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A Qualitative Study of Participant Perceptions of a Cancer Research Education Program

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Abstract

Kentucky ranks first in the nation in cancer incidence and mortality rates, with the greatest burden of disease being in the Appalachian region. The cancer disparities in the Appalachian region of the state are tied to high poverty rates, low education attainment, low health care access, and high rates of poor health behaviors, such as tobacco use. The University of Kentucky (UK) Markey Cancer Center (MCC) developed the Appalachian Career Training in Oncology (ACTION) program to address the cancer and education disparities in the region. ACTION is a two-year program that focuses on cancer education and training for high school and undergraduate students from Appalachian Kentucky and features a variety of cancer-focused training activities, including faculty-mentored cancer research, clinical shadowing opportunities, cancer education activities, career development support, and community outreach projects. ACTION has been funded by the National Cancer Institute as a Youth Enjoy Science R25 research education program since 2018. The qualitative study herein used a semi-structured interview approach to identify participants' perceptions of the program including the influential aspects that have helped students pursue their desired academic career paths. Ten ACTION alumni were chosen to participate in the study, including students currently in medical school, graduate school, physician assistant school, and pharmacy school. Thematic analysis generated five themes: motivation for participation, career development, mentorship and future opportunities, knowledge gained, and program improvements. Overall, this study demonstrates that the ACTION program is having a significant impact on students' career preparation.

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Keywords

Appalachian Kentucky; Career development; Cancer research; Research education program; Workforce development; Youth enjoy science

Introduction

Cancer is a major public health issue in the USA, with over 1.9 million new cancer cases and more than 600,000 cancer deaths projected for 2023 [1]. With the severity of cancer incidence and mortality levels, there is an increasing need for education and research training programs that encourage and prepare a larger and more diverse group of students, especially at the high school and undergraduate level, to pursue careers in cancer-related fields. While several cancer-related training programs exist for students at this education level, the number of students participating may be insufficient, and the programs available may not fully meet the needs of future cancer professionals. Specific and highly integrated programs are needed to address specific cancer workforce needs [2–4].

There exists a challenge to recruit and retain students in the field of oncology, especially students of diverse and traditionally underrepresented backgrounds. This challenge likely perpetuates the low diversity of the science, technology, engineering, and mathematics (STEM) workforce, which consists of only 34% women, 14% Hispanic or Latino workers, and 9% Black or African American workers [5]. Rural students are also underrepresented in the STEM workforce. For example, the number of students from rural areas entering the medical field has been consistently declining, with these students representing less than 5% of all incoming medical students in 2017 [6].

Diversity is critical, as it enhances research and problem solving and is necessary to reduce disparities in clinical care and education [7]. Diverse groups can help attract the best available talent, which can improve problem-solving abilities, and institutions with more diverse faculty have a greater ability to achieve research goals [8]. Diversity also enhances learning outcomes. For example, one study found that a highly diverse peer group helps create positive learning outcomes for students [9, 10]. However, a qualitative study found that premedical and predoctoral students from underrepresented backgrounds face challenges during college such as limited clinical experience opportunities, inadequate resources, and inadequate mentorship, demonstrating a need for specialized education, training, and mentorship programs for such students [11].

To enhance biomedical workforce diversity, programs such as CURE (Continuing Umbrella of Research Experience) by the NCI Center to Reduce Cancer Health Disparities (CRCHD), have been established to enrich and diversify groups of students by addressing their specific areas of scientific interest and expanding training opportunities [7]. The NCI Cancer Center Supplements for High School and Undergraduate Student Research Experiences (P30S) program, which provided funding to engage students from underrepresented populations to participate in cancer research, had success enhancing the diversity of the STEM workforce, as it experienced a retention rate of 88% in health or science-related fields [7]. More recently, CRCHD launched the NCI Youth Enjoy Science (YES) Research

Education Program (R25), which focuses on providing holistic support for diverse students from underrepresented backgrounds through research opportunities, education, professional development, and community outreach [7].

One of the currently funded NCI YES programs is the Appalachian Training in Oncology (ACTION) program P at the University of Kentucky Markey Cancer Center. The ACTION Program was developed to address cancer and education disparities in Kentucky's Appalachian region. Kentucky ranks first in the nation in overall cancer incidence and mortality rates, with the greatest burden of disease being in the Appalachian region [1, 12, 13]. The cancer disparities are caused by high poverty, low education attainment, unequal health care access, and high rates of poor health behaviors, such as tobacco use [12–20]. The education disparity is significant, with Kentucky being in the bottom quartile of states awarding bachelor's degrees in science and engineering fields. Only 24% of Kentucky's population holds a bachelor's degree or greater compared to 32% of the general U.S. population. The education disparity is greatest in the state's Appalachian region, where 21% of the population does not have a high school diploma, compared to 12% of the US population; only 15% hold a bachelor's degree, compared to 32% of the US population; and less than 1% of the population holds a doctoral degree [21]. The cancer and education disparities in Appalachian Kentucky make it imperative for the existence of cancer-related education and training programs that effectively recruit and prepare students from these areas to enter the oncology field so they can aid in reducing the region's cancer burden.

The ACTION Program engages students from Appalachian Kentucky for 2 years and is specifically designed to focus on training the next generation of cancer researchers, education and prevention experts, and health care professionals. The ACTION Program trains 16 UK undergraduates and 20 high school students every year. Features of the program include a variety of cancer-focused training activities: faculty-mentored cancer research experiences, mentored clinical shadowing opportunities, cancer education activities, career development support, and community outreach projects. As of 2023, there have been seven cohorts of undergraduate students and three cohorts of high school students. Further details of the program have been described in another study [22].

We performed a qualitative assessment of 10 students who completed the ACTION Program when they were undergraduates and are now in graduate or professional school. The goal of this study was to identify influential aspects of the ACTION Program that have helped students pursue their desired academic career paths and to identify their ideas for program improvements during their undergraduate education. This article can serve as a resource to others wishing to create a similar cancer training program.

Methods and Evaluation

Overall Design

This study was approved by the University of Kentucky Institutional Review Board (IRB #44537). The study followed a descriptive qualitative approach based on semi-structured interviews. This approach is useful to gather information on participants' overall thoughts, feelings, and opinions on a specific topic while also generating a large amount of detail

and specific examples. Semi-structured interviews feature open-ended questions that allow participants to delve deeper into their personal opinions and experiences.

Sampling and Recruitment

A purposive sampling technique was used to identify potential participants. The target population comprised all students who were undergraduates when they completed the ACTION program and had completed at least 1 year of post-undergraduate education at the time of the study. Participants were invited via email to participate in the study. Originally, six participants were identified and contacted; after interviews were conducted; four more participants were identified. The final sample, therefore, consisted of 10 study participants (Table 1).

Data Collection

Interviews were conducted from December 2021 to June 2022 using an online video conferencing software. The questions/prompts are included as Supplementary Material (Appendix 1: Interview Guide). On average, interviews lasted 45 min and produced 6 pages of transcription. Interviews began with a short description of the study, followed by an opportunity for participants to give an overview of their educational and professional background. Questions were open-ended and focused on participants' learning experiences, professional experiences, research opportunities, views, challenges, and suggestions for improvements related to the ACTION Program. Interviews concluded with participants having the opportunity to provide any general feedback or opinions on the ACTION Program. Interviews were conducted until data saturation was reached.

Data Analysis

This qualitative study was conducted through the theoretical framework of phenomenology. Interviews were recorded, anonymized, and transcribed for analysis. The coding and data processing method followed a multi-step process using a phronetic iterative approach, in which emergent ideas from the data alternate with existing questions. First, interviews were outlined, and transcripts were created. Second, the transcripts were read to get acquainted with the information. The transcripts were annotated, and a general theme was given for each finding. Themes were identified by recognizing repeated keywords, phrases, and quotes from similar answers to questions from multiple participants. Third, a list of themes was generated and shared with the rest of the research team to determine the relationship between themes. In the fourth step, the themes were refined, and the list of themes was finalized. Finally, the results were summarized in tabular and paragraph format. Findings and conclusions were supported using relevant quotes. Sample quotes for each theme are provided as Supplementary Tables 1–5.

Results

We conducted 10 interviews with previous ACTION participants who had varied academic majors, backgrounds, and career path plans. Participants were all at least 1 year removed from their undergraduate education experience. The analysis of the interviews generated

five themes: Motivation for Participation, Career Development, Mentorship and Future Opportunities, Knowledge Gained, and Program Improvements.

Motivation for Participation

Participants cited a variety of reasons for applying to and enrolling in ACTION. Overall, participants pointed to hometown cancer incidence, both within their community in general as well as personal experiences, as motivation. One participant indicated that a family member's cancer diagnosis "ignited a rage inside" that encouraged a desire to "learn about why there was so much cancer in Eastern Kentucky." One participant had family members who had been diagnosed with cancer and that cancer had always been a topic that "touched at her heart," motivating her to learn more. Participants also cited a general knowledge about the lack of access to cancer care in their community, motivating them to learn more about why this occurs and what they can do to reduce it. One participant stated, "I think it's really important to learn about your home state, especially too because Kentucky has so many health disparities. I know that it is inspiring to me to want to do health care because I see so many things in our state that are harming Kentuckians. So, I think it's inspiring to want to help and make a difference and be an advocate for people."

Although not the primary reason for participation, all participants found the financial compensation provided by the program (that is, students receive a stipend for their participation in the program) to be a beneficial aspect, citing decreased financial stress, and the ability to be paid for activities that students usually do not receive compensation for, such as clinical shadowing. Related to the stipend, one participant stated, "I was able to focus on what I was passionate about and learning," while another said, "having that financial compensation helped me comfortably pay for groceries for the week, and I didn't have to take as many loans as I know other people who weren't in the program had to."

Career Development

The primary goal of ACTION is to prepare students for a career in the oncology field. Although all participants were interested in the medical field and oncology entering the program, some participants were unsure of the specific career they would pursue. Participants noted being exposed to a variety of careers they had never considered before, particularly careers in research. One participant said, "[the program] helped amplify my desire to do research and to learn about and help people with cancer...If I didn't do the ACTION Program, I would not be doing graduate school." Others experienced reassurance in their chosen field and a certainty to pursue their career due to hands-on exposure to medicine and professional experiences: "I'm pretty set on oncology now. I don't think I would be nearly as set if I didn't have this experience in undergrad, and it's helpful to know early on in medical school... I'm in the oncology interest group now." Through experiences such as shadowing and interaction with guest speakers, participants learned about the variety of the oncology field even within the role of a physician, citing that the program "definitely showed the breadth of oncology."

Mentorship and Future Opportunities

Participants cited that one of the most positive aspects of the program was the new community of mentors and peers they met who helped them focus and make more informed career choices. One participant noted, “I really liked meeting people who were similar-minded and had a similar career path like the other students. [I] just felt really supported.” This peer support created a less competitive and more welcoming atmosphere. “I think having peer support is really important so you’re not feeling like you are always in competition with people, because I think that’s a common thing for STEM majors in general.”

Students received letters of recommendation from research mentors, physicians they shadowed, and program leaders to gain admittance to graduate or professional programs. Mentors, particularly research mentors, also served as confidants (for professional life and school) who had the students’ best interests in mind. One participant said, “[ACTION] allowed me to be very involved in ways I wouldn’t have been if I hadn’t had that catalyst at the beginning.”

Participants cited a desire to continue research after their positive experience. As a result of students’ participation in undergraduate research and strong relationship with their mentors, they had the opportunity to co-author a paper, be hired at a research laboratory, pursue research in medical school, and complete a master’s program.

Knowledge Gained

Participants noted the variety of new information they learned during the program, for example, how certain social determinants of health could cause or exacerbate cancer rates in Eastern Kentucky. Prior to the program, participants primarily stated that they knew cancer was an issue in Eastern Kentucky but could not pinpoint why this was the case: “[ACTION] illuminated the specificity of the public health issue in a way that I didn’t know.” The program changed participants’ understanding of the causes of cancer in the area. One participant noted: “During the program, I learned a lot more about health disparities that have led to cancer in Appalachia, something that I wasn’t aware of because when you’re in it, like when you’re home, you don’t really see that your area is different than anywhere else.” Other participants specifically talked about health care access issues across the state: “[ACTION] also really illuminated for me ... [the] huge issue with [healthcare] accessibility because people that live in far Western or Eastern Kentucky physically cannot make it to Lexington or Louisville to get to appointments.”

Participants gained knowledge on specific laboratory techniques, clinical practices, cancer biology, and behavioral factors through their research. From research, participants noted increased confidence in presenting, reading, and writing articles and posters, such as during weekly laboratory meetings or conference presentations. One participant said that their research experience “helped with the MCAT. A lot on the MCAT is interpreting scientific data. If you’ve done that hands-on and if you’ve done the technique they’re asking you about ... it’s way easier than understanding the theory behind it.” Participants also felt that they learned more about clinical practices through their shadowing experiences and

began to feel more comfortable in that setting. A participant noted, “Even if I don’t know what’s happening during something, I’m at least comfortable enough to be there, rather than worrying about me feeling weird in a scenario and feeling like I don’t belong.”

Program Improvements

While the participants’ experiences were overall positive and very informative, some expressed ideas for potential improvement. Several students had difficulty in finding a research mentor, while others expressed that their research experience lacked structure, causing them to think they did not receive the same level and depth of knowledge and skills learned as other students. Some participants said it was difficult to manage their time between classes, research, and other obligations or even felt pressured to log more hours for the program. Some wished they had prioritized one aspect of the program more, such as shadowing, rather than research, but found it difficult to do so because of their class schedule. One student suggested that the program should require a very small number of hours over a semester for one activity, so they can experience other aspects of the program. They said, “for example, every semester, you could do 10 hours of [clinical] shadowing... just so you can have the experience.” However, the student also appreciated the flexibility the program allows for participation in all the available activities. One student found ways to manage their time more effectively, such as scheduling their classes in blocks, and appreciated the program’s cap on the number of participation hours per week.

Based on participant feedback, in future years more emphasis could be placed on providing additional student interactions, reserving time to participate in clinical shadowing, and identifying research mentors for students. Participants suggested including a list of potential research mentors who are willing to advise an undergraduate student rather than participants “having to reach out to faculty” and setting stricter guidelines on expectations once a student begins working in a particular laboratory. Despite these suggestions, many participants stated that they appreciated how flexible ACTION was and that they felt they truly had the ability to tailor the program to their interests and needs. One participant said, “the fact that [the program] is so broad is probably the strongest part of [ACTION]. We can do whatever we want with that knowledge.”

Discussion

This study aimed to evaluate and identify the influential aspects of the ACTION Program through a qualitative approach. More specifically, this study determined what students gained from various aspects of the program, including research, shadowing, and professional development activities. The study also identified possible areas for improvement. Results indicated that students had an overall positive experience in the program, with participants citing a greater confidence in their chosen career, new knowledge gained about research techniques and practices, and an inclusion in a network of peers and mentors who helped them further their career.

Previous quantitative studies assessing the ACTION program found similar results. A survey-based quantitative study found that ACTION participants experienced a significant increase in their understanding of cancer-related topics between an entry, midpoint,

and exit survey and a significant increase in their comfort with research, clinical, and outreach activities between entry and midpoint surveys and entry and exit surveys [23]. This corresponds to the results in this current study in which we found that participants' knowledge of certain laboratory techniques for cancer-related research was expanded; participants had increased awareness of how social, environmental, and biological determinants of health can lead to higher rates of cancer in certain areas, such as Appalachia; and participants experienced an increased comfort level in a clinical setting.

Through their participation in ACTION, many students feel more empowered and informed about how they could reduce the burden of cancer in their hometowns as practicing clinicians or researchers. After understanding the lack of access to cancer treatment and preventative care where they lived, one participant expressed the long-term goal of advocating for a cancer treatment facility that is more accessible to Eastern Kentuckians, as they learned that the Markey Cancer Center is the only National Cancer Institute (NCI)-designated cancer facility in the state, despite Kentucky having some of the most drastic cancer disparities in the country. The participant said, "A lot of these disparities that [the program] talked about could be pretty well generalized to different aspects of life as well. Getting that education really enabled me to see that the reason my community was the way it was wasn't due to one population or one person. It really was a systematic and geographical issue that needs to be addressed. There needs to be more advocacy for [the people in the region] and different [intervention] programs that are being implemented." In conjunction, a previous study that evaluated essays written by ACTION students has also revealed that participants knew cancer was an issue where they lived before enrolling in the program, but through ACTION, participants were able to learn more about why this was the case, including geographical factors, environmental factors, tobacco use, low education attainment, poverty, prevention, and health care provider mistrust [24].

ACTION is having a strong impact on participants' career trajectories. One ACTION alumnus is part of the Rural Physician Leadership Program at the University of Kentucky's College of Medicine. This program trains students to be able to deliver high quality care in rural areas and work with community leaders to improve the health of the general population in the area. Also, over thirty ACTION alumni, including everyone in this study, have gone on to professional school and graduate programs in Kentucky. One participant said, "helping people here is something I really want to do with my career and changing some of those struggles is really inspiring for me." This indicates a desire of students to go back and serve their community, using their new knowledge of both the clinical, biological, and public health aspects of cancer.

Other similar YES programs focusing on training students interested in STEM have noted similar outcomes with their participants. The YES program at the University of Nebraska Medical Center aims to engage American Indian and Alaska Native students to increase representation of individuals from these backgrounds in health and science-related fields. Similar to ACTION, evaluation of this program found that students were able to learn more about the depth of the healthcare field and the variety of opportunities available. Participants cited that the healthcare field "didn't have to necessarily be something so specific, so narrow. It's actually something that's very broad" [25]. Participants of the

Nebraska YES program also cited learning a variety of new laboratory techniques, such as Western blotting and immunofluorescence, as well as learning how research is written and published [25]. Participants in the Nebraska YES program had similar ideas for possible improvements, including being in a research laboratory with increased guidance and structure and having more opportunities for participants to collaborate and get to know each other [25]. The Chicago EYES (Educators and Youth Enjoy Science) on Cancer Program at the University of Chicago Medicine Comprehensive Cancer Center aims to diversify the cancer workforce by engaging minority high school and college students in immersive cancer research experiences, mentored career-exploration, and educational outreach activities for participants' communities. Similar to ACTION, the Chicago YES program found that trainees had improved self-confidence in their ability to perform research and were able to better understand the path to becoming a researcher [26]. Trainees also cited being exposed to new areas of research, career opportunities, and professional networks [26]. Most trainees (65.5%) left the program with an increased commitment to pursue a research career, compared to when they started the program, and many trainees reported significant growth regarding their knowledge of the different careers available in biomedicine [26].

While this study provides greater insight into ACTION participants' experiences with the program, there are some limitations to the study. One possible limitation was the difficulty students may have faced participating in certain aspects of ACTION due to the COVID-19 pandemic, such as having limitations on working in-person in a research laboratory, shadowing in the hospital, or interacting in-person with faculty and peer mentors, potentially causing participants to miss out on some opportunities previous cohorts experienced. For example, one participant was not able to shadow physician assistants, as they were not accepting students at the time. At the same time, however, ACTION participants may have had an easier time participating in some of these activities during the pandemic compared to non-ACTION students. For example, one participant talked about how they did not have any difficulties completing the requirements to shadow even when they knew non-ACTION friends that had difficulties completing the shadowing requirements during the pandemic.

As Appalachian Kentucky continues to rank first for overall cancer incidence and mortality in the USA, more research is needed to identify and test the best practices for educating students to best prepare them to make an impact in the field of oncology in the Appalachian region. This paper provides evidence that the ACTION Program is positively impacting the careers and lives of undergraduate students. By systematically investigating the perspective of past ACTION students who are currently enrolled in a professional or graduate program, we hope to provide a framework for developing a robust program that will be beneficial for as many students as possible and provide them with the skill set needed to reduce the burden of cancer in their home areas.

Conclusion

Cancer research education programs are important to prepare the next generation of diverse cancer professionals. The ACTION Program is working to prepare high school and undergraduate students from Appalachian Kentucky to pursue cancer careers, thereby

enhancing the diversity of the biomedical workforce. The results from this study, as well as previous evaluations of the program, suggest that ACTION has numerous supportive components that have positive influence on students and their academic success. The program can serve as a model for how other programs could support rural students in their pursuit of specific types of careers.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Participant biographies

Participant	Major and home county	Undergraduate years in ACTION	ACTION research experiences	Current status
1	Human Health Sciences; Powell County, KY	Freshman and sophomore	The participant had two research experiences, one focused on the molecular mechanisms related to colorectal cancer and the other on oncology precision medicine from a clinical research perspective.	Second-year medical student at the University of Kentucky
2	Agricultural and Medical Biotechnology; Whitley County, KY	Junior and senior	The participant's research focused on the molecular mechanisms of pediatric acute lymphoblastic leukemia.	Third-year medical student at the University of Kentucky
3	Agricultural and Medical Biotechnology; Metcalfe County, KY	Sophomore and junior	The participant's research also focused on the molecular mechanisms of pediatric acute lymphoblastic leukemia.	Fourth-year PhD candidate at the University of Kentucky
4	Agricultural and Medical Biotechnology; Pulaski County, KY	Sophomore and junior	The participant's research focused on molecular mechanisms of colorectal cancer.	Fourth-year medical student at the University of Kentucky
5	Human Nutrition; Wayne County, KY	Sophomore and junior	The participant engaged in clinical research.	Graduated with a Master's degree in Physician Assistant Studies at the University of Kentucky and now employed as a physician's assistant in Appalachian Kentucky
6	Agricultural and Medical Biotechnology; Pulaski County, KY	Sophomore and junior	The participant engaged in tobacco-related behavioral research.	Third-year pharmacy student at the University of Kentucky
7	Public Health; Powell County, KY	Freshman and sophomore	The participant's research focused on molecular mechanisms of colorectal cancer.	Third-year medical student at the University of Kentucky
8	Public Health; Harlan County, KY	Sophomore and junior	The participant engaged in behavioral science research related to health insurance literacy and numeracy.	Second-year physician assistant student at the University of Kentucky
9	Biology; Rockcastle County, KY	Sophomore and junior	The participant engaged in biopharmaceutical research focusing on developing cancer drugs.	Fourth-year medical student at the University of Kentucky through the Rural Physician Leadership Program
10	Human Nutrition; Johnson County, KY	Sophomore and junior	The participant engaged in research focused on molecular mechanisms of liver cancer.	Second-year medical student at the University of Kentucky