Published in final edited form as:

South Med J. 2020 November ; 113(11): 541–548. doi:10.14423/SMJ.0000000000001171.

Evidence for Cancer Literacy Knowledge Retention Among Kentucky Middle and High School Students After a Brief Educational Intervention

Lauren Hudson*, Chris Prichard*, L. Todd Weiss*, Nathan L. Vanderford*,#

*Markey Cancer Center, University of Kentucky. Lexington, KY, USA

#Department of Toxicology and Cancer Biology, College of Medicine, University of Kentucky, Ben F. Roach Building, 800 Rose Street, cc140, Lexington, KY 40536-0096, USA

Abstract

Objective: Although cancer is observed in every state in the United States, it does not affect every geographic area and population equally. Kentucky experiences the highest cancer incidence and mortality rates in the country, with an unusually high number of cases localized in its Appalachia region. Risk factors like sun exposure, tobacco use, poor diet/exercise, poverty, and lack of access to healthcare centers all contribute to this disparity. Because education levels in the area are low, cancer literacy (defined as how well a person can understand the advice of a healthcare professional and make appropriate lifestyle decisions) is also low. In this study, we examined the short-term and long-term effects of a brief cancer-related intervention on the cancer literacy of Kentucky middle and high school students.

Methods: This study targeted middle and high school students in Kentucky. We administered an online 10-item cancer literacy pretest, followed by a brief educational intervention and a posttest to 164 students at 6 Kentucky middle and high schools. This posttest also included questions asking how likely students would be to change their habits or to encourage others to change their habits as a result of the intervention. All participating students were also sent a 3-month follow-up online survey with items identical to the pretest; forty-eight (48) students completed the 3-month follow-up test, leading to a response rate of 29.2%. The data were summarized as frequencies, average, median and confidence intervals of correctly marked answers. A paired t-test was used to test for significance.

Results: We observed an increase in the overall average test score from 50.2% (95% CI, 47.8%, 52.6%) on the pretest to 77.1% (95% CI, 74.6%, 79.7%) on the posttest immediately following the intervention. There was also an increase in the average number of correct responses on each item. The 3-month follow-up test similarly showed average test score improvement (75.4%). When asked how likely students would be to change their habits as a result of the intervention on a scale from 1–10 (1=extremely unlikely, 10=extremely likely), the median was a 6. When asked how likely students would be to encourage another to change their habits, the median was an 8.

Corresponding author: Nathan L. Vanderford, nathan.vanderford@uky.edu.

The authors have no financial disclosures and no conflicts of interest to report.

Conclusion: These results provide evidence that a brief educational intervention can increase cancer literacy, improve cancer knowledge retention, and encourage behavior change in Appalachian Kentucky students. Increasing cancer literacy may result in increased participation in preventative cancer screenings and improved health habits, which could ultimately lower cancer rates in the region.

Keywords

health literacy; cancer literacy; cancer risk factors; cancer disparities; Appalachian health disparities; educational intervention

Introduction

Cancer is the second leading cause of disease-related deaths in the United States (US), with nearly 600,000 fatalities each year¹. It is responsible for 21.1% of all deaths, many of which are caused by preventable cancers, such as lung or skin cancer¹. However, people can take measures to decrease their risk for developing a preventable cancer. Several of these measures include developing a balanced diet, avoiding smoking/tobacco use, limiting alcohol consumption, avoiding excessive sun exposure, and creating a sustainable exercise regimen^{2,3-5}.

Although cancer affects individuals in every state in the US, some states and regions experience significant disparities in cancer rates and mortalities. While California is number one in number of cancer-related deaths per year, Kentucky has the highest mortality rate in the country. Kentucky experiences 197.9 cancer-related deaths per 100,000 members of the population⁶. Additionally, Kentucky has the highest incidence of new cancer cases in the US⁷. Within Kentucky, certain regions experience higher cancer rates than others. Rural areas typically observe higher cancer mortality rates. This trend is evident in the Eastern, Appalachian region of Kentucky, where residents face some of the highest incidence and mortality rates in the US^{2,8}. Furthermore, residents of Appalachia Kentucky are 8% more likely to die from a screenable or preventable cancer malignancy⁹.

Cancer can be caused by a variety of factors that are outside of the control of the patient, such as genetic predisposition or community exposure to hazardous waste. People can take precautions or make lifestyle choices that lower this risk. However, many residents of Appalachia Kentucky do not take these precautions, thus increasing the cancer incidence and mortality rates. Hazardous travel conditions caused by rural road systems, fewer healthcare centers, and poverty-stricken residents in Appalachia Kentucky also contribute to the high cancer statistics in this region⁴.

Education also plays a role in the preventable cancer mortalities in Appalachia Kentucky. The state ranks among the least educated states in the US. When counting the number of adults with at least some college experience in each state, Kentucky ranks 45th ¹⁰. Lower education levels make it difficult for people to achieve higher rates of health literacy, meaning they are unable to understand and make appropriate decisions based off health information provided to them by professionals¹¹. A recent study showed that 49% of adult participants who did not complete high school had below basic levels of health literacy,

while only 3% of those with a bachelor's degree had this same level¹². Despite its importance, 36% of people older than 16 in the US have limited health literacy. This means that roughly 78 million adults are unable to perform basic health tasks, such as properly following instructions on a medication label, reading an immunization schedule, or understanding a growth chart¹³. Adults living below the poverty line have significantly lower health literacy levels than those living above the poverty line¹². A person has high cancer literacy when they are able to understand the cancer-related advice of a medical professional and make decisions about lifestyle habits and potential treatment following this opinion. Increased cancer literacy increases a population's likelihood to participate in cancer activities, such as screenings, which can lower the cancer rates in that population¹⁴. The ideal outcome from this increased participation is that the cancer mortality and incidence rates will decrease following improved cancer literacy.

Increasing the cancer literacy of youth presents a unique public health opportunity. Youth, specifically students, are at a critical point in their development where they are more likely to create habits like smoking, drinking, and tanning. By reaching these students at this point in their growth, educators and professionals can encourage students to participate in cancer prevention and control activities and make healthy lifestyle choices.

Similar to cancer literacy, cancer numeracy also presents a unique opportunity for improving the health outcomes in less educated regions. Health numeracy was previously presented as a subset of health literacy but has since been differentiated by some researchers. Health numeracy, which specifically focuses on the numeric healthcare tasks, includes 4 overlapping categories (basic, computational, analytical, and statistical) that are each important to decreasing health disparities. People with low health numeracy are unable to take the proper number of pills as instructed, determine levels that are in a healthy range, and make approximations based off their specific risk factors¹⁵. Fewer studies have been conducted on cancer numeracy, and as a result, this study focuses only on cancer literacy and the effect it may have on the cancer rates in Appalachia Kentucky.

Our previous pilot study created connections with Kentucky middle and high schools and demonstrated that a brief cancer-related educational intervention can significantly increase the short-term cancer literacy in these students¹⁶. The current study replicates this short-term cancer literacy enhancement of the pilot study, while also providing evidence that students retain their cancer knowledge up to 3 months after the initial intervention. Increasing cancer literacy permanently in students may be an essential aspect to improving the cancer disparity in Appalachia Kentucky and the state as a whole.

Methods

The methods for this study were adapted from the initial pilot study¹⁶. The target population was middle and high school students, and participants included students from six middle and high schools located in central and eastern Kentucky. These schools are different from the schools included in the original study. The research team initially contacted and worked closely with individual science or health teachers or school administrators to gain access to the participants. The intervention occurred in participants' schools during normal school

hours. The schools and participants were anonymized, but general demographics including gender, race, ethnicity, and grade level were collected from each participant.

The study was approved by the University of Kentucky Institutional Review Board (Protocol 44637). Parental consent was waived, and students were informed of the goals of the study prior to their participation.

Participants completed an online survey (in Redcap) with the same 10-questions as were used in the pilot study. Immediately following completion of the pretest, participants watched a 40-minute educational intervention. This intervention first addressed the basics of cancer, including information on what cancer is and how mutations drive the development of the disease, before describing cancer risk factors. The intervention included a special focus on cancer disparities, particularly in Kentucky, and discussed why these disparities exist predominantly in the Appalachian region. Participants were not able to go back to the pretest or skip forward to the posttest during the intervention. They then completed a posttest with 10 identical items to the pretest. The posttest also contained 3 additional questions, asking about how the intervention affected their understanding of cancer and lifestyle choices. It also asked how likely students would be to share the information they learned in the intervention with others. Because the intervention was conducted in a classroom environment, all students present participated in the intervention, but participants were permitted to skip questions, so the response rate for each question was not 100%. Three months after completing the educational intervention, a follow-up email was sent to all original participants with a link to a survey with identical items to the initial pretest. The response rate for the follow-up survey was 29.27%.

One-way frequencies for all respondents were calculated for the demographic variables. For the pretest and posttest data, the percent of correctly marked questions was calculated for each student. Their average and median scores were computed along with their 95% confidence intervals. For the median, a distribution free method was used. A paired t-test was performed on both the binary outcomes of individual questions (correct or incorrect) and percent of total correct score to obtain their differences, confidence intervals, and p-values. The confidence intervals for the question percentages were also calculated using a general linear model with a binary outcome to check the confidence limits calculated from the paired t-test. The general null hypotheses were that either the difference in the percentages (for each binary question) or means of total percent between pretest and posttest were equal to 0. All statistical analyses in this study were performed with SAS, Version 9.4.

Results

Participants in this study (N=164) were students in grades 8–12 from six Kentucky schools, including students from both middle and high schools. Supplemental Figure 1 shows the location of these schools on a map of the state. The majority (51.3%) of the students were in 8th or 9th grade. Ninety-seven (59.2%) of the participants were female, while 67 (40.9%) were male. Eighty-seven percent of the participants identified as Caucasian, while only 0.6% identified as Asian, 3.1% identified as African American, and 9.2% identified as more than

one race (Supplemental Table 1). These demographics are aligned with the demographics of Kentucky¹⁷.

The average percentage of correct responses increased from 50.2% on the pretest (95% confidence interval [CI], 47.8%, 52.6%) to 77.1% on the posttest (95% CI, 74.6%, 79.7%) immediately following the educational intervention. The median percentage of correct responses improved from 50% to 80% (Figure 1). There was a statistically significant increase in the percent of correctly marked questions from pretest to posttest and this pattern was exhibited across each level of gender, school and grade. Percent increases in correct answers to each question were also observed; item 9 (how does Kentucky compare to other states in cancer rates?) had the highest improvement (from 28.8% to 93.9%) of the ten questions (Table 1). Ninth grade students saw a 31.8% increase (pretest=43.5%, posttest=75.3%), the largest increase out of all grades (Table 2). Questions 1 and 8 were answered correctly by >80% of participants on the pretest, and questions 4 and 5 were answered correctly by >75% of participants on the pretest (Table 1).

The 3-month follow-up survey data was collected from 48 students that participated in the intervention. The data shows that the average number of correct responses was a 75.4% (95% CI, 71.3%, 79.5%) (Figure 2). All questions besides item 8 (Cancer can impact populations or groups of people differently?) saw an increase in correct number of responses when compared to the initial pretest. Item 8 saw a slight decrease from 84.52% on the pretest to 83.33% on the 3-month follow-up (Table 3).

When students rated how the intervention affected their understanding of cancer on a scale from 1 to 10 (1=not affected at all, 10=extremely affected), the median rating was a 7 (95% CI, 7, 8). The students' ranking when asked how likely they are to change their habits on a scale from 1 to 10 (1=extremely unlikely, 10=extremely likely) following the intervention had a median of 6 (95% CI, 5, 8). When asked how likely they would be to encourage a friend or family member to change their habits on a scale from 1 to 10 (1=extremely unlikely, 10=extremely likely), the median was an 8 (95% CI, 7, 10) (Table 4).

Discussion

This study replicated findings from our previous pilot study¹⁶, while also providing insight into students' long-term retention of cancer literacy knowledge. It also examined how likely students would be to change their habits or encourage someone else to change their habits as a result of the intervention. Each item showed a significant increase in the correct number of responses immediately following the intervention, and all but one item showed a significant increase in the correct number of responses 3 months after the intervention. This data suggests that even a brief intervention can improve the short-term and long-term cancer literacy of Kentucky middle and high school students. Additionally, students are moderately likely to change their behaviors and extremely likely to encourage others to change their behaviors following the intervention. This data suggests that the intervention has the potential to alter the thought-process and actions of students with respect to preventative and future cancer care.

Previous studies in a wide variety of populations illustrate the potential public health implications for the work. First, a study found that both online and in-person cancer-related interventions improve cancer literacy in elderly colon cancer patients but noted that intervention materials specifically designed for that population's education rates, poverty levels, and culture will result in even larger improvements¹⁸. Because the materials for this intervention were designed for residents of Appalachia Kentucky, they will be more effective for this population than for others. A 2009 study including adults in the United Kingdom found that participants with decreased cancer literacy are less likely to seek further information and obtain screenings for colorectal cancer¹⁹. A similar study shows that 76% of Canadian adult participants indicated they would be more willing to seek cancer screenings if they were aware of their specific risk factors²⁰. Finally, a study including 529 young multiethnic and multicultural women found evidence that cancer literacy is the more reliable indicator of how likely participants were to participate in cervical cancer screenings. Neither race nor culture influenced cancer screening participation significantly to the degree of cancer literacy²¹. These studies demonstrate the practical importance of increasing cancer literacy, making this work using an educational intervention to improve short and long-term cancer literacy in an underserved population relevant and crucial to lowering the cancer rates in Appalachia Kentucky.

Like other studies, this study is most relevant when its limitations are taken into consideration. First, this study exclusively included Kentucky middle and high school students. Because students are developmentally dissimilar from adults, the results of this study may not be applicable to adults living and working in the same region. Similarly, this study included mostly Caucasian, non-Hispanic/Latino students, meaning the results may not be generalizable to other areas where different cultural and racial commonalities predominate. In order to observe the effects of a cancer-related intervention on adults' or other racial populations' cancer literacy in Appalachia Kentucky, this study would need to be adapted to properly fit that population. Second, some questions in the survey were answered by >80% or >75% of the population, suggesting that they faced ceiling effects. This means many students were already aware of these topics prior to the intervention and makes it more difficult to determine how the intervention affected students' knowledge on those questions because the score increase was marginal compared to the increase on other items. Third, not all students who participated in the study completed the follow-up survey. Only 48 responses were received on the 3-month follow-up and, as a result, the long-term effects of the intervention are not representative of the entire sample. This study was in final stages at the beginning of the US COVID-19 pandemic, which could have influenced the 3-month follow up response rate. Additionally, it is not uncommon for online surveys distributed by email to receive response rates of 25%–30%²². The response rate of the 3-month follow-up falls in the high end of that range at 29%. Despite these limitations, this study still aligns with our past pilot data that a brief cancer-related intervention can increase students' short-term cancer literacy. It also provides new data to suggest that the intervention can affect students' long-term cancer literacy and influence their actions regarding cancer preventative activities and care. Future work will test this affect in larger, more diverse populations.

There is potential for this intervention to be adapted to fit different contexts. First, the intervention can be altered to fit within the context of various populations (for example, rural

vs. urban, impoverished vs. wealthy, African American vs. Caucasian). Because cancer risk factors and disparities are different for each population, adapting the intervention in this way may increase the potential impact on students' knowledge. Additionally, this intervention can be altered to fit classroom time constraints. For example, if a class has two 20-minute sessions instead of one 40-minute session, the intervention can be stopped halfway and resumed the following day, likely with little detriment to knowledge retention. Lastly, including discussion questions following the session(s) would encourage critical thinking in students, creating the potential to further enhance students' cancer literacy.

Conclusion

Kentucky faces some of the harshest cancer disparities in the country, with the majority of the cancer incidence and mortality concentrated in the Appalachian region of the state. Previous studies have shown that increased cancer literacy is correlated with improved participation in cancer-preventative habits and screenings. This cancer literacy study confirmed the findings of a prior pilot study by testing students in different schools and finding that a brief cancer-related intervention improves short-term cancer literacy. It also provides evidence that this same intervention can increase long-term cancer literacy and can encourage students to share their newfound knowledge with others in order to improve their habits and participation. If a similar educational strategy is more widespread, it shows promise of lowering cancer incidence and mortality rates in Appalachia Kentucky and diminishing the disparity in this region.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was supported by the University of Kentucky's Appalachian Career Training in Oncology (ACTION) Program [NCI R25CA221765] and the Cancer Center Support Grant [NCI P30CA177558]. Lauren Hudson was supported by a summer research fellowship funded by the University of Kentucky's Office of the Vice President for Research and the Office of Undergraduate Research and the University of Kentucky's Appalachian Center Eller and Billings Student Research Award.

References

1. Leading Causes of Death. Center for Disease Control and Prevention. 2017.
2. Rodriguez SD V N, Huang B, Vanderpool RC A social-ecological review of cancer disparities in Kentucky. *Southern Medical Journal*. 2018;111.
3. Charlton M S J, Chioreso C, Ward M, Vikas P. Challenges of rural cancer care in the United States. *Oncology*. 2015;29(633–640).
4. Crosby RA W M, Vanderpool RC, Casey Rural populations and health. 2012.
5. Schoenberg NE S C, Shelton BJ, Liu M, Clayton R, Bispo JB, Fields N, Dignan M, Cooper T. A randomized controlled trial of a faith-placed, lay health advisor delivered smoking cessation intervention for rural residents.. *Prev Med Rep*. 2016;3:317–323. [PubMed: 27419031]
6. State Cancer Profiles: Dynamic View of Cancer Statistics for Prioritizing Cancer Control Efforts Across the Nation. National Cancer Institute. 2019.
7. Prevention CfDCa. Rates of New Cancers in the United States. *US Cancer Statistics: The Official Federal Cancer Statistics*. 2016.

8. Mokdad AH D-L L, Fitzmaurice C, Stubbs RW, Bertozzi-Villa A, Morozoff C, Charara R, Allen C, Naghavi M, Murray CJ Trends and patterns of disparities in cancer mortality among US counties. *JAMA*. 2017;317:388–406. [PubMed: 28118455]
9. Blake KD M J, Gaysynsky A, Srinivasan S, Croyle RT Making the case for investment in rural cancer control: an analysis of rural cancer incidence, mortality, and funding trends. *Cancer Epidemiol Biomarkers* 2017;10:992–997.
10. McCann A. Most & Least Education States in America. *Wallet Hub*. 2020.
11. Adler Nancy E. N K. Socioeconomic Disparities in health: Pathways and Policies. *Health Affairs*. 2002;21(2):60–76. [PubMed: 11900187]
12. Kutner M Elizabeth G; Ying Jin; Christine Paulsen. The Health Literacy of America's Adults: Results from the 2003 National Assessment of Adult Literacy. *National Center for Education Statistics*. 2006.
13. Sanders Lee M. F S, Klass Perri, Ann Abrams Mary, Dreyer Benard,. *Literacy and Child Health: A systematic Review*. *Archives of Pediatrics and Adolescent Medicine*. 2009;163(2):131–140. [PubMed: 19188645]
14. Rakhshkhorshid M N M, Nouri N, Safarzai F. The association of health literacy with breast cancer knowledge, perception and screening behavior. *European Journal of Breat Health*. 2018;14.
15. Golbeck Amanda L. A-S CR, Paschal Angelia M., Dismuke S. Edwards. A Definition and Operational Framework for Health Numeracy. *American Journal of Preventative Medicine*. 2005;29(4):375–376.
16. Hudson Lauren S KM, Dicken Haley E., Prichard Chris, Weiss L. Todd, Edward Jean, Vanderpool Robin C., Vanderford Nathan L.. A Brief Educational Intervention Enhances Basic Cancer Literacy Among Kentucky Middle and High School Students. *Journal of Cancer Education*. 2020.
17. United States Census. 2018.
18. Meade CD, McKinney W Paul. Barnas Gary P. Educating patients with limited literacy skills: The effectiveness of printed and videotaped materials about colon cancer. *American Journal of Public Health*. 1994;84(1):119–121. [PubMed: 8279598]
19. Von Wagner Christian S C, Good Anna, Wardle Jane. Health literacy and self-efficacy for participating in colorectal cancer screening: The role of information processing. *Patient Education and Counseling*. 2009;75(3):352–537. [PubMed: 19386461]
20. Donelle L A JF, Hoffman-Goetz L. Health literacy and numeracy: Key factors in cancer risk comprehension. *Chronic Diseases in Canada*. 2008;29(1).
21. Lindau Stacy T. T C, Lyons Tom, Langseth Lizbet, Bennett Charles L., Garcia Patricia. The association of health literacy with cervical cancer prevention knowledge and health behaviors in a multiethnic cohort of women. *American Journal of Obstetrics and Gynecology*. 2002;186(5):938–943. [PubMed: 12015518]
22. Fincham Jack E. P. Response Rates and Responsiveness for Surveys, Standards, and the Journal. *American Journal of Pharmaceutical Education*. 2008;72(2):43. [PubMed: 18483608]

Key Points:

1. Cancer rates are disproportionally high in Kentucky. The state has the highest cancer incidence and mortality rates in the country, and a significant percentage of these cases originate in Kentucky's Eastern Appalachian region.
2. Low cancer literacy rates, which results in decreased participation in preventative cancer behaviors such as screenings and healthy lifestyle habits, is more common in populations with low education and high poverty levels.
3. A brief presentation on the basics of cancer biology, risk factors, and treatment can significantly increase the short and long-term cancer literacy of Appalachian Kentucky students and encourage students to share this information with others.

Brief Description:

Cancer literacy – a patient’s ability to understand and make appropriate cancer healthcare decisions when provided with advice from a professional – may be essential to decreasing the high cancer incidence and mortality rates in Appalachia Kentucky. This study builds off a previous pilot study, examining the short-term and long-term effects of a cancer-related intervention on Kentucky middle and high school students’ cancer literacy. Students’ test scores increased from pretest to posttest both immediately following and 3 months after the educational intervention.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Figure 1.

Overall pretest versus posttest scores. Participants (N=164) completed an online 10-item pretest through Redcap before completing a 40-minute cancer-related educational intervention. Average score, median score, and confidence intervals were calculated.

Figure 2.

3-month follow-up scores. Three (3) months after completing the initial intervention, participants (N=48) completed an online survey identical to the pretest. Average score, median score, and confidence intervals were calculated.

Table 1.

Cancer literacy survey items (correct answer bolded), pretest and posttest scores, and percent responsiveness.

Question	N	Pre-Score %	Post-Score %	% Responsiveness	95% Confidence Interval	P-value
1. What is cancer? a. Cancer is a disease caused by mutations that leads to uncontrolled cell growth. b. Cancer is a virus that causes abnormal formations in the body. c. Cancer is a bacterial infection that causes abnormal processes in the body. d. Cancer is a metabolic disorder that causes changes in metabolism. e. Cancer is a mental disorder that causes changes in emotions.	162	87.7	96.3	8.6	4.3, 13.0	0.0001
2. What are the two major types of cancer? a. Solid and Liquid. b. Bone and organ. c. Breast and Lung. d. Leukemia and metastatic. e. All of the above.	164	1.2	59.8	58.5	50.9, 66.2	<.0001
3. A benign tumor is cancerous. a. True. b. False.	151	44.4	73.5	29.1	21.8, 36.5	<.0001
4. What are common cancer risk factors. a. Age. b. Carcinogens including environmental factors. c. Obesity. d. Viruses/infectious agents. e. All of the above.	158	77.2	97.5	20.3	13.9, 26.6	<.0001
5. What are some lifestyle choices that increase one's likelihood of developing cancer? a. Smoking. b. Unhealthy diet. c. Risky behaviors. d. All of the above. e. None of the above.	164	75.0	96.3	21.3	15.0, 27.7	<.0001
6. When cancer has metastasized it means it has: a. Spread to other parts of the body. b. Spread to other parts of the originally affected organs. c. Stopped spreading.	147	59.9	88.4	28.6%	21.2, 36.0	<.0001

Question	N	Pre-Score %	Post-Score %	% Responsiveness	95% Confidence Interval	P-value
d. Been cured. e. None of the above.						
7. A biopsy of a tumor is done to: a. Remove it. b. Diagnose it. c. Treat it. d. Cure it. e. None of the above.	155	58.1	71.0	12.9	7.6, 18.2	<.0001
8. Cancer can impact populations or groups of people (for example, men versus women) differently? a. True. b. False.	155	84.5	96.	11.6	6.5, 16.7	<.0001
9. How does Kentucky compare to other states in cancer rates? a. Kentucky is 15th in overall cancer incidence and mortality rates. b. Kentucky is 1st in the nation in overall cancer incidence and mortality rates. c. Kentucky has the lowest overall cancer incidence and mortality rates. d. Kentucky has the same cancer incidence and mortality rates as other states. e. None of the above.	163	28.8	93.9	65.0%	57.6, 72.4	<.0001
10. What four types of research are being conducted on cancer? a. Population/Behavioral, Transcriptional, Clinical, Systematic. b. Basic, Clinical, Translational, Population/Behavioral. c. Clinical, Basic, Qualitative, Quantitative. d. All of the above. e. None of the above.	150	7.3	30.7	23.3	16.5, 30.2	<.0001
Overall	164	50.2	77.1	27.0	24.9, 29.0	<.0001

Table 2.

Pretest and posttest scores and percent responsiveness by school, gender, and grade for the 10-item cancer literacy survey.

Demographic	N	Pre-Score %	Post-Score %	% Responsiveness	95% Confidence Interval	P-value
<i>School</i>						
School A	7	55.7	85.7	30.0	19.3, 40.7	0.0005
School B	4	75.0	100	25.0	9.1, 40.9	0.0154
School C	23	50.0	75.2	25.2	18.2, 32.2	<.0001
School D	19	54.2	81.1	26.8	21.5, 32.2	<.0001
School E	65	47.7	76.2	28.5	25.1, 31.8	<.0001
School F	46	49.1	74.6	25.4	21.6, 29.2	<.0001
<i>Gender</i>						
Female	97	52.0	78.2	26.3	23.7, 28.9	<.0001
Male	67	47.6	75.5	27.9	24.6, 31.2	<.0001
<i>Grade</i>						
8	67	47.5	76.0	28.5	25.2, 31.9	<.0001
9	17	43.5	75.3	31.8	23.8, 39.7	<.0001
10	26	55.4	74.6	19.2	14.8, 23.6	<.0001
11	39	54.1	81.3	27.2	23.3, 31.0	<.0001
12	15	50.7	78.0	27.3	21.2, 33.4	<.0001

Table 3.

Cancer literacy survey items (correct answer bolded), 3 month follow-up scores.

Question	N	3 month follow-up %	95% Confidence Interval
1. What is cancer? a. Cancer is a disease caused by mutations that leads to uncontrolled cell growth. b. Cancer is a virus that causes abnormal formations in the body. c. Cancer is a bacterial infection that causes abnormal processes in the body. d. Cancer is a metabolic disorder that causes changes in metabolism. e. Cancer is a mental disorder that causes changes in emotions.	48	97.9	88.9, 100.0
2. What are the two major types of cancer? a. Solid and Liquid. b. Bone and organ. c. Breast and Lung. d. Leukemia and metastatic. e. All of the above.	48	29.2	17.0, 44.1
3. A benign tumor is cancerous. a. True. b. False.	48	77.1	62.7, 88.0
4. What are common cancer risk factors. a. Age. b. Carcinogens including environmental factors. c. Obesity. d. Viruses/infectious agents. e. All of the above.	48	91.7	80.0, 97.7
5. What are some lifestyle choices that increase one's likelihood of developing cancer? a. Smoking. b. Unhealthy diet. c. Risky behaviors. d. All of the above. e. None of the above.	48	95.8	85.8, 99.5
6. When cancer has metastasized it means it has: a. Spread to other parts of the body. b. Spread to other parts of the originally affected organs. c. Stopped spreading. d. Been cured. e. None of the above.	48	91.7	80.0, 97.7
7. A biopsy of a tumor is done to:	48	79.2	65.0, 89.5

Question	N	3 month follow-up %	95% Confidence Interval
<ul style="list-style-type: none"> a. Remove it. b. Diagnose it. c. Treat it. d. Cure it. e. None of the above. 			
8. Cancer can impact populations or groups of people (for example, men versus women) differently? <ul style="list-style-type: none"> a. True. b. False. 	48	83.3	69.8, 92.5
9. How does Kentucky compare to other states in cancer rates? <ul style="list-style-type: none"> a. Kentucky is 15th in overall cancer incidence and mortality rates. b. Kentucky is 1st in the nation in overall cancer incidence and mortality rates. c. Kentucky has the lowest overall cancer incidence and mortality rates. d. Kentucky has the same cancer incidence and mortality rates as other states. e. None of the above. 	48	72.9	58.2, 84.7
10. What four types of research are being conducted on cancer? <ul style="list-style-type: none"> a. Population/Behavioral, Transcriptional, Clinical, Systematic. b. Basic, Clinical, Translational, Population/Behavioral. c. Clinical, Basic, Qualitative, Quantitative. d. All of the above. e. None of the above. 	48	35.4	22.2, 50.5

Table 4.

Participants perceptions of the intervention's impact on their cancer knowledge and willingness to change their behaviors or to try to influence behaviors of others.

Question	N	Median Score	95% Confidence Interval
A. On a scale of 1–10, rate the degree to which this intervention affected your understanding of cancer in Kentucky.	156	7	7, 8
B. On a scale of 1–10, rate how likely are you to change your habits (ex: tobacco, sun exposure, diet) following this intervention.	153	6	5, 8
C. On a scale of 1–10, rate how likely you are to encourage a friend or family member to change their habits.	155	8	7, 10