

# The knowledge and perception of opioid abuse and its long-term effects among high schoolers

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## SUMMARY

The opioid crisis is a major problem in the United States. After discussing with researchers who are on the front-line of this crisis, it was determined that information about the perception of adolescents on the opioid crisis was limited. Therefore, we assessed if there are differences in knowledge about opioids between 9<sup>th</sup> and 12<sup>th</sup> graders in a suburban, independent high school. Knowledge and perception of opioid abuse and its long-term effects was measured by a series of surveys. Hypothetically, 12<sup>th</sup> graders would have a greater knowledge of opioid abuse and its long-term effects as compared to the 9<sup>th</sup> graders because the 12<sup>th</sup> graders have spent more time in school. An educational intervention trial was done with the 9<sup>th</sup> grade students, and surveys were given to assess if the participants of the lecture gained any knowledge. The statistically significant results collected demonstrated that 12<sup>th</sup> graders had a greater knowledge of opioid abuse and its long-term effects than the 9<sup>th</sup> graders, confirming our hypothesis. Our sample size could have limited the statistical significance of some of the trials and confidence in our results can be strengthened by further replications of our experiment. The data collected in this study can be beneficial to fighting the opioid crisis present in the United States by targeting specific age groups with different educational strategies.

## INTRODUCTION

Prescription opioids are usually given to children and adolescents after they undergo surgery. Persistent opioid use after surgery is a concern among adolescents and may represent an important pathway to opioid misuse (1). The lack of safe, regulated pain management in pediatric patients may have significant impacts later in their lives. One study that examined insurance claims from patients aged 13–21 showed that 29.3% of these patients refilled their opioid prescription between 4 to 6 times. Persistent opioid use was found in 4.8% of the adolescent surgical patient population (1). This study demonstrates the addictive nature of opioids in younger patients may be due to their naivety to opioids and their underdeveloped prefrontal cortex, which controls generation and regulation of emotions (1). Opioid medication that is prescribed for pain management after surgery could lead to use of nonmedical prescription opioids later in life.

Over the last four decades, “one-fourth of high school seniors in the United States self-reported medical and nonmedical use of prescription opioids.” (2) Among the general population, white patients are primarily at risk for misuse of prescription opioids because doctors tend to prescribe more opioids to white patients as compared to African American patients. This occurs for a variety of reasons including but not limited to socioeconomic status and racial preferences (i.e., lack of treatment for African Americans) (2). Further, white male adolescents are most at risk for opioid misuse because they are more likely to take nonmedical opioids to achieve the feeling of getting a high.

Age also factors into susceptibility of opioid misuse with adolescents (12–17) and young adults (18–25) being the most susceptible (3). These age ranges include most high school seniors in the United States. These trends were observed in a single study from 1976 to 2014 and have remained relatively consistent over the years (3). The prevalence of opioid prescription misuse is 4.8% in adolescents and increases to 7.6% in young adults, indicating that these age groups are particularly susceptible to prescription opioid misuse and need to be given particular focus (3).

Given the evidence showing the susceptibility of adolescent age groups to opioid misuse, we wanted to determine if there was a difference in the perception and knowledge between 9<sup>th</sup> and 12<sup>th</sup> graders regarding the opioid crisis. These age groups were chosen because they have the greatest difference in education in a traditional high school, as 9<sup>th</sup> graders would have just entered high school, whereas 12<sup>th</sup> graders would have had finished 4 years of high school. We hypothesized that 12<sup>th</sup> graders would have a greater knowledge than 9<sup>th</sup> graders, as they have been exposed to more information on the topic and may have had more opportunities to be exposed to opioids (3). The study also included an educational intervention to teach the younger students more about opioid abuse and its long-term impacts. Using self-report surveys, we found that 9<sup>th</sup> graders were 61% less likely to have known the possible side effects of opioid misuse than 12<sup>th</sup> graders. We also found that 9<sup>th</sup> graders were 1.73 times as likely to know the age group most susceptible to opioid misuse as compared to the 12<sup>th</sup> graders. Lastly, we found that 9<sup>th</sup> graders were 52% less likely to know that one-time opioid misuse could lead to death. This study aimed to help future researchers and educators know where there are possible gaps in the knowledge of high school students in

the United States. Addressing this lack of knowledge and implementing an increase in education about the negative consequences of opioids and the opioid crisis may limit the number of opioid overdoses in the next generation.

**RESULTS**

To examine the difference in the perception of the opioid crisis between 9<sup>th</sup> graders and 12<sup>th</sup> graders, surveys were distributed and collected from 69 12<sup>th</sup> graders and 72 9<sup>th</sup> graders. The survey was completed by 88.89% of 9<sup>th</sup> graders and 82.14% of the 12<sup>th</sup> graders. The 9<sup>th</sup> grade population was then further broken down to those who received the educational lecture about opioids (n = 42) and the control group which received an educational lecture about nicotine (n = 25).

Of the students surveyed, 74% identified as white, 12% as Asian, 5% as Black, 4% as a part of the Hispanic/Latinx community, and 5% as two or more races. The gender distribution in the population surveyed was about 54.2% female and 45.8% male.

First, we compared the pre-surveys from the 9<sup>th</sup> graders and 12<sup>th</sup> graders to assess the difference in the perception and knowledge about opioids. The questions assessed the difference in knowledge regarding which age group is most susceptible (Question 6), people who have taken nonmedical opioids (Question 7), which substances were opioids (Question 8), side effects of opioids (Question 10), and the number of times opioids can be taken before causing death (Question 12). Because this was an interventional study, risk ratios (RR) were used. The entire population was at risk therefore risk ratios can be used to evaluate the exposed vs unexposed groups. Because the entire population that is at risk is known, risk ratios were the most useful tool to find associations between the data.

For Question 6, 9<sup>th</sup> graders were 1.73 times more likely to know the age group which was most susceptible to opioids than 12<sup>th</sup> graders (RR 1.41, 95% CI: 1.01–2.95) (Table 1). For question 10, 9<sup>th</sup> graders were 61.67% less likely to know the side effects of opioids as compared to 12<sup>th</sup> graders (RR 0.38, 95% CI: 0.23–0.65) (Table 2). For question 12, 9<sup>th</sup> graders were 52.08% less likely to know that a onetime use of opioids can cause death (RR 0.48, 95% CI: 0.29–0.79) (Table 3). There were no statistically significant differences between

Question 6: What age groups are most susceptible to opioid abuse?	Correct	Incorrect
9 <sup>th</sup> Graders	27	45
12 <sup>th</sup> Graders	15	54

**Table 1: Responses to Question 6.** The correct response was the age group 12-17. 9<sup>th</sup> graders were 1.73 times more likely to know the age group which was most susceptible to opioids than 12<sup>th</sup> graders (RR 1.41, 95% CI: 1.01-2.95). The 9<sup>th</sup> grade results were from the survey before the lecture.

Question 10: What are the common side effects of opioid abuse?	Correct	Incorrect
9 <sup>th</sup> Graders	14	58
12 <sup>th</sup> Graders	35	37

**Table 2: Responses to Question 10.** The correct response is All. 9<sup>th</sup> graders were 61.67% less likely to know the side effects of opioids as compared to 12<sup>th</sup> graders (RR 0.38, 95% CI: 0.23-0.68). The 9<sup>th</sup> grade results were from the survey before the lecture.

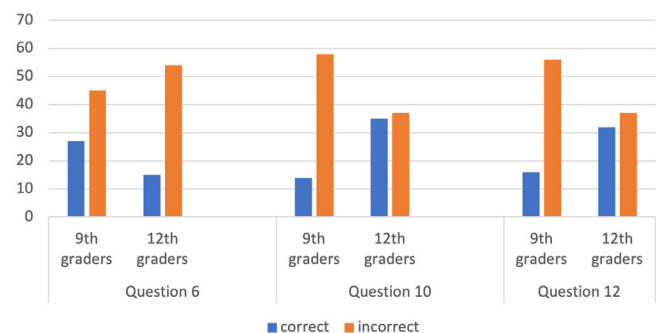
Question 12: How many times may an opioid be taken before overdose and death?	Correct	Incorrect
9 <sup>th</sup> Graders	16	56
12 <sup>th</sup> Graders	32	37

**Table 3: Responses to Question 12.** The correct answer is 1. 9<sup>th</sup> graders were 52.08% less likely to know that a onetime use of opioids can cause death (RR 0.48, 95% CI: 0.29-0.79). The 9<sup>th</sup> grade results were from the survey before the lecture.

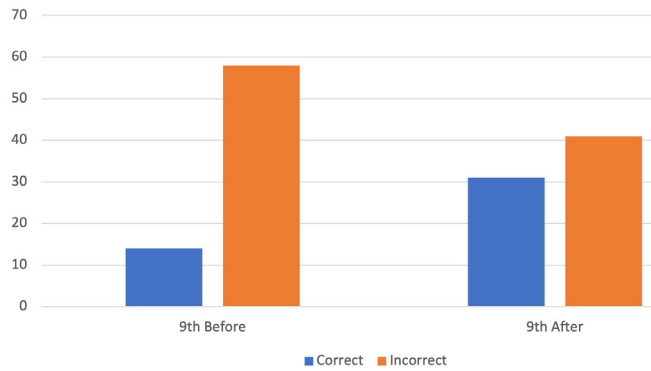
the risk ratios of 9<sup>th</sup> and 12<sup>th</sup> graders for Question 7 (RR 0.89, 95% CI: 0.54–1.47) or Question 8 (RR 0.51, 95% CI: 0.24–1.06) (Figure 1).

Next, we compared the overall 9<sup>th</sup> grade knowledge before and after the lecture. The questions analyzed between these two populations were questions 5, 6, 8, 9, 10, and 12. Question 5 asked about where opioids can be acquired. Question 9 asked about the number of opioid related deaths in the United States in 2017. Question 10 was the only risk ratio with a statistically significant result (Figure 2). The calculations for this comparison were also computed by risk ratios. The following table assesses the difference in knowledge of the 9<sup>th</sup> graders before and after the lecture was given.

Risk ratios between the 9<sup>th</sup> grade class before the lecture and after the lecture were compared and the results found that 9<sup>th</sup> graders before the lecture were 54% less likely to know the side effects of opioid misuse than 9<sup>th</sup> graders



**Figure 1: Statistically significant results.** This figure shows the number of incorrect and correct responses for 9<sup>th</sup> and 12<sup>th</sup> graders for Questions 6, 10, and 12.



**Figure 2: Responses of 9<sup>th</sup> graders before and after the lecture.** This figure demonstrates the correct and incorrect responses for 9<sup>th</sup> graders before and after the lecture was given. It shows the results of Question 10.

after the lecture. Questions 5 (RR 0.65, 95% CI: 0.35-1.20), 6 (RR 0.65, 95% CI: 0.35-1.20), 8 (RR 0.53, 95% CI: 0.25-1.11), 9 (RR 0.87, 95% CI: 0.53-1.47), and 12 (RR 0.45, 95% CI: 0.36-1.16) did not reach statistical significance.

Lastly, we compared the changes between individuals before and after the lecture and the control group. Questions 8 and 10 were assessed on a stepwise improvement. Improvement meant that the individual answered the question incorrectly in the pre-survey but answered it correctly in the post-survey. For Question 8, if two out of the three correct answers were improved on, we considered it a positive change. For Questions 10, 2 out of 6 had to be improved on to be considered a positive change. Question 6 demonstrated that 9<sup>th</sup> graders who participated in the lecture were 2.419 times as likely to have a positive change as compared to the control group (RR 2.42, 95% CI: 0.56-10.53). Question 8 showed that 9<sup>th</sup> graders who participated in the lecture were 3.049 times as likely to have a positive change in knowledge as compared to the control group (RR 3.05, 95% CI: 0.73-12.8). Question 10 demonstrated that 9<sup>th</sup> graders who participated in the lecture were 29.08% less likely to have a positive change in knowledge as compared to the control group (RR 0.71, 95% CI: 0.40-1.26). Question 12 showed that 9<sup>th</sup> graders who participated in the lecture were 55.56% less likely to have a positive change in knowledge as compared to the control group (RR 0.44, 95% CI: 0.18-1.1). The previous results were all statistically insignificant.

## DISCUSSION

An understudied area in the response to the opioid crisis is the assessment of how much knowledge adolescents have about opioid misuse and its long-term effects. We hypothesized that 12<sup>th</sup> graders would have a greater understanding of opioid abuse and its long-term effects as compared to 9<sup>th</sup> graders. We also hypothesized that incorporating a lecture about the biology and consequences of opioid addiction into a 9<sup>th</sup> grade biology class would increase knowledge of the subject. The hypothesis was based on the general greater knowledge of

12<sup>th</sup> graders as compared to 9<sup>th</sup> graders.

This study sought to explore the association between age and knowledge of opioid abuse using surveys. In the examination of the differences in knowledge between 9<sup>th</sup> graders and 12<sup>th</sup> graders, three out of six results were statistically significant. Two of these three corroborated the hypothesis that 12<sup>th</sup> graders had a greater knowledge about opioid abuse and its long-term effects. These results discussed understanding of side effects and how many uses of opioids can lead to death. Thus, we concluded from this study that 12<sup>th</sup> graders were more knowledgeable about this topic. However, to strengthen this association, a larger sample size would be needed. This population should include 9<sup>th</sup> and 12<sup>th</sup> graders from diverse socioeconomic statuses and geographic regions to accommodate for the impact of these variables. This could allow the opportunity for age to be a stronger indicator of the difference in knowledge and perception (3).

The study also sought to educate the younger age group and evaluate the results of that education. One out of six of the results was statistically significant. This result indicated that 9<sup>th</sup> graders after the lecture had a better understanding of the side effects of opioid misuse than the 9<sup>th</sup> graders before the lecture. Thus, this section of the study weakly concludes that the lecture was effective to the general 9<sup>th</sup> grade population that participated in the lecture. However, this association was relatively weak because only one result was statistically significant. The results may have been more pronounced if the participants who received the lecture knew when the second round of surveys were going to be distributed. The second round of surveys distributed two days after the lecture was given in hopes that the information would be relatively fresh in the participants minds. Had the participants known when the second round of surveys was going to be distributed, the participants may have felt inclined to study the material presented to them. This could have changed the results of the post-surveys.

The results of the second round of surveys were further broken down to assess the change in knowledge of each individual that either participated in the lecture or was a part of the control group. The results that were statistically insignificant may have occurred due to limitations in sample size, but it cannot be determined. This study surveyed a group of students who go to a private school in Marietta, a suburb of Atlanta, GA. The group surveyed most likely does not relate to all adolescents more broadly as the sample size is so small. Therefore, the results of this study most likely represent the knowledge and perception of other private school students in the metropolitan Atlanta area. To get a better understanding of the knowledge and perception of all adolescents the population size would need to be significantly larger and more diverse.

The survey included a question regarding if anyone in the sample knew someone who had taken nonmedical opioids. This question was evaluated but did not mean that those

students knew more about opioids than the student who did not have any type of interaction.

Nelson *et al.* conducted a study evaluating how emergency room patients perceived the efficacy and safety of opioid analgesics. While this study did not focus on the perception of children, it did focus on another group that is particularly susceptible to opioid abuse and its long-term effects. Emergency room patients sometimes are in acute pain that needs to be subdued through the use of opioids and they often do not have good follow up with their doctor. About 70.1% of the 715 subjects reported pain as the reason of visit to the emergency room. Of these, 72% had previously taken opioids and 62.7% of those would be willing to take them again. About 78% considered prescription opioid abuse a public health problem, but they seemed to underestimate the number of deaths. The participants acknowledged the prescription drug crisis as a serious health problem, but it did not deter them when they needed to take it for pain relief (4).

Another study viewed parental perception on the prescription of opioids to adolescents. The views of parents can affect the knowledge of the children. This study conducted by Carr *et al.* showed that 63.9% of respondents (parents or caregivers) felt discomfort seeing their child in pain. However, 29.9% were concerned about addiction through the use of opioids as pain relief drugs. Another 26.6% were concerned about drowsiness as a sequela of narcotic use (5).

The lecture showed a statistically significant result for Question 10; however, the other questions yielded a statistically insignificant result. The lecture could have been improved if the students knew that the survey would be given again, so that they might have been more inclined to pay attention. Alternatively, if the information was worked into the curriculum, the results may have been different.

This study is beneficial because it analyzed data about the gaps in adolescent's knowledge about opioid abuse and its long-term effects. These gaps in knowledge could lead to possible misuse of opioids by individuals in the future. Educating this age group about the opioid crisis and opioid misuse could help decrease the number of opioid overdoses in the next generation. Education would also be beneficial for adolescents who have undergone surgery, but do not understand the addictive nature of opioids (6). Future studies should have a larger sample size to increase confidence in the results. A lecture style of teaching may still be effective, but an assessment of the material with an established deadline would be necessary to properly evaluate how much knowledge was gained from the lecture.

### MATERIALS AND METHODS

Surveys were distributed to 9<sup>th</sup> grade biology classes and 12<sup>th</sup> grade advisories at a suburban Atlanta, Georgia independent day school. The surveys were anonymous and were placed back into a folder once completed. Each 9<sup>th</sup> grade participant was assigned a random number, and their identity was only known to the research supervisor

to accurately compare the results from the pre- and post-surveys. The surveys had an informed consent statement before the questions on the survey. The initial questions were demographic information, but after Question 5 they were arranged randomly to limit response bias. Participants not in either 9<sup>th</sup> or 12<sup>th</sup> grade who completed the survey were excluded from the study.

Subsequently, the age group hypothesized to be less knowledgeable, the 9<sup>th</sup> graders, was given a lecture to further their knowledge of the topic. This was done in conjunction with the curriculum that was being taught in biology classes to 9<sup>th</sup> graders at the time. The lecture was created by the researcher but was presented by one of the biology teachers. The lecture incorporated how opioids affect the brain on a molecular level and included epidemiological data present in the survey (7). A class of students that received an educational lecture about the molecular actions and consequences of nicotine, but not opioids, served as a control group and also completed a pre-survey. Then, a post-survey was administered two days after the lecture. The surveys were then analyzed using Google Sheets and OpenEpi to evaluate if the educational aspect of the research was effective. All surveys that were complete were included in the data analysis. All surveys were kept in a locked cabinet and destroyed at the end of the study.

The risk ratio was the statistical measure used in this study; it is the quotient of the risk of an event in an experimental group and the risk of an event in a control group.

**Figure 3** illustrates how a risk ratio is calculated:  $RR = [A / (A+B)] / [C / (C+D)]$  where A is the portion from the indicated demographic that gave the correct answer, B is the portion from the indicated demographic that gave the incorrect answer, C is the portion from the indicated demographic that gave the correct answer, and D is the portion from the indicated demographic that gave the incorrect answer. The software OpenEpi was used to create the 2x2 tables (8).

		Disease		Totals
		(+)	(-)	
Exposure	(+)	A	B	
	(-)	C	D	
Totals				

**Figure 3: Open Epi 2x2 table.** A representative 2x2 table was created using the software OpenEpi and was used to calculate the risk ratio.



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# Supplemental Information

## Survey

Anya Shroff is conducting this study at the Walker School in Marietta, Georgia. The purpose of this study is to determine if adolescents' perception and knowledge of opioid abuse and its long-term effects vary between the beginning and end of high school. Each participant will be assigned a random number, and their identity will only be known to the research supervisor. This is needed to accurately compare the results from the first survey and the second survey. This survey should take about five minutes. All responses will be anonymous and confidential. The surveys will be destroyed at the end of the study. Participation in this study is entirely voluntary. There are no anticipated personal benefits or risks for participating in this study. All responses will be used for purely educational purposes. By completing the survey, you are indicating that you understand this information and that you agree to be involved in this study.

- 1) What is your biological sex?
  - a) Female
  - b) Male
- 2) What grade are you in?
  - a) 8<sup>th</sup>
  - b) 9<sup>th</sup>
  - c) 10<sup>th</sup>
  - d) 11<sup>th</sup>
  - e) 12<sup>th</sup>
- 3) What ethnicity are you? Choose all that apply.
  - a) Caucasian (white)
  - b) Black or African American
  - c) Asian (including the Indian subcontinent)
  - d) American Indian or Alaskan Native
  - e) Hispanic or Latino
  - f) Native Hawaiian or Other Pacific Islander
- 4) Have you ever learned about opioids or opioid abuse in school?
  - a) Yes
  - b) No
- 5) Where might an individual obtain opioids for non-medical purposes from? Choose all that apply.
  - a) Family (including siblings)
  - b) Friends
  - c) Teachers or mentors
  - d) Online
- 6) What age groups are most susceptible to opioid abuse?
  - a) 12-17-year-olds
  - b) 18-21-year-olds

- c) 22-23-year-olds
- d) 24-25-year-olds
- e) 26-29-year-olds
- f) 30-34-year-olds

7) Do you know anyone who has taken nonmedical opioids?

- a) Yes
- b) No

8) What of these substances are opioids? Choose all that apply.

- a) Marijuana
- b) Synthetic Marijuana
- c) Percocet
- d) Cocaine
- e) Heroin
- f) Methamphetamines
- g) Ecstasy
- h) Fentanyl
- i) Steroid pills or shots

9) In 2017, approximately 70,237 deaths were caused by drug overdose in The United States of America. What percentage of those were from an opioid overdose?

- a) 35%
- b) 48%
- c) 68%
- d) 84%

10) What are the common side effects of opioid abuse? Choose all that apply.

- a) Nausea
- b) Constipation
- c) Muscle rigidity
- d) Hormone dysfunction
- e) Hyperalgesia (increased sensitivity to pain)
- f) Death

11) In 2017, how many opioid-related deaths occurred in Georgia?

- a) 856
- b) 923
- c) 987
- d) 1014
- e) 1096

12) How many times may an opioid be taken before overdose and death?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5