Brain Camp

A Summer Pipeline Program to Increase Diversity in Neurosciences

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Background: Despite calls to increase diversity in the health care workforce, most medical fields including neurology have seen minimal advances, owing in part to the lack of developing a robust pipeline for trainees from underrepresented backgrounds. We sought to create an immersive, replicable neurology-themed summer camp and longitudinal mentorship program for underrepresented-in-medicine (URM) high-school students to encourage them to enter the training pipeline in neuroscience-related fields.

Methods: We established an annual, no-cost 1-week camp for local URM students with the goals of exposing them to different health care professions within neuroscience while providing them with college application resources and long-term mentorship. A postprogram survey was distributed to assess the students' attitudes towards the camp and their desires to pursue health care careers.

Results: Over the 4 years since the founding of the camp (2016-2020), a total of 96 students participated, of whom 53% were URM, 74% came from very low-income households, and 61% had parents who did not attend college. In total, 87 students (91%) completed the postcamp survey. Nearly all (97%) of the respondents were likely to recommend the camp to their peers, and the vast majority (85%) felt that Brain Camp made them more likely to pursue careers in health care.

Conclusions: Brain Camp seeks to address the unmet need for low barrier-to-entry programs designed for URM high-school students interested in health care careers. We envision that our camp may serve as a blueprint for other similar programs across the nation with the goal of addressing the URM pipeline in neuroscience.

Key Words: education, diversity, pipeline, outreach

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BACKGROUND

A diverse health care workforce significantly reduces health care disparities, enhances cultural sensitivity, and improves the quality of care for patients.[1,2] The stalled progress in diversifying most medical fields, including neuroscience specialties, is often attributed to a poorly developed pipeline for trainees from underrepresented backgrounds.[3–6] Underrepresented-in-medicine (URM) students receive less exposure to health care careers during formidable stages of their education.[7] The financial and opportunity costs of such exposures are high for both students and parents. Even for those who overcome the high barriers of entry into the pipeline, URM students are more likely to drop out of the decades-long training pipeline due to onerous financial, academic, and social obstacles (ie, the so-called "leaky pipeline"), as well as due to a paucity of role models in health care who can provide longitudinal mentorship and support.[7,8]

While there are a number of established pipeline programs, and even some targeted to high-school students, most are expensive to attend or costly to run, rendering them financially prohibitive for many URM students.[9,10] While some successful programs follow a multitiered or "cascading" organizational structure where content and mentorship is successively conveyed from faculty all the way down to high-school students, these are more administratively challenging to organize and often led by faculty or administrators.[10,11] Furthermore, few programs feature both a deep immersion to expose URM students to health care fields and longitudinal mentorship critical for retaining students in the training pipeline.

Program Objectives

In light of these challenges, we sought to create a cost-free and immersive experience for URM high-school students to expose them to the practice of medicine and neuroscience-related health care professions. We hoped to inspire our students to pursue careers in health care while providing concrete steps needed to achieve those goals. Following the immersive experience, we continue to mentor these students as they progress through the career pipeline. Moreover, we designed this program in a streamlined and cost-effective manner such that it can serve as a model for similar implementation at other institutions.

METHODS

Program Conception

In 2016, we established Brain Camp @ UCSF, an annual, no-cost 1-week summer day camp for URM high-school students in the San Francisco Bay Area. Neuroscience was the ideal area of focus, as it is broadly relatable to high-school students and easily expandable to include multiple health care disciplines (eg, neurology, psychiatry, and neurosurgery) and careers (eg, physicians, surgeons, nurses, physical therapists, neuroscientists).

The camp is limited to 1 week, and ~25 to 30 students for a compressed, immersive experience that is (1) logistically feasible, (2) financially viable for students and organizers, and (3) serves as a springboard for the longitudinal mentorship program. Importantly, Brain Camp is organized and run by UCSF professional (MD, MD/PhD, PT) and PhD graduate (eg, in neuroscience) students with the help from a faculty advisor (S.A.J.) and other UCSF faculty and residents. As graduate and professional school students still in the training pipeline

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themselves, Brain Camp coordinators and counselors have proximal knowledge of the challenges that current high-school students encounter and more closely reflect participant demographics. This program also provides current professional students with a unique opportunity to mentor, teach and share their passions with a younger generation of students.

The financial sustainability of the program is one of our overarching goals. The week-long camp costs <$400 per student with no cost to the student. The streamlined budget goes towards curricular supplies (brain dissection, neuro examination tools, etc.), activities (undergraduate college visit, CPR certification, etc.), and daily lunches for the students. We received funding from multiple academic departments, philanthropic sources, and diversity initiatives across UCSF to cover the costs of the program for the participants.

Postcamp Survey

At the conclusion of the program, students responded to a survey to evaluate their camp experience and how it may have altered their attitudes towards pursuing a health care career. The survey was voluntary, anonymously collected, and compiled. The results presented here represent the aggregate responses from 4 cohorts (2016-2020) of students who attended the camp. This study was performed in accordance with the University of California, San Francisco institutional guidelines. This retrospective analysis was approved by the UCSF Institutional Review Board.

RESULTS

Program Description

We recruited prospective students through extensive outreach at local public high schools and targeted schools that had a higher percentage of students who come from URM backgrounds and low-income households. We partnered with UCSF's Early Academic Outreach Program (EAOP) and the Science Education Partnership (SEP) to identify target schools and design an interactive and engaging in-classroom outreach effort. Our in-person outreach strategy was formed with input from the EAOP, outreach contacts from previous years (teachers, school counselors, students), San Francisco Unified School District (SFUSD) demographic data, and high-school sponsored summer activities fairs.

Admission requirements often remain a persistent challenge for students who come from URM backgrounds and can be attributed to a variety of reasons including lack of mentors concordant with a student's intersecting identities, being negatively impacted by existing stereotypes, limited exposure to health care careers, and insufficient advising. With this in mind, we aimed to lower unnecessary barriers of entry to our program by creating a streamlined application that asks only for demographic information and single-paragraph responses to 2 reflective prompts, without requiring additional burdensome documentations (eg, letters of recommendation, transcript verifications, etc.). Our streamlined application asks for contact and demographic information, evidence of a C or greater in their science coursework, and a single-paragraph response to 2 reflective prompts: (1) Why are you interested in Brain Camp at UCSF? and (2) Tell us about significant adversity or challenge in life and how you overcame it. These essay questions were created with the intent to elicit student reflection and to provide an opportunity for self-description beyond academic measures.

Each application is reviewed holistically initially by 3 reviewers followed by the entire admissions committee, taking into consideration the responses to short answer questions, background demographics (race/ethnicity, family income, first-generation status), and high-school resources. These criteria have been effective in helping the admissions committee assess the motivation, enthusiasm, and fit of the students for our program. Ultimately, we prioritize students that we believe could benefit the most from attending the camp and the subsequent mentorship program, particularly students who come from URM backgrounds.

A total of 96 students attended Brain Camp over the past 4 years, of which 53% were underrepresented minorities, 74% came from families with *very low-income* (< 50% of median household income in San Francisco, <$87,000 in 2020, according to US Department of Housing and Urban Development) and 61% did not have parents who graduated from college. Our most recent cohort of Brain Camp attendees in 2020 had 66% of students from URM backgrounds, 79% from very low-income backgrounds, and 73% of students with parents who did not complete college.

The curriculum introduces our students to anatomy and physiology in the first days before describing disease states during the remainder of the week. Materials presented in seminar format by faculty from various specialties are accompanied by hands-on activities. For example, the anatomy and physiology seminar is supported by an electroencephalogram demonstration and sheep brain dissection. Thus, despite ambitiously covering vast areas of neurology in 1 week, the camp presents multiple modalities to reinforce the material and accommodate different types of learning.

We found that *story* is one of the most impactful ways of assuring our students that they are capable of handling the rigors of the health care professions. For instance, during the neural networking lunch, our students are paired with a UCSF faculty member or student, many of whom are also from low-income and URM backgrounds, and have an opportunity to hear about their journeys, challenges they faced and overcome, and, commonly, impostor phenomenon. In this way, the power of *story* enables our students to relate to and humanize health care trainees and professionals such that they can see themselves in those roles.

This approach often translates to our students' serious consideration of their future goals. The most immediate challenge facing high-school students is whether and how to apply to college. To this end, our curriculum incorporates goal-setting activities, an extensive college workshop, and a day trip to the University of California, Berkeley, where our students tour the campus, interact with prehealth undergraduate students, meet admissions officers, and visualize themselves in this next step of their journey.

A thematically grouped list of sessions from Brain Camp 2019 is presented in Table 1.

While single immersive experiences may inspire students to enter the health care pipeline, sustained support is required to retain students in this path. To this end, we developed a free longitudinal mentorship program open to all camp alumni. The goals of the mentorship program are 3-fold: (1) sustain alumni interest in the exploration of health care careers; (2) provide alumni with the cultural capital (ie, knowledge of institutions and careers) and social capital (eg, interpersonal connections) to continue exploring these careers; and (3) impart alumni with skills that are important to succeed in their academic pursuits. The mentorship program achieves its mission through quarterly themed large group mentorship events, addressing topics such as the college application, and through small mentorship groups that serve as forums for support tailored to each mentee. Since the inception of the mentorship program, we have had over 40 camp alumni who remain actively engaged as mentees in the mentorship program. Through our mentor recruitment efforts, we found that a striking number of graduate and professional

TABLE 1. Brain Camp Sessions

Thematic Areas	Topics and Activities
Brain Anatomy and Disease	Anatomy and Physiology of the Brain and Nerves
	Epilepsy and Seizures with EEG demo
	Stroke and Vascular Interventions
	Introduction to Psychiatry
	Neurodegeneration and Dementia
Treatments and Technology	Advances in Neurosurgery
	Brain Machine Interfaces
Hands-on Activities	Introductions and Icebreakers
	Brain Dissection
	Review Session
	Knot Tying and Suturing
	Neuropathological Specimens
	CPR Training
	Build Your Own Brain Machine
	Brain Jeopardy
College Preparation	How to know what you want?—Choosing Your Future
	College Workshop
	UC Berkeley Campus Tour
	Admissions Office Presentation
Doctoring Skills	Taking a Patient History
	A Day in the Life of a Neurologist
	Neurology Physical Exam Skills
	Introduction to Health Care Disparities
	Meet at Patient
	Interprofessional Care for Neurology Patients
	Tour and Introduction to the Berkeley Free Clinic
Professional Networking	Lunch with UCSF Health Science and Graduate Students
	Lunch with Neurology Faculty
	Lunch at the Berkeley Dining Hall with Berkeley Students

EEG indicates electroencephalogram; UCSF, University of California, San Francisco.

students were eager to take on mentorship roles such that each mentor could be paired to one mentee even as the program continues to grow in enrollment year after year.

Program Evaluation and Feedback

At the conclusion of the camp, students respond to a survey to evaluate their camp experience and how it may have altered their attitudes towards pursuing a health care career. A total of 87 students (91%) completed the postcamp survey. Overall, our students consistently rate the camp highly. Nearly all (86/87, 99%) students thought the camp was an "amazing" or "great" experience (mean = 4.79/5), and a similar proportion (84/87, 97%) were likely or very likely to recommend the camp to one of their peers (mean = 4.71/5). In particular, our students were most enthusiastic about the interactive and hands-on activities, including brain dissection, building a simple "brain-machine-interface," and the field trip to the University of California, Berkeley. Importantly, the vast majority of students responded that Brain Camp made them more likely to join a health-related or science-related career (74/87, 85%).

Qualitatively, many students responded that the camp enhanced their desire to pursue a career in health care. One student remarked that, "I think that Brain Camp was an amazing experience. Being able to interact with neurologists and neurosurgeons and to just learn more about the brain allowed me to manifest my passion for the health care profession further." Another commented that "This camp has helped me decide whether or not health care was for me, and it has made me more interested in the brain than I was before." For others, Brain Camp allowed them to realize the vast possibilities of careers and opportunities available within health care and the feasible paths to reach those goals. A student wrote that "I had a great time learning about the brain and learning more about future career choices. I had a time where I wanted to give up a career in health care for many reasons, such as financial problems, the amount of time, etc. But after Brain Camp, it gave me hope and more resources." Another added that "This [program] has opened up so many horizons that I didn't know I could aspire to." Overall, the quantitative and qualitative feedback we received from the students on the postcamp survey suggested that Brain Camp was successful in its proximal objectives to expose URM and underserved students to a fascinating field of medicine while encouraging them to consider or continue pursuit of a health care career.

It is difficult to assess the long-term impact of early pipeline programs, including this one which is only 5 years old and geared towards high-school students. Nevertheless, we are encouraged by the early results of this intervention and the longitudinal mentoring program. We will continue to follow-up with our students as they progress through their training in the coming years to gauge the full effect of the program. Every 5 years after their participation in Brain Camp, participants will receive a short follow-up survey regarding their current academic status and future career plans. In addition, we will assess their perspective on Brain Camp's role in encouraging their current career trajectory, as well as significant hurdles they may have faced in navigating the health care pipeline. This feedback will inform the impact of our program as well as guide changes that may enhance the program's long-term mission.

DISCUSSION AND CONCLUSIONS

Brain Camp continues to grow and evolve based on feedback from our alumni and staff. One example is the development of our junior counselor program in which camp alumni can continue their involvement in the camp by serving as counselors for subsequent classes of students. Through working with senior counselors, mentoring small teams of 4 to 5 campers, and leading content review sessions, the junior counselors develop teamwork, leadership, and teaching skills while reinforcing knowledge they had learned as campers and gain a substantial volunteer experience that they can leverage when applying to college or future employment. Since the inception of this program, nearly half of our camp alumni (44%) have applied to be junior counselors.

During the 2020 pandemic, our camp met new challenges by adapting to a new virtual format due to the pandemic. Recruitment efforts transitioned to an online presentation given at science classes of local high schools. Although this new outreach format did not allow for the same level of engagement as an interactive in-person demonstration, it reached a broader range of schools and overall resulted in a similar recruitment outcome. While the in-person experience of the camp itself is difficult to replicate online, we sought to lessen this divide by sending each camper supplies for hands-on activities to follow along at home. We further tailored our curriculum and established new avenues of communication (eg, Slack) to maximize active engagement. By dividing the students into smaller groups and increasing the relative number of hands-on and interactive activities, we encouraged more active participation from each of our students. Overall, these adaptations were well-received by campers and counselors alike and led to similarly positive feedback from the students on the postcamp survey.

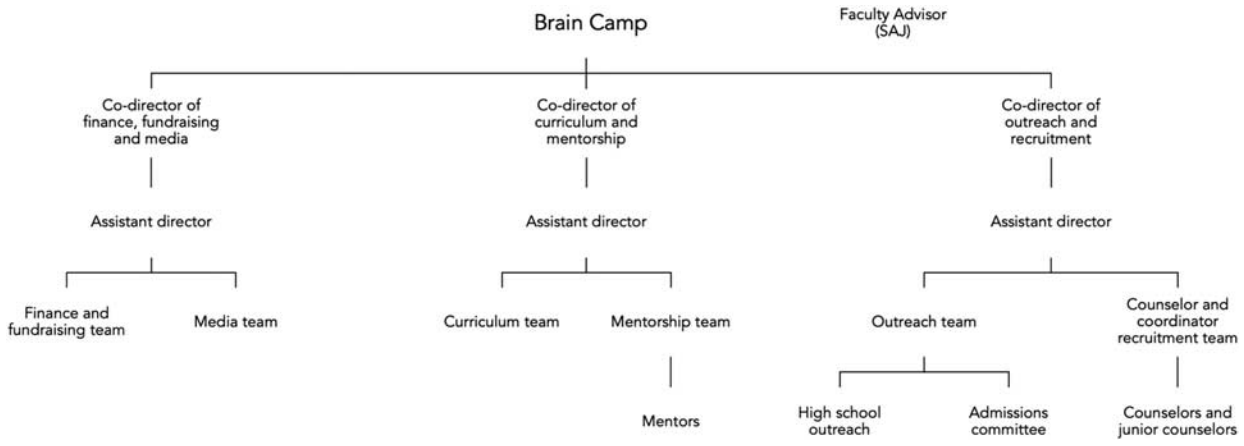

FIGURE 1. The organizational structure of Brain Camp. The camp is led by 3 co-directors and organized by 6 core teams (finance and fundraising, media, curriculum, mentorship, outreach, counselor and coordinator recruitment).

As Brain Camp develops and progresses through the years, the sustainability of the program is crucial to its long-term success. Thus, we developed a leadership and program structure that takes into account the transient nature of medical and graduate training while preserving the institutional knowledge required to maintain the quality of the camp. Each year, 3 co-directors lead the various aspects of camp (curriculum and mentorship, outreach and recruitment, finance, and media) and are closely assisted by 3 assistant directors (directors-in-training) that take over the directors' roles the subsequent year (Fig. 1). Thus, while there is relatively frequent turnover at the coordination, mentorship, and counselor levels, the core planning team remains intact from year to year. In addition, a Brain Camp Handbook was created to detail the logistics of planning and running the camp, the lessons learned over the years, and areas for continued improvement. The long-term financial stability of the program depends upon forming close partnerships with sponsoring departments, establishing strategies for continued growth and development, as well as engaging in larger fundraising efforts that may help to fund the camp in perpetuity.

Brain Camp is designed as a modular, accessible, and sustainable concept that may be replicated and adapted at other academic medical institutions. We are fortunate to be at UCSF, where diversity, equity, and community outreach are institutional and departmental priorities. The recent national reckoning on race has reemphasized the critical need to diversify the health care workforce for improving patient outcomes, and thus may provide additional momentum for starting similar programs across the country. While we acknowledge there may be limitations in resources (financial and staff) that may preclude a full replication of our program at other institutions, we believe that other variations of Brain Camp can be achieved, tailored to the available level of institutional and financial support. For instance, certain curricular activities, such as CPR certification and the field trip to a local university, can be easily replaced with other, less costly activities. Moreover, in lieu of lectures that are led by faculty, didactic sessions can instead be taught by senior medical students or residents who are passionate about their field and mentorship. Furthermore, financial and professional contributions from external entities (eg, unrestricted academic grants from industry partners or volunteer external faculty) may also provide an additional layer of support for new programs. Our hope is that Brain Camp serves as a blueprint that may inspire the development of other locally run programs to make a collective and much-needed impact in encouraging a more robust pipeline to increase diversity in health care.

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