

An Introduction to the OutSMART Cancer Serious Game: Current and Future Directions

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An Introduction to the OutSMA?T Cancer Serious Game: Current and Future Directions

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Abstract

Given that cancer is a challenging disease that plagues millions of individuals of all age groups and social economic status globally, developmentally appropriate education is often lacking for young people, particularly adolescents. Increasing cancer awareness and prevention education among adolescents using innovative strategies such as game-based learning is critical in reducing the burden of this disease. Adolescents are understudied in the field of cancer prevention and control, yet vulnerable as they tackle creating life-long health behavior patterns. Targeting cancer prevention education for adolescents has the potential to support long term healthy behavior and reduce their risk of cancer.

This paper provides an overview of the Collaborative Research on MEDication safety and family health (CRoME) Lab's novel game-based cancer prevention education tool. OutSMA?T Cancer is an innovative, novel educational intervention in the form of a serious game. Serious games are educational tools that seek to impart knowledge and improve behaviors in their players. This commentary is a summary of the developmental process for the OutSMA?T Cancer game. We describe in detail the work preceding initial game development, the current version of the game, and future directions for the game and its educational potential. The long-term goal of OutSMA?T Cancer is to improve cancer awareness and knowledge regarding prevention behaviors in adolescents and support a lifetime of health and wellness.

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Original Manuscript

Viewpoint

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Abstract

Given that cancer is a challenging disease that plagues millions of individuals of all age groups and social economic status globally, developmentally appropriate education is often lacking for young people, particularly adolescents. Increasing cancer awareness and prevention education among adolescents using innovative strategies such as game-based learning is critical in reducing the burden of this disease. Adolescents are understudied in the field of cancer prevention and control, yet vulnerable as they tackle creating life-long health behavior patterns. Targeting cancer prevention education for adolescents has the potential to support long term healthy behavior and reduce their risk of cancer.

This paper provides an overview of the Collaborative Research on MEdication safety and family health (CRoME) Lab's novel game-based cancer prevention education tool. OutSMART Cancer is an innovative, novel educational intervention in the form of a serious game. Serious games are educational tools that seek to impart knowledge and improve behaviors in their players. This game covers information related to breast cancer, colon cancer, and lung cancer. This commentary is a summary of the developmental process for the OutSMART Cancer game. We describe in detail the work preceding initial game development, the current version of the game, and future directions for the game and its educational potential. The long-term goal of OutSMART Cancer is to improve cancer awareness and knowledge regarding prevention behaviors in adolescents and support a lifetime of health and wellness.

Keywords: Serious game; Cancer; Health education; Adolescents; Health behavior

Introduction

The ubiquity of cancer in the United States denotes both the immense burden of the disease and the countless individuals devoted to spreading awareness. While preventative and treatment-based measures have improved outcomes and averted cancer deaths, incidence for some of the most common cancers is on the rise [1]. Some studies have suggested that people in the US lack necessary knowledge and awareness of cancer, particularly those of lower socioeconomic status [2,3]. Similar results have been indicated in adolescents in the United Kingdom and US [4-7]. Thus, however prevalent cancer awareness is, there is still a salient and critical need to encourage cancer awareness and knowledge from a young age so that individuals can better understand not only the basic biological etiology of this disease, but support life-long prevention behaviors.

For educational interventions to be successful, especially those involving complex and emotionally charged chronic conditions, they must be tailored to the intended audience. The Collaborative Research on MEdication safety and family health (CRoME) Lab has a history of engaging with and educating adolescents and parents on health topics such as cancer prevention, medication safety, and vaping prevention [8]. The CRoME Lab has co-designed serious games for adolescents and parents around prescription opioid medication safety [9]. Serious games are games designed with a characteristic purpose of imparting knowledge to the player, not merely as a recreational experience [10]. In this viewpoint, we detail the work leading to the development of a cancer education serious game named OutSMART Cancer, the current state of the game, and future directions.

Early Work with Youth Stakeholders

In 2020, our team began research in Wisconsin with middle and high schools, holding focus groups with 327 students, and conducting a further survey with 235 students [11-13]. In one study, the CRoME Lab held 25 focus groups with 188 middle and high school students between the ages of 12 and 18 years old [11]. Through exploring adolescent perceptions, we found that many adolescents were interested in learning about cancer, specifically, cancer prevention. As youth in this study recounted familiarity with basic cancer biology, students indicated unfamiliarity with how to assess cancer risk and what behaviors they can institute to prevent cancer.

One survey study examined adolescent's knowledge and attitudes towards cancer as well as acceptability of a game-based learning approach for cancer education in homes, healthcare settings, and schools [12]. The survey responses reiterated the findings from initial previous focus groups. While most students expressed basic cancer knowledge, only 66% knew that individuals have some level of control over their cancer risk. Moreover, only 37.3% reported knowing how to lower their cancer risk while 50% suggested they try to make healthy choices to reduce their risk. Study findings provided further evidence for the need to educate youth on cancer and prevention. Most adolescents (82%) reported that they would be accepting of the use of a game to help them learn about cancer.

These initial studies with adolescents informed the CRoME Lab's design of the OutSMART Cancer gameplay book that was further assessed through focus groups with adolescents. This gameplay book showed adolescents the initial conceptualization of OutSMART Cancer informed by the Cancer Clear and Simple Curriculum [14]. A total of 18 focus groups comprised of 139 adolescents provided in-depth feedback on the playbook [13]. Adolescents indicated that they preferred a serious game over educational modalities such as websites and videos. Our cumulative research to date has shown that a serious game which focuses on cancer knowledge and prevention and is tailored to the preferences of adolescents could be integral in improving adolescent cancer prevention behavior.

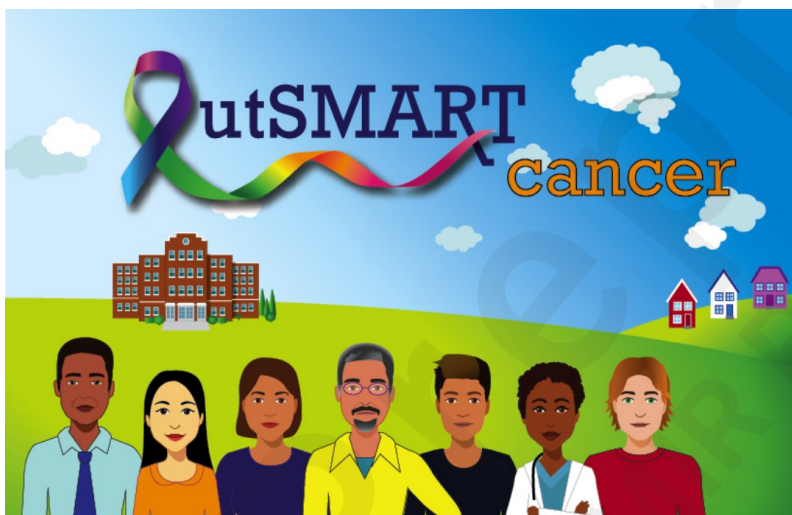
In 2023, OutSMART began early evaluation by adolescents and parents. This demonstration

is currently unavailable to the public as it is evaluated among key stakeholders—adolescents and parents. Informed consent has been collected for participants in each study related to the development and testing of this game. Findings from this study will result in an adapted version of the game which will be used to evaluate efficacy and implementation.

The OutSMART Cancer Game

OutSMART is a web-based, computer videogame which presents three familiar, cancer-related scenarios in a narrative, choice-based format (Figure 1) [15]. It is built upon the Unity WebGL game engine and is currently optimized for browser gameplay on laptops and computers [16]. Within this game, players interact with the environment through a first-person perspective, taking the role of an adolescent. Players are faced with three scenarios which cover information related to breast, colon, and lung cancers. In each scene, players progress by clicking on pop-up bubbles, giving the player choices that move the storyline along. Players progress from one scene to the next once they have completed that scene's storyline. After completion of a scene, players are taken to a map to choose the next available scene.

Figure 1. OutSMART Cancer Gameplay Title



In the first scene, the player heads downstairs for a day at school to see their mother on the couch. After asking why she had not left for work, the mother tells the player that she is experiencing a painful lump in her breast alongside fatigue and would be going her doctor that day. As the player offers to attend the appointment with her, the scene switches to the car ride to the doctor's office. During this ride the mother shares her family history of breast cancer and her anxiety. Later, in the doctor's office, the player and their mother learn that the lump is cancerous. This level espouses key information such as early warning signs of breast cancer, screening tools, basic cancer biology and cancer stages.

Figure 2. Screenshot of Mom Ill Laying on the Couch

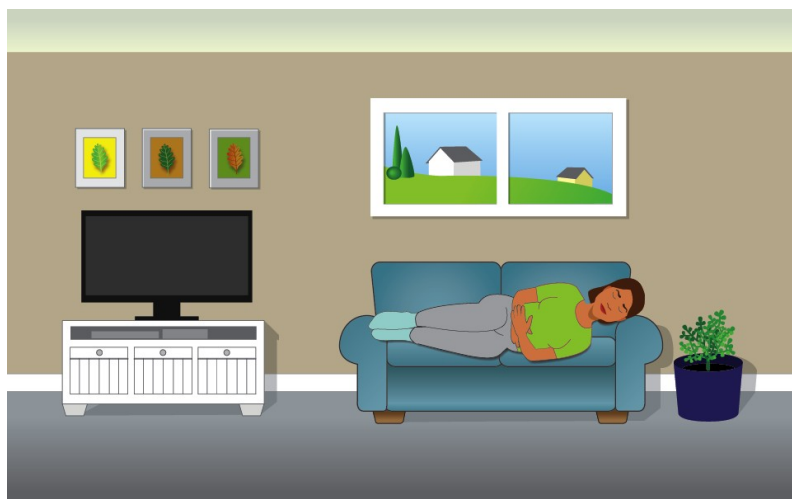


Figure 3. Screenshot of Doctor's Office Scene



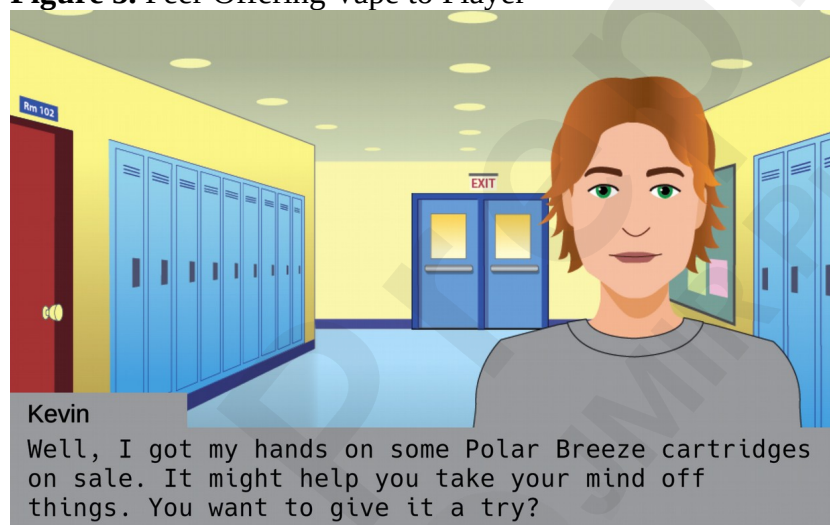
In the second scene, the player brings mail inside for their father and discovers a letter from his doctor's clinic encouraging him to schedule a colonoscopy. During this scene, the player tells their father about the letter and encourages him to schedule an appointment. However, at first, their father is apprehensive and talks of anxiety after his previous colonoscopy that had uncovered polyps. After some conversation with their father, his attitude changes and decides to schedule a visit. This scene introduces colon cancer and screening strategies as well as introduces the player to the types of emotions that are screening barriers.

Figure 4. Colon Cancer Scene with Father



In the final scene, the player goes to school and learns about cancer in a simulated classroom environment. Following class, their friend introduces them to a new person, who, when left alone with the player offers them a vape (electronic cigarette). Though peer pressure is evident, the player must refuse, articulating their own reasoning why they are choosing to protect their own health. This scene introduces players to the power of personal choice and how everyday choices can influence cancer risk.

Figure 5. Peer Offering Vape to Player



The Future for OutSMART

While preliminary evaluation and targeted adaptation of this game is ongoing, a simultaneous endeavor has begun to create a more adapted cancer-education game. This adaptation of OutSMART Cancer will emphasize the need for cancer awareness and targeted education among Black Americans and African immigrant youth and parents (OutSMART Cancer: Africana). The creation of OutSMART Cancer: Africana is responsive to the need for culturally competent cancer education for youth and African immigrant families living in the US using culturally familiar language and imagery. Black Americans and African immigrants experience cancer and healthcare uniquely, requiring a tailored educational approach [17].

The initial intention is to disseminate this serious game widely utilizing clinical settings such as community pharmacies, primary care offices and cancer clinics, as well as community settings such as schools and community health organizations. It is the intention of the researchers that this

intervention would be taken up by adolescents and their families across the US. We expect that this game will one day be available publicly on the internet for online and app-based play through computers and mobile devices. The long-term goal of the OutSMART Cancer games is to facilitate family communication about cancer prevention, associated healthy behaviors, and early detection and cancer screening.

Conflicts of Interest

None declared.

Author Contributions

OA: conceptualization; writing-original draft; writing-review & editing; supervision. TJM: writing-original draft; writing-review & editing.

Abbreviations

CRoME Lab: Collaborative Research on MEdication safety and family health Lab

US: United States

UK: United Kingdom

Generative AI Statement

The authors attest that generative AI was not used in the ideation, preparation, or revision of this manuscript.

References

1. Siegel RL, Giaquinto AN, Jemal A. Cancer statistics, 2024 [published correction appears in *CA Cancer J Clin*. 2024 Feb 16;]. *CA Cancer J Clin*. 2024;74(1):12-49. doi:10.3322/caac.21820
2. Sarma EA, Quaife SL, Rendle KA, Kobrin SC. Negative cancer beliefs: Socioeconomic differences from the awareness and beliefs about cancer survey. *Psychooncology*. 2021;30(4):471-477. doi:10.1002/pon.5573
3. Sarma EA, Rendle KA, Kobrin SC. Cancer symptom awareness in the US: Sociodemographic differences in a population-based survey of adults. *Prev Med*. 2020;132:106005. doi:10.1016/j.ypmed.2020.106005
4. Magni, C., Segrè, C., Finzi, C., Veneroni, L., Clerici, C.A., Massimino, M., Casanova, M., Martinella, V., Chiaravalli, S., Ricci, A., Biondi, A. and Ferrari, A. (2016), Adolescents' Health Awareness and Understanding of Cancer and Tumor Prevention: When and Why an Adolescent Decides to Consult a Physician. *Pediatr Blood Cancer*, 63: 1357-1361. <https://doi.org/10.1002/pbc.25985>
5. Portnoy, B. and Christenson, G.M. (1989), Cancer Knowledge and Related Practices: Results from the National Adolescent Student Health Survey. *Journal of School Health*, 59: 218-224. <https://doi.org/10.1111/j.1746-1561.1989.tb04708.x>
6. Richard G. Kyle, Avril Nicoll, Liz Forbat, Gill Hubbard, Adolescents' awareness of cancer risk factors and associations with health-related behaviours, *Health Education Research*, Volume 28, Issue 5, October 2013, Pages 816–827, <https://doi.org/10.1093/her/cyt055>
7. Kirubarajan, A., Leung, S., Li, X. et al. Barriers and facilitators for cervical cancer screening among adolescents and young people: a systematic review. *BMC Women's Health* 21, 122 (2021). <https://doi.org/10.1186/s12905-021-01264-x>
8. The CRoME Lab Research in Action. <https://pharmacy.wisc.edu/crometeam/research/>. Accessed November 13, 2023.
9. Abraham O, McCarthy TJ. An Overview of the CRoME Lab's MedSMART Families Intervention for Promoting Opioid Medication Safety among Adolescents and Parents. 2023;14(3):11. *Innov Pharm*. doi:<https://doi.org/10.24926/iip.v14i3.5678>
10. Drummond D, Hadchouel, A. & Tesnière, A. Serious games for health: three steps forwards. *Adv Simul* 2, 3 (2017). <https://doi.org/10.1186/s41077-017-0036-3>
11. Abraham O, Szela L, Khan M, Geddam A. Exploring middle school students' perspectives on utilizing serious games for cancer prevention education: a focus group study. *JMIR Serious Games*. doi: 10.2196/31172
12. Abraham O, Rosenberger C, LeMay S, Bittner S. Adolescents' perceptions about cancer and preferences for cancer education. *Cancer Control*. 2021;28:1-12. <https://doi.org/10.1177/10732748211036057>
13. Abraham O, Szela L, Feng E. et al. Exploring Youth Perceptions About Cancer Prevention and Preferences for Education: a Qualitative Study. *J Canc Educ* 38, 50–59 (2023). <https://doi.org/10.1007/s13187-021-02077-0>
14. Fredrick CM, Linskens RJ, Schilling MA, Eggen AT, Strickland RA, Jacobs EA. The cancer clear & simple story: developing a cancer prevention curriculum for rural Wisconsin through a community partnership. *J Canc Educ* 37, 338-342 (2022). <https://doi.org/10.1007/s13187-020-01819-w>
15. OutSMART Cancer. <https://crome.wisc.edu/OutSmart/#top>. Accessed November 13, 2023.
16. Haas, J.K., A history of the unity game engine. 2014.
17. Abraham, O, Agoke, A, Sanuth, K, Ogunsanya, M, Fapohunda, A, Piper, M, Trenthan-Dietz, A. The need for culturally-tailored cancer education for youth and African immigrant

families: viewpoint. JMIR Cancer. Accepted for Publication February 12, 2024



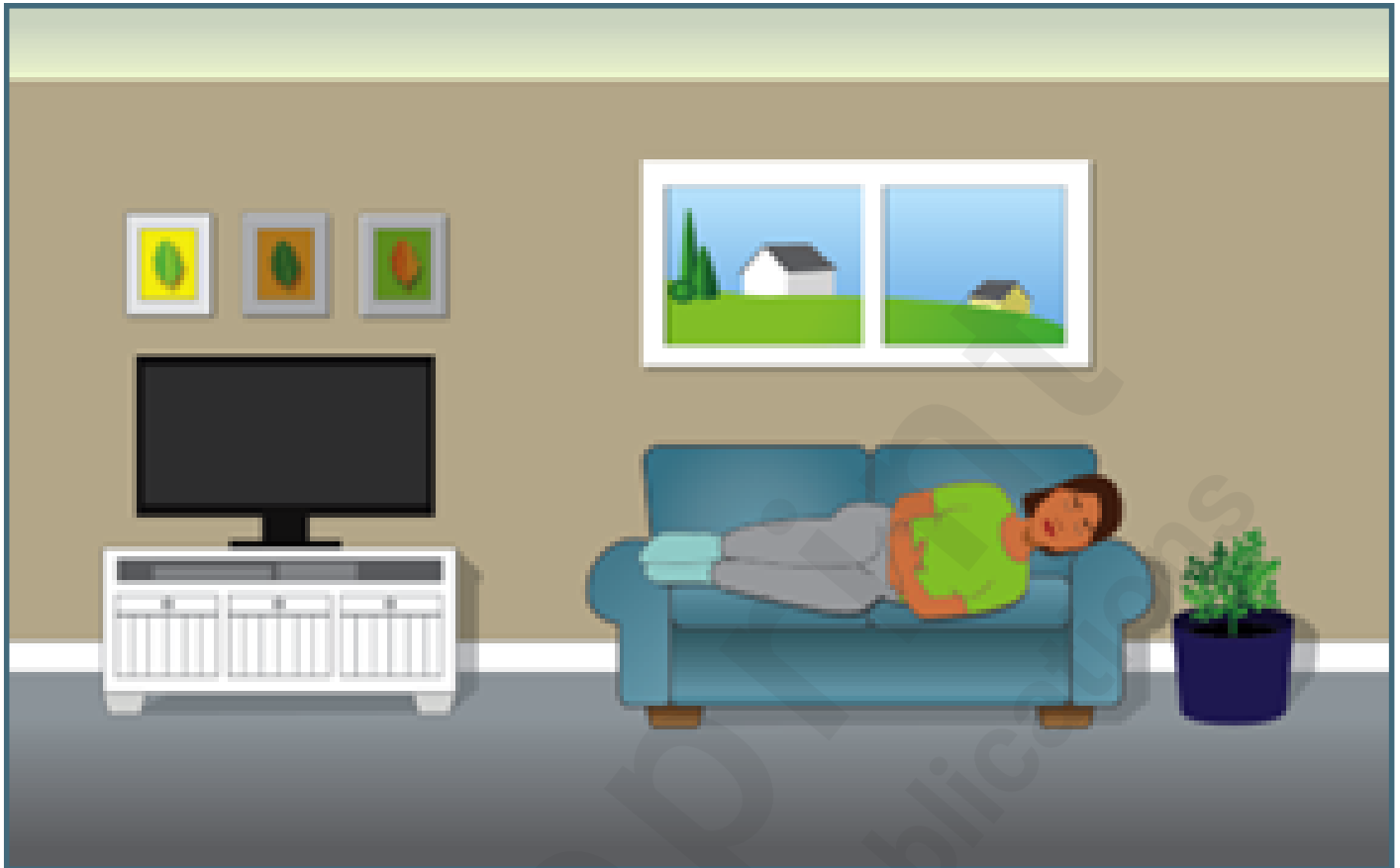
Supplementary Files

Figures

Game Design.



Screenshot of Mom Ill Laying on the Couch.



Screenshot of Doctor's Office Scene.



Colon Cancer Scene with Father.



Peer Offering Vape to Player.



TOC/Feature image for homepages

Game Graphic.

