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Female African Neuroscientists of Tomorrow: Assessing the Impact of Ubongo Brain Awareness Workshops on Kenyan High School Girls' Interest in Neuroscience Careers

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ABSTRACT

Background: Africa faces a significant disparity in neurological care due to a shortage of specialized practitioners. This is further compounded by the underrepresentation of women in neuroscience careers. This study aimed to assess the impact of the Ubongo Brain Awareness Campaign on female high school students' interest and perceptions regarding neuroscience careers. **Methodology:** This study used a cross-sectional survey with female high school students from twos schools in Nairobi who participated in the Ubongo Brain Awareness Campaign. Workshops included lectures and practical sessions on neuroscience. Data was collected through surveys and analyzed using descriptive statistics and thematic analysis to assess students' interest and knowledge in neuroscience**. Results:** The study involved 42 female high school students (ages 14-18) who participated in the Ubongo Brain Awareness Campaign. Post-campaign, students reported increased interest in neuroscience, with average interest levels rising from 3.88 to 4.14 on a 5-point scale. Nearly 98% felt more informed about career opportunities in neuroscience, and 75% experienced a positive perception change. Key challenges included lack of resources, financial constraints, and concerns about the demanding nature of the profession. Students suggested more practical workshops, continuous engagement, expanded outreach, and detailed career information to enhance future neuroscience campaigns and support their career aspirations. **Conclusion:** The Ubongo Brain Awareness Campaign significantly boosted students' interest in neuroscience, highlighting the campaign's success. Key challenges included resource shortages, financial barriers, and limited mentorship. Recommendations include increasing hands-on activities, continuous engagement, expanded outreach, and mentorship programs to address gender disparities in neuroscience.

Key words: Future neuroscientists, female neuroscientists, neuroscience workshops, neuroscience careers

INTRODUCTION

Africa has been reported to have a significant disparity in the neurosurgical landscape due to the high demand for neurosurgical care and the disproportionately smaller number of specialized practitioners in neuroscience (1). Despite Africa accounting for 15% of the global burden of neurosurgical disease, the continent has access to less than 1% of neurosurgeons globally (2). The number of

trained neurologists in Africa is also significantly lower than the global average, with only 0.03 neurologists per 100,000 people, compared to Europe's 8.45 neurologists per 100,000 individuals (3). This shortage also extends to critical subspecialty services such as neuro-radiology, psychiatry, neurologic rehabilitation services, neuroscience research, and stroke units, among others (4–6).

A particularly critical issue within this context is the under-representation of women in neuroscience careers (7). Globally, women are significantly under-represented in the sciences, and this trend is even more pronounced in specialised fields like neurosurgery and neuroscience (8). Barriers such as gender biases, burnout, lack of role models, and insufficient support systems contribute to this disparity (9). As of 2022, there were only 6 qualified female neurosurgeons in Kenya out of a total of 39 neurosurgeons present in the country, which accounts for 15% (10).

Addressing these disparities requires a multi-faceted approach with a focus on long-term strategies. Published literature indicates that a key long-term strategy to address this workforce deficit involves offering students educational and career development opportunities in neuroscience at the early stages of their education (11). Ubongo Brain Awareness Campaign serves as the Kenyan chapter of the annual International Brain Awareness Week (BAW) Campaign, which aims to increase awareness of neuroscience among marginalized and disadvantaged groups as well as inspire students to pursue a career path in neuroscience (12). By targeting female high school students, the 2024 edition of the Ubongo Brain Awareness Campaign sought to address these barriers by generating an interest in neuroscience among students early on and fostering a more gender-inclusive environment for future generations of neuroscientists.

This study aimed to assess the influence of the Ubongo Brain Awareness Campaign on high school students' interests and perceptions regarding a career in neuroscience. By employing surveys, the study gauged the campaign's impact on students' understanding of neuroscience, their interest in pursuing a career in the field, and any changes in perceptions about the discipline. The findings from this study provide valuable insights into the effectiveness of science outreach programs, particularly those targeting high school students, and inform educational strategies to inspire and cultivate interest in neuroscience careers.

METHODS

Study Design

This study employed a cross-sectional survey comprising close-ended and open-ended questions.

Participants

Participants in the study included female high school students from two girl schools in Nairobi, Kenya. The two schools represented students from two socio-economic backgrounds: one from a higher-income neighbourhood of Nairobi and the other from a lower-income neighbourhood, which was a slum area. The choice of schools was based on proximity and logistical feasibility since this was an outreach campaign. The inclusion criteria were students who had participated in the Ubongo Brain Awareness Campaign activities. The sample included students from different levels of study, ranging from Form 1 to Form 4. Girls-only schools were chosen due to the focus on the experiences and perspectives of female students. Approval and consent for these workshops was sought from the school administrations. The students were accompanied by their teachers at all times.

Neuroscience Workshop Details and Data Collection Procedures

The one-day workshops comprised basic lectures and practical sessions on various

aspects of neuroanatomy, neurophysiology, and mental health as well as career talks from two neurosurgeons. The neuroscience lectures and practicals were facilitated by medical students with intercalated degrees in either human anatomy or Physiology. These sessions were conducted at the Department of Human Anatomy and Physiology, University of Nairobi Chiromo Campus. The basic lectures explored the structure and function of the cerebrum, brainstem, and cerebellum. The practical sessions entailed practical demonstrations of the anatomy of the brain using cadaveric specimens. Data was collected using a survey questionnaire comprising closed-ended Likert scale questions as well as open-ended questions. This survey included questions designed to assess students' interest in neuroscience before and after the campaign, their self-reported knowledge of neuroscience, and the sources they used to learn about neuroscience before the campaign. Additionally, the survey collected demographic information, including age, gender, and level of study. The survey questions were as follows:

Section 1: Demographics

1. What is your age?
2. What is your gender?
3. What level of study are you currently in?
4. What is your school's name?

Section 2: Baseline Interest and Knowledge in Neuroscience

5. Before the Ubongo Brain Awareness Campaign, how interested were you in neuroscience? (Scale from 1 to 5, where 1 is not interested at all and 5 is very interested)
6. How would you rate your knowledge of neuroscience before participating in the campaign? (Scale from 1 to 5, where 1 is no knowledge and 5 is very knowledgeable)
7. What sources have you previously used to learn about neuroscience?
    - school
    - internet
    - books
    - none
    - other (expound)

Section 3: Experience with the Ubongo Brain Awareness Campaign

8. How did you participate in the Ubongo Brain Awareness Campaign?
    - attended a workshop,
    - watched a presentation,
    - participated in a quiz,
    - participated in a hands-on activity,
    - other (expound)
9. How engaging did you find the activities of the Ubongo Brain Awareness Campaign? (Scale from 1 to 5, where 1 is not engaging at all and 5 is very engaging)
10. What was the most interesting thing you learned from the Ubongo Brain Awareness Campaign?

Section 4: Impact on Interest and Perception

11. After participating in the Ubongo Brain Awareness Campaign, how interested are you in pursuing a career in neuroscience? (Scale from 1 to 5)
12. Has your perception of what it means to be a neuroscientist changed after participating in the campaign? (Yes/No) If yes, how?
13. Do you feel more informed about the career opportunities in neuroscience after attending the campaign? (Yes/No)
14. What aspect of the campaign most influenced your interest or perception of neuroscience?

Section 5: Future Intentions and Feedback

15. How likely are you to pursue further education or a career in neuroscience after participating in this campaign? (Scale from 1 to 5)
16. What additional information or activities related to neuroscience would you be interested in?
17. What suggestions do you have for improving the Ubongo Brain Awareness Campaign?

Section 6: Open-Ended Responses

18. In your own words, describe how the Ubongo Brain Awareness Campaign has impacted your view of neuroscience.
19. What challenges do you think you might face in pursuing a career in neuroscience?
20. Any other comments or feedback about the campaign?

Data Analysis

Quantitative data from the surveys were analyzed using descriptive statistics to summarize the levels of interest and knowledge of neuroscience before and after the campaign. Categorical data were converted into numerical values where necessary for analysis. Subgroup analysis such as a comparison of the different levels of study was not performed because of the class imbalance in the distribution of students across different levels. Qualitative data from the surveys were analyzed using thematic analysis. The approach was iterative, so identify then refine the key themes arising from the responses. The key themes and patterns in the responses identified were categorized even further to provide a comprehensive understanding of the impact of the Ubongo Brain Awareness Campaign on students' views and interests in neuroscience.

RESULTS

Demographic Analysis

The study included 42 participants, all of whom were female. The age distribution of the participants was between 14 and 18 years, with an average of 16.31 years. The participants were distributed across all four levels of high school study, from form one to form four.

Interest and Knowledge Levels Pre- and Post-Campaign

The survey results indicated a significant increase in the interest levels of students in neuroscience after participating in the Ubongo Brain Awareness Campaign. The average interest level before the campaign was 3.88 on a scale of 1 to 5, while the average interest level after the campaign increased to 4.14 out of 5. The average self-reported knowledge level before the campaign was 2.15 on a scale of 1 to 5, which indicated a moderate level of prior knowledge among the students. 97.56% of the respondents reported feeling more informed about the career opportunities in neuroscience after the workshops, while 75.61% reported that their perception towards neuroscience careers had changed positively after the workshops.

Sources of Neuroscience Information

The survey results revealed that the most common sources of neuroscience information for students were the high school curriculum, the internet, and books.

Impact Analysis

Qualitative responses from the surveys indicated that the Ubongo Brain Awareness Campaign had a positive impact on students' views of neuroscience. Key themes identified in the responses included:

- **Encouragement and Inspiration**: Many students reported feeling encouraged and inspired to learn more about neuroscience and consider it as a potential career path. The campaign activities, including workshops, presentations, and interactive sessions, were cited as particularly motivating.
- **Increased Knowledge and Understanding**: Students reported an increase in their knowledge and understanding of neuroscience concepts. They appreciated the practical sessions and hands-on activities, which helped them grasp complex topics more effectively.
- **Positive Perception Change**: Several students mentioned that their perception of neuroscience as a difficult and inaccessible field changed positively after participating in the campaign. They gained a better understanding of the diverse career opportunities in neuroscience and felt more informed about the field.

Challenges and Suggestions

The survey responses highlighted several challenges faced by students in pursuing a career in neuroscience, as well as

suggestions for improving the Ubongo Brain Awareness Campaign.

The most commonly mentioned challenges included:

- **Lack of Resources**: Students cited a lack of resources, such as textbooks, laboratory equipment, and limited access to online materials, as a significant barrier to learning more about neuroscience at an early age.
- **Financial Constraints**: Financial constraints were another major challenge, with students expressing concerns about the cost of higher education and the affordability of pursuing a career in neuroscience.
- **Limited Access to Information and Mentorship**: Students reported limited access to information about neuroscience career paths and a lack of mentorship opportunities to guide them in their educational and career decisions.
- **Difficult nature of the profession**: The high level of demanding nature of neuroscience careers as well as burnout were mentioned as a challenge, with students feeling uncertain about their ability to succeed in such a demanding environment. Concerns such as “Lack of motivation to stay in school for 10 years”, “Difficulty balancing social life”, and “Burnout” were cited.

The most frequently provided suggestions for improving the neuroscience outreach campaigns included:

- **More Practical Sessions and Workshops**: Students expressed a desire for more practical sessions and workshops to gain hands-on experience and a deeper understanding of neuroscience concepts.
- **Continuous Engagement and Follow-Up Activities**: Students recommended continuous engagement and follow-up activities to maintain their interest and provide ongoing support. This could include regular workshops, mentorship programs, and online resources.
- **Involving More Schools and Students**: Expanding the reach of the campaign to include more schools and students was suggested as a way to maximize its impact and inspire a larger number of students to consider a career in neuroscience.
- **Providing Detailed Career Information**: Students requested more detailed information about the various career paths in neuroscience, including the educational requirements, potential job opportunities, and the skills needed to succeed in the field.

DISCUSSION

The findings of this study indicate that the Ubongo Brain Awareness Campaign had a significant positive impact on high school students' interest and perceptions regarding a career in neuroscience. The increase in interest levels and the positive changes in perceptions highlight the effectiveness of the campaign in inspiring and motivating students.

The challenges identified in the study, including the lack of resources, financial constraints, and limited access to information and mentorship, underscore the need for targeted interventions to support students in pursuing a career in neuroscience. Addressing these challenges through increased funding, provision of resources, and the establishment of mentorship programs could help mitigate the barriers faced by students (13).

The suggestions provided by the students for improving the campaign, such as more practical sessions, continuous engagement, and expanded outreach, offer valuable insights for enhancing the effectiveness of science outreach programs. Implementing these suggestions could help sustain students' interest and provide them with the

necessary support to pursue a career in neuroscience.

Given the focus on female students in this study, the results also underscore the importance of targeted interventions to address gender disparities in neuroscience. The under-representation of women in neuroscience careers is a significant issue that requires concerted efforts to address (7). By providing educational and career development opportunities for female students, the Ubongo Brain Awareness Campaign contributes to creating a more inclusive environment in the field of neuroscience.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

- **Enhance Practical Engagement**: Increase the number of hands-on activities and workshops to deepen students' understanding and interest in neuroscience. Practical sessions can help students grasp complex concepts more effectively and provide them with valuable skills.
- **Sustained Follow-Up**: Implement continuous engagement strategies to maintain students' interest and provide ongoing support. This could include regular workshops, mentorship programs, and online resources to keep students motivated and informed.
- **Expand Outreach**: Include more schools and reach a broader student audience to maximize the impact of the campaign. Expanding the reach of the campaign can inspire a larger number of students and provide them with opportunities to learn about neuroscience.
- **Provide Detailed Career Information**: Offer comprehensive information about the various career paths in neuroscience, including the educational requirements, potential job opportunities, and the skills needed to succeed in the field. Providing detailed career information can help students make informed decisions about their educational and career choices.
- **Address Resource and Financial Constraints**: Increase funding and provision of resources to support students in pursuing a career in neuroscience. Addressing resource and financial constraints can help mitigate the barriers faced by students and provide them with the necessary tools to succeed.
- **Establish Mentorship Programs**: Develop mentorship programs to guide students in their educational and career decisions. Mentorship programs can provide students with valuable support, advice, and networking opportunities to help them navigate their career paths.
- **Focus on Gender Inclusivity**: Implement targeted interventions to address gender disparities in neuroscience. This includes creating supportive environments for female students, providing role models, and addressing gender biases in the field.

Future Research

Future research should continue to explore the impact of science outreach programs on students' interest and perceptions of neuroscience, with a particular focus on gender disparities. Longitudinal studies could provide valuable insights into the long-term effects of such programs and the factors that contribute to sustained interest and success in neuroscience careers. Additionally, further research on the specific barriers faced by female students and effective strategies to overcome these barriers can further inform the design and implementation of inclusive science outreach programs.

Conclusion

The Ubongo Brain Awareness Campaign increased high school students' interest and improved their perceptions of neuroscience. Addressing challenges and implementing suggestions, such as enhancing resources, financial support, mentorship, and outreach, will further amplify its impact. These insights highlight the campaign's role in addressing

the neuroscience workforce deficit and inspiring future neuroscientists.

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