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Development and Pilot Evaluation of Native CREST – a Cancer Research Experience and Student Training Program for Navajo Undergraduate Students

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Abstract

The Mayo Clinic Cancer Center and Diné College received funding for a 4-year collaborative P20 planning grant from the National Cancer Institute in 2006. The goal of the partnership was to increase Navajo undergraduates' interest in and commitment to biomedical coursework and careers, especially in cancer research. This paper describes the development, pilot testing and evaluation of Native CREST (Cancer Research Experience & Student Training), a 10-week cancer research training program providing mentorship in a Mayo Clinic basic science or behavioral cancer research lab for Navajo undergraduate students. Seven Native American undergraduate students (5 females, 2 males) were enrolled during the summers of 2008 - 2011. Students reported the program influenced their career goals and was valuable to their education and development. These efforts may increase the number of Native American career scientists developing and implementing cancer research, which will ultimately benefit the health of Native American people.

INTRODUCTION

This paper describes the development, pilot testing and evaluation of a cancer-focused summer mentored undergraduate research fellowship for Navajo undergraduate students. The reduction of cancer health disparities among American Indian and Alaska Native (AI/AN) people is a major national public health priority [1-3]. Cancer is the second leading cause of death among AI/AN people[4]. Part of the reason for this high mortality is that often AI/ANs are diagnosed with cancer at an advanced stage [5-7]. Additional and contributing reasons include lack of availability and/or cultural appropriateness of screening services, lack of access to medical care, and large travel distances to prevention and treatment services[8].

A greater number of AI/AN practitioners could help reduce health disparities, but American Indians and Alaska Natives (AI/AN) remain underrepresented in the medical professions [9]. Lack of cultural competence among non-AI/AN providers is a significant barrier to quality health care for AI/ANs [10, 11]. Training more AI/AN physicians is critical to addressing these problems. AI/AN physicians are better prepared to deliver culturally appropriate and sensitive care [12, 13].

One issue contributing to inadequate cancer prevention and treatment within Native American communities is the scarcity of programs designed to strengthen science education and promote mentored biomedical and public health research experiences [14]. Programs tailored specifically to prepare students for careers in medicine or health care and facilitated by strategies appropriate to the academic, and cultural needs of AI/AN students have been useful in promoting their participation [9].

Few Native Americans complete Bachelor's degrees nationally, and not many continue on to graduate school or other professional programs. According to the 2012 U.S. Census Bureau, AI/AN students accounted for less than 1% (0.8%) of the total 1.6 million bachelor's degrees awarded in 2009 [15, 16]. They represented only 0.6% earning a graduate degree, 0.5% a doctoral degree, and 0.7% a professional degree [15]. The most common barriers for Native Americans receiving scientific degrees are lack of role models and mentors in the sciences and in their communities; limited opportunities to obtain experience in a scientific field of study (e.g., through a summer internship); and cultural constraints such as encouragement and support from their families and communities to achieve a career in science [17-20].

There is a paucity of Native American scientists who are pursuing successful cancer research careers. Accordingly, few studies of cancer prevention and control or of cancer etiology among AI/ANs in the US have included AI/ANs as investigators. Despite various initiatives, AI/AN researchers in Principal Investigator roles in community-based cancer research projects have been particularly uncommon. Although many cancer control studies by non-AI/ANs in Native American communities have been conducted with good intentions toward reduction of cancer incidence and mortality, they often have failed to achieve a reduction in cancer-related disparities affecting these populations. This lack of progress may be related partly to the many challenges that 'outsiders' experience in working within AI/AN communities, including the lack of trust that can take many years to establish. AI/AN investigators in key roles in community-based cancer control projects are needed to more effectively address the cancer burden in AI/AN communities. The cultural perspectives of AI/AN scientists are essential to the successful conduct of many forms of research involving Native American populations and patients.

In 1968, Diné College was established by an Act of the US Congress as the first Native American tribally-controlled college. Diné College is a two-year undergraduate institution chartered by the Navajo Nation serving approximately 2,000 students. Diné College operates 8 campuses to serve a reservation community spread over 27,000 square miles. In 2004, Diné College became the first tribal college to establish a degree program in Public Health.

The Mayo Clinic Cancer Center (MCCC) is one of 61 medical centers designated by the National Cancer Institute as a comprehensive cancer center. Mayo Clinic has experience working with and serving AI/AN communities through its Native American programs [21]. In 2006, Diné College and the MCCC received funding for a 4-year P20 collaborative planning grant from the Minority Institution/Cancer Center Partnership program of the Center to Reduce Cancer Health Disparities of the National Cancer Institute entitled "Dine' College/Mayo Clinic: Developing Cancer Researchers". One of the primary goals of the partnership was to increase Navajo undergraduates' interest in and commitment to pursuing biomedical coursework and careers, especially in cancer research, that will benefit their community. As a result of this collaboration, the Cancer Center had the opportunity to reach students and Native American communities in new and more effective ways that can assist in reducing cancer risk behaviors.

The project focused on three aims: faculty cancer research education, student cancer research education, and student training in cancer research. This paper focuses on the aim of student training in cancer research, specifically, to develop and implement a summer student research training experience at Mayo Clinic for Diné College students. A successful partnership and collaboration between Diné College and the Mayo Clinic Cancer Center focusing on cancer research training and education has been developed and nurtured [22]. MCCC's assets combined with Diné College's Native American student and faculty resources and history of community activity placed the two institutions in an exceptional position to effectively reach the Navajo community. The Native CREST (Cancer Research Experience & Student Training) program builds on an existing Summer Research Enhancement Program (SREP) at Diné College that focuses on diabetes and cancer prevention and public health research [22] and is also modeled on Mayo's Summer Undergraduate Research Fellowship (SURF) program, a competitive research training experience for undergraduate students to participate in a research training internship. SREP is a 10-week research program conducted in a culturally supportive atmosphere where each student is encouraged to adopt a strong, multi-cultural approach to cancer and diabetes prevention research. SREP was developed to help students develop their skills and interests in these areas as well as participate first hand in community based, on-going research projects at Diné College and at other institutions on the Navajo Nation and in other Native communities. The SURF program is a research-intensive 10-week program for undergraduate students from all over the country, designed to build their investigative and research skills in a collegial, collaborative environment. The SURF program plays a critical role in encouraging undergraduate students to become researchers and scientists.

We did not specify hypotheses because our goal was to design the program and to obtain preliminary data on acceptability. In future studies we will test the program using a larger sample and include hypotheses.

METHODS

The student-cancer research training aim was founded on a shared responsibility between Mayo Clinic and Diné College to develop, pilot-test, and refine the summer research experience. Mayo Clinic faculty was responsible for identifying skilled mentors, implementing the mentored research program, and facilitating program evaluation by the students and mentors. Diné College faculty had primary responsibility for selecting students and for ensuring the cultural appropriateness of the program for Native American students. Both institutions shared responsibility for ongoing follow-up with and support of the students.

1. Development of Native Cancer Research Experience & Student Training (CREST)

The motto of the Native CREST program is, "Preparing Tomorrow's Native Researchers Today". Native CREST is a 10-week, mentored, summer enrichment training program in cancer research methods for Native American Diné College undergraduate students offered at Mayo Clinic's Rochester, Minnesota and Scottsdale, Arizona campuses. Through the P20 grant collaboration the Native CREST program has been developed and implemented to increase the number of students at Diné College preparing to pursue advanced degrees in the health fields by providing opportunities to obtain experience in cancer research and training. Students appointed to this program are interested in the public health and healthcare fields and are considering a future health-related career through biomedical research, nursing, or pursuing PhD, MD, or MPH degrees.

The program introduces students to the research process and to health professions, providing a foundation for assisting in basic research and evaluation capacity development. The

students work with a Mayo Clinic researcher who is interested in mentoring a student on a cancer related research project with the goal of developing their research interests and experiences. To assess potential interest in mentoring a student and to establish the process for selecting mentors at Mayo we conducted an email survey of all Mayo Rochester Cancer Center investigators (N=339) in January 2008. A total of 36 (11%) responded they were definitely interested, 6 (2%) indicated “maybe,” 15 (4%) declined, and 282 (83%) did not respond to the survey. Despite the very low response rate, we had a good pool of potential mentors from which to draw.

Students participating in the SREP program were recruited each summer for Native CREST and the Mayo Clinic program coordinator traveled to Diné College to recruit for the program as well. Recruitment materials for the Native CREST program were developed jointly with Diné College and included a brochure, recruitment flyer, application and recommendation forms as well as student and mentor evaluation forms. The community advisory committee for our P20 project reviewed and provided feedback and advice on all materials. Native CREST students received either a program stipend of \$4,000 and a scholarship from the Spirit of EAGLES for \$1,000 (2008-2010), or a program stipend of \$5,000 (2011), but the students were required to pay for their travel, housing and meals for the 10 weeks of the program. Mayo Clinic staff assisted the students with their travel and housing arrangements. The students who worked in Rochester, Minnesota for the summer were housed at a location that was either connected or a short walking distance to the Mayo Clinic. A free downtown bus pass was provided so they wouldn't need a vehicle while participating in the program. For the one student who stayed in Scottsdale, Arizona there was housing available at several hotels that offered extended stay rates and provided free shuttle services to the clinic.

Eligibility Requirements—We identified the selection criteria and defined the level of integration of the Native CREST students with the SURF students and the didactics they would participate in. The requirements for the students accepted into the Native CREST program were to have: a cumulative GPA of at least 2.5 (four-point scale); successful completion of at least one year at Diné College and/or completion of a previous Diné College Summer Research Enhancement Program (SREP) or similar summer research experience (academic/professional – supported by letters of recommendation); and completion of the Native CREST program application form (which included a personal statement/essay).

Diné Educational Philosophy—In the development and design of this new program for students, we drew from the Diné Educational Philosophy (DEP) which informs and guides college-wide curriculum development and reform including public health education [23]. Developed by Navajo cultural specialists, this philosophy represents the essence of the Navajo outlook on life. The core philosophical concept around which the DEP is based is the statement *Sa' h Naaghái Bik'eh Hózhóón* defined as “The Diné traditional living system, which places human life in harmony with the natural world and the universe. The philosophy provides principles both for protection from the imperfections in life and for the development of well-being” (*General Catalog* of Diné College).

Important insight to the Diné Philosophy has been articulated by Mr. Frank Morgan, a Navajo language and cultural consultant to Diné College. Frank Morgan, who has a BA in Psychology, has over twenty-five years of experience participating in and consulting on a variety of research projects. Mr. Morgan visited Mayo Clinic Rochester in July of 2007 and gave a presentation “*Mentoring Navajo Students in Research*”, which addressed topics on Navajo culture and cultural factors to consider when mentoring Navajo students. A DVD of his presentation is available for future potential mentors. This presentation was informative for Mayo researchers who are interested in mentoring Diné College students, as well as

other faculty and trainees who wish to gain an increased understanding of Native American cultural considerations in conducting research.

Some of the topics he discussed were:

- There is no lack of interest in science among Navajo students, but there are barriers to success related to cultural misunderstandings and limitations in funding and support.
- Navajo undergraduate students tend to be older and many have families and numerous obligations and responsibilities, necessitating lengthier undergraduate careers.
- Navajo students are highly influenced by family. Cultural practices may require interruption of degree progress to be present to represent or honor family and relatives.
- Cultural and spiritual beliefs may conflict with standard scientific and medical training, such as matters related to nature, illness, death and dissection. Such conflict may require students to seek alternate pathways to pursue careers in research or medicine. Alternatively, they may require students to undergo extensive ceremonies before and after engaging in training activities that are counter to their beliefs.
- Communication styles may be unfamiliar between the mentors and the Navajo students. Mentors need to understand these differences, be patient, and ask students to review their understanding.

Cultural Activities—Native CREST students bring with them their own cultural and traditional experiences, values and knowledge, and the program works to respect and learn from them. The intention is to reinforce the students' understanding and appreciation of the Native American lifestyle, while emphasizing the significance to modern life. These experiences assist students in drawing their own conclusions as to how they may play a role in organizing and conducting research in their own communities. Students are more likely to develop an interest in prevention research if those interests are nurtured in a culturally supportive environment.

Native CREST Program Goals—The goals of the Native CREST program were to provide the student with: 1) experience in research methods and thus skills in research design and carrying out research; 2) working knowledge through the introduction of basic lab principles as well as the learning and understanding of the process in which research translates to new medical advances and treatment; 3) career path advising and continued learning through science specific classes, seminars, and cancer education; and 4) preparation through encouraging professional relationships by interaction with lab staff and researchers and experience preparing and formally presenting their research experience to other students and faculty at the end of the program. Equally as important was the goal to increase cultural competence of Mayo Clinic staff through the training about Native American cultures and values to enhance awareness and cultural sensitivity as this may affect not only mentoring quality, but also research issues and quality of care.

Based on their interests and preferences, the students were placed in either a basic science or behavioral health research lab for a mentored research experience. The students participated in cancer education or cancer prevention research where they either were assigned to their own project or contributed to a variety of ongoing activities. The students were expected to gain experience through their participation in research activities, data collection, as well as

engaging with Mayo Clinic staff. The experience was designed to empower the student with practical knowledge and research skills and to be able to apply this knowledge in either a quantitative and/or qualitative research setting. Objectives for the impact that the program should have on the department and for the benefit of the mentor include expectations that the student should directly contribute to the accomplishment of the objectives of the research project. The student was encouraged to build upon this knowledge as well as adopt a strong bicultural approach in the research activities, bridging Native American healing knowledge and western biomedical knowledge.

2. Pilot Evaluation

Students—Native CREST was implemented and pilot tested with a total of 7 Native American undergraduate students (5=F; 2=M) in the summers of 2008 - 2011 at MCR (n=6) and MCA (n=1). Four of the students expressed interest in a basic science experience, two preferred a behavioral science mentorship, and one student was able to spend some time in both (table 1).

Measures—Both students and mentors filled out a brief evaluation form at the end of the research experience that assessed the quality and their satisfaction with the program and they were also asked to provide suggestions for improving the program and reducing barriers for future Navajo students. The students were asked to rate the Native CREST program on a scale of 1 to 5, where 1 is “poor” and 5 is “excellent.” Feedback responses assessing the students’ and mentors’ opinions and attitudes were collected using four-point Likert scale variables with possible responses of “strongly agree,” “agree,” “disagree,” and “strongly disagree” and response options for whether the student or mentor would recommend the program to others were “yes” and “no.” The surveys also asked for qualitative feedback from the students on what they liked best about the Native CREST program as well as their specific project, how the Native CREST program has influenced their career goals, and what improvements they would recommend to the format or structure of the Native CREST program. Additionally, we asked the mentors to describe their student’s strengths related to his/her potential for a career in cancer research.

RESULTS

The overall program was highly rated with six of the seven students indicating they would recommend the program to another student (table 2). When the students were asked “How would you rate the program on a scale of 1 to 5, where 1 is “poor” and 5 is “excellent?”” four of the students gave the program a 5, two students gave the program a 4, and one student didn’t respond. When the students were asked if the Native CREST program had influenced their career goals and if their experience in the Native CREST program was valuable to their education and development, they all agreed (with five strongly agreeing). Specific student comments included: “Being in the research laboratory has been a wonderful experience, and if my path in life crosses research again, I’ll know what do; but I am grateful that I know how research is done and how much time it takes”; “It’s helped me to understand the need for more cancer researchers but as well has helped guide me into the right career path especially with the help of the people I’ve worked with”; “Confirmed that I want to remain on the reservation and that I would like to be involved with public health research”; “It has allowed me a window into how clinical research is conducted, used, or not used” and “I know what research is like and the experience has helped [me] think about my options.”

The students learned about the program from a teacher at Diné college (n=5) or their advisor (n=1) with four hearing about it from another program (SREP, n=3; RISE, n=1). When the

students were asked what they liked best about the program they had a variety of responses: “Meeting new people and getting a chance to work in the research lab of Mayo. I got a chance to explore [a] different environment.”; “The resources you gain of how to prepare/to figure out what career path you would like to take whether it be Medical school/MD PhD program.”; “Great support from co-workers”; “Opportunity to observe a major hospital corporation from the inside and observe the inner workings of a hospital based research study.”; “I enjoyed having access to the intellectual community of Mayo.”; “I liked the experience in the lab, the seminars, and meeting the graduate students.” and “Hands on experience.” When the students were specifically asked what they liked best about their project they responded, “...you could feel free to ask questions about anything and that the project I did was important.”; “The new information and the different ways of protocols to get to the final result. There was something to learn everyday...”; “Help from other researchers”; “It was relevant to my passion and my future. It was an excellent networking opportunity. It was a venue in which I was comfortable”; “I was able to claim ownership of my project and I was required to defend it myself within an academic setting”; “That I was helping future patients” and “I was independent...” Finally, when the students were invited to tell us what they think of the program, specifically what improvements could be made to the format or structure of the Native CREST program, we received mostly positive responses. The first student responded, “...I really had an astonishing time and a great experience...staff of the laboratory were very kind and helpful...” One student replied, “great program,” another recommended “making it more accessible for more Native students to make it into the program, because students often sell themselves short to what the world has to offer. I know I almost did, but I was fortunate to have worked with great people to get me through and into the program” and our last student said “it was a great experience and I had fun doing it!”

All of the Native CREST mentors would recommend the program to other faculty members (table 3). Two of the mentors estimated spending 5% of their time, three estimated spending 20% of their time, one estimated spending 30% of their time, and one estimated spending 40% of their time working one-on-one with their student. The mentors described the strengths of the students as: Passionate for learning (5), enthusiastic (4), excellent work ethic (2), outstanding maturity (2), professionalism (2), the confidence to attack problems independently (2), excellent diligence and attention to detail, excellent leadership capacity, and an intense desire to impact the level of care within the Navajo Nation. Additional comments from the mentors were: “Your selection process and student guidance are outstanding”; “The Native CREST program did an excellent job of identifying students with the level of maturity needed to get the most out of the program”; and “The summer student was a great contribution to our research unit and we would be greatly interested to mentor future students through this program.”

FOLLOW-UP

We have had recent (one to four years following program) follow-up with all seven of the Native CREST students where we asked them about their current status and future plans. Currently six of the seven students are still in college pursuing the following degrees: public health, nursing, kinesiology, health occupation and biology, and dietetics and chemistry. The only one who is not currently in college encountered some financial complications but hopes to return to pursue a bachelor of arts in public health and nursing. All of the students plan to continue with their education or pursue careers in the health care field. Two of the students plan on pursuing careers in nursing, one student plans on getting her Registered Dietician degree, one student plans on either completing the nursing program or continuing for his Masters in Public Health, another plans to obtain her Master’s in Public Health, and one plans to apply for the Initiative for Maximizing Student Diversity (IMSD) Post

baccalaureate Program at Mayo and to seek out a graduate degree either in the health sciences or engineering field.

Four students have specified that they want to continue living and working in the Navajo Nation. One student added, “all of what I have learned from the summer up to this point has guided me toward my career path” and another mentioned, “I hope to work for the Navajo Nation and help to influence positive change in my community on the reservation regarding public health.”

DISCUSSION

Overall, students found that the program influenced their career goals and was also valuable to their education and development. Students also thought the program was culturally acceptable and resulted in changes in some of their attitudes and opinions about research and about cancer. It is important to reach Navajo students early in their post-secondary education to enhance their skills in conducting research and interest in pursuing science degrees. Ultimately, these efforts and this collaboration may serve to build capacity in Native American communities, by developing a pipeline of future scientists to develop and implement culturally appropriate cancer research that will not only benefit the health status of Native Americans but also lead to enhanced opportunities to address the cancer burden and reduce cancer disparities affecting all Native American people [24, 25].

While the program was highly acceptable to those who participated, efforts are needed to enhance and improve recruitment of Native CREST students for future programs. A limitation of this pilot study is the small sample. While the enrollment numbers were low these can't be directly compared to those of SREP. Logistically there are some very important differences between SREP and Native CREST. SREP was conducted on the reservation and Native CREST was offered in a completely different environment (Rochester, MN). We were able to enroll less students because of these logistical constraints. Moreover, due to the expenses involved we did not have the same number of funded slots for Native CREST.

“Lessons learned” through the process of developing and implementing the program are that major barriers to participation were the need for child care and the substantial geographic distance between the program sites and the Navajo Nation. There is a need to develop cultural approaches to engage the community in a dialogue about cancer prevention and research to help increase the social and emotional support of the family and community for student participation in such activities. A new “Cancer Prevention and Control” course now in the curriculum at Diné College is also a potential avenue to reach and engage potential students to participate in Native CREST. A goal is to develop a long-term tracking system to follow-up with the students who participated in the Native CREST program to assess long-term impacts. Moreover a limitation of the program was that we didn't assess the changes in attitudes and beliefs of the mentors. Measuring mentor beliefs and attitudes may impact the student performance or outcomes. Thus, we recommend this step for future implementation.

CONCLUSION

There are strong Navajo cultural values that discourage discussions of cancer or causes of cancer. The Native CREST program described in this article as well as our prior activities [22] may collectively help to address the “silence” and avoidance regarding cancer in Navajo and other Native American communities.

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Table 1

Native CREST Student Demographics (N=7)

Year	Age	Gender	Race	Class Standing	Type of Research Lab Experience	Research Presentation Title
2008	23	Female	NA	Senior	Basic Science	"Rin2 Regulation of HGF/c-Met Signaling"
2009	28	Female	NA	Junior	Basic Science	"Purification of Assembled ESCRT-III for Reconstituting a Late Step in MVB Sorting"
	23	Male	NA	Senior	Behavioral Science	"A Comprehensive Narrative of the Behavioral Health Research Program Internship"
	60	Female	Cauc	Junior	Basic Science & Behavioral Science	"Nursing Research at Mayo Clinic"
2010	23	Male	NA	Senior	Behavioral Science	"Time Allocation of Internal Medicine Residents"
2011	32	Female	NA	Sophomore	Basic Science	"Bone Morphogenic Protein Expression in Bacteria"
	21	Female	NA	Junior	Basic Science	"Real Time Analysis of Vps4 ATP Hydrolysis"

Table 2

Native CREST Student Feedback (N=7)

Rate Native CREST Program	
1 "poor"	0% (0)
2	0% (0)
3	0% (0)
4	29% (2)
5 "excellent"	14% (0)
The Native CREST program has influenced my career goals.	
Strongly Agree	71% (5)
Agree	29% (2)
No Opinion	0% (0)
Disagree	0% (0)
Strongly Disagree	0% (0)
My experience in the Native CREST Program was valuable to my education and development.	
Strongly Agree	71% (5)
Agree	29% (2)
No Opinion	0% (0)
Disagree	0% (0)
Strongly Disagree	0% (0)
I have decided to pursue a career in research.	
Yes	43% (3)
No	0% (0)
Undecided	57% (4)
I have decided to pursue a <u>career</u> in cancer research.	
Yes	14% (1)
No	0% (0)
Undecided	86% (6)
Do you plan to pursue a graduate degree?	
Yes	71% (5)
No	0% (0)
Not Sure	29% (2)
The Native CREST Program influenced my decision whether or not to pursue a graduate degree.	
Strongly Agree	86% (6)
Agree	14% (1)
No Opinion	0% (0)
Disagree	0% (0)
Strongly Disagree	0% (0)

Table 3

Native CREST Mentor Feedback (N=7)

Would you recommend the program to other faculty?	
Yes	100% (7)
No	0% (0)
My student's abilities met my expectations.	
Strongly Agree	71% (5)
Agree	29% (2)
No Opinion	0% (0)
Disagree	0% (0)
Strongly Disagree	0% (0)
My student's enthusiasm and work ethic met my expectations.	
Strongly Agree	71% (5)
Agree	29% (2)
No Opinion	0% (0)
Disagree	0% (0)
Strongly Disagree	0% (0)
I had an excellent working relationship with my student.	
Strongly Agree	86% (6)
Agree	14% (1)
No Opinion	0% (0)
Disagree	0% (0)
Strongly Disagree	0% (0)
My time spent mentoring a student in the CREST program was worth it.	
Strongly Agree	86% (6)
Agree	14% (1)
No Opinion	0% (0)
Disagree	0% (0)
Strongly Disagree	0% (0)
My student made a positive contribution to my research program.	
Strongly Agree	57% (4)
Agree	43% (3)
No Opinion	0% (0)
Disagree	0% (0)
Strongly Disagree	0% (0)