

Emily's Hope Upper Elementary School Substance Use Curriculum: Knowledge, Attitude and Perception Outcomes — a Cross-Sectional Study

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Abstract

Background: Substance use severely harms health, mental health, and is a leading cause of preventable morbidity and mortality. To help prevent substance use, developmentally appropriate educational interventions during elementary school are much needed.

Methods: An evidence-based and age-appropriate substance use prevention curriculum targeted at upper elementary school students (4th and 5th grades) was developed by a multidisciplinary educational committee. The curriculum was administered to 514 upper elementary over the 2023-2024 school year.

Results: A pre-curriculum baseline knowledge survey was administered to 274 students in 4th grade and 240 students in 5th grade over the 2023-2024 school year. At the end of the school year, following instruction of the curriculum, the survey was re-administered post-curriculum (n=158 in 4th grade; n=162 in 5th grade) with student retention rates of 58% and 68%, respectively. This pilot study demonstrated increased knowledge, changes in attitude, and improved perceptions about health promotion and substance use prevention in both 4th and 5th grade students.

Conclusion: These results support well-designed and age-appropriate curriculum as effective prevention programs that would ideally mitigate risk and reinforce protective factors. It further suggests that elementary school-based prevention programs are likely to be successful, which could help reduce exposure to substances during middle and high school.

Introduction

Substance use severely harms health, increases risk of chronic diseases, mental health conditions, and is a leading cause of preventable mortality. It places a burden on the individual, their families, and their communities. The percentage of adolescents reporting any illicit substance use remains a concern. According to the Monitoring the Future study, 10.9% of 8th graders, 19.8% of 10th graders, and 31.2% of 12th graders reported illicit drug use in 2023.¹ Substance use can significantly disrupt normal brain development, potentially leading to lasting cognitive and behavioral issues.² The brain continues to develop until the mid-20s, with the prefrontal cortex, responsible for higher-level executive functions, being one of the last regions to mature. Additionally, the epigenetic changes from adverse childhood experiences and impaired childhood mental health can further increase vulnerability for substance use.³ The likelihood of developing a substance use disorder increases significantly when individuals initiate substance use during adolescence. Youth who begin drinking before

age 15 have four to six times the rate of lifetime alcohol dependence than those who remain abstinent from alcohol use until age 21. Most people with a substance use disorder started using before age 18, and developed substance use disorder by age 20, underscoring the need to prevent youth substance use/experimentation.⁴ Multiple individual, family, peer, school, and community related intervention targets have been identified by various studies. Much emphasis has been paid to adolescents, but targeting students during upper elementary school years with educational interventions may cultivate and foster lifelong understanding surrounding personal health, brain function, safe medication use, and harms from substance use. Many children have their first encounter with substances in middle school due to being exposed to new social situations and stressors related to adolescence.⁵ The upper elementary school-based setting would be an ideal environment to pursue this important goal of prevention by promoting general wellbeing, health, school connectedness, and parent engagement. The present times need valid, preventative, and educational interventions

in upper elementary school level aimed at enhancing protective factors and decreasing risk factors to reduce initiation of substance use and improve social-emotional-psychiatric-substance use-economic outcomes. These targeted interventions may alleviate emotional dysregulation, academic failure, peer rejection, access to substances, and medication misuse while fostering coping skill building to channel emotions/impulses positively, improving parental monitoring, facilitating academic competence, and cultivating peer and family cohesion.

Fear based educational programs delivered in a didactic form, like Drug Abuse Resistance Education (DARE), have struggled to achieve desired prevention outcomes among youth.⁶ The *Emily's Hope* substance use prevention curriculum was designed with the help of local educators, school administrators, school counselors, addiction medicine specialists, addiction psychiatrists, and local physicians to address growing concerns surrounding substance use and overdose in the upper Midwest. A previous study, piloting *Emily's Hope* curriculum, in a third-grade student body (n=324), demonstrated statistically significant gains in third grade students' knowledge about the brain and its function, attitudes toward substance use, and harm perception, the curriculum was expanded to upper (4th and 5th) elementary school grades.⁷ This study was aimed at evaluating the effectiveness of a pilot health promotion and substance use prevention curriculum introduced at upper elementary school grade level.

We assembled a multidisciplinary educational committee, including experts from child psychiatry, psychology, addiction studies, education, and school administration, with the goal of developing an evidence-based elementary school substance use prevention curriculum that can be utilized by schools locally and beyond. A pilot version of the *Emily's Hope* substance use prevention program was administered to 4th and 5th grade students (n=514) in 14 different school districts over the 2023-2024 school year, and students completed baseline knowledge surveys prior to receiving the curriculum. After a year of instruction, the survey was re-administered, and students demonstrated significant improvements regarding body functions, safety, and substance use.

Methods

A multidisciplinary educational committee developed an upper elementary school health promotion and substance use prevention curriculum. The school administrators obtained consent from guardians at the beginning of the

school year to allow the administration of our curriculum in the classroom. The curriculum committee conducted orientation sessions for educators and counselors involved in the study. The schools were provided with required teaching aids and other equipment. The accompanying lesson books, tailor-made for each grade level, were developed to present educational content in an age-appropriate manner. Each lesson incorporates interactive elements such as group activities, discussions, and student-driven interactions to ensure active engagement. To further augment learning, animated videos, narrated stories, and quizzes are also incorporated. The students complete lesson-based surveys after lesson completion. Additionally, each lesson has an exit ticket to assess student learning. Students fill out exit tickets that then gauge responses regarding whether they gained knowledge from the material. These assessments are usually to analyze student learning, improve lessons, and help clarify contents that students may have struggled with. The curriculum was administered to more than five hundred students in upper elementary school, defined as 4th and 5th grades. The curriculum lessons are based on age-appropriate general themes intended for students to have repeated longitudinal exposure to prevention content over subsequent elementary grades. The curriculum focused on body systems, brain anatomy, impact of drug use on the body, reward pathway, neuronal signaling, assertive communication, medication safety, substance use disorder and its progression, emotional regulation, and brain recovery. The pre- and post-curriculum survey data were analyzed using ANOVA and repeated measures t-test in SAS. Nonparametric tests, including the Kruskal-Wallis and Wilcoxon tests, were used for non-normal data.

Results

Five-hundred and fourteen students in 4th and 5th grade from 16 school districts in 4 different upper Midwest states participated in the study. The median class size was 30.5 and 30 students in 4th and 5th grades. The curriculum's efficacy was assessed via pre- and post-curriculum surveys to estimate changes in knowledge, attitude, and perceptions about health promotion, healthy behaviors, body systems, brain health, medication safety, and substance use. The multiple-choice survey was designed by the education committee, focusing on basic concepts from the curriculum. The instrument was administered via Google Forms at the start of the academic year, capturing baseline data from 274 and 240 students from 4th and 5th grade, respectively, across the participating schools. All surveys were completed voluntarily, and no identifying information was collected. The initial survey was

re-administered at the conclusion of the academic year. Of the initial late elementary school cohort, 158 and 162 in 4th and 5th grade students participated, for student retention rates of 58% and 68%. The data were analyzed using SAS.

Both 4th and 5th grade students demonstrated gains from the curriculum, as measured by the difference between correct post- and pre-curriculum responses. The mean improvement in knowledge ranged from 8.6% in 4th grade to 7.6% in 5th grade ($p < 0.05$). The 4th grade showed improvement in knowledge about body systems ($\Delta = 12\%$), adverse impact of substances ($\Delta = 5\%$), Fentanyl as a “dangerous” drug ($\Delta = 12\%$), and consequential thinking “Pause-Think-Act” ($\Delta = 31\%$) (Fig. 1). In fifth grade, significant changes were seen in cause-and-effect reasoning ($\Delta = 48\%$), impact of substances on neuronal communication ($\Delta = 10\%$), medication safety ($\Delta = 17\%$), and impact of substance use disorder ($\Delta = 16\%$) (Fig. 2). The results indicate increased knowledge, changes in attitude, and improved perceptions about body function,

healthy behaviors, substance use and its impact, substance use disorder, and medication safety.

Conclusion

The study results showed an increased understanding of body systems, nervous system, impact of substance use on body systems and brain function, personal self-management, general social skills, medication safety, problem solving skills, and drug resistance. Our post-curriculum survey indicated an overall enhancement in the percentage of correct answers for most questions when compared to the pre-curriculum baseline. The differences between the pre-curriculum and post curriculum were statistically different for both 4th and 5th grade students, indicating knowledge gains from the provided course content. This study highlights that a well-structured curriculum can promote upper elementary school students’ understanding about physical health, mental health, brain function, impact of substance use, and medication safety. This improvement suggests that the

Figure 1. 4th grade results: mean improvement in knowledge was 8.6% ($p < 0.05$).

Question no.	Question (answer)	Baseline % correct (N = 274)	Post-curriculum % correct (N = 158)	Difference	P-value
1	What does the cardiovascular system do? (pumps blood)	56.93%	68.35%	+11.42%	$p = 0.02$
2	What system is the brain a part of? (nervous system)	53.65%	65.82%	+12.17%	$p = 0.01$
3	Drugs affect different systems in the body. (true)	93.43%	98.73%	+5.30%	$p = 0.01$
4	What system carries messages from the brain to other parts of my body? (nervous system)	73.36%	68.35%	-5.00%	$p = 0.27$
5	Information from the brain reaches the body through _____. (nerves)	74.82%	81.01%	+6.19%	$p = 0.14$
6	Who should I take medication from? (a trusted adult)	81.39%	82.91%	+1.52%	$p = 0.69$
7	What part of the brain reacts when there is danger? (amygdala)	38.83%	50.63%	+11.81%	$p = 0.02$
8	Fentanyl is an opioid that is _____. (dangerous)	81.75%	93.67%	+11.91%	$p = 0.0006$
9	Drugs affect the prefrontal cortex by lowering impulse control and making it difficult for people to stop using the drug. (true)	85.40%	91.14%	+5.74%	$p = 0.08$
10	It is okay to take someone else's prescription medication. (false)	92.70%	91.77%	-0.93%	$p = 0.73$
11	People are more susceptible to developing a substance use disorder if _____. (all of the above)	39.78%	51.90%	+12.12%	$p = 0.015$
12	What does PTA stand for? (Pause-Think-Act)	51.10%	82.23%	+31.18%	$p < 0.0001$
Mean totals		68.60%	77.22%	8.62%	$p < 0.0001$

4th grade significant areas of improvement: knowledge about body systems ($\Delta = 12\%$), adverse impact of substances ($\Delta = 5\%$), Fentanyl as a “dangerous” drug ($\Delta = 12\%$), and consequential thinking “Pause-Think-Act” ($\Delta = 31\%$).

Figure 2. 5th grade results: mean improvement in knowledge was 7.6% ($p < 0.05$).

Question no.	Question (answer)	Baseline % correct (N = 240)	Post-curriculum % correct (N = 162)	Difference	P-value
1	What does PTA stand for? (Pause-Think-Act)	41.00%	88.89%	+47.88%	p < 0.0001
2	Who should I take medication from? (a trusted adult)	85.83%	85.19%	-0.65%	p = 0.86
3	Drugs and alcohol hurt _____. Multiple correct answers. (nervous system, respiratory system, circulatory system, muscular system)	27.08%	33.33%	+6.25%	p = 0.18
4	Which system works when we are eating? (digestive system)	87.50%	88.89%	+1.39%	p = 0.67
5	What is the last part of my brain to develop? (prefrontal cortex)	36.25%	45.68%	+9.43%	p = 0.0588
6	The amygdala is the brain's alarm system, alerting us to things and situations that seem threatening. (true)	82.50%	86.42%	+9.43%	p = 0.29
7	Match the lobe to its function. TOTAL	11.25%	12.35%	+1.10%	p = 0.74
7a	Parietal lobe. (processes sensory information)	30.42%	32.72%	+2.30%	p = 0.63
7b	Frontal lobe. (processes coordinating movements and problem solving/thinking)	39.17%	40.12%	+0.96%	p = 0.85
7c	Occipital lobe. (processes visual information coming into the brain)	28.33%	37.04%	+8.70%	p = 0.07
7d	Temporal lobe. (processes auditory information)	42.44%	37.04%	-5.40%	p = 0.28
8	The 4 lobes of the brain work together. (true)	80.33%	78.40%	-1.94%	p = 0.64
9	Neurons of the brain talk to each other using _____. (neurotransmitters)	66.25%	74.70%	+8.44%	p = 0.07
10	Drugs activate neurons because of the chemical structure neurotransmitters. Because drugs mimic neurotransmitters, they can _____ the messages in the brain. (mimic & disrupt)	57.92%	67.90%	+9.98%	p = 0.04
11	When you call 911, you should _____. (identify yourself, identify the emergency, identify where you are, who needs help, and remain on the line)	84.17%	89.51%	+5.34%	p = 0.13
12	A key difference between prescription medication and over-the-counter medication is _____. A key similarity between prescription medication and over-the-counter medication is _____. (one can only be obtained from a doctor, dentist, or other medical practitioner; they are both dangerous)	31.25%	48.15%	+16.90%	p = 0.0006
13	Prescription and over-the-counter medications are dangerous to misuse or abuse. (true)	71.67%	76.54%	+4.88%	p = 0.28
14	Substance use disorder can cause _____. (all of the above)	54.17%	70.99%	+16.82%	p = 0.0007
15	When a person experiences an addiction, they need more of the drug to produce the same effect as before. When the person tries to stop using, they may experience withdrawal symptoms such as _____. (all of the above)	65.00%	74.07%	+9.07%	p = 0.0548
		53.82%	61.47%	+7.65%	p < 0.0001

5th grade significant areas of improvement: cause-and-effect reasoning ($\Delta=48\%$), impact of substances on neuronal communication ($\Delta=10\%$), medication safety ($\Delta=17\%$), and impact of substance use disorder ($\Delta=16\%$).

curriculum effectively conveyed the information that the educational committee postulated. These findings show that targeted and age-appropriate educational interventions can positively impact students' knowledge base, attitudes, and perceptions surrounding general health, brain function/health, emotional regulation, medication safety, substance use, substance use disorder, health advocacy, and recovery. Our study strengths include broad curriculum implementation across diverse settings, ranging from rural school districts to small urban towns. The study included a considerable sample-size across many schools in the Midwest. Additionally, the completion of lessons by all curriculum providers highlights the program's feasibility and ease of implementation in school settings.

An effective prevention program would ideally mitigate risk and reinforce protective factors in schools, families, and communities, to decrease risk of substance use. Elementary school-based prevention programs are likely to be successful with increased focus on peer relationships, self-control, positive coping skills, health-promoting behaviors, social and academic skills, and drug refusal skills. This pilot study involving upper elementary school students supports that a well-designed age-appropriate curriculum can significantly enhance knowledge, attitudes, and perceptions about physical health, brain functions, medication safety,

emotional recognition/regulation, substance use, health advocacy, substance use disorder, and brain recovery. Given the promising results, we have expanded the availability of our curriculum to multiple schools in several states including South Dakota, North Dakota, Minnesota, Iowa, and Indiana.

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