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Otolaryngology -- Head and Neck Surgery 2014 151: 246 originally published online 20 May 2014
DOI: 10.1177/0194599814533647

The online version of this article can be found at:
http://oto.sagepub.com/content/151/2/246

Published by:
SAGE
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AMERICAN ACADEMY OF OTOLARYNGOLOGY--HEAD AND NECK SURGERY
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>> Version of Record - Jul 23, 2014
OnlineFirst Version of Record - May 20, 2014

What is This?
Do AAO-HNSF CORE Grants Predict Future NIH Funding Success?

Jean Anderson Eloy, MD¹,²,³, Peter F. Svider, MD⁴, Vivek V. Kanumuri¹, Adam J. Folbe, MD⁴, Michael Setzen, MD⁵,⁶, and Soly Baredes, MD¹,³

Abstract
Objective. To determine (1) whether academic otolaryngologists who have received an American Academy of Otolaryngology—Head and Neck Surgery Foundation (AAO-HNSF) Centralized Otolaryngology Research Efforts (CORE) grant are more likely to procure future National Institutes of Health (NIH) funding; (2) whether CORE grants or NIH Career Development (K) awards have a stronger association with scholarly impact.

Study Design and Setting. Historical cohort.

Methods. Scholarly impact, as measured by the h-index, publication experience, and prior grant history, were determined for CORE-funded and non–CORE-funded academic otolaryngologists. All individuals were assessed for NIH funding history.

Results. Of 192 academic otolaryngologists with a CORE funding history, 39.6% had active or prior NIH awards versus 15.1% of 1002 non–CORE-funded faculty (P < .0001). Higher proportions of CORE-funded otolaryngologists have received K-series and R-series grants from the NIH (P-values < .05). K-grant recipients had higher h-indices than CORE recipients (12.6 vs 7.1, P < .01). Upon controlling for rank and experience, this difference remained significant among junior faculty.

Conclusions. A higher proportion of academic otolaryngologists with prior AAO-HNSF CORE funding have received NIH funding relative to their non–CORE-funded peers, suggesting that the CORE program may be successful in its stated goals of preparing individuals for the NIH peer review process, although further prospective study is needed to evaluate a “cause and effect” relationship. Individuals with current or prior NIH K-grants had greater research productivity than those with CORE funding history. Both cohorts had higher scholarly impact values than previously published figures among academic otolaryngologists, highlighting that both CORE grants and NIH K-grants awards are effective career development resources.

Keywords
scholarly productivity, scholarly impact, research output, research productivity, academic promotion, academic advancement, academic appointment, National Institutes of Health funding, AAO-HNSF CORE grants, CORE

Introduction
Maintaining active research interests and having an impact on scholarship within the field play important roles in the hiring and promotions process in academic otolaryngology, as well as other fields of medicine.¹⁻¹¹ Identifying and retaining faculty with the ability to secure funding from external sources is advantageous for an institution and takes on special importance in light of recent cutbacks in research support.¹¹,¹² With these issues in mind, several grant programs are focused on providing support for junior practitioners to help them mature into advanced researchers.

One of the grant types offered by the National Institutes of Health (NIH) is the Career Development Award, designated as “K-series” grant. Some of these, such as the mentored clinical scientist development awards (K01, K08, K23), are usually

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focused on supporting junior faculty early in their careers; additionally some of these, such as K12 awards, are institutional awards. Other career development grants include K18 awards (Career Enhancement Award for Stem Cell Research, aimed at midcareer individuals) and K24 (Midcareer Investigator in Patient-Oriented Research) awards. Research (R) Grants are the most common funding mechanism offered by the NIH, particularly the R01 program, which is open to researchers at all levels of their career.

An alternate source of support for early-career otolaryngology investigators includes grants awarded by the American Academy of Otolaryngology—Head and Neck Surgery Foundation (AAO-HNSF) Centralized Otolaryngology Research Efforts (CORE) grants program. Created in 1985, CORE grants are intended to promote career development for investigators hoping to make basic, clinical, or translational science a component of their careers. This program was designed with an eye toward future participation in the NIH peer review and funding process. A previous analysis demonstrated that procurement of AAO-HNSF CORE grant is associated with greater scholarly impact among academic otolaryngologists. A primary objective of the present analysis was to determine whether receiving a CORE grant ultimately leads to future NIH funding success. Furthermore, we were interested in evaluating whether CORE grant recipients in academic otolaryngology receive Career Development (K) NIH grants, Research (R) NIH grants, and multiple NIH grants at a higher rate than non–CORE-funded academic otolaryngologists. Additionally, we were interested in exploring whether CORE grants or Career Development (K) NIH grants have a stronger association with greater scholarly impact.

**Materials and Methods**

This analysis compares two cohorts: (1) CORE-funded academic otolaryngologists and (2) non–CORE-funded academic otolaryngologists, comparing the proportion of individuals in each of these cohorts who have received NIH funding. We obtained a listing of all CORE grant recipients from 1985 to 2012 from the AAO-HNSF. This listing contained 494 grants awarded to 432 different individuals. An Internet search of these individuals with the term otolaryngology was conducted to determine their practice setting. Only individuals confirmed to be full-time faculty in an academic otolaryngology department were included in this analysis, while the following practitioners were excluded: those not possessing an MD or MD-equivalent degree, part-time faculty, and voluntary faculty. The NIH Reporter website (http://projectreporter.nih.gov/reporter.cfm) was searched to determine whether these individuals had active or previous NIH grants and what types of grants they had received. This resource contains NIH grants dating back to 1989.

In further comparison of CORE-funded faculty versus K-grant recipients, we considered only individuals receiving one of these grants (not both) to facilitate comparison of independent groups, unless mentioned otherwise. In other words, “CORE-funded faculty” includes those who received CORE funding but not K-grants (unless otherwise mentioned), while individuals receiving K-series grants do not include CORE-funded faculty for the purposes of this analysis.

The Scopus database was used to determine publication experience and scholarly impact, as measured by the \( h \)-index, of all faculty included in this analysis. An individual’s \( h \)-index is the number \( (h) \) of their papers that have been cited in the literature at least \( h \) times each. Its definition, strengths, and weaknesses have been widely discussed in the literature. While other databases such as Publish or Perish and ISI’s Web of Knowledge contain this information, Scopus has been used in a multitude of analyses utilizing the \( h \)-index, and results from this database have been shown to correlate highly with other commonly used bibliometric databases, such as Google Scholar. Publication experience was defined as the number of years from an individual’s first publication to the present.

NIH funding status was similarly determined for practitioners included in the non–CORE “control” cohort. The American Medical Association’s FREIDA database was used to find a list of academic otolaryngology departments, and an Internet search of online faculty profiles was used to gather all available academic otolaryngologists meeting inclusion criteria as specified previously. Any individuals with a CORE funding history were excluded from this group, as they were already counted in the “CORE-funded” academicians cohort. Academic rank, scholarly impact (as measured by the \( h \)-index), and publication range were determined for NIH-funded individuals. Data collection was completed in May 2013. This study qualified as nonhuman subject research and was thus exempted from needing Institutional Review Board approval per the standing policy of the Institutional Review Board of Rutgers New Jersey Medical School.

**Statistical Analysis**

Mann-Whitney U-tests and Pearson’s chi-square tests were used for comparison of continuous and categorical data, respectively, with threshold for significance set at \( P < .05 \) (two-tailed). SPSS version 20 (an IBM Company, Chicago, Illinois) was used for statistical calculations.

**Results**

Out of 432 individual CORE grant recipients since 1985, 192 were confirmed to be current full-time MD faculty serving in an academic otolaryngology department as per our methodology. This group was used for comparison to the non–CORE-funded cohort of 1002 academic otolaryngologists included in this analysis (Table 1).

As previously stated, the present analysis compares 2 cohorts, specifically (1) CORE-funded academic otolaryngologists and (2) non–CORE-funded otolaryngologists. Seventy-six of 192 (39.6%) academicians with a CORE-funding history have received NIH funding, a statistically greater proportion than the 15.1% (152 out of 1002) of non–CORE-funded otolaryngologists who have received NIH funding (\( P < .01 \))
Of these 76 academicians with both a CORE and NIH funding history, 71 (93.4%) received at least 1 NIH grant after receiving a CORE award. In addition to comparing overall NIH funding success between CORE and non–CORE-funded otolaryngologists, the authors were interested in seeing whether differences in NIH success were present between these 2 groups upon further examination of specific grant types. Therefore, the proportion of CORE-funded otolaryngologists who have received multiple NIH grants, any K-grants, and any R-series grants were compared to the proportions of non–CORE-funded who have received multiple NIH grants, any K-grants, and any R-series grants. A statistically greater proportion of CORE-funded otolaryngologists received K-grants (15.6%) than the proportion of non–CORE-funded otolaryngologists receiving K-grants (4.9%) (\(P < .001\)) (Table 2). Similarly, a statistically greater proportion of CORE-funded otolaryngologists received R-grants (20.8%) than the proportion of non–CORE-funded otolaryngologists receiving R-grants (9.6%) (\(P < .001\)) (Table 2). The proportion of otolaryngologists receiving multiple NIH grants did not differ upon comparison of the CORE-funded and non–CORE-funded cohorts (9.4% vs 5.4%, \(P = .06\), 95% CI of difference, 0.02%-8.5% (Table 2).

Upon assessment of scholarly impact, individuals receiving AAO-HNSF CORE grants (but not receiving NIH Career Development K awards) had a statistically lower h-index than those receiving K-grants (\(P < .0001\)) (Figure 1). We considered only individuals receiving 1 of these grants to facilitate comparison of independent groups. When considering the 30 academicians who have received both CORE and K-grants, there was a statistical trend toward higher scholarly impact in these individuals than those receiving only CORE grants (\(P = .09\)); additionally, individuals receiving both CORE and K-grants had lower \(h\)-indices than individuals in the K-grant cohort (\(P = .01\)).

We further compared the relative scholarly impact of these groups by controlling for academic rank and publication experience. CORE recipients at the assistant professor level had lower scholarly impact, as measured by the \(h\)-index, than their K-grant counterparts (\(H = 7.1 \pm 4.9\) SD vs 12.6 \(\pm 7.5\) SD, \(P < .01\)). These differences disappeared upon comparison of promoted faculty, as there was no statistical difference in scholarly impact among associate professors (\(H = 13.5 \pm 5.9\) SD vs 14.4 \(\pm 5.5\) SD, \(P = .69\)) and

### Table 1. Sizes of Cohorts Included in This Analysis.\(^a\)

<table>
<thead>
<tr>
<th>Number Non–CORE-Funded</th>
<th>Number CORE-Funded</th>
<th>Number NIH-Funded</th>
<th>Number K-Grant-Funded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>1002</td>
<td>192</td>
<td>227</td>
</tr>
<tr>
<td>Assistant</td>
<td>439</td>
<td>90</td>
<td>49</td>
</tr>
<tr>
<td>Associate</td>
<td>240</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Professor</td>
<td>323</td>
<td>41</td>
<td>115</td>
</tr>
</tbody>
</table>

\(^a\)Among CORE-funded academicians, 11 full-time academic faculty did not have a designated rank.

### Table 2. Comparison of NIH Funding Success between CORE and Non–CORE-Funded Academicians.

<table>
<thead>
<tr>
<th></th>
<th>CORE-Funded (n)</th>
<th>Non-CORE (n)</th>
<th>Difference (95% CI)</th>
<th>(P) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIH (any) funding history</td>
<td>39.6% (76)</td>
<td>15.1% (151)</td>
<td>24.5% (17.5%-31.9%)</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>K-series grants</td>
<td>15.6% (30)</td>
<td>4.9% (49)</td>
<td>10.7% (6.0%-1.7%)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>R-series grants</td>
<td>20.8% (40)</td>
<td>9.6% (96)</td>
<td>11.2% (5.7%-17.8%)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Multiple NIH grants</td>
<td>8.9% (17)</td>
<td>5.4% (54)</td>
<td>3.5% (-0.02% to 8.5%)</td>
<td>.06</td>
</tr>
</tbody>
</table>

\(h\)-index

Figure 1. Scholarly impact, as measured by the \(h\)-index, organized by career development resource. K represents NIH K-series career development awards, CORE represents AAO-HNSF CORE awards. Both represents individuals who have received both of these grant types. Error bars represent standard deviations.
Comparison of Scholarly Impact between K-Grant Recipients and CORE Grant Recipients.

<table>
<thead>
<tr>
<th></th>
<th>CORE Grant 11.7</th>
<th>K-Grant 18.2</th>
<th>Difference (95% CI) 6.5 (5.2-6.5)</th>
<th>P Value &lt; .0001</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-index at &lt; 10 years of experience</td>
<td>4.9</td>
<td>16.0</td>
<td>11.1 (9.2-11.1)</td>
<td>.0002</td>
</tr>
<tr>
<td>H-index at 11-20 years of experience</td>
<td>12.7</td>
<td>15.6</td>
<td>2.9 (1.5-4.3)</td>
<td>.14</td>
</tr>
<tr>
<td>H-index at 21-30 years of experience</td>
<td>19.0</td>
<td>21.6</td>
<td>2.6 (0.15-5.0)</td>
<td>.25</td>
</tr>
</tbody>
</table>

To facilitate comparison of independent groups, this refers to individuals with only one type of these grants, not individuals with both.
NIH funding,13 the size of these awards is still many times the magnitude of CORE funding, as the median CORE award in the database provided to use was $10,000. This perspective is valuable in reinforcing the CORE program’s primary goal of preparation for the rigorous NIH peer review process. Additionally, it should be emphasized that CORE grants are aimed toward trainees and early-career investigators, which may partially explain the discrepancies in publication experience we report.

Individuals receiving K-grants but no CORE grants (H = 18.2) (Figure 1), CORE grants but no K-grants (H = 11.7) (Figure 1), both K and CORE grants (H = 13.1) (Figure 1), and R-grants (regardless of other grants; H = 19.2) all had far higher scholarly impact than previously cited values for otolaryngologists. One study of scholarly impact in various surgical subspecialties reported a mean h-index of 7.8 among academic otolaryngologists.43 Comparison with another analysis of otolaryngologists organized by academic rank puts the scholarly impact of NIH- and CORE-funded individuals in this analysis above associate professors (previously reported to have an h-index of 8.13) and for some groups, above the level of professors (previously calculated to be 15.6).11

We have previously explored the relationship between scholarly impact, as measured by the h-index, and NIH funding among faculty from the top 20 NIH-funded otolaryngology departments.41 That analysis demonstrated a strong relationship between NIH funding and scholarly productivity, as NIH-funded colleagues had far higher h-indices than their non-funded peers at the same 20 departments. Our present analysis builds on this analysis by analyzing the relationship between procuring CORE grants and future NIH funding success, as well as comparing 2 grant programs intended as career development research support tools, namely, CORE funding and NIH Career Development (K) grants. This analysis highlights that individuals benefitting from either of these programs have greater scholarly impact. While K-grant recipients have higher h-indices, receiving CORE funding may play a role in preparing young investigators for future success with the NIH application process.

A limitation inherent to this analysis is our use of the h-index to assess scholarly impact. Departments and institutions may take into account a variety of factors, subjective and objective, when considering research output. Subjective factors, such as an individual’s reputation or the number of one’s “significant” publications, have obvious limitations in that they are not uniform and are considered differently by different individuals.17 Commonly used objective factors, such as number of publications, also have limitations. Number of publications does not relay the strength, relevance, or quality of a person’s research. One’s total number of citations in the literature may be disproportionately influenced by a single or a handful of papers. We chose to look at the h-index because it is an objective bibliometric that indicates the consistency at which an individual is producing impactful work and has been shown to have a strong association with scholarly impact, academic promotion, NIH funding, and even fellowship training in a multitude of specialties, including otolaryngology.2,9,11,19,24-26,29-39,41,43-53 Its definition, strengths, and weaknesses have been discussed extensively in the literature.2,9,17,18,21,24,26,31,35,54,55

This evaluation analyzed the 192 CORE-funded practitioners confirmed to be currently in academic practice in an attempt to compare practitioners in similar practice settings. It is likely that the 230 other CORE-funded persons may possibly not be as productive in terms of scholarly impact, whether using measurements such as NIH funding procurement or objective bibliometrics such as the h-index. Another limitation is the retrospective design of this analysis, which makes it impossible for us to attribute causation. A future analysis of interest may include a prospective design focusing on AAO-HNSF CORE grant applicants and other otolaryngologists-in-training along with their subsequent research trajectories. In addition, an attempt was made to create a more robust prediction model based on some of the predictive factors for NIH funding and h-index suggested in this article (including K-grants, CORE grants, years of publications); however, analysis suggested that these factors were not independent using the Durbin-Watson statistic.

Another limitation in this analysis relates to the NIH RePORTER database only reporting awards dating back to 1989, representing a 4-year gap since the start of the CORE funding program in 1985 in which CORE-funded individuals may have received NIH funding that was not included in this analysis. Finally, this analysis was not able to nor was it intended to take into account numerous other sources of support for research in the field, including local organizations, intra-institutional funding opportunities, and even internal departmental mechanisms. These potential sources may have value in encouraging individuals to incorporate research into their careers and providing the skills necessary to mature into advanced researchers.

Conclusions
A higher proportion of academic otolaryngologists with an AAO-HNSF CORE funding history have received NIH funding relative to their non–CORE-funded peers. This is true when further considering individuals awarded Career Development (K) awards and Research (R-Series) grants from the NIH, as a higher proportion of CORE-funded academicians are successfully awarded these grants than their non–CORE-funded academic colleagues. This suggests that the CORE program may be successful in its stated goals of preparing individuals for the NIH peer review application process, although further prospective study is needed to evaluate whether this association represents a cause and effect relationship. Upon further comparison of relative scholarly impact, individuals with current or prior NIH K-grants had greater research productivity than those with a CORE funding history. Both of these cohorts have higher scholarly impact values than previously published figures among all academic otolaryngologists, highlighting that both AAO-HNSF CORE grants and NIH K-grants awards are effective career development resources.
The authors would like to thank Stephanie Jones and the CORE grant committee members for their assistance in providing a database of previous grant recipients.

Jean Anderson Eloy, conception, design, analysis, and interpretation; revision; final approval; Peter F. Svider, conception, design, data acquisition, analysis; drafting; final approval; Vivek V. Kanumuri, data acquisition; revision; final approval; Adam J. Folbe, analysis; revision; final approval; Michael Setzen, analysis; revision; final approval; Soly Baredes, analysis; revision; final approval.

Michael Setzen, speaker for TEVA and MEDA on their Speakers Bureau (not related to current subject).

Competing interests: Michael Setzen, speaker for TEVA and MEDA on their Speakers Bureau (not related to current subject).

Sponsorships: None.

Funding source: None.

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