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What Does It Take To Be A Successful Pediatric Surgeon–Scientist?

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ABSTRACT

Background: The factors that contribute to success as a pediatric surgeon–scientist are not well defined. The purpose of this study is to define a group of NIH-funded pediatric surgeons, assess their academic productivity, and elucidate factors that have contributed to their success. **Methods:** Pediatric surgeons were queried in the NIH report database to determine NIH funding awarded. Academic productivity was then assessed. An online survey was then targeted to NIH-funded pediatric surgeons. **Results:** Since 1988, 83 pediatric surgeon–investigators have received major NIH funding. Currently, there are 37 pediatric surgeons with 43 NIH-sponsored awards. The mean *h*-index of this group of pediatric surgeons was 18 ± 1.1, mean number of publications (since 2001) was 21 ± 2.1, and both increase commensurate with academic rank. In response to the survey, 81% engaged in research during their surgical residency, and 48% were mentored by a pediatric surgeon–scientist. More than 60% of respondents had significant protected time and financial support. Factors felt to be most significant for academic success included mentorship, perseverance, and protected time. **Conclusions:** Mentorship, perseverance, institutional commitment to protected research time, and financial support are considered to be important to facilitate the successes of pediatric surgeon–scientists. These results will be useful to aspiring pediatric surgeon–scientists and departments wishing to develop a robust research program.

The subspecialty of pediatric surgery has a long tradition of engaging and promoting basic science research amongst its trainees and faculty. As a result, over the years the field has been transformed by the efforts of pediatric surgeon–scientists in multiple areas of scientific research. Traditionally, as a part of the training process for pediatric surgery, residents complete dedicated time for research in addition to their clinical training program [1]. Anecdotally, over the last few years, there is a trend for fewer residents to engage in basic science research and pursue more clinical and translational research opportunities. This may in part be a result of the restrictive research funding environment that currently exists today which amplifies the barriers to becoming a successful surgeon–scientist.

Ultimately, success as a surgeon–scientist can be measured by the positive impact the work has on the care of patients. Unfortunately, this can be difficult to quantify. It is far less complex to assess the contribution and success of a pediatric surgeon–scientist in terms of academic productivity. Historically, academic benchmarks for the productivity of a surgeon–scientist have been based on factors such as grant productivity, number of publications, number of times an author's publications have been cited by others, as well as the impact factor of the journal in which the work is published. A new academic benchmark that is more widely used in non-surgical fields is the *h*-index. The *h*-index is a new index that is "a particularly simple and useful way to characterize the scientific output of a researcher and broadly assess the impact of the work" [2].

The other major benchmark of academic success is obtaining federal extramural funding. Grant support from the National Institutes of Health (NIH) has traditionally been the sine qua non for an individual's independence and success in scientific research. However, in today's academic environment, the continued research contributions of pediatric surgeon–scientists is threatened by an overall decrease in available NIH funding [3]. It has been previously shown that surgical grant proposals to the NIH are less likely to be funded and often come with a smaller award as compared to non-surgical subspecialties such as medicine and psychiatry [4,5].

In light of today's academic environment of increasing clinical demands and decreasing funding pay lines, there are significant challenges to becoming a successful pediatric surgeon–scientist. The purpose of this study is to define a group of NIH-funded pediatric surgeons, assess their academic productivity, and then elucidate the factors that have contributed to their success. These results will be useful to aspiring pediatric surgeon–scientists and departments wishing to develop a robust research program.

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1. Methods

Our study population consisted of all current members of the American Pediatric Surgical Association (APSA) as listed in the directory in July of 2012. The NIH Research Portfolio Online Reporting Tools (RePORT) database was then used to query this list of pediatric surgeons in order to obtain NIH funding information for all surgeons receiving a grant during the period of 1988 to 2012. The NIH RePORT is an online database provided by the NIH with reports, data, and analysis of NIH research activities with data available starting in 1988.

We then assessed academic productivity of this cohort of pediatric surgeons by determining academic rank and using publication history and *h*-index as a surrogate for academic progress. Publication history was determined using a query of PubMED and SCOPUS databases (for previous 10-year period from 2002 to 2012), *h*-index, and academic rank. The *h*-index or Hirsch index is an index that attempts to measure both productivity and impact of the published work of a scientist. A scientist has an index *h* if *h* of his/her N_p papers have at least *h* citations each, and the other $(N_p - h)$ papers have no more than *h* citations each. Therefore, a scientist with an *h*-index of *h* has published *h* papers each of which has been cited in other papers at least *h* times. The index is meant to help quantify the cumulative impact and relevance of an individual's scientific research output [2]. Academic rank for each individual surgeon was grouped into assistant professor, associate professor, professor, and chairman/surgeon in chief.

To elucidate factors that this group of NIH funded surgeons believed was important to their success; we used an APSA-approved online survey to target this cohort of NIH-funded surgeons. The survey was approved by the institutional review board (IRB study ID: 2012-1949). The survey consisted of 28 questions related to training, prior research experience, current research experience, and additional factors felt to be major contributing factors to their success. The data are presented as mean ± SEM.

2. Results

During the time period of 1988–2012, 105 pediatric surgeons (16% of APSA members in 2012) received funding through the NIH through various mechanisms. Eighty-three (13% of APSA members) of these surgeon–scientists have received major funding other than an F32 grant (National Research Service Award). There were 37 pediatric surgeons with current funding claiming 43 NIH-sponsored awards, including 17 R01 and 9 K08 awards. Twenty-one percent of investigators used the K08 award mechanism to transition to independent investigator status (R/U grants). For the year 2012, pediatric surgeon–scientists received a total of $7.2 million dollars from various NIH institutes and centers.

To assess academic productivity of this group of funded pediatric surgeons (n = 105), we utilized the PubMed database, which revealed a total of 2214 publications listed during the 10-year period from 2002 to 2012. These publications were in a wide variety of both basic science and clinical journals. However, the 5 most common journals where this cohort of surgeons published were the following: Journal of Pediatric Surgery (32.1%), Fetal Diagnosis & Therapy (5.8%), Pediatrics (3.8%), Obstetrics & Gynecology (2.8%), and Annals/Archives of Surgery (1.6%) (Fig. 1). The mean number of publications per pediatric surgeon–scientist in this 10-year period was 21 ± 2.1. Additionally, using the SCOPUS database, we were able to derive the *h*-index for each individual surgeon–scientist. The mean *h*-index in this study was 18 ± 1.1. Additional internet database searches were used to find the academic rank for each individual surgeon–scientist. Both number of publication and *h*-index commensurately increase with academic rank (Fig. 2).

We then designed an online survey to elucidate the perceptions of these funded scientists about their research path and what factors they believed contributed to their success. The response rate for the survey was 40% (42 of 105). We divided the survey into three parts,

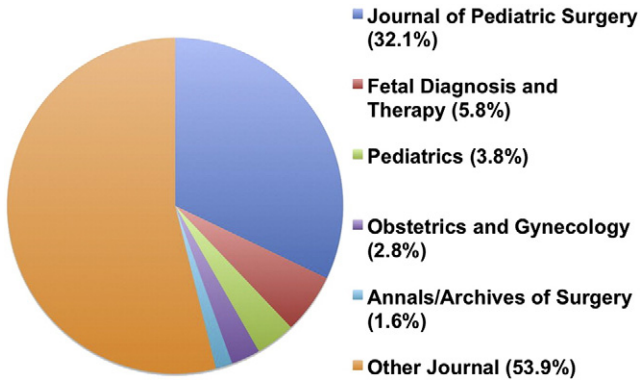

Fig. 1. Most common journals for submission by NIH-funded pediatric surgeon–scientists during the years 2002–2012.

(1) demographics and research experience as a trainee, (2) characteristics of the first faculty position and (3) factors that contribute to scientific success.

Demographics and research experience as a trainee. One hundred percent of the respondents had an MD (or equivalent) degree and 20 (48%) had an additional degree including PhD, MBA, or MS. Ten (50%) of those with an additional degree felt that the extra degree was helpful in their pursuit of an academic career. Sixteen (38%) had at least 1 year of research experience prior to their general surgery residency and 31 (74%) completed at least 6 months of research between the start of general surgery residency and starting a pediatric surgery fellowship. We then inquired about mentorship during their training period and their perception about pursuing a research-oriented career. Thirty-three (79%) had a surgeon–scientist as a research mentor and 20 (48%) specifically had a pediatric surgeon–scientist. Twenty-three (55%) had a focus in basic science, whereas 16 (38%) had a focus in both basic and clinical science. Twenty-five (60%) either intended or strongly intended to pursue a research-oriented career at the start of their general surgery residency. This number substantially increased for those that intended or strongly intended to pursue a research-oriented career by the time they started their pediatric surgery fellowship to 38 (90%).
Characteristics of the first faculty position. After fellowship in their first faculty position, 33 (79%) had a position which included a research component. Twenty-seven (64%) also initially had protected

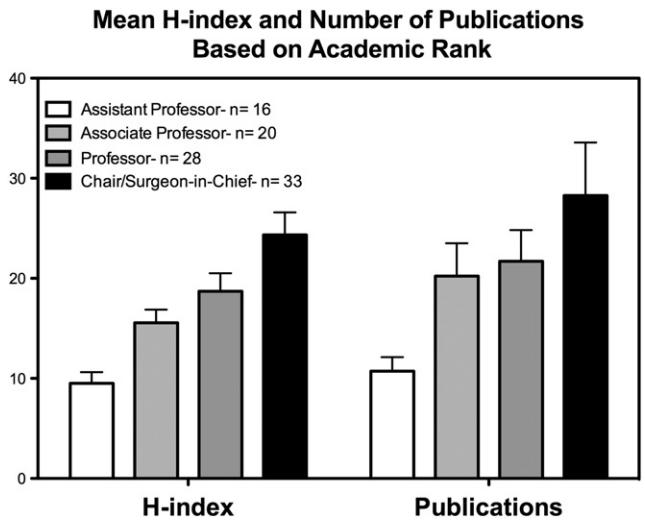

Fig. 2. Mean *h*-index (overall) and number of publications (2001–2012) based on academic rank. Both *h*-index and number of publications increase with increasing academic rank. Data represented = mean ± SEM.