

Future MEDIC: Medical Student–Led Healthcare Career Exploration Program for Underserved Middle School Students

Sydney Sharp, Meeti Mehta, Rachel Weger,
Chiazam Omenyi, Thuy Bui, and Catherine Rebitch

Abstract

Future Medical Education and Development Introductory Course (Future MEDIC) is a medical student–led school program designed to inspire primary school students in underserved communities by sharing a passion for medicine and healthcare careers. Through hands-on activities—including physical examination workshops, an on-site airport introduction to flight medicine, and interactive demonstrations with a patient simulator—26 eighth-grade students were empowered to actively explore the world of healthcare. To assess the impact of Future MEDIC on students' knowledge and interest in healthcare careers, we administered pre- and post-surveys, informal exit interviews, and participation prizes. Survey responses were analyzed with a Mann-Whitney U test for significance. There was a significant increase ($p = 0.01$) from pre- to post-survey about “I enjoy learning about how the body works.” Yet there was also a significant decrease ($p = 0.03$) from pre- to post-survey about “In the future, I am interested in working in healthcare or medicine.” Despite enjoying the activities and content of the Future MEDIC program, students did not have an increased interest in entering the healthcare field. Although interest in entering the healthcare field was not increased, Future MEDIC was a rewarding and fun experience for students to partake in, and an opportunity to create a multidimensional view of the healthcare field.

Introduction

Background and Historical Context

Pittsburgh has been central to many cultural and ethnic groups who call neighborhoods in this western Pennsylvania city home. One neighborhood of particular historical significance to the African American community is the Hill District. The Hill District is Pittsburgh's oldest Black community and was colloquially referred to as “Little Haiti” following the independence of Haiti in 1804 (African American Registry, n.d.; Carnegie Library of Pittsburgh, 2003). Mass migration to the Hill District occurred in the early twentieth century on the heels of the Civil War. Beginning in the 1910s, Pittsburgh was a frequent destination for those in the Great Migration, a movement in which millions of African Americans left the Jim Crow rural South to move to the urban North, Midwest, and West (Carnegie Library of Pittsburgh, 2003). The “Black population in the Hill District grew rapidly from 10,000 in 1890 to over 37,000 by 1920” and, due to segregation, Black residents were mainly limited to housing options in the Hill District (African American Registry, n.d.).

From the 1920s to the 1950s, the Hill District was a hub of intellectual and cultural revival of African American music, art, literature, theater,

and scholarship (African American Registry, n.d.). The Hill, as it was called, was one of the nation's most prosperous predominantly Black communities at the time, referred to as the “Crossroads to the World” by Harlem renaissance poet Claude McKay (Benz, 2015). The Hill was also home to jazz icons like Stanley Turrentine and Art Blakey, as well as world-renowned writers like August Wilson, whose Pulitzer Prize–winning play *Fences* was set in the Hill District (African American Registry, n.d.; Clemetson, 2002). The *Pittsburgh Courier* was run from the Hill and, according to Lynette Clemetson at the *New York Times*, was once “the nation's most influential Black weekly newspaper” (2002). For sports, the Negro National League baseball team, the Pittsburgh Crawfords, played in the Hill District and produced baseball legends that many recognize today such as Satchel Paige, Josh Gibson, and Cool Papa Bell (Clemetson, 2002).

Following World War II, the federal government committed to upgrade housing across the nation, and in Pittsburgh, 95 acres of the Hill District were selected for redevelopment to provide housing to returning war veterans (Carnegie Library of Pittsburgh, 2003). In the mid-1950s, the lower Hill was demolished by the city of Pittsburgh as part of an “urban renewal” project, displacing

8,000 residents to build the former Civic Arena (Carnegie Library of Pittsburgh, 2003; Clemetson, 2002). This redevelopment severed the Hill District and initiated the neighborhood's economic decline. This structural problem was exacerbated by the decline of Pittsburgh's population more generally, as jobs disappeared due to industrial restructuring and numerous middle-class residents moved out to newer suburban housing (Clemetson, 2002). Between 1950 and 1990, the Hill lost 71% of its residents (more than 38,000 individuals) and about 400 businesses, leaving the neighborhood in stark contrast to its past state (Stoker & Robert, 1996; Trotter Jr. & Day, 2010). As of 2019, around 72% of the residents of the Hill District identify as non-Hispanic Black, and 60% of Black households in the Hill District make less than \$25,000 a year (Greater Hill District Master Plan Steering Committee, 2022). For 30 years, the neighborhood lacked a grocery store and, for a decade, there was no pharmacy (Blazina, 2013; Nereim, 2010). Since the late twentieth century, hundreds of millions of dollars in public and private funds has been committed to infrastructure investment in the Hill District, leading to worries among some residents that development will lead to gentrification (Clemetson, 2002). Organizations like the Hill District Community Development Corporation (<https://www.hilldistrict.org>) have been investing in Black ownership and revitalization without displacement or erasure of the historical legacy (Clemetson, 2002).

Opening in 2008, the University Preparatory School at Margaret Milliones (UPrep) serves around 330 students in grades 6–12 in the Hill District. It was established by a partnership between the University of Pittsburgh and Pittsburgh Public Schools. UPrep's mission is "to provide each student with the opportunity to discover the value and attainability of post-secondary education" (Pittsburgh Public Schools, n.d.). A+ Schools' 2022 Report to the Community on Public School Progress in Pittsburgh shared that 88% of the student body identifies as Black, 5% are White, 5% are Multiethnic, 2% are Hispanic, and 1% are Asian. Additionally, 84% of the student body identifies as low income and 30% of students have an individual education plan (IEP) for special education. 65% of students are marked as chronically absent, missing more than 10% of a given school year. The graduation rate has been steadily declining and was 64% in 2021. 11% of students met the SAT reading and math standard.

Post-high school statistics show that 10% attend a college or trade school after graduation (A+ Schools, 2022).

The history of the Hill District and background of UPrep is key to understanding the context in which the Future Medical Education and Development Introductory Course (MEDIC) took place.

Purpose

Similar to many other urban cities, Pittsburgh is not immune to health disparities due to race, economic factors, and neighborhood. In 2015, the rate of infant mortality per 1,000 live births was 14.4 for Black women in Pittsburgh (on a steady increase from the last couple years compared to 4.2 for White women in Pittsburgh). From 2006 to 2010, the five regions making up the Hill District—Crawford-Roberts, Middle Hill, Upper Hill, Bedford Dwellings, and Terrace Village (African American Registry, n.d.)—had infant mortality rates of 24.54, 21.51, 22.73, 0, and 4.35 per 1,000 live births, respectively. At the same time, the rate of infant mortality in the city of Pittsburgh at large was 9.19 (Allegheny County Health Department, 2015; Zuberi et al., 2015). Disparities in access to quality healthcare based on race/ethnicity, language, and socioeconomic status (SES) are well documented in the United States. In particular, underrepresented minorities (URMs)—which includes African-Americans/Blacks, Hispanics/Latinos, Native Americans, and Pacific Islanders—have less access to healthcare than Whites. Moreover, those who are poor or low income have less access than those who are middle-to-high income (Agency for Healthcare Research and Quality, 2022). Multiple factors contribute to this inequity, namely healthcare workforce shortages, lack of health insurance, and persistent health disparities (Agency for Healthcare Research and Quality, 2022). Data shows that healthcare providers from URM groups are more likely to practice in underserved areas than White practitioners, even among Whites from a lower SES (Marrast et al., 2014). Yet URMs continue to be underrepresented in the healthcare field. Despite comprising over one-third of the total U.S. population aged 20–35, only about 15% of graduates for degrees in medicine, 15% of graduates for degrees in dentistry, and 26% of graduates for degrees as registered nurses are African-American, Hispanic, or Native American (Salsberg et al., 2021). To increase

the number of healthcare workers from lower socioeconomic and minority backgrounds to work in underserved areas of Pittsburgh, youth from these backgrounds must be exposed to and inspired by healthcare professionals.

Historically, gender inequity has also posed a barrier to entrance into healthcare careers. Gender inequity is not only an issue in society at large, but also with healthcare careers and health education (Wänggren & Finn, 2022). As reported by the U.S. Department of Health and Human Services, females outnumbered males in 25 of the 30 health occupations they collected data for between 2011 and 2015. The five professions in which men outnumbered women were dentists, chiropractors, physicians, optometrists, and emergency medical technicians and paramedics (U.S. Department of Health and Human Services, 2017). Not only do these occupations ones tend to require more lengthy schooling, but they are also health professions that tend to earn higher salaries. Thus, although women proportionally outnumber men in many health occupations, they are less likely in health roles that more forward-facing, with leadership potential and decision-making autonomy. This gender disparity had been shown to lead to poorer outcomes for women regarding pain management, gynecologic diagnostic delays, and large-scale excesses in mortality and morbidity globally (Wänggren & Finn, 2022; Shannon et al., 2019). In analyses of medical institutions with increased gender diversity, there was a promotion of economic growth, reduction of child mortality, and nutrition improvement (Shannon et al., 2019). They also found that “gender-diverse institutions are more likely to outperform those that are not gender diverse” (Shannon et al., 2019). At the educational level, out of a cohort of prospective pharmacy students “62% indicated they knew a current or past pharmacist who influenced their decision to pursue pharmacy and were more likely to do so if that individual was perceived as similar to themselves. . . . When considering the statistically greater number of pharmacists who are women, the field may continue to attract more female than male trainees” (Bissell et al., 2021). This helps prove there is an increasing need for early programming centering gender equity in all healthcare careers for budding healthcare professionals to feel seen and inspired. Achieving gender equity has wide-ranging benefits as a shared determinant of health for men, women, boys, girls, and gender-diverse people, and will ultimately lead to the promotion of health and social justice for everyone.

Future MEDIC is a school program led by medical students designed to inspire primary school students by sharing a passion for learning, health, and healthcare careers. Future MEDIC offers a collaborative, interactive approach to healthcare with a focus on interprofessional education. Through hands-on activities such as physical-examination workshops, group role-playing, and interactive demonstrations with the SimMan patient simulator, students are empowered to actively explore the world of healthcare. Started by University of Pittsburgh (Pitt) medical students, Future MEDIC was first implemented in 2021 at UPrep and restructured in 2022 with a focus on interprofessional health careers.

Future MEDIC was designed based on the tenets of community-based research (CBR), in which projects are designed in collaboration with the community. CBR bridges the gap between academic researchers and community members—whose role in the traditional research model is solely to be studied. In communities such as the Hill District, whose members have a shared sentiment of being exploited by traditional academic researchers in general and the University of Pittsburgh in particular, best practices in community engagement and CBR are particularly important. Recognizing this history, the University of Pittsburgh collaborated with the Hill District to create the Hill District Community Engagement Center (CEC). The Hill District CEC (<https://cec.pitt.edu/hilldistrict>) is a long-term initiative that facilitates dialogue between an internal advisory council composed of interdisciplinary Pitt faculty and a neighborhood advisory council of Hill District community leaders and long-term residents. Together, they decide on programming that will support the CEC’s goals of building neighborhood capacity, empowering the community, improving the quality of life of residents, and supporting youth through tutoring and mentorship programs. Given this context, it was critical for the CEC to be involved in the design and implementation of the Future MEDIC program and for the program to be executed according to ethical CBR practices.

Other studies have implemented similar programs for middle and high school-aged youth with a focus on increasing self-efficacy (Niehaus et al., 2012) and STEM career intention (Christensen & Knezek, 2016; Holubec et al., 2007; Knox et al., 2003), particularly in careers in healthcare (Ali et al., 2017; Goldsmith et al., 2014; Wallace et al., 2015). However, there are few projects in the literature that assess the impact of interprofessional health

programming with URM middle school students, and none to the authors' knowledge that featured the same careers as in MEDIC. Additionally, we drew inspiration from Mouza et al., who assessed attitudes towards gender equity in computer science among middle school students enrolled in a computer science after-school program (2016). As far as the authors are aware, this is also the first of the healthcare career curriculums for middle school youth to analyze students' perceived gender equity in health careers. The purpose of this paper is to detail the development and assessment of this program—and as such, this paper serves as a program evaluation.

Methods

Authors' Positionalities

Sydney Sharp is a third-year medical student at the University of Pittsburgh School of Medicine, originally from Silver Spring, Maryland. She identifies as a generational African American woman—a descendant of enslaved people. She earned her Bachelor of Science in Biological Sciences and her Bachelor of Arts degree in African American studies from the University of Maryland. This educational foundation has allowed her to explore the various intersections of health and social justice as well as the impact of disenfranchisement of the Black community in many social sectors. Sydney has maternal familial ties to multiple historically Black neighborhoods in Pittsburgh. Throughout her educational career, she has prioritized working with underserved communities and specifically working to mitigate health disparities via community engagement and service. She has previously served as a program coordinator and mentor to teens living with sickle cell disease at Children's National Hospital, where she was responsible for creating lesson plans and providing individualized support to participants. All these experiences informed Sydney's ability to develop and implement the Future MEDIC program and continue to uplift and inspire the next generation of young African American scholars.

Meeti Mehta is from Orlando, Florida, and earned a Bachelor of Science in Biomedical Sciences from the University of Central Florida. During her undergraduate studies, she focused on service and research with underserved youth, which had a profound impact on her research interests. As an Indian-American woman who attended public schools throughout her primary education, she has a unique perspective on educational programming. While she aims for

objectivity, she knows her personal experiences can influence her views; therefore, she is committed to transparency about her background and works diligently to minimize any potential biases. This commitment stems from her dedication to maintaining the credibility and relevance of her research, especially when addressing disparities in underserved communities.

Rachel Weger is a third-year medical student at the University of Pittsburgh School of Medicine who participated in the design and implementation of MEDIC. She is a White cisgender woman who moved to Pittsburgh in 2021 for medical school, meaning she came to this project as an outsider to the history of the Hill District and the experiences of the students she worked with. Her identities afford her multiple levels of privilege and accordingly shape the lens of her work. She has striven to find experiences that encourage reflection, continuous self-education, and respectful and ethical engagement with community collaborators. These include obtaining a certificate in Community-Based Research from American University and participating in the Academy on Health Disparities at the National Institutes of Health (NIH) and the Social Medicine Fellows program during medical school. Given the rich history of the Hill District and her training in CBR, it was important to her to bridge her skills and humility as an outsider with the knowledge and perspectives of collaborators who work, live, and teach within this community.

Chiazam Omenyi is a first-generation Nigerian-American whose parents emigrated to the United States to further their education. Growing up the youngest of four siblings, Chiazam has always had a passion for working with youth and advancing the minds of tomorrow. In college, she volunteered with a predominantly African American after-school program as a Science and Math Explorations Leader. She designed and carried out science- and math-related lesson plans each week for students from kindergarten to third grade in order to encourage and foster interest in these subjects outside of the classroom, and to be a representative figure for the students that a Black woman could be successful in an elite college setting. Chiazam drew on these experiences and lessons learned when building and implementing Future MEDIC, in hopes that she could continue to have a positive impact on the young African American community and create a program that the students could benefit from.

Dr. Thuy Bui is a clinician educator with 30 years of medical education experience. She

identifies as Vietnamese-American, started her life in the U.S. as a refugee at age 12. She worked as a physician and Peace Corps volunteer in Malawi for two years and continues to mentor Malawian trainees ever since. Most of her patients self-identify as either African American, Vietnamese-speaking, and Spanish-speaking individuals. She is a BIPOC ally and utilizes critical race theory and intersectionality in patient care, teaching, and her scholarly endeavors.

Dr. Catherine Rebitch has been a pharmacist faculty member at the University of Pittsburgh since 2011. She is passionate about improving access to care for underserved populations. As part of her role within the community-engagement infrastructure at the university, she partners with community organizations and students of various healthcare disciplines to increase availability of health and wellness resources and to raise awareness of healthcare careers among underrepresented youth.

Community-Based Research Foundation

Community-engaged research contains four main domains: the context of the community, institution, and their relationship; the partners and their approach to partnership; the intervention that results from the shared decision-making process; and the short- and long-term outcomes (Wallerstein et al., 2020).

The history between the Hill District community and the University of Pittsburgh and other institutions contains many instances of exploitation. This has led to distrust among residents and a perception that they are used by researchers as “guinea pigs” (Ohmer et al., 2018). In an acknowledgment of this history, Pitt established the Pitt Neighborhood Commitments, which are long-term, neighborhood-based commitments to provide investment, programming, and the university’s resources to the Hill District and Homewood, another historically underserved neighborhood. The Hill District CEC is the physical facility representing this commitment in the Hill District, providing the space and staffing for ongoing projects. The CEC aims to amplify existing strengths of the community and serve as a front door to the university when appropriate to mediate ethical community engagement. For example, the Hill District CEC asks those who partner with them to read their study on respectful and effective community engagement and complete a Hill District-specific training (Ohmer et al., 2018; Pitt Community Engagement

Centers, n.d.). In this way, researchers can engage with the tenets of CBR by learning the history and showing respect to our community partners (Michener et al., 2012).

There were three main partners who comprised this project: the healthcare professionals from the University of Pittsburgh, the teachers, and students at UPrep, and the Hill District CEC. The conception of the project sprung from the Hill District CEC’s priority to provide science, technology, engineering, arts, and mathematics (STEAM) programming for their community members and their existing partnership with schools in the neighborhood. They facilitated the connection between the University of Pittsburgh and UPrep teachers who were interested in providing such programming for their students.

Four medical students (Sydney Sharp, Meeti Mehta, Rachel Weger, Chiazam Omenyi) from the University of Pittsburgh led the curricular development under the guidance of a physician (Dr. Thuy Bui) and pharmacist (Dr. Catherine Rebitch) and with multiple rounds of feedback from the CEC and the teachers at UPrep. The medical students were members of the University of Pittsburgh School of Medicine’s Social Medicine Fellows program (<http://meddiversity.pitt.edu/social-medicine-fellows-program>), a fellowship for students who are particularly interested in community engagement and building relationships with local community-based organizations and working on initiatives and projects together. In this program, each cohort of fellows carries on and improves upon the work of the previous year’s cohort, abiding by a key tenet of CBR: sustainable, iterative, and long-term partnerships (Israel et al., 1998; Michener et al., 2012). Thus, the Hill District CEC has a long-standing relationship with the Social Medicine Fellows and this paper describes the second iteration of the Future MEDIC program, which took into account the feedback from the previous year’s fellows. Similarly, after this second iteration, we disseminated our results to our partners so they could view the outcomes and make informed changes for the next iteration. This also aligns with the principle of CBR to disseminate the findings to the community partners (Israel et al., 1998; Michener et al., 2012).

Every CBR project has both intermediate- and long-term outcomes, with the long-term outcome being related to social justice (Strand et al., 2003; Wallerstein et al., 2020). The short-term outcomes of this project were to address the CEC’s need for STEAM programming, expand on the

previous curriculum by adding interprofessional collaboration and hands-on group-based activities, maintain the partnerships between all parties, and boost students' exposure to and interest in careers in healthcare. The long-term goals were to address inequities in the healthcare workforce for URM students and women.

Curriculum

Presented here are the results from the 2022-23 iteration of the Future MEDIC program, in which 26 students participated. This program ran from October 2022 to January 2023, and was incorporated into the students' routine classroom activities such that all eighth-grade students participated in the program during their usual science class. Four female medical students served as the primary instructors for the program, facilitating activities, enforcing timelines, and setting classroom expectations. Two male schoolteachers provided additional support in facilitating the sessions.

Curriculum Development

Curricular development took place during summer 2022 by the primary team of four medical students, working in collaboration with Pitt faculty mentors, the Hill District CEC, and educators from UPrep. The curriculum was based on the principle that students learn best when they are actively engaged (Beckman, 1990; Slavin, 1994). The development of curriculum content involved the following principles of universal design: present material using multiple media and delivery methods to encourage active learning; design course content to accommodate diverse learning styles; reinforce key topics and takeaways; implement activities that are hands-on, practical, and relevant; facilitate peer engagement through group work; and encourage peer interaction and feedback (Burgstahler, 2006a, 2006b).

Taking into account the feedback from previous years of the program, we implemented additional hands-on activities to maintain student interest and engagement. We identified three main areas for the creation of sessions: 1) introduction to health professions, with emphasis on careers in nursing, dentistry, medicine, and pharmacy; 2) developing practical healthcare skills, including physical examination; and 3) real-world applications of healthcare, with hands-on exposure to various practice settings and medical equipment. Based on these content areas, we developed five sessions with material intended for eighth graders.

One of these sessions included a field trip to visit an airport base for an air medical transport service, where students learned firsthand how medical air transport works and had the chance to tour helicopters and ambulance vehicles with frontline professionals. The flight medicine field trip acted as an icebreaker to introduce the students to Future MEDIC and an engaging activity to excite students about the different healthcare careers, including some that we would explore in future sessions.

While the curriculum from the 2021-22 iteration of the program focused on physician roles in healthcare, we sought to collaborate with different healthcare professionals to offer a broader perspective of the medical field. We assembled a team of colleagues from various health professional schools at the University of Pittsburgh, including a dental student, a recent nursing graduate, and several pharmacy students as well as a faculty member from the school of pharmacy. Each of these fields (dentistry, nursing, and pharmacy) was allotted a period of time for a presentation and activity, and the respective collaborators developed a lesson plan with feedback from the medical students and educators from UPrep. Faculty mentors, including a physician and a pharmacist, also provided feedback and suggestions during this collaborative curricular development.

To ensure that this curriculum was tailored to the specific needs of the Hill District, we worked intimately with the CEC, meeting several times with the director to discuss our partnership with UPrep, program expectations, lessons learned from previous years, and ideas to incentivize student participation. Additionally, the CEC played a crucial role in curricular development by offering feedback on the specific content as well as its implementation to ensure that it was most relevant and interesting to our students. Educators from UPrep, including the school principal and two teachers, also provided important guidance during the curricular development process to maximize student participation. We also sought advice from a Heinz Fellow from the University of Pittsburgh Center for Urban Education who provided guidance on bridging the curriculum with the Hill District community and local community organizations.

We then planned the spatial organization of the sessions to ensure optimal student participation. The 26 students were divided into two classrooms that were set up in preparation for each session. Each classroom had two medical student instructors and one teacher to facilitate each session. These

small groups created a supportive environment to encourage hands-on learning and exploration. To encourage student participation, we implemented three main incentives: 1) candy for raising hands to answer questions or participate; 2) raffle tickets for group activities such as jeopardy (raffle winners were selected at the end of the program, with prizes such as football game tickets, sweatshirts, and swag bags); and 3) snacks, often during breaks between different activities, used to motivate students to complete the first activity of each workshop.

Sessions lasted between 45 minutes and 105 minutes once a week for five weeks, totaling approximately eight hours of instructional time. We implemented a general framework for each session to ensure balance between didactic and hands-on activities. Each day began with a brief (5-minute)

reminder of classroom conduct expectations and an overview of the days' activities. This was followed by a didactic session or interactive activity based on the session's key topic that lasted 10–20 minutes. A 10-minute snack break typically served as a transition to the next hands-on activity, which lasted approximately 10–15 minutes. Lastly, each session was concluded with a reflection or knowledge check of the day's key takeaways that lasted 5–10 minutes. The specific content and sequence of the program are shown in Figure 1.

Assessment Methods

We utilized a variety of objective and subjective approaches to evaluate the course: pre- and post-surveys, observation of in-class activities, and informal exit polls with students at the end of

Figure 1. Future MEDIC Program Timeline

Week 1: Flight Medicine
<ul style="list-style-type: none"> • Introduction • Flight medicine presentation • Field trip to MedEvac base of operations at Allegheny County Airport
Week 2: Introduction to Healthcare Careers
<ul style="list-style-type: none"> • Introduction • Pre-survey • Discussion of healthcare careers • Healthcare careers quiz • Quiz reflection/discussion - What did you think about your quiz results?
Week 3: Nursing and Dentistry
<ul style="list-style-type: none"> • Introduction • Nurse guest speaker presentation • Dental student guest speaker presentation • Nursing and Dental Jeopardy - What do they do? How do you pursue this career? How do they work with other members of the healthcare team?
Week 4: Physical Examination
<ul style="list-style-type: none"> • Introduction • Heart rate/pulse station • Stethoscope - heart, lung, and abdominal sounds station • Pupillary reflexes station • Muscular reflexes station • Reflection - Which station did you find the most interesting? What station was the most educational?
Week 5: Pharmacy and SimMan Patient Simulation
<ul style="list-style-type: none"> • Introduction • Pharmacy student guest speaker presentation • Raffle • SimMan patient simulation • Post-survey • Blood pressure measurements with simulation arm • Reflection - What do pharmacists do? How do you become a pharmacist? How do pharmacists work with other members of the healthcare team?

the program. This approach allowed us to assess the impact of the program within the constraints of a five-week course during which we had limited time for instruction and activities. The exit poll results are not reported in this paper as they were mainly used to engage the students and reinforce what they had learned as they left class.

To document changes in student attitudes toward careers in healthcare, we administered a pre- and post-survey, modeled after other surveys of middle-school student programming (e.g., Mouza et al., 2016). According to their Uprep teachers, the students were familiar with similar surveys and these evaluations were designed in conjunction with and approved by those teachers. The surveys as written were deemed to be below a sixth-grade reading level (Readable, 2023).

Each survey asked students to rate their agreement or disagreement on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) and took approximately 10 minutes to complete. The pre-survey included 12 items organized around six constructs that were adapted from other surveys of middle-school student programming: a) enjoyment when learning about healthcare (Mouza et al., 2016; Romine et al., 2016); b) interest in healthcare careers (Marcelin et al., 2004; Romine et al., 2016); c) knowledge about healthcare careers (Goldsmith et al., 2014); d) identifying with a career in healthcare (Mouza et al., 2016); e) perception of social support and resources (Aschbacher et al., 2009); and f) attitudes on gender equity in healthcare (Holubec et al., 2007; Mouza et al., 2016). The post-survey also included questions assessing the workshops and students' long-term interest in healthcare.

To test for changes in student responses, the Mann-Whitney U test for significance was used to analyze pre-and post-surveys. To assess the impact of the program and gender on the gender-related survey question, four analyses were conducted in line with other studies that compared survey results by gender (Baker, 2013; Partlo, 2016; Rinderknecht & Smith, 2004). We compared pre and post results for males, pre and post results for females, pre results for males and females, and post results for males and females. The Mann-Whitney U tests were used for the first two analyses and Wilcoxon rank-sum tests were used for the latter two. Statistical analyses and figures were produced in R Statistical Software (v4.2.2; R Core Team, 2022) using the tidyverse (Wickham et al., 2019) and PairedData packages (Champely, 2018).

In-class activities were observed by the four instructors and student comments, quotations, and responses to the activities were noted. Optional exit-poll questions provided additional opportunities for students to discuss their thoughts about the program and/or specific activities. These informal discussions centered on what students liked about the course, what they learned, and their recommendations for future improvement.

The purpose of this paper is to serve as a program evaluation and as such, was given an exception from oversight by the University of Pittsburgh Institutional Review Board (IRB). Reasons for exemption are as follows: no identifying information was recorded about any of the individuals who provided responses to our surveys and there is no way to re-identify any of the subjects who provided us with this data. Therefore, our project does not meet the definition of Human Subjects Research as defined by federal regulations and, as such, does not require IRB oversight.

Results

Pre- and Post-Survey

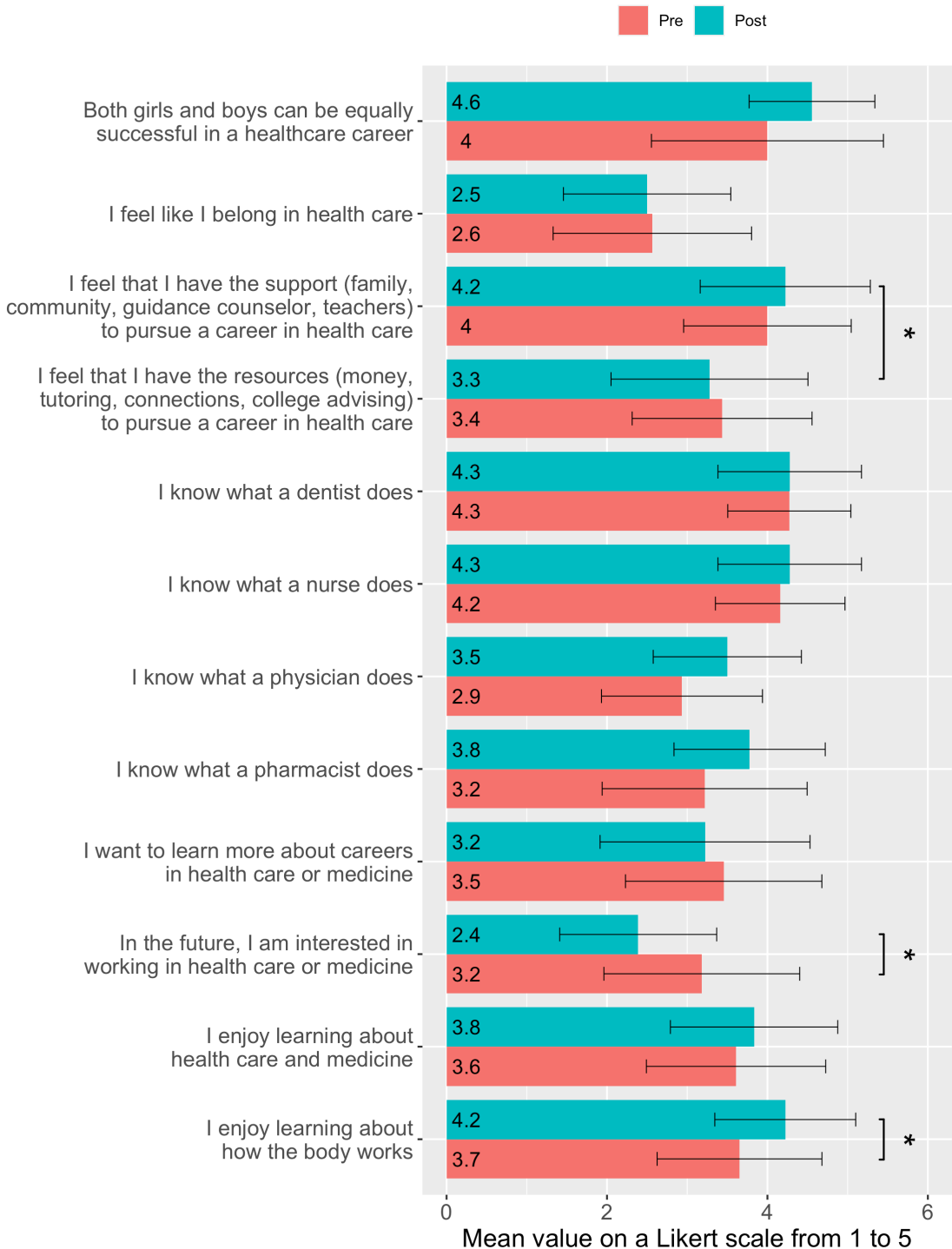
The results of the pre- and post-survey are shown in Figure 2. In total, 23 students completed the pre-survey (all the students who were in class on week 2), and 18 students completed the post-survey (all the students who were in class on week 5).

There were two questions that showed significant ($p < .05$) changes from the pre- to post-survey. There was a significant increase ($p = .01$) from pre- to post-survey about "I enjoy learning about how the body works." There was also a significant decrease ($p = .03$) from pre- to post-survey about "In the future, I am interested in working in healthcare or medicine."

In addition, we noticed that students responded differently to two related questions: students had a higher mean score on "I feel that I have the support (family, community, guidance counselor, teachers) to pursue a career in healthcare" (post-survey $M = 4.2$, $SD = 1.1$) than they did to "I feel that I have the resources (money, tutoring, connections, college advising) to pursue a career in healthcare" (post-survey $M = 3.3$, $SD = 1.2$) on the post-survey ($p = .02$).

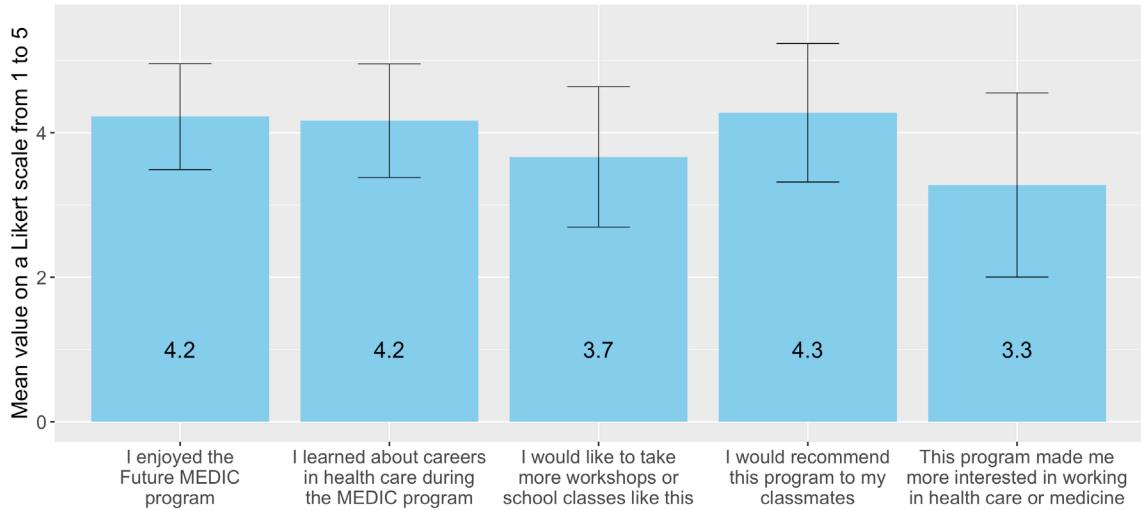
The results of the questions that were solely on the post-survey which asked students to evaluate the overall program are shown in Figure 3. Their answers showed that students generally enjoyed the program and learned more about healthcare. On a Likert scale of 1 (Strongly Disagree) to 5 (Strongly Agree), the mean answer was > 4 in

Figure 2. Comparisons Between the Results of the Pre- and Post-Survey



Note. Figure 2 plots the results to 12 questions that were asked on both the pre- and post-survey. The questions were asked on a Likert scale (from Strongly Disagree to Strongly Agree) which were then numerically represented on a 1 to 5 scale. The results are plotted by the means (with the mean values listed on each bar) and the error bars represent the standard deviations. Significant differences between questions are represented by *, which indicates that $p < 0.05$.

Figure 3. Results of the Post-Survey Program Evaluation Questions



Note. Figure 3 plots the results to five questions that were asked on the post-survey to evaluate the program. The questions were asked on a Likert scale (from Strongly Disagree to Strongly Agree) which were then numerically represented on a 1 to 5 scale. The results are plotted by the means (with the mean values listed on each bar) and the error bars represent the standard deviations.

three questions: “I enjoyed the Future MEDIC program,” “I learned about careers in healthcare during the Future MEDIC program,” and “I would recommend this program to my classmates.” The lowest scoring question ($M = 3.3$, $SD = 1.3$) was in response to “This program made me more interested in working in healthcare or medicine.”

Figure 4 shows a comparison between responses to the Likert-scale survey question, “Both girls and boys can be equally successful in a healthcare career” grouped by gender of the respondent and pre-/post-survey.

Overall, girls responded very positively to the question on both the pre- ($M = 4.3$; $SD = 1.25$; $n = 13$) and post-surveys ($M = 4.5$; $SD = 0.76$; $n = 8$). The boys scored higher on the post-survey ($M = 4.6$; $SD = 0.84$; $n = 10$) than they did on the pre-survey ($M = 3.6$; $SD = 1.65$; $n = 10$), although the difference was not significant ($p = .09$). The sample sizes were limited by the number of participants who responded to both the pre- and post-survey question, so the analysis was run with eight girls and nine boys.

Free Responses

The students’ responses to the open-ended questions on the post-survey showed the aspects that they most enjoyed about the program and what healthcare-related topics they would like to learn more about.

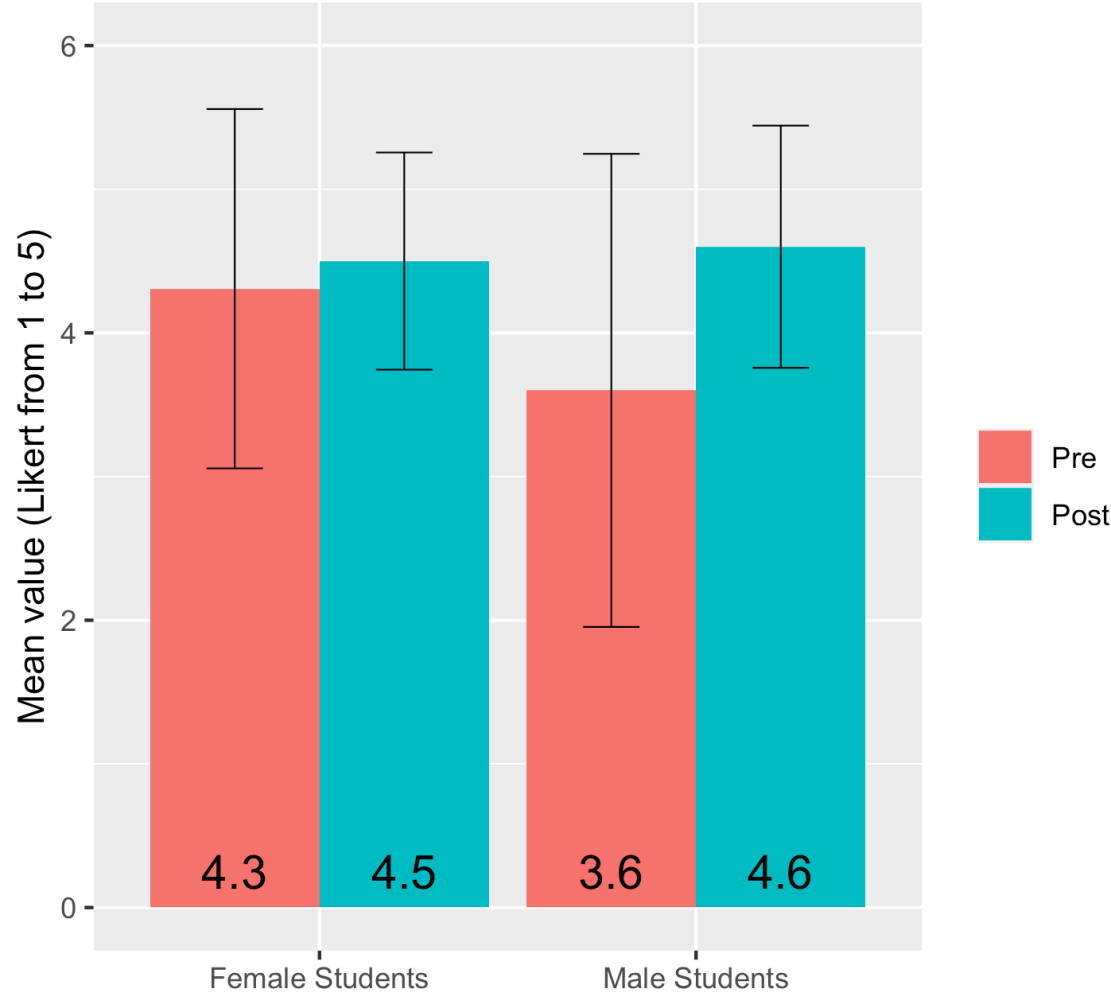
When asked, “What was your favorite part of the program?” many students responded that their favorite parts were learning about physical exam maneuvers (especially how to check a pulse, use a stethoscope, and elicit reflexes) and participating in other hands-on activities such as the patient simulations and learning to take blood pressure on a simulation arm. Some of the students noted, “The hearing of the heart and the arm,” “I like the hands-on stuff,” “Having something like a fake arm or we can test it out on our peers [sic],” and other quotes indicating the interactive activities were a success. Some students highlighted “the medical things” and “learning about different parts of the body” as their favorite parts of the program.

When asked “What topics related to healthcare would you like to learn more about?” some students wanted to learn more about the topics already covered in the course, specifically about dentistry, nursing, doctors, and testing reflexes. Some students wanted to learn about medications, and some students wanted to learn about pregnancy and women’s health: “Femenine [sic] things like periods and body parts” and “About pregnancy and how birth works.” Students were also interested in learning about CPR, surgery, and sports medicine.

Student Impact

Student anecdotes are one of the most tangible ways to determine the impact of the program.

Figure 4. Pre- and Post-Survey Results About Gender Equality in Healthcare



Note. Figure 4 plots the results to a question on gender equality in healthcare that was asked in both the pre- and post-survey. The question was asked on a Likert scale (from Strongly Disagree to Strongly Agree) which was then numerically represented on a 1 to 5 scale. The results are plotted by the means (with the mean values listed on each bar) and the error bars represent the standard deviations.

Most Future MEDIC sessions ended with an open class discussion where students were able to share their experience with the session. The following are quotes from open class discussion:

- “The reflex station was my favorite. I could test reflexes all day!”
- “Teeth are the coolest. I wanna be a dentist.”
- “8 years of school! That’s way too much!”

Discussion

Students generally enjoyed the program and enjoyed learning about the content we presented, especially the hands-on activities. This was evidenced by the overall positive responses on the post-survey to questions like “I enjoyed the Future

MEDIC program” and “I would recommend this program to my classmates” (see Figure 3). They listed various aspects of the course they enjoyed in the free-response question that mostly centered around the hands-on activities. There was also a significant increase from the pre- to post-survey in the question, “I enjoy learning about how the body works.”

Despite their enjoyment of the program, the steepest change from the pre- to post-survey was a significant decrease to the question, “In the future, I am interested in working in healthcare or medicine” (see Figure 2). Their responses to a similar question about interest in healthcare careers on the post-survey were lower than their

responses to the other questions about enjoying the program and learning from the program (see Figure 3). This was surprising; the goal of the program was to introduce students to careers in healthcare with fun and engaging activities in the hopes of fostering interest in these careers in some of the students. However, it shows the limitations of the program and our approach. It is unlikely that a five-week program is going to change eighth graders' minds about their future careers. The strength of the program may be that they had fun; instead of changing their minds right away, providing them with a memorable and engaging experience will hopefully keep careers in healthcare in their minds as they advance through the rest of their schooling and think more seriously about their careers. Moreover, they may have perceived it as just another school class; by implementing this during the school day and collaborating with their teachers, all students in the class were mandated to take part even if they were not necessarily interested in careers in healthcare. Many of the other studies in the literature that run similar programs (Marcu et al., 2010; Mouza et al., 2016; Niehaus et al., 2012; Wallace et al., 2015) hold them after school or during the summer, meaning they are voluntary and therefore recruit only the students that are already interested.

In the post-survey, we asked the students to share their favorite part of the Future MEDIC program. Based on these responses, students enjoyed the hands-on interactive sessions where they practiced using medical instruments and elicited physical exam findings. Engaging in these activities excited the students and gave them the opportunity to role play as clinicians taking care of their classmates.

We asked the students what healthcare-related topics they would like to learn more about to gauge what lessons should be included in future iterations of Future MEDIC. Some students responded that they wanted to learn more about careers, medications, women's health, CPR, surgery, and sports medicine. As Future MEDIC expands, any feedback given by the students will be incorporated into future lessons to ensure students are continuously engaged and participating in lessons on topics they are interested in, and that the program is used as a tool for general career exposure.

A goal of our pre- and post-surveys was to evaluate students' perception of the impact of gender on success in healthcare careers. Both male and female students had increased scores on

the post-survey compared to the pre-survey on our question about gender equity in healthcare. We believe this may be due to students' increased exposure to the four female primary instructors of the course, as well as the guest speakers who were also, coincidentally, mostly female. Furthermore, this discrepancy in pre- and post-survey scores among male students may also be attributed to students observing their female peers rising to the challenge in several sessions. Despite these differences, our results were not significant, which may be a result of our small sample size of students who completed both the pre- and post-survey ($n = 17$). Ultimately, despite the lack of significant results, we believe the increased exposure to diverse healthcare leaders broadened students' perspective on gender and healthcare careers.

When developing the curriculum of MEDIC, we wanted to incorporate diversity in multiple aspects to show the students that any career they hoped to achieve was possible. Three out of the four primary medical-student instructors identified as URM in medicine, and a majority of our guest speakers identified as women in medicine. We felt extremely grateful to have a broad representation of the medical field for students to appreciate, including in our flight medicine lesson.

The Future MEDIC program contributes to the limited body of literature focusing on interprofessional healthcare careers in the context of middle school-aged educational programming. Interprofessional collaboration was crucial in designing the Future MEDIC program. One of the aims of the program is to increase diversity in the future healthcare workforce and per the World Health Organization (WHO), "*interprofessional education is essential to the development of a 'collaborative practice-ready' health workforce. ... It is within these settings where the greatest strides towards strengthened health systems can be made*" (World Health Organization, 2010). The representation of multiple professional careers not only strengthened the delivery of programming content, but also provided a holistic and multidimensional view of healthcare to the student participants.

Future MEDIC was conducted by medical, nursing, dental, and pharmacy collaborators, all of whom play different roles within the healthcare team but still maintain the ultimate goal of patients' health and wellbeing. To this end, a dedicated question-and-answer session was needed because students had so many questions about various career paths. Our collaborators

were necessary to the goal of the program, as they shared their experiences and answered questions about their specific fields. This could not have been achieved with solely medical-student facilitators. From post-survey results, it can be gleaned that students enjoyed different activities spanning each of the weeks and wanted to continue to learn about different professional careers. Interpretation of these results indicate that different health careers matched the varied interests of the student participants and ultimately contributed positively towards the implementation of the Future MEDIC program.

Overall, hands-on activities or memorable stories stuck with students and the desire to engage more with various healthcare careers could be elicited from students' responses. Although it was clear that many students did not enter the program with an initial interest in healthcare, they still appreciated the opportunity to learn more about these careers. Students were proactive in asking questions about length of training, salary potential, and patient responsibilities—and this additional knowledge fueled their excitement. Personal experience working with students showed the Future MEDIC team that there was an apparent desire to learn generally and the opportunity to work in team-based, hands-on activities were welcomed.

During the implementation of the Future MEDIC program, there were many challenges and many novel strategies employed to overcome them. Access to technology was the first issue encountered while running the program. All classrooms had access to a digital smartboard, but the initial impression was that students would also have access to laptops, which ultimately was not the case. While students were provided laptops by the school, they were frequently forgotten at home or had incredibly slow run time, making it hard to implement online activities and stay on schedule. Thus, the program was required to pivot to less digital-based activities and focus more on other options.

Secondly, it was often difficult to keep students focused on one task at a time. Given the feedback from the previous iteration of Future MEDIC and our conversations with teachers prior to starting, it was known that this was a possibility, however experiencing it firsthand showed how important it was to work within the students' attention spans. A major improvement to Future MEDIC to solve this was the use of team-based, hands-on activities that allowed the students to

expend their energy while productively engaging with program content and socializing with their fellow classmates. It was evident that paper-based activities or large amounts of stationary time in large groups led to more outbursts and distracting behavior; thus, minimizing this allowed for more impact on all students and ease of content delivery. In coordination with smaller groups and active activities, snacks were often used as motivating factors or incentives to move the program along. Snack breaks were placed during transitions between activities so students had scheduled time where they could socialize instead of during portions of Future MEDIC that required content delivery.

Lastly, because Future MEDIC was held during regular school hours, but was considered an extracurricular activity by students, it was at times challenging for students to make the connection that classroom expectations should still be upheld for outside speakers and field trips. It was also difficult as facilitators to strike a balance between authority and being a trustworthy figure for the students. Per the recommendation of UPrep teachers, after week one, all Future MEDIC sessions began with a reiteration of the same classroom expectations that are used during a regular school day to ensure that students were focused and respectful of the time and effort of everyone involved in the implementation of the Future MEDIC program.

There are some key limitations to our analysis, particularly relating to the survey's interpretability. First, this was a small sample size overall ($n = 24$ who answered both the pre- and post-survey). It was even smaller when making paired statistical analyses that required that students be present for both the pre- and post-survey because there were several absences. Second, since there was a field trip on the first session and it was not possible to administer the survey then, most of the class completed the pre-survey on the second week of the program. Those who were absent in the second week completed it in the third week. This meant that students had already completed some program activities before completing the pre-survey. Third, due to scheduling complications, the fifth week of the program was held two months after the fourth week, perhaps leading to students forgetting previous sessions. The post-survey was also administered in between two stations during the fifth week, meaning not all students had completed the same activities when they filled out the survey. Finally, this was an ungraded

survey that was not piloted. As a result, although the survey was reviewed by their teachers, the survey's questions may not have been interpreted by the students the way we intended. The survey was also typically administered right before snack time, meaning some students might have rushed through the evaluation. For example, we noticed three survey responses with the same answer to almost every single question.

In future iterations of the program, we plan to feature careers that are more diverse in terms of healthcare field and length of schooling (x-ray technicians, medical assistants, therapists, etc.). We wonder if the careers we selected were very similar in terms of being patient-facing and requiring lengthy schooling, which might have decreased some of the students' interest (they typically asked our guest speakers about how much school was involved). We will also plan to limit the number of didactics in favor of small groups working in interactive sessions and hands-on activities, including field trips to the university's simulation center and hospital helipad. Finally, we are also interested in expanding the program to different age ranges, particularly elementary schools, to implement longitudinal involvement. The Hill District CEC has prior relationships with some elementary schools in the area and conversations have begun on how to roll out Future MEDIC to these students with a focus on fun and learning rather than assessing whether the program affected their career aspirations in the short term.

Future MEDIC was implemented at the Pittsburgh Hill District's UPrep with a focus on interprofessional healthcare careers, hands-on learning, and career exploration. UPrep students were thoroughly engaged in learning the material and participating in activities, although this did not directly correlate with an interest in joining the healthcare field. Students did express that they had resources to pursue a career in medicine, and we hope with further continuation and improvement of Future MEDIC, the program will strengthen students' overall perception of achieving their career goals and potentially pursuing a career as a healthcare professional. Most importantly, we created a fun and nurturing environment for students to step out of their comfort zones, try something new, and discover that there were no limits to what they could achieve. Even if students did not show an increase in interest in pursuing healthcare careers, we found the Future MEDIC program was influential and impactful in establishing a renewed sense of confidence in

students' own goals for their future and offering reassurance that whatever they wanted to achieve was attainable and possible for people who looked like them. Given the colorful history of the Hill District and the neighborhood's existing state today, it is imperative to invest in the next generation to guarantee advancement. Pittsburgh's Hill District has a rich past, and with sustained community development and empowerment, the neighborhood will see a prosperous future.

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Author Contributions

Sydney Sharp, Meeti Mehta, Rachel Weger, Chiazam Omenyi and Dr. Catherine Rebitch contributed to the design and implementation of the Future MEDIC program. Sydney Sharp, Meeti Mehta, Rachel Weger, Chiazam Omenyi contributed to the analysis of the results and to the writing of the manuscript in collaboration with Dr. Catherine Rebitch and Dr. Thuy Bui.

About the Authors

At the time of this writing, Sydney Sharp, Meeti Mehta, Rachel Weger, and Chiazam Omenyi were medical students at the University of Pittsburgh School of Medicine. Thuy Bui is a professor of medicine at the University of Pittsburgh School of Medicine. Catherine Rebitch is an associate professor in the University of Pittsburgh School of Pharmacy.