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An Evaluation of Health Rocks! with a Control Group

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An Evaluation of *Health Rocks!* with a Control Group

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Youth substance use challenges their health and well-being. There is research and practical need for rigorous evaluation of substance use prevention programs in prompting positive youth development. This study examined the program effectiveness of Health Rocks!, a youth substance use prevention program, with a quasi-experimental two-factor mixed evaluation design. We gathered data from 584 participants (i.e., 475 youth in the treatment group and 109 youth in the control group) and conducted paired-sample t-tests for each group to compare youth substance use-related outcomes before and after the training. Results showed that youth in the treatment group reported significant increases in substance use knowledge, perceived support, and assets to make healthy life decisions, whereas the youth in the control group showed no significant differences in these outcomes. These findings, consistent with previous evaluations, highlight program effectiveness and the continued use of post-then-pre-evaluations in practice.

Keywords: *Health Rocks!*, youth substance use, prevention, program effectiveness, two-factor mixed evaluation

Introduction

Youth substance use challenges their health and well-being (Johnston et al., 2016; Peiper et al., 2016; Young et al., 2002). Tobacco, alcohol, and illicit drugs such as marijuana are the most commonly used substances among youth (National Institute on Drug Abuse, 2022). Previous studies have shown that youth involved in substance use are more likely to have health problems associated with overdose and addictions and are more likely to experience violence, mental health issues, suicidal ideations, and risky sexual behaviors than their peers (Centers for Disease Control and Prevention, 2020; Gray & Squeglia, 2018; Litwiller & Brausch, 2013; Poorolajal et al., 2016). Nevertheless, youth substance use remains a major societal challenge in the U.S., with

approximately 1.1 million youth aged 12 to 17 having substance use disorders in 2019 (Substance Abuse and Mental Health Services Administration, 2020). More recent national data show that over half of 12th graders report having used alcohol in the past year, and over 8% of 8th graders, 19% of 10th graders, and 30% of 12th graders report using cannabis in the previous year (National Institute on Drug Abuse, 2022).

In Delaware, where the project data have been collected, the high rate of youth substance use is also imperative to address and calls for effective prevention programs. According to the latest data from the Youth Risk Behavior Surveillance System (YRBSS) (Centers for Disease Control and Prevention, 2021), nearly 17% of middle-school youth reported they had ever drunk alcohol, and 20.2% of high-school youth reported they were actively drinking alcohol at the time of data collection. This number was statistically similar to the national average of high-school youth who currently drank alcohol (22.7%). Moreover, around three in ten high-school youth (29.4%) in Delaware reported having used marijuana, which is also not statistically different from the national rate (27.8%) (CDC, 2021). Finally, 11% of middle schoolers and 33% of high schoolers in Delaware have ever used electronic vapor products, but no national data were available on middle schoolers from YRBSS. In sum, youth substance use in Delaware is representative of the concern in the U.S.

Given the high prevalence and adverse consequences of youth substance use, it is critical to examine evidence-based prevention programs in prompting positive youth development using rigorous research designs (Department of Health and Human Services, 2016; Skiba et al., 2004). Therefore, our study used a two-factor mixed design to evaluate the effectiveness of *Health Rocks!*, a national curriculum for preventing youth substance use.

Health Rocks!

Health Rocks! is a National 4-H Council curriculum that is intended to prevent youth substance use by enhancing knowledge of consequences, promoting positive social norms, and developing healthy behaviors and life skills. The curriculum is premised on extant research and theory on positive youth development that identifies risk and protective factors linked to various positive youth outcomes (Lerner et al., 2009). The curriculum uses an experiential learning framework in which activities are interactive and designed to foster critical thinking and reflection (Kolb, 2014). *Health Rocks!* is intended to be delivered for a minimum of 10 hours of participation, though there is substantial flexibility in delivery schedules (e.g., *2 hours* a week for 5 weeks versus 5 hours a day for 2 days). *Health Rocks!* has been used in a variety of settings, including summer camps, after-school programs, and school enrichment activities. Since 2009, the program has been adopted in at least 21 states across the country. An 11-year evaluation shows the program has positive effects in increasing youth knowledge about substances, supporting youth to develop life skills, and promoting healthy life choices (Wang et al., 2024).

Program Effectiveness

Prior evaluation of the effectiveness of the *Health Rocks!* program relies on a retrospective pre-post design, a relatively easier method for practitioners to identify self-reported behavior changes, as it is administered only once at the end of the program (Rockwell & Kohn, 1989). Findings under this evaluation design show positive gains in youths' awareness of the negative consequences of substance use and their ability to apply positive stress-coping strategies (e.g., see Kumaran et al., 2014; Kumaran et al., 2015; Park & Jang, 2018; Reeves et al., 2017; Self et al., 2013; Taylor et al., 2019; Wang et al., 2024; Xia et al., 2016). Although the post-then-pre design captures the changes in knowledge and attitudes before and after the program, the lack of a comparison group (i.e., control group) limits the conclusion that the program causes the change instead of other factors, such as developmental changes over time. A quasi-experimental design includes both the treatment group (which has program participants) and a control group (which consists of people with similar characteristics to the program participants, but who do not receive the training). This design provides stronger evidence of the program's effectiveness, in that it can account for potential developmental changes in participant characteristics over time better than a single group design. The two-factor mixed design incorporates the strengths of both the within-group comparison (i.e., post vs. pre) and between-group comparison (treatment vs. control group) in evaluating program effectiveness (Kelly & Perkins, 2012).

Current Study

The current study aims to examine the effectiveness of *Health Rocks!* with a two-factor mixed design. The research question was: What is the effectiveness of the *Health Rocks!* program in improving youth substance knowledge, perceived support, and intrapersonal and interpersonal assets compared to a control group? To address the research question, we proposed three research hypotheses:

> H1: Youth who participated in the *Health Rocks!* program (treatment group) show significant positive changes in their substance knowledge, perceived support, and intrapersonal and interpersonal assets after the training than before the training.
> H2: Youth who did not participate in the *Health Rocks!* program (control group) show no significant positive changes in their substance knowledge, perceived support, and intrapersonal and interpersonal assets after the training than before the training.
> H3: There are significant effects of *Health Rocks!* program on youth outcomes.

Method

Research Design

This study used a two-factor mixed design to evaluate the effects of the *Health Rocks!* program on substance use prevention outcomes. Youth participants in the treatment group (i.e., youth who

completed 10 hours of the *Health Rocks!* program) and the control group (i.e., who did not participate in the program) responded to the same survey before and after the program at the same time points. All the surveys were collected using pens and paper. Youth were all recruited from the 4-H after-school programs in Delaware. Extension staff collaborated with after-school program staff to deliver the *Health Rocks!* training to youth in school settings of the counties participating in the 4-H programs. The *Health Rocks!* program sessions (the curriculum) were delivered by two facilitators, including one youth peer trainer and one adult trainer. All youth and adult trainers attended a 2-day workshop for delivering the curriculum and received ongoing support and monitoring from the state 4-H *Health Rocks!* staff. The Institutional Review Board at the University of Nebraska-Lincoln approved the participant recruitment and data collection.

Participants

At the pre-test, 588 youth completed the survey. Of these 588 youth, 584 completed the post-test survey. We removed four youth responses missing the post-test from the analysis, resulting in our current sample size. A total of 584 youth participants completed the evaluation surveys at pre-test and post-test, with 475 youth in the treatment group and 109 youth in the control group. Table 1 summarizes the demographic information of participants in the pre-test. Pearson's Chi-square tests were conducted to compare youth gender, race, ethnicity, residence, and extracurricular activity participation between the treatment and control groups. An independent samples *t*-test was used to compare the means of youth age in the two groups.

Youth in the treatment and control groups had no statistically significant differences in gender, age, race, and ethnicity. Notably, although the means of age in the treatment and control groups had no statistically significant difference, the control group had a higher proportion of youth aged 10 years or younger and 16 years and older (61.3%) than in the treatment group (23.4%). In addition, the treatment group had smaller numbers of youth who resided in rural areas and who attended extracurricular activities than the control group. These differences can be related to the self-selection bias (White & Sabarwal, 2014). In this case, the two groups are comparable.

Table 1. Demographic Characteristics of Participants

	Treatment Group		Control Group		Difference	
	n	Percent	*n*	Percent		*p*-value
Gender					χ^2 = .89	.346
Boy	224	51.6	45	56.7		
Girl	239	48.4	59	43.3		
Age					*t* = .94	.350
10 and younger	27	5.9	31	29.8		
11	58	12.6	13	12.5		
12	98	21.3	10	9.6		
13	87	18.9	7	6.7		
14	72	15.6	0	0		

	Treatment Group		Control Group		Difference	
	n	Percent	*n*	Percent		*p*-value
15	38	8.2	0	0		
16 and older	81	17.5	33	31.7		
M (SD)	13.32 (2.10)		13.04 (2.86)			
Median	13		12			
Race					$\chi^2 = 3.47$	.482
Caucasian American	109	30.6	35	38.9		
African American/Black	104	29.2	21	23.3		
Native American	11	3.1	1	1.1		
Asian/ Asian American	13	3.7	3	3.3		
Multi-racial	119	33.4	30	33.3		
Ethnicity					$\chi^2 = .01$	.929
Hispanic/Latino	170	41.0	36	40.4		
Non-Hispanic/Non-Latino	245	59.0	53	59.6		
Residence					$\chi^2 = 6.96$	.031
Urban	48	10.8	10	9.5		
Suburban	322	72.7	66	62.9		
Rural	73	16.5	29	27.6		
Extracurricular activity participation					$\chi^2 = 16.88$	<.001
Yes	195	42.5	69	64.5		
No	264	57.5	38	35.5		

Note. χ^2 = Chi square.

Measures

Both the pre-test and post-test surveys consist of 29 items. Each item has a 4-point Likert scale with response options ranging from 0 to 3 (0 = *Strongly Disagree*; 1 = *Disagree*; 2 = *Agree*; 3 = *Strongly Agree*). Higher scores indicate stronger agreement with the items. As a background, the survey with 29 items was created by the *Health Rocks!* evaluation team in 2009. The robustness of the original measure was tested and validated using the test-retest and split-half methods. After the data were collected with a large-enough sample size, the original *Health Rocks!* research team conducted the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA) to ensure the reliability of the measures. The national data revealed four constructs (i.e., actions, knowledge, attitudes, and skills).

In our study using the two-factor mixed design, the research team conducted the exploratory factor analysis (EFA) with the 29 items to check the reliability of the measures with our sample. The data from all the 584 participants were included in the analysis. EFA results with pre-test and post-test data were consistent. The results showed four different constructs and were titled *knowledge* of substance use consequences (five items), perceived *support* from and for others (six items), *intrapersonal assets* related to healthy decision-making (ten items), and *interpersonal assets* in interactions with people (nine items). The composite score for each

subscale was created from the means of the items under the subscale. The total score was calculated by averaging all the 29 items that measured the overall youth healthy living outcomes. Table 2 shows the items under each subscale and the measures' reliability scores (Cronbach's alphas) before and after the training by group. Except for the knowledge subscale before the training in the treatment group, Cronbach's alphas are all at least .70 for each subscale across times and groups, indicating acceptable internal consistency.

Table 2. Measures and Cronbach's Alphas by Group

	Treatment Group (n = 475)		Control Group (n = 109)	
	Before	After	Before	After
(a) Knowledge	.52	.70	.70	.74
(b) Support	.70	.75	.77	.75
(c) Intrapersonal assets	.79	.84	.76	.81
(d) Interpersonal assets	.77	.84	.79	.79

Analysis

First, the research group conducted independent samples *t*-tests to compare mean scores between the treatment and control groups before the training. Second, the research group ran paired-sample *t*-tests to compare responses before and after the training for each treatment and control group to test the hypotheses. Third, we calculated the effect size using Cohen's *d* formula for paired samples *t*-test. We calculated Cohen's *d* using the differences between the means divided by the differences between standard deviations. The effect sizes are assessed by Cohen's standards of being small ($d = 0.2$), medium ($d = 0.5$), or large ($d \geq 0.8$) (Cohen, 1988). Finally, given that this study was a mixed factor design, the research group also conducted two-way repeated measures ANOVA. Results showed that in addition to the unequal sample sizes between the treatment and control groups, the data in two subscales (i.e., the knowledge and interpersonal assets) violated the assumption of sphericity, showing unequal variances of the differences between all combinations of related groups. Therefore, we presented the results with the Greenhouse-Gieser correction.

Results

Independent samples *t*-test results show that, although youth in the treatment group on average scored slightly higher than those in the control group before the training, the differences were nonsignificant (see Appendix A). Paired sample *t*-test results indicate that, in accordance with H1, participants in the treatment group reported statistically significant positive changes in knowledge, support, intrapersonal assets, interpersonal assets, and total average scores after completing the *Health Rocks!* program (see Table 3). In comparison, as hypothesized in H2, youth participants in the control group showed no statistically significant differences in scores. Specifically, in the treatment group, youth participants' average scores on *knowledge* of substance use consequences increased from 2.33 before the program to 2.41 after the program (*t*

= 3.88, $p < .001$). Their average scores on *support* increased from 2.28 before the program to 2.31 after the program ($t = 2.01$, $p = .045$). Their average scores on *intrapersonal assets* increased from 2.32 before the program to 2.35 after the program ($t = 3.64$, $p = .035$). Their average scores on *interpersonal assets* increased from 2.29 before the program to 2.34 after the program ($t = 3.64$, $p < .001$). In total, youth participants' average scores were 2.30 before the *Health Rocks!* program and 2.35 after ($t = 3.71$, $p < .001$).

Table 3. Means, Standard Deviations, and Paired Sample t-test Results

	Treatment Group (n = 475)					Control Group (n = 109)				
	Before	After	Effect Size	t	p	Before	After	Effect Size	t	p
(a) Knowledge	2.33 (.44)	2.41 (.49)	.18	3.89	<.001	2.29 (.55)	2.35 (.61)	.16	1.63	.107
(b) Support	2.28 (.47)	2.31 (.48)	.09	2.01	.045	2.25 (.55)	2.25 (.58)	.00	0.05	.963
(c) Intrapersonal assets	2.32 (.38)	2.35 (.43)	.10	2.11	.035	2.25 (.42)	2.27 (.46)	.06	0.66	.511
(d) Interpersonal assets	2.29 (.41)	2.34 (.43)	.17	3.64	<.001	2.23 (.45)	2.28 (.45)	.14	1.47	.145
Total	2.30 (.34)	2.35 (.39)	.17	3.71	<.001	2.25 (.39)	2.28 (.43)	.13	1.40	.165

Note. Effect sizes were calculated using Cohen's *d.*

Finally, Table 4 displays two-way repeated measures ANOVA results that account for both between-group (i.e., treatment vs. control group) and within-group (i.e., before and after the program) factors. Results only partially supported H3, with the *Health Rocks!* program having statistically significant effects on youth *knowledge* and *interpersonal assets* but no statistically significant effects on youth perceived *support* and *intrapersonal assets*. Specifically, in terms of between-subject effects, there were no significant differences between the treatment and control groups across all four measures. In terms of within-subject effects, there were significant main effects of the program on youth *knowledge* ($F = 8.83$, $p = .003$, $MSE = 55.12$) and *interpersonal assets* ($F = 7.91$, $p = .01$, $MSE = 30.04$). There was no significant interaction between the program participation and group on youth *knowledge* and *interpersonal assets*. Follow-up pairwise comparisons showed that youth in the treatment group had more *knowledge* and *interpersonal assets* after the training than before. Youth in the control group reported no significant changes in these two measures. However, regarding youth perceived *support* and *intrapersonal assets*, none of the main effects of the group, the main effects of the program, and the interactions between program and group were significant. In sum, the program significantly increases youth knowledge and interpersonal assets but does not change youth perceived *support* and *intrapersonal assets*.

Table 4. Results of Between-Subject and Within-Subject Effects

Between-Subject Effects						
Measure		Sum of Squares	*df*	Mean Square	*F*	*p*
Knowledge						
	Group	.44	1	.44	1.14	.285
	Error	222.70	582	.38		
Support						
	Group	.374	1	.37	.90	.344
	Error	242.13	582	.42		
Intrapersonal assets						
	Group	.93	1	.94	3.26	.071
	Error	166.90	582	.29		
Interpersonal assets						
	Group	.85	1	.85	2.74	.099
	Error	180.75	582	.31		
Within-Subject Effects						
Measure		Sum of Squares	*df*	Mean Square	*F*	*p*
Knowledge						
	Knowledge	.84	1	.836	8.83	.003
	Knowledge x Group	.023	1	.023	.240	.624
	Error	55.12	582	.095		
Support						
	Support	.06	1	.06	.85	.356
	Support x Group	.05	1	.05	.72	.397
	Error	41.19	582	.07		
Intrapersonal assets						
	Intrapersonal assets	.11	1	.11	2.20	.138
	Intrapersonal assets x Group	.01	1	.01	.14	.714
	Error	30.11	582	.05		
Interpersonal assets						
	Interpersonal assets	.41	1	.41	7.91	.01
	Interpersonal assets x Group	.01	1	.01	.15	.70
	Error	30.04	582	.05		

Discussion

The evaluation of *Health Rocks!* program with a quasi-experimental design suggests that the program helped youth participants in several aspects. Paired sample *t*-test comparisons show that the *Health Rocks!* program is effective in increasing youths' knowledge of substance use consequences, perceived support from and for others, and assets in healthy decision-making and interactions with people. Two-way repeated measures ANOVA results support that the *Health Rocks!* program is effective in increasing only youth knowledge and interpersonal assets. The results of the current evaluation, with a more rigorous design, are partially consistent with the

findings of the *Health Rocks!* annual evaluations throughout a dozen implementing states over the past years (e.g., Kumaran et al., 2014; Kumaran et al., 2015; Park & Jang, 2018; Reeves et al., 2017; Self et al., 2013; Xia et al., 2016). In addition, this study identifies different numbers and characteristics of the constructs from other studies using the post-then-pre design (e.g., Self et al., 2013). The discrepancies in the measurement and findings suggest the need for measurement validation with data across sites and time and triangulation from different research methods for research purposes. Researchers and practitioners need to balance the tradeoff between research rigor and practical considerations when evaluating program effectiveness.

The *Health Rocks!* program has lesser effects on perceived support and intrapersonal assets than on knowledge and interpersonal assets. These findings are consistent with other *Health Rocks!* evaluation outcomes using the post-then-pre research design. For example, Self et al. (2013) found larger effects of the program on youth knowledge and actions (related to behavior changes) than on youth beliefs and skills. Wang et al. (2024) also found the same pattern that the program consistently had the largest effect on knowledge, followed by skills and assets in their eleven-year review of the *Health Rocks!* training program. The logic model of evaluation and the theory of change may explain the differences in their effect sizes (Funnell & Rogers, 2011; Savaya & Waysman, 2005). In the program evaluation, knowledge and interpersonal skills are primarily considered short-term outcomes, which can be immediately detected after the program. In contrast, support and intrapersonal assets are intermediate and long-term outcomes, which show minimal effects immediately after the training. Youth need to take more time to seek supportive relationships and strengthen intrapersonal assets. In this case, longitudinal evaluations of the intermediate and long-term effects would be helpful to examine the effects. The findings also provide implications for evaluating training programs with different types of project outcomes.

The small effect sizes (.09 to .17) of the program may be due to several reasons. First, meta-analyses show mixed results or minimum effect on the effectiveness of large-scale substance use prevention programs with more rigorous research designs (Lize et al., 2017; Tobler & Stratton, 1997). These studies call for evidence-based research to compare findings using different research designs. Second, as discussed, the changes in perceived support and interpersonal assets may take longer to observe than immediately after the training. Future longitudinal research that measures the intermediate and long-term effects of the training may compare the effects over time. Finally, results suggest the need for continuous updates of program curricula to address new challenges to youth. For example, the recent 2019 edition of the program curriculum adds more information about supporting youth dealing with influences from social media. Still, given that the *Health Rocks!* program takes only 10 hours to complete as a universal prevention program, these program effects are small but meaningful.

Implications

In the annual evaluation, a post-then-pre design is used as a way to balance the feasibility and rigor of the evaluation method. Given that the program's effects are partially consistent with quasi-experimental and pre-post designs, this study highlights the trade-off that researchers and practitioners make between research rigor and practical convenience in program evaluation and encourages them to carefully weigh the risks and benefits of different designs. It supports the use of surveys to assess program effects related to curriculum content and targeted outcomes. The findings also highlighted the necessity for other prevention programs to design curricula related to youth intrapersonal and interpersonal assets that help them cope with stress and make healthy life decisions.

Limitations

Results should be interpreted in light of several study limitations. First, the knowledge subscale before the training for the treatment group (youth who participated in the program, Cronbach's alpha = .52) showed low internal consistency. Yet the subscale for the control group (youth who did not participate in the program, Cronbach's alpha = .70) shows acceptable internal consistency. None of the other studies with the same measure but a post-then-pre design reported any problems with the scale. Future evaluation of knowledge would help better understand the difference. Second, only the immediate effect of the program is evaluated in this study. Whether these positive effects are sustained over time remains unclear. Future longitudinal assessments of the program will help to examine the long-term effects. Third, the uneven sample sizes between the treatment and control groups may require caution when comparing differences in program effectiveness even though the sample size in the control group is large enough to detect changes. Fourth, youth who participated in the program may be affected by self-selection biases and thus reported more positive changes after the training than youth in the control group. The absence of random assignment could lead to biased results. Furthermore, youth who self-selected to enroll in the study, either in the treatment or control groups, may be nonrepresentative of youth in general. These youth may be more interested in the program and substance use topics than others. In this case, the program effects might be either greater when the youth are more motivated and engaged in the learning, or smaller when the youth have already gained the information from other sources. These self-selection biases can limit the generalizability of the findings from the program. Additionally, different levels of potentially influential factors of the program also need to be addressed. Specifically, the program-level and school-level characteristics, such as facilitators' background knowledge and disciplinary referrals at school, may impact youths' responses to outcomes. Although this study adopted treatment and control groups to compare and test before- and after-training outcomes, it is possible that personal characteristics (e.g., engagement in extracurricular activities) still can affect results. Future research using a true experiment with stricter inclusion criteria is recommended.

Conclusion

Overall, this study adopts a rigorous design and provides more robust evidence for the effectiveness of the *Health Rocks!* curriculum than any previous evaluation of the program. Findings suggest that the program is effective in improving youth substance use outcomes in terms of their knowledge about substance use, perceived support in dealing with stress, and assets to make healthy life decisions. The partially consistent findings with previous evaluations using post-then pre-evaluations on this program call for a balance between research rigor and practical convenience.

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Appendix A

Table 5. Mean Comparisons Between the Treatment and Control Groups Before the Program

	Treatment Group (n = 475)	Control Group (n = 109)	t	p
(a) Knowledge	2.33	2.29	.68	.500
(b) Support	2.28	2.25	.56	.575
(c) Intrapersonal assets	2.32	2.25	1.60	.110
(d) Interpersonal assets	2.29	2.23	1.42	.078
Total	2.30	2.25	1.43	.077

Note. Independent sample *t*-tests were conducted.