



Contents lists available at ScienceDirect

## The American Journal of Surgery

journal homepage: [www.americanjournalofsurgery.com](http://www.americanjournalofsurgery.com)

## Pipeline program recruits and retains women and underrepresented minorities in procedure based specialties: A brief report



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### ARTICLE INFO

#### Article history:

Received 2 July 2016

Received in revised form

25 October 2016

Accepted 16 November 2016

#### Keywords:

Medical education

Pipeline programs

Physician workforce

Diversity

Surgery

Procedure-based specialties

### ABSTRACT

As the US population continues to grow in racial and ethnic diversity, we also continue to see healthcare disparities across racial lines. Considerable attention has been given to creating a physician workforce that better reflects the population served by healthcare professionals. To address the low numbers of women and underrepresented minorities in procedural based specialties, Nth Dimensions has sought to address and eliminate healthcare disparities through strategic pipeline initiatives. This is a retrospective observational cohort study of 118 medical students from 29 accredited US medical schools, who were awarded a position in the Nth Dimensions Summer Internship program between 2005 and 2012. Overall, 84 NDSI scholars applied and 81 matched into procedure-based specialties; therefore the overall retention rate was 75% and the overall match rate across the eight cohorts was 72.3%. Through intervention-based change, the authors hypothesize that greater numbers in the residency training cohorts can lead to a greater number of physicians with diverse backgrounds and perspectives. Ultimately, this will enhance quality of care for all patients and improve decision making process that influence healthcare systems.

**Summary:** Strategic pipeline programs increase successful recruit women and underrepresented minorities to apply and matriculate into procedure based residency programs. This is a retrospective observational cohort study of 118 medical students who completed the Nth Dimensions Summer Internship program between 2005 and 2012. Overall, 84 NDSI scholars applied and 81 matched into procedure-based specialties; therefore the overall retention rate was 75% and the overall match rate across the eight cohorts was 72.3%.

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## 1. Introduction

As the US population continues to grow with increasing in racial and ethnic diversity, we also continue to see healthcare disparities across racial and ethnic lines. The causes of healthcare disparities are multi-factorial, and include limited access to care, cultural insensitivity, lack of cultural education amongst healthcare professionals, and implicit bias influencing surgical and non-surgical treatment decisions.<sup>7</sup> To minimize access issues, the Patient Protection and Affordable Care Act (ACA) sought to increase coverage for over 6.4 million low and middle income Americans. Despite enormous efforts from provisions outlined within the ACA, healthcare disparities in the US remain pervasive.

In addition to increasing access, one of the primary goals of the ACA were to decrease costs and improve quality. It is estimated that eliminating disparities for minorities alone could reduce medical care expenditures by more than \$57 billion annually.<sup>6</sup> Studies suggest surgical patients of minority backgrounds suffer from inability to access care, increased morbidity and mortality, advanced presentation of disease and delayed surgical intervention even after presenting to a surgical provider.<sup>8–10</sup> To increase cultural concordance and therefore improve health outcomes, considerable attention has been given to creating a physician workforce that better reflects the US population served by healthcare professionals. A recent study comparing allopathic medical school applications and enrollment by race and ethnicity found that race distribution within US medical schools was significantly different than distribution of race for the general, regional, and sub regional populations.<sup>5</sup> Procedure-based subspecialty residency programs in particular reflect lower numbers of female and minority residents,

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despite females making up ~50% of medical graduates.<sup>11</sup>

There are very few pipeline programs at the medical school level that help to funnel quality applicants into residency programs.<sup>1</sup> To address the low numbers of women and underrepresented minorities in procedural based specialties, Nth Dimensions (a not-for-profit organization founded by physicians in 2004) has sought to address and eliminate healthcare disparities through strategic pipeline initiatives. In this study, we assess the impact the Nth Dimensions' program can have on not only garnering and retaining medical student interest in surgical and/or procedural based specialties, but also on successfully increasing the number of underrepresented minorities and women that successfully match in procedure-based specialties. We present a brief report of our preliminary findings in this study.

## 2. Methods

To address the low numbers of women and underrepresented minorities in medicine, Nth Dimensions, a NFP founded by board-certified surgeons, implemented a longitudinal set of strategic pipeline initiatives, the Nth Dimensions Pipeline Initiatives Curriculum™ (NDPIC™) beginning in 2002, and formally incorporated in 2004. The NDPIC™, consisting of 3 phases, engages approximately 300–400 US medical students annually at 39 medical schools. The phases include 1) early initial exposure and hands-on experience, 2) clinical and research experience, 3) mentoring and professional development. Once students are selected to participate in the program, they begin a tri-phasic process that starts during the summer after their first year of medical school, and culminates with their successful matriculation into a residency program. During Phase 1, students participate in a bioskills workshop to gain hands-on exposure and experience with surgical instruments and technique. Phase 2 encompasses the NDSI program where students spend 8 weeks that expose them to clinical care which includes shadowing clinical surgeons, learning about anatomy and surgical technique, scrubbing into to surgical procedures, and seeing patients in outpatient setting. Additionally, each student is required to complete a research project in a procedural based specialty with their surgical preceptor, although the project may be basic science or clinical research. Students present their research project in a poster presentation format at a national meeting, and are encouraged to continue their research endeavors following the initial 8-week experience.

Medical students that participated in Nth Dimensions programs in each phase were tracked throughout their medical school matriculation. This paper addresses the impact of the NDPIC™ Phase 2 program, for the purpose of examining the effectiveness of this discrete intervention on its select student participation. Following completion of the Nth Dimensions Summer Internship (NDSI), scholars receive on-going mentoring and attend professional development programs during phase 3 of the NDPIC™ as second, third, and fourth year students.

This is a retrospective observational cohort study of 118 medical students from 29 accredited US medical schools, who were awarded a position in the Nth Dimensions Summer Internship program between 2005 and 2012. Between 2005 and 2012, eight cohorts of first-year medical students were awarded an internship during the 8-week NDSI program at one of 40 US medical schools. Students were included in this report based on successful completion of the program and were followed to matriculation into a residency program. Exclusion criteria for the first arm of this study included students who did not complete the entire OSI program or were lost to follow up upon completion of the program. Their decision to apply to a self-elected specialty was followed to ascertain both application (retention) and match rates in surgical and procedure-

based specialties. For the purpose of this study, those specialties were defined as those in which the resident gains skills that requires hands-on intervention by merging sensory and cognitive capabilities and is then able to perform tasks such as suturing, incision and drainage, and/or other invasive diagnostic or therapeutic measures. The following specialties were included: General Surgery, Orthopaedics, Anesthesiology, Neurosurgery, Emergency Medicine, Urology, and Obstetrics/Gynecology.

Forty surgical preceptors, from academic and community practices, who are members of the varying racial, ethnic and gender minority groups were selected because of their teaching and mentoring achievements in procedure-based specialties. Preceptors remain actively engaged with internship mentees and provide core support to develop professional skills to achieve their procedure-based residency aspirations. The students are also encouraged to develop mentoring relationships with additional surgeons and residents through scheduled interactions and mentoring activities during annual programs.

To assess the effectiveness of the Nth Dimensions Summer Internship and additional programming, the primary outcome was the number of women and underrepresented minority students who were recruited through the program and retained into procedure-based specialties. The number of scholars who retained interest in procedure-based specialties was indicated by their application for procedure-based residency positions. The final outcome measure of the program's impact was determined by the number of NDSI scholars who successfully matched into a procedure-based residency position as fourth year medical students. We stratified our data to focus on women and underrepresented minorities; the latter subdivided into Black and Latino students. We then evaluated the proportions of women and underrepresented minority students who completed the Nth Dimensions Summer Internship and then applied to a procedure based residency program.

### 2.1. Statistical analysis

Descriptive statistics were obtained for each variable in the study and Stata 13.1 (College Station, TX) was used to establish rates of retention and match acceptance for all 8 cohorts. All statistical analyses were performed using Stata 13.1 (College Station, TX, USA) with a two-sided significance level set at  $p < 0.05$ . An institutional review board waiver was obtained before conducting this study (institutional review board #11053/eCAP# 2015-140).

## 3. Results

Between 2005 and 2012, total of 118 first-year medical students across eight cohorts were awarded an internship during the 8-week NDSI program at one of 40 US medical schools. Six students were lost to follow up, and as a result the total number included in this study was 112 participants. Amongst the 112 scholars, the 8 cohorts were composed of 48 (43%) females; the cohorts were ethnically composed of 82 (73%) Black, 16 (14%) Latino, 9 (8%) White, 3 (2.6%) Native Americans/Indian, and 2 (1.7%) Asian participants (Tables 1 and 2).

Overall, 84 NDSI scholars applied and 81 matched into procedure-based specialties; therefore the overall retention rate was 75% and the overall match rate across the eight cohorts was 72.3%. Specifically, 22 (19.6%) matched into general surgery, 38 (33.9%) into orthopaedic surgery, 4 (3.6%) into anesthesiology, 0 into interventional radiology, 2 (1.8%) in neurosurgery, 5 (4.4%) in emergency medicine, 4 (3.6%) in urology, and 4 (3.6%) into obstetrics/gynecology residency programs, Table 1. The remaining OSIs matched into primary care specialties such as family medicine,

**Table 1**

Demographics of medical student participants in the Orthopaedic Summer Internship program from 2005 to 2012 (n = 112).

	Number (%)
Gender	
Male	70 (56)
Female	48 (43)
Race/ethnicity	
Black	82 (73)
Latino	16 (14)
White	9 (8.0)
Other	3 (2.6)
Asian	2 (1.7)

**Table 2**

Nth Dimensions Summer Internship Participants by gender and cohort year from 2005 to 2012 (n = 112).

Cohort	Male number (%)	Female number (%)
I	5 (50)	5 (50)
II	11 (69)	5 (31)
III	8 (66)	4 (34)
IV	8 (62)	5 (38)
V	2 (29)	5 (71)
VI	10 (59)	7 (41)
VII	10 (50)	10 (50)
VIII	10 (59)	7 (41)
<b>Total</b>	64 (56)	48 (43)

pediatrics, physical medicine and rehabilitation (PM&R). Fig. 1 reflects the distribution of specialties that scholars matriculated into amongst those who applied to procedure-based specialties.

#### 4. Discussion

In 2009, the US Department of Health and Human Services

published a report entitled “Pipeline Programs to Improve Racial and Ethnic Diversity in the Health Professions: An Inventory of Federal Programs, Assessment of Evaluation Approaches, and Critical Review of the Research Literature”.<sup>12</sup> This report concluded, in part, that pipeline programs are consistently associated with positive outcomes for racial/ethnic minority and disadvantaged students. As of 2016, the Nth Dimensions Summer Internship Program has consistently shown positive outcomes for the underrepresented minorities and women that were the focus of its creation. Current evidence supports that existing healthcare disparities may be diminished when the physician workforce more directly reflects the diversity in the US population.<sup>3,5</sup> Data also indicates that the resident pool is representative of the pool from which fellows and faculty are mentored and recruited. It is therefore important to diversify the pool of residents not only to positively impact the diversity of the physician workforce, but also to impact the diversity of faculty who are responsible for choosing future residents. Although the long-term effects of the Nth Dimensions Summer Internship Program are in the process of being followed, effectiveness in the short term was assessed based on participating students’ application to procedure-based residency programs. Therefore, for women and underrepresented minorities, we evaluated the program’s success in increasing the proportion of these students applying to procedure-based programs, particularly those with proportions of underrepresented minorities and woman lower than their population percentages. The overall goal of this evaluation is to provide a report that demonstrates the effectiveness of the program with the intent to expand its reach nationally and to encourage similar programs in other medical specialties where women and minorities are underrepresented.

There were several limitations to this study. First, national comparison data detailing the application rates of medical students based on gender, race, and ethnicity was difficult to obtain. In addition, complete national data regarding acceptance or “match” rates into procedural based training programs of medical students

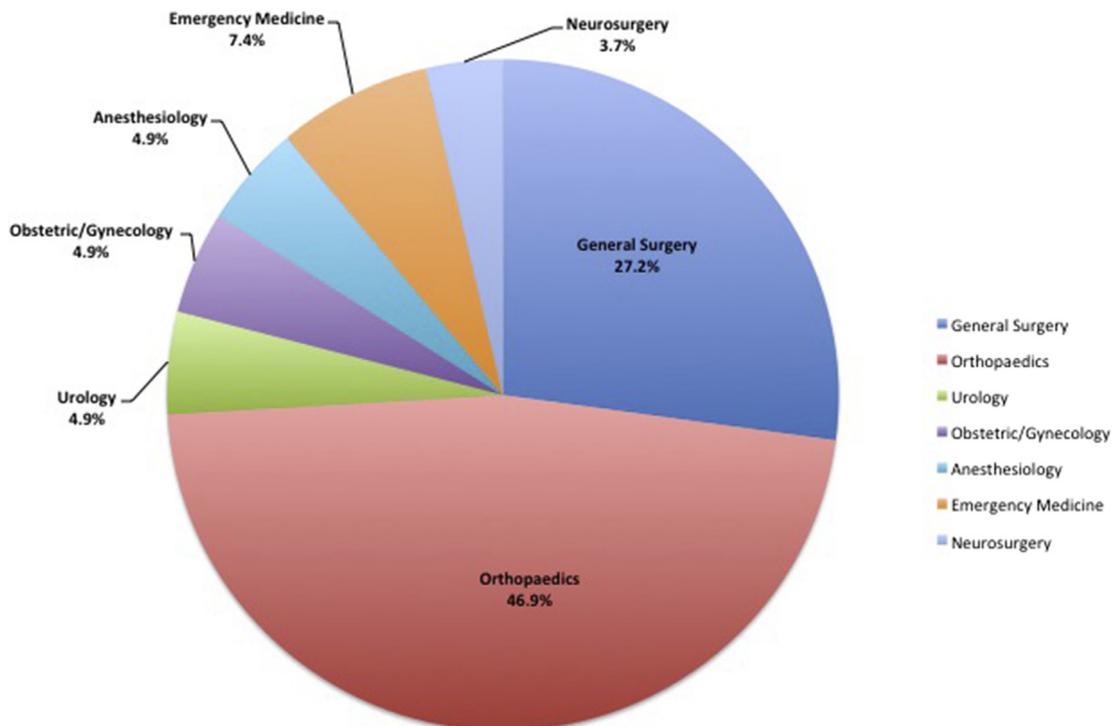


Fig. 1. Procedure based specialties of matched OSI Scholars.

based on gender, race, and ethnicity are publically unavailable. The difficulty in obtaining this information highlights the need for greater transparency of this data. We are, therefore, unable to compare the match rates of those women and minority students who participated in the Summer Internship Program versus those who did not. Our data indicates that students recruited to the Nth Dimensions Summer Internship frequently applied to procedure-based programs that are traditionally underrepresented regarding gender, race and/or ethnicity. Second, our current data ends with acceptance into a residency program. Additional follow-up that assesses completion of residency will be a valuable determinant of the long-term success of the program.

Additional study limitations concern the potential for self-selection bias among participants. Although many of our Nth Dimensions Summer Internship participants are introduced to surgery through our hands-on workshops in the first phase of our additional programming, some participants may already have exposure and interest in procedure-based specialties. Though our study clearly demonstrates that the students who participate in the summer internship are more likely to apply to procedural based programs, it is difficult to determine to what degree some of these students were influenced by preexisting interest in addition to their contact with the program.

An additional limitation is the relatively small numbers in our cohorts in comparison to data encompassing all applicants to procedural based residency programs during the years evaluated. In addition, six students who completed the summer internship were lost to follow-up, so it is possible that our reported outcomes may underestimate (or possibly overestimate) the effectiveness of our program.

Finally, cost remains a limitation to our ability to serve the vast number of students that apply to the program. With one position available for every three applications received, there is great demand and need to expand our effectiveness. It is anticipated that more available positions within each summer internship cohort will allow us to expose a greater number of students to procedural based specialties. As such, we will also be able to increase our ability and power to compare our data outcomes with that of the national averages. Such a study would provide the impetus and the evidence to validate and further support strategic, targeted pipeline programs, such as Nth Dimensions. A cost-efficiency analysis would allow us to optimize the resources available and maximize the impact of this program in diversifying the physician workforce.

This report suggests that the Nth Dimensions Orthopaedic Summer Internship and additional programming is effective in increasing the retention of its participants (women and underrepresented minorities) applying to a procedural based residency program. It is important to note that though this study was not designed to show a cause-effect relationship between participation in the Summer Internship and subsequent application to a procedural based residency program, a strong association between the two is demonstrated. "It is our intention is to raise awareness of procedural-based specialties as a real option for all students. Our program can impact a student's course in a number of ways: 1) Nth Dimensions converts a number of students that may not have had any initial exposure to procedural-based specialties and exposes students who may have shown initial interest; 2) Nth Dimensions continues to engage students through the course of medical school to retain their interest in procedural-based specialties; 3) Nth Dimensions supports a student's interest through mentorship and

progressive exposure to various aspects of the programs; and 4) Nth Dimensions remains actively involved in academic workshops and environments to ensure students have the best chances of a successful matriculation to residency.

The positive impact that this pipeline program demonstrates lends support to efforts promoting the ongoing exposure, preparation, and mentorship of women and underrepresented minority applicants to procedure based programs. It is becoming clear that continued exposure to clinical skills, didactics, professional development workshops and ongoing mentorship help support and develop students into competitive applicants for all procedural based specialties. Prior initiatives, such as the Diverse Surgeon Initiative (DSI), have proven to be beneficial in providing the necessary clinical knowledge and surgical skills needed by residents to excel in a surgical career.<sup>1</sup> To our knowledge, there is no published data regarding similar focused pipeline programs at the medical school level. It is our hope that programs of this type continue to garner support for expansion to serve greater numbers of interested medical students and perhaps be implemented in other fields of medicine and health sciences.

In 2016, Nth Dimensions received the highest number of applicants to its summer internship in the programs' history. As the program expand, continued research of outcomes data and matriculation of women and underrepresented minorities will be pursued. Additional data comparing the rate at which the Nth Dimensions Summer Internship Program participants are accepted into procedure based residencies, as well as scientifically rigorous studies comparing data on these students compared with appropriate national control groups will also be a goal of continued efforts. Hopefully, the success of this program will stimulate further support of this segment of the physician diversity pipeline and encourage greater collaboration with other pipeline programs regarding best practices.

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