetes in this population. This literature review included the following areas: diabetes education and screening in schools and the use of peer support.

The Problem of Type 2 Diabetes and the Need for Screening in Schools

There is debate if school children need to be screened for Type II diabetes. The USPSTF (Jonas et al., 2022) reported insufficient evidence on the effect of screening for and early detection and treatment of type 2 diabetes on health outcomes. However, the American Diabetic Association (ADA; 2020) recommends risk-based screening. SEARCH for Diabetes in Youth (Dabelea et al., 2021), referred to as SEARCH, is a registry started in 2000 as a multicenter study in the United States to address the need to understand diabetes in children. This continuous registry has followed children under the age of 20 who have developed diabetes. It tracked the "prevalence, annual incidence, and trends by age, race/ethnicity, sex, and diabetes type" (Dabelea et al., 2021, p. 99). Several factors lead to the development of this disease, such as the increased incidence of obesity in youth and the presence of ethnic and racial disparities. The authors noted that a particular risk for these youth was living

further away from a supermarket but being centrally located to fast food restaurants. Offering programs within schools and community centers could bring type 2 diabetes education and prevention directly to the youth and help to stave off the increasing number of adolescents who are at risk for type 2 diabetes. The CDC also advocates for teaching students self-care management in schools (CDC, n.d.)

The increase in obesity and associated diabetes is a concern. The increasing prevalence of childhood obesity and its association with diabetes with long-term impact on public health outcomes has been reported (Oranika et al., 2023). This is not a U.S. phenomenon but a global one. Pang et al. (2021) noted obesity in the adolescent population in Hong Kong and a tenfold increase in type 2 diabetes cases between 1997 and 2007. To combat this growing health concern, in 2005, the Hong Kong Student Health Service (SHS) created a urine glucose screening protocol in schools for students between the ages of 10 and 18 years who had a body mass index (BMI) of over 97%. This type of assessment was implemented in Japan, Korea, and Taiwan, and it was deemed practical and proved to be a significant first-line assessment for type 2 diabetes diagnosis. Pang et al. (2021) reported the results of urine glucose screenings from 2005-2006 and 2017-2018. In total, 219,276 eligible students were screened, and the results showed that 381 students tested positive for glucose in their urine, while 18 were positive for urine ketones. Healthcare professionals further evaluated these students, and the results showed that 120 students were diagnosed with type 2 diabetes, 41 were noted to be pre-diabetic, and 126 were determined to be normal. Of the rest of the 381 that tested positive, 43 students and their families refused referral, and 51 had a known diabetes diagnosis. Urine glucose testing proved to be a practical approach for type 2 diabetes screening for students within a school setting. High prevalence of Type 2 Diabetes is a health problem in India (Kumar et al., 2021), Nigeria (Oluwayemi et al., 2021), the United Kingdom (Candler et al., 2018),

Cameroon (Chedjou-Nono et al., 2017), U. S. (Wheelock et al., 2016), United Arab Emirates (Al Amiri et al., 2015), and other countries.

Although the USPSTF did not find sufficient evidence for screening in those without symptoms, it is known that simple tests can detect diabetes early. It is known and researchers validated that prediabetes and type 2 diabetes can be detected by measuring fasting plasma glucose or HbA1c level, or with an oral glucose tolerance test as (Dabela et al., 2014; Jonas et al., 2022). Hu et al. (2022) conducted a systematic review of peer-reviewed articles written between 2001 and 2021, focusing on the need for an adolescent diabetes screening tool and the use of supervised machine learning to predict diabetes in this population. IBM (n.d.) described supervised machine learning as a combination of artificial intelligence (AI) and machine learning that uses data to create an algorithm that will lead to predicted outcomes. The authors reported that contributing features or data that lead to diabetes in youth are physical characteristics, dietary information, and demographics. The physical characteristics would include height, weight, and waist measurements. The dietary information would need to focus on sodium and protein intake. The development and implementation of screening tools that could utilize supervised machine learning would substantially contribute to focusing on adolescents at risk for developing type 2 diabetes. This tool and its software could be used in outpatient pediatric clinics and within school districts to assist in identifying students who are at risk for this disease. Other innovations, such as over-the-counter continuous glucose monitoring devices, may appeal to adolescents (U.S Food and Drug Administration, 2024).

While screening for Type 2 Diabetes is important, education must be provided to prevent and manage the disease well. To educate the younger population to raise awareness and early

recognition, schools must be intentional and use innovative ways to get their attention. Additionally, peers can be instrumental in raising awareness.

Raising Awareness about Type 2 Diabetes with Peer Support: An Innovative Approach

Peer groups can be effective in educating individuals on type 2 diabetes. Peer groups were used to educate K-8 students through theatre and through an adolescent peer support group to encourage weight loss. Fenn et al. (2007) used a method to teach diabetes awareness that was appropriate for age and culture. The program was called *Don't Monkey Around with Diabetes: A Program for Helping Kids Learn How to Prevent Type 2 Diabetes*. It was developed by a Tucson-based, five-member Girl Scout troop that needed to provide community service to achieve a Silver Award. This award is the highest achievement available to girls aged 11-14 years. The young girls chose the topic of diabetes after recognizing that some of their family members had this disease (Fenn et al., 2007). The girls, with the assistance of their troop leader, discussed the need to increase awareness of diabetes, engage students in their peer group, and be aware of the cultural needs of Mexican American youth. The girls desired to teach diabetes awareness to students who were not currently at risk and have them share information with their families at home. This innovative strategy to use a play was developed by two members of the troop (Fenn et al., 2007).

The Play

The play was 30 minutes in length and included information on diabetes given in five informational sessions. As part of the performance, the student audience was encouraged by the cast to answer questions. The students were given a verbal pre-test before the performance and a verbal post-test after the play. It has been performed for several years in schools,

conferences, and tribal reservations. The troop designed the diabetic tool kits so that they could be used to train groups to educate students in the future. Unfortunately, there was no reliability or validity information available on the pre-test and post-tests used. This was an innovative approach to educating youth on type 2 diabetes to involve students, the community, and their peers.

Other researchers found a similar effect of peer support on diabetes education. For example, Ameneh et al. (2023) completed a clustered randomized trial study of 168 female adolescent students 14 years of age in Tehran, Iran. The experimental group (n = 84) received diabetes education from eight trained peers in sessions for 90 minutes, including lectures and classroom discussions. The control group (n = 86) did not receive diabetes education from peers. Both groups received a pre-test that included collecting demographic information and knowledge of diabetes and risk factors. The intervention group received peer education on diabetes, and both groups completed a post-test two months after these educational sessions. The results showed that the intervention group that received "peer education increased (their) knowledge and improved adolescents' health beliefs and behaviors" (Ameneh et al., 2023, p. 1). Healthcare professionals and educators must embrace peer education to address type 2 diabetes risk factors within the adolescent population.

The American Diabetes Association (n.d.) has published lessons for students about diabetes from kindergarten to grade 6 (K-6) and for grades 7 to 12 (7-12). The lessons created for students in grades 7-12 could be implemented into health or physical education courses for middle and high school students. These lessons include five-day interactive lesson plans for students that include a diabetes scavenger hunt and activities such as "food police" that could guide students to make healthier food choices. These lessons could be implemented through

schools or as a health project that could address the needs of the community. The literature reviews type 2 diabetes in the adolescent population. Each study addresses an important aspect of the assessment, detection, education, or prevention of this disease.

There is a need to ensure that adolescents are assessed for type 2 diabetes in both the clinical and school settings. It is through assessments such as urine glucose testing (Pang et al., 2021) and through the use of an AI-driven screening tool that healthcare providers can properly assess for type 2 diabetes in adolescents. An additional way to educate adolescents about healthy eating is through the use of gamification. Miller et al. (2023) completed a qualitative study on 250 students between the ages of 13 and 16 years. Each student experienced an online game called the Nutrition Transformational Games (NTG), which was designed to teach students about nutrition and food systems. The results from the focus groups of what the students learned developed into three themes: the process of growing food, food waste, and the need to market healthy food options. The experience and use of this online game gave these students knowledge of healthy eating and food production. Although this study was completed in 2009, it aimed to increase awareness of type 2 diabetes in the adolescent population through a theatre activity using *Don't monkey around with diabetes: A kit for helping kids prevent type 2 diabetes* (Fenn et al., 2003) which has been used extensively in schools. The program has five categories of information on type 2 diabetes such as the definition of diabetes, prevalence, risk factors, signs and symptoms, and prevention. This theatrical program could be updated and presented to adolescents in school districts even today.

Purpose and Research Question

The purpose of this research study was to examine the effectiveness of education through theatre to raise awareness among adolescents about Type 2 Diabetes.

Methodology

Design and the Research Question

A quasi-experimental one-group pretest-posttest design was used to complete this study. “Can theatre be used to raise awareness about Type 2 Diabetes among seventh and eighth grade students?” The study was reviewed and approved by the institutional review board in CA. The IRB required that study participants receive and complete an assent form prior to enrollment in this study. The students completed an assent form, and the parents completed consent forms prior to the start of this study. Data collection began in January 2009. The consent allowed the parents or guardians to decide whether or not they wished to have their children’s knowledge assessed through testing. If they opted not to have their child involved, this student was not given a test.

Settings and Population

The students in seventh and eighth grades enrolled in physical education classes at a local school were enrolled in this study. The total student population in the school located in a rural area in northern California was approximately 300 (Public Schools Report, 2007) at the time of this study. This school is located in a rural area in northern California. The total population of the entire county in 2008 was 60,000 people (U.S. Census Bureau, 2008), and the main industries included ranching and farming. The median income in 2005 was $32,100 per household. There are primarily White non-Hispanic (72.9%) and Hispanic (19.7%) people in the area (Onboard Informatics, 2008). The seventh and eighth-grade students enrolled in physical education classes at a local school were recruited. Of the 57 students recruited, 47 completed the study.

Tools and Procedures

The program called, *Don’t Monkey Around with Diabetes: A Program for Helping*

Kids Learn How to Prevent Type 2 Diabetes (Fenn et al., 2003) was used. In this program, a play was created by Girl Scouts from Troop 509 in Tucson, Arizona. It was their desire to educate young people about this disease. It has been performed in towns along the Arizona-Mexico border and at other venues. The Girl Scouts received a Silver Award for this achievement, and it is the highest award given to girls 11-14 years of age (Girl Scouts, 2009). They decided to make it available to others, and they created the Diabetes Tool Kit. These kits were funded through the Arizona Department of Health Services and the U.S. Mexico Border Health Commission (Fenn et al., 2007). This program was used in this study after obtaining approval.

This program was used to teach seventh and eighth-grade students enrolled in physical education classes. The curriculum involved peer education in the form of an informational session (lecture) and play. The researcher utilized the services of "Friday Night Live" (FNL), a Red Bluff community-based prevention group. This group consisted of a director and high school students who educate their peers on subjects such as smoking cessation and drug awareness. Before this play, an educational session was offered on type 2 diabetes using the PowerPoint presentation included in the toolkit. The performance was facilitated at a rural elementary school.

The verbal pretest, supplied by the Diabetes Tool Kit, was revised to a written format with the assistance of an educator (see Appendix A). This test was written at a fourth-grade reading level, as validated by the Flesch Reading Ease Readability Score (2009) of 73 out of 100. The higher score denotes an easier reading, and the lower score indicates a higher difficulty level. Flesch-Kincaid Readability Score (2009) of 4.7 which correlates to school grades. All the answers for this multiple-choice test were retrieved from the lecture material

given to the students before the play. An educator with over eight years of experience as a teacher and as a school administrator with a background in curriculum development and evaluation assisted in developing the tool.

This same test was administered again to the students within one week of the performance. This posttest was to investigate the increased awareness of type 2 diabetes. Retesting within one week allowed the inclusion of all the enrolled students and even those who might have been absent and the retention of information.

Educational Program Implementation

This program was designed for students to deliver scripted material to their peers on type 2 diabetes (Fenn et al., 2003). The cast consisted of five high school students who were involved in the informational session and play. In the beginning, the cast encouraged the audience to stand up and participate in a song that required physical movements. This exercise, or "ice breaker," allowed the students to interact with the troop in a positive and entertaining manner. The researcher observed participation throughout the song by the students and their teachers. After the song, the audience settled into their seats, and the informational session began. The areas covered were the definition of type 2 diabetes, prevalence, risk factors, signs and symptoms, and prevention. The cast used a lecture format and visual cues to review the topic of type 2 diabetes. For example, one cast member discussed signs and symptoms of diabetes, such as being thirsty and tired. Another student demonstrated these symptoms by drinking water quickly from a bottle and placing her head on a pillow. These teaching strategies addressed multiple learning modalities.

The play followed the informational session and it involved all members of the troop. A narrator described the fictional battle between Sir Insulin Monk and Diana Betes. In

addition, the audience was encouraged to participate, by the cast, through signs that read "Boo" for Diana Betes character and "Yeah!" for the Sir Insulin Monk character. The researcher observed participation by the audience when the signs were used. The plot was to rescue Princess Low-n- Sweet from her tower. Other knights failed to help her because "they came armed with fatty foods and no veggies and no exercise at all" (Logue & Toci, 2003, p. 4). Ultimately, Sir Insulin Monk succeeded in rescuing the Princess because he used his tennis racket to battle Diana Betes and threw fresh fruit (props) at her. These actions led to her defeat. The researcher observed that the audience was engaged in the play and cheered loudly when it concluded. This program used a non-traditional approach to health education through the use of theatre. In addition, the performance was an entertaining medium and had a non-threatening approach.

Data Collection Procedures

All students participating in this study received a random identification number supplied by the researcher. The identification numbers and student information were available to the researcher's team. This information was kept in a secure location to protect student confidentiality. If a student was unable to complete all the testing, prior data submitted by that student was removed from the study. The researcher graded each test according to a standardized answer sheet. All possible answers for the test were addressed during the lecture portion of the performance. The graded test scores were collected and placed on an Excel (Microsoft, n.d.) spreadsheet. This data was used by the researcher to document increased awareness of type 2 diabetes. This was demonstrated by an increase in the number of correct answers between the pre-test and post-test.

Data Analysis

The data were entered into Excel (Microsoft, n.d.), and the descriptive statistics and test score mean, and percentages were calculated and compared to identify any increase in score after the theatrical event. Of the 57 students recruited, 47 completed the study, which had a participation rate of 82%. The 47 students involved in this study had given their assent and their parents completed the consent forms. There was no response bias related to this study (Cressell & Cresswell, 2022). All students of the 57 were able to experience this theatrical event regardless of their participation in this study.

There were 52 students enrolled in this study. Each received a randomized number generated by the researcher in order to protect their confidentiality. The pre-tests were distributed to the students during their physical education classes one week prior to the performance. Pencils and paper were provided, and the researcher was available to answer any questions and encourage a quiet atmosphere for test-taking. Of the 52 enrolled students, 4 missed both the pre-test and the performance due to extensive absenteeism. All 4 students had traveled out of state for one week to attend a conference. The researcher was unaware of this event prior to recruitment. One student also moved out of the school district during this time frame. This left a total of 47 students enrolled, 82% of the originally recruited group. All these students watched the performance and completed the post-tests.

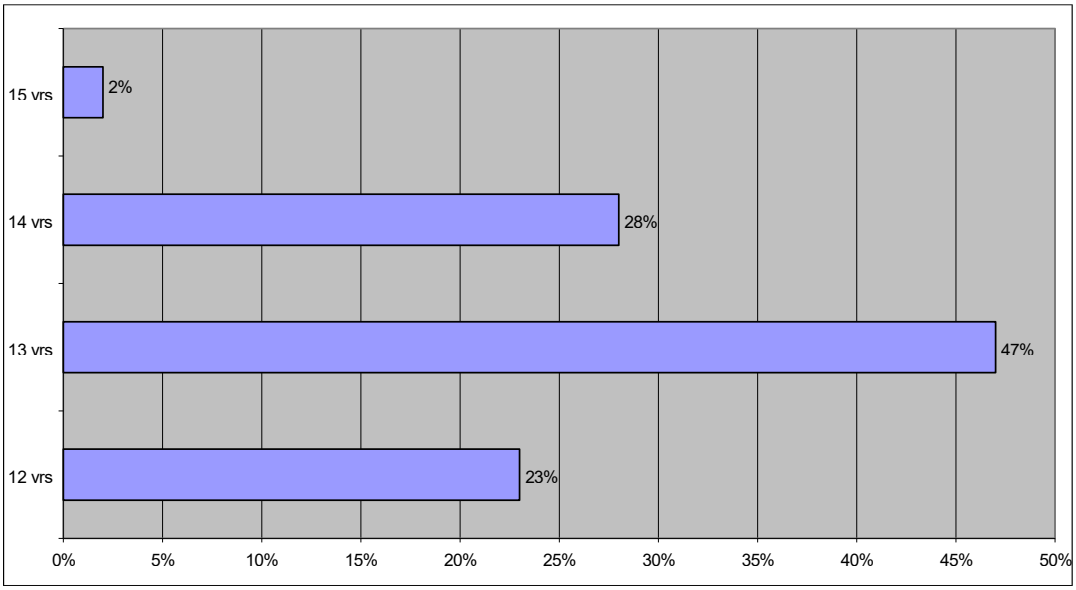
Results

Forty-seven students from seventh and eighth grades participated in the study. There were 24 male students (51%) and 23 females (49%). The ages ranged from 12 to 15 years (See Figure 1). The average pre-test score was 78%, with a post-test score of 84%. This was a 6% difference in the results. The participants and their test results were further organized into

separate categories by age. The 12-year-old group (23% of the participants) received an average pre-test score of 83% and a post-test score of 90%. The 13-year-olds (47% of the participants) scored an average of 76% on the pre-test and 78% on the post-test. The 14-year-olds (28% of the participants) had an average pre-test score of 82% and a post-test of 89%. All experienced an increase in test scores between the two tests: 7%, 2%, and 7%, respectively. There was one 15-year-old enrolled in the study, and this student also had an increase in the test score from 40% in the pre-test to 80% in the post-test.

Figure 1.

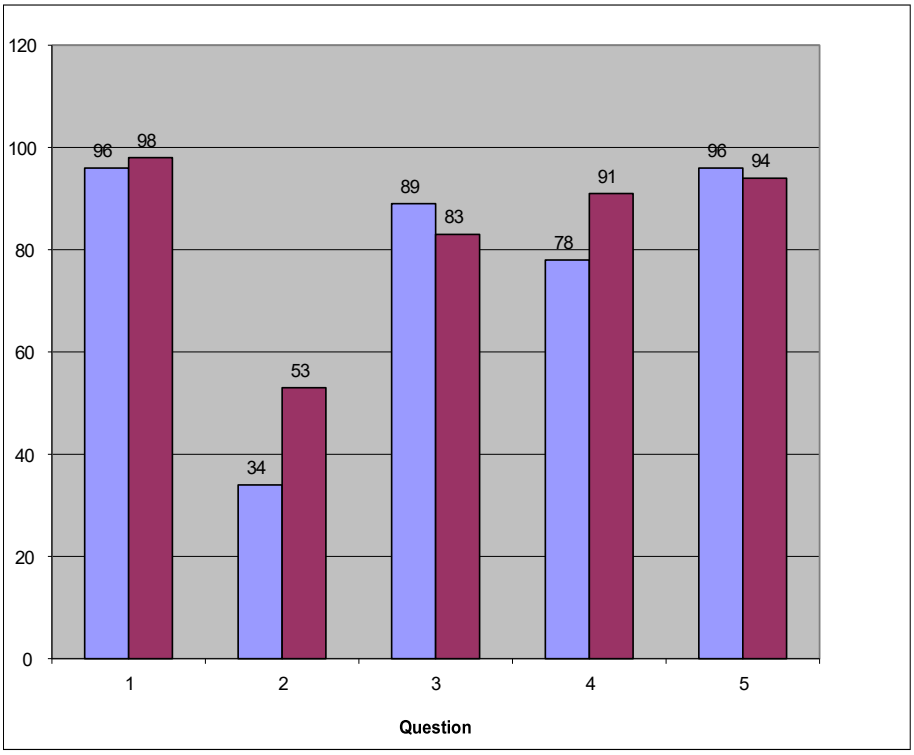
Student Age Distribution



The test scores of the male students were compared to the scores of the female students. The girls scored an average of 82% on the pre-test and 86% on the post-test, indicating a 4% increase from baseline. The boys had an average of 75% on the pre-test and 82% on the post-test, with an 8% increase in scores. Each question used in the testing was further analyzed for trends. Figure 2 below illustrates the mean pre-test and post-test scores for each item.

Figure 2

Mean Scores for Each Question: Pre-test and Post-test (n = 47)



Discussion

Forty-seven students participated in the study that examined the pre and post-test scores after type 2 diabetes education via theatre using the written version of the diabetes tool kit. The post-test scores were found to be higher, indicating the effectiveness of the teaching strategy. The growing problem of type 2 diabetes in the adolescent population is a worrisome health issue. The importance of diabetes education, prevention, and the use of peer education should be addressed with all age categories, specifically in the adolescent population (Ameneh et al., 2023; Dabelea et al., 2021; Pang et al., 2021). The informational session and play offered in the program, *Don't Monkey Around with Diabetes: A Program for Helping Kids Learn How to Prevent Type 2 Diabetes* (Fenn et al., 2003) played an important role in educating the adolescents in the school. This grant-funded program was instrumental in

obtaining a copy of the Train-the-Trainer toolkit to subsequently initiate this program in this rural community.

The audience was engaged in the play and cheered loudly when it concluded. This program used a non-traditional approach to health education through the use of theatre. In addition, the performance was an entertaining medium and had a non-threatening approach. Mohandespour (2023) completed a systematic review of the use of theatre to teach sexual health to adolescents. Seven studies were reviewed that covered numerous topics, such as sexually transmitted diseases. The results showed that through the use of theatre, there was an increased knowledge and improved attitudes among adolescents regarding sexual health. Two studies in the systematic review concluded that theatre-based sexual education was an appropriate education strategy for adolescents.

Implications

As nurses, we need to be innovative in our approach to combat the problem of type 2 diabetes, especially in our adolescent population. Education on the prevention of this disease needs to be taught to our young students in an engaging way. The use of theatre and the performing arts may be the catalyst that is needed to pique the interest of our youth to improve their health and decrease their risks of developing type 2 diabetes. This approach should also be embraced by other healthcare providers, including school nurses and diabetic educators. Through these interdisciplinary partnerships, theatrical education programs can be shared in areas outside of schools, such as community outreach programs. Educating adolescents on type 2 diabetes should be a priority to ensure the health and well-being of the next generations.

Limitations

The limitations of this study were the small number of participants, the test, and the

use of the FNL troop. The small number of participants was unavoidable. A larger group of students or the addition of other schools might have been beneficial to a larger audience. An expert panel reviewed the pre/post-test used in this study for content validity. The test could have received further refinement through a pilot study and input from a student population. There were two limitations regarding the FNL troop. First, there was a learning curve for the troop involved in mastering a performance. was the first time the performance was implemented in front of a live audience. Second, there was time and dedication required to accomplish this performance. The FNL group practiced weekly for three months. Lastly, this study was completed more than a decade ago. New and technological innovations may be available currently. However, a theatrical method is engaging to the audience.

Summary

This study sought to increase awareness of type 2 diabetes in adolescents. The program used to teach this subject was creative, and it appealed to different learning styles. It encompassed auditory and visual elements throughout the play that could reach a greater number of students. The diabetes tool kit allowed a group of talented students and their director to deliver educational material through an entertaining medium. Although the toolkit is available upon request, it requires many hours of preparation from the theatre troop. This study was able to accomplish the main objective of increasing awareness of type 2 diabetes in adolescents. It is the hope that this performance will continue to educate other students throughout the community. This play is relevant today, and this type of peer education through theatre should be used for engaging adolescents particularly.

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Appendix A: Don't Monkey Around with Diabetes

Name: _____School: _____
Gender: (Circle one) Male / Female Age: _____

Please print clearly

Circle the best answer for each question.

1) There are over 23 million people in the U.S. with diabetes.
   a. True
   b. False

2) What is diabetes?
   a. Diabetes means that your blood sugar is too low
   b. Diabetes is a disease that impairs the body's ability to use food
   c. Diabetes affects very few people
   d. Diabetes cannot be affected by diet and exercise

3) What makes you more at risk for getting diabetes?
   a. Gaining too much weight
   b. Not being active
   c. Family history of diabetes
   d. All of the above

4) What are two signs or symptoms of diabetes? (Circle 2)
   a. Going to the bathroom very often
   b. Having lots of energy
   c. Being very thirsty
   d. Healing quickly from cuts

5) How do you prevent diabetes?
   a. Stay active and exercise
   b. Eat meals that are high in fat
   c. Wear aluminum hats
   d. Don't eat fruits and vegetables

Correct answers noted in red