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Reaching Across the Aisle: Cross-Disciplinary Collaboration in Otolaryngology Research

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**Objectives:** Collaboration and diversity of expertise are increasingly emphasized in the production of successful research. However, the degree of cross-disciplinary collaboration in otolaryngology research is unknown. In this study, we quantify cross-disciplinary collaboration in otolaryngology publications.

**Methods:** We retrospectively analyzed authorship and study characteristics for all original articles published from January 2014 to December 2016 in three key peer-reviewed otolaryngology journals: Laryngoscope, Otolaryngology–Head & Neck Surgery, and JAMA Otolaryngology–Head & Neck Surgery. Author affiliations and online searches were used to determine author’s primary discipline. Subspecialty topic of article, study design, and funding sources were also recorded. Fisher exact test was used to compare characteristics of articles with and without cross-disciplinary authorship.

**Results:** A total of 2,378 articles were reviewed, of which 1,312 (55%) articles had one or more cross-disciplinary collaborators. Among articles with cross-disciplinary collaboration, the greatest representation of disciplines was from other medical specialties (1,109, 50.9%), epidemiology/biostatistics (266, 12.2%), pathology/histology (175, 8.0%), biologic sciences (168, 7.7%), and radiology/imaging (144, 6.6%). Cross-disciplinary studies had a significantly greater proportion of articles on the topic of head and neck compared to studies without collaboration ($P < 0.0001$). The proportion of funded studies was significantly greater among articles with collaboration compared to articles without collaboration ($P < 0.0001$).

**Conclusion:** The majority of articles published during a 3-year period in three influential otolaryngology journals had cross-disciplinary collaboration. There is potential opportunity for further leveraging expertise, funding opportunities, and dissemination of key findings through collaborative research.

**Key Words:** Collaboration, otolaryngology research, cross-discipline.

**Level of Evidence:** NA

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**INTRODUCTION**

Collaboration, teamwork, and diversity of expertise are increasingly emphasized to address the complexities of biomedical research. Leveraging both a wider breadth of knowledge and depth of specialization, team science is an essential component of interprofessional collaborative research practice.¹ This increased emphasis on teamwork has been reflected in the rise in number of authors per article (4.5 in 1980 to 6.9 in 2000) in prestigious U.S. medical journals over the past several decades.² The benefits of cross-disciplinary authorship have also been well-documented, producing more frequently cited, high-impact research in comparison to solo authors in the production of scientific knowledge.³ In a variety of specialties, trends in authorship have been investigated, confirming the increased number of authors per article and a decrease in single-author publications.⁴–⁶

Although various studies investigating authorship trends have been performed in other specialties such as orthopedic surgery, neurosurgery, and plastic surgery,⁴–⁶ no prior study has specifically evaluated cross-disciplinary collaboration in otolaryngology literature. Although the number of authors per article can be expected to follow trends observed in other fields, there is a lack of knowledge about the characteristics of authorship with regard to specialty or study design. With its diversity of specialties and extensive reach into intertwined specialties such as audiology, speech language pathology, or plastic surgery, the field of otolaryngology is well-poised for cross-disciplinary collaborative research. Furthermore, describing cross-disciplinary research in otolaryngology literature provides insight into subspecialties or study designs with high potential for collaboration and funding. Assessing the nature of collaboration in otolaryngology research provides evidence-based support for designing initiatives that enhance the effectiveness of collaboration.

The purpose of this study was to quantify the degree of cross-disciplinary collaborative research in three common, influential, peer-reviewed otolaryngology journals. Specifically, we conducted a retrospective analysis of individual and team authorship characteristics to evaluate the representation of 1) collaborating disciplines, 2) otolaryngology subspecialties, 3) study design and level of...
evidence (LOE), and 4) funding sources between 2014 to 2016. We hypothesized a difference in the proportion of funded studies between articles with and without cross-disciplinary collaboration.

**MATERIALS AND METHODS**

We retrospectively reviewed all original articles published during a 3-year period (between January 1, 2014 and December 31, 2016) in Laryngoscope, Otolaryngology–Head & Neck Surgery, and JAMA Otolaryngology-Head & Neck Surgery using the Scopus database. These English-language, non–subspecialty-specific otolaryngology journals were chosen based on their recognized influence in the field as determined by their Hirsch index. Literature reviews, editorial comments, letters to the editor, historical pieces, and articles without abstracts (generally case reports) were excluded from review.

Data were extracted and reviewed independently by three coauthors (A.H.L., S.J.K., W.K.C.). Articles were assessed for collaborating disciplines, subspecialty topic, study design, LOE, and funding sources. Authors’ departmental and institutional affiliations were scrutinized to determine collaborating disciplines for each article. Additional online searches were used to further elucidate specialty information from department websites when specialty affiliations were not specified or when an author had multiple department affiliations (in these cases, the author’s primary listed affiliation was utilized for this study). Any inconsistency in speciality designation was addressed through consensus between the three reviewers. Each abstract was categorized by subspecialty topic into the following: allergy, education, facial plastics, general, head and neck, laryngology, otology, pediatric, rhinology/skull base, sleep, and other. When a study had overlapping subspecialty topics, discussion including a third investigator (A.H.L.) was used to reach consensus on the main subspecialty focus. Study design categories included basic science, case report, educational, novel technique, prospective clinical, retrospective clinical, survey, systematic review/meta-analysis, translational, and other. Level of evidence was extracted from the article abstract, if specified, or assessed by two reviewers (S.J.K., W.K.C.) based on author guidelines from Laryngoscope. Funding sources were ascertained using the Scopus database, which tabulates the presence of funding as reported by the authors in the published article.

Two-tailed Fisher exact tests were used to compare characteristics of articles with and without cross-disciplinary collaboration. We defined cross-disciplinary collaboration as articles with at least one coauthor from another discipline or medical specialty. A Bonferroni correction was applied to limit false positive findings. P values <0.05 were considered to be significant.

**RESULTS**

**Inclusion of Articles and Collaborating Disciplines**

A total of 2,441 articles were reviewed across the three journals, of which 2,378 (97.4%) met the inclusion criteria. Among the 2,378 articles reviewed, there was an average of 5.4 ± 2.7 authors per article. A total of 1,312 (55%) articles had one or more coauthors from another discipline or medical specialty, with an average of 1.4 ± 0.8 collaborating disciplines per article (Table I). The distribution of authors per article and number of articles with cross-disciplinary collaboration is shown in Figure 1. Cross-disciplinary collaboration was more common among articles with a greater number of authors.

For example, 87% of articles with 10 or more authors had cross-disciplinary collaboration, compared to 41% of articles with five or fewer authors.

Several collaborating disciplines were represented, ranging from those in the biological sciences to other medical specialties to nonbiomedical fields such as law, music, and veterinary medicine. Among articles with cross-disciplinary authorship, the most represented disciplines included other medical specialties (1,109, 50.9%), epidemiology/biostatistics (266, 12.2%), pathology/histology (175, 8.0%), biologic sciences (168, 7.7%), and radiology/imaging (144, 6.6%). Specialties closely tied to otolaryngology were also highly represented including speech-language pathology (129, 5.9%) and audiology (54, 2.5%) (Fig. 2).

The most frequent individual collaborating specialties were pathology (173, 7.9%) and radiology (130, 6.0%). Among medical specialties, neurosurgery (122, 11%) was most frequently represented, followed by radiation oncology (91, 8.2%) and pediatrics (90, 8.1%). Within the biological sciences, biology (31, 18.5%) was most frequently represented, followed by pharmacology (24, 14.3%) and genetics (21, 12.5%) (Fig. 2).

**Subspecialty Topic and Collaboration**

When examining the subspecialty topic of the article and the presence of cross-disciplinary collaboration, our results show that articles with collaborators had a significantly greater proportion of studies on the topic of head and neck (350[26.7%] vs. 165[15.5%], P < 0.0001) compared to those without (Fig. 3). In contrast, articles with cross-disciplinary collaborators had a significantly smaller proportion of studies on otology than those without cross-disciplinary collaborators (197[15.0%] vs. 213 [20.0%], P = 0.0015) (Fig. 3).

**Study Design and Level of Evidence Versus Collaboration**

We also compared study design between articles with and without cross-disciplinary collaborators. These
results are demonstrated in (Fig. 4). Studies with cross-disciplinary collaborators had a higher proportion of translational/basic science study designs (216 [16.5%] vs. 102 [9.6%]). In contrast, those without had a greater proportion of case report/series (72 [5.5%] vs. 107 [10.0%]) and educational (24 [1.8%] vs. 53 [5.0%]) study designs ($P = 0.017$ for all) (Fig. 4).

Level of evidence was also assessed to see if the quality of the evidence was superior in studies containing cross-disciplinary collaborators. Articles with cross-disciplinary collaborators had a significantly greater proportion of studies with prospective observational design (LOE 2) (169 [12.9%] vs. 89 [8.3%], $P = 0.0004$) compared to articles with no cross-disciplinary collaborators (Fig. 5).

**Collaboration and Funding**

Two hundred and seventeen (9.1%) articles reported a funding source. One hundred and fifty-four of the 217 (71.0%) articles reporting a funding source included at least one cross-disciplinary collaborator (Table II). The proportion of funded studies was significantly greater among articles with collaboration compared to articles without collaboration (154 [11.7%] vs. 63 [5.9%], $P < 0.0001$).

**DISCUSSION**

Cross-disciplinary research involves team members with diverse content expertise working interdependently...
to combine and integrate their knowledge, perspectives, and research methods. The benefits of cross-disciplinary research have been well-documented. Wuchty et al. examined 19.9 million papers over 5 decades and found that teams produce more frequently cited, high-impact research compared to solo authors. A follow-up study highlighted an increase in publications by authors from multiple institutions, with team-based research crossing institutional and geographic boundaries. Within this context of increasing cross-disciplinary research across medical specialties, we sought to quantify the degree of collaboration in otolaryngology research. We found that the majority of articles had cross-disciplinary collaboration. Confirming previous research on the quality of studies generated by cross-disciplinary research, otolaryngology articles with collaborators had a significantly greater proportion of articles with LOE 2 compared to those without cross-disciplinary collaboration. Lastly, studies with cross-disciplinary authorship had a significantly greater proportion of funded studies, supporting our hypothesis that collaboration is increasingly valued in otolaryngology research.

Recent authorship trends in otolaryngology are in line with expectations set by authorship proliferation observed across numerous specialty-specific medical journals. In radiology, the number of authors per article significantly increased for all radiologic subspecialties, with the mean number of authors increasing from 5.1 to 7.1 over a 20-year period. In orthopedics, the mean number of authors per original research article increased from 1.6 in 1949 to 5.1 in 2009. Our findings of an average of 5.4 authors per article between 2014 and 2016 in otolaryngology are consistent with that of
other specialties, with cross-disciplinary collaboration in other medical specialties (50.9%) more common among articles with a greater number of authors. This trend in otolaryngology research aligns with findings from prior literature on authorship proliferation that highlight the increased scale and complexity of research questions necessitating teamwork and collaboration. We also acknowledge, however, that authorship proliferation may be due to non-scholarly forces such as an increased pressure to publish. With longer author lists, the likelihood of the next author contributing from another department or discipline may increase, potentially overestimating the degree of cross-disciplinary collaboration.

Regarding study design, we found that studies with cross-disciplinary collaborators had a higher proportion of translational/basic science studies. This finding is unsurprising, given the greater breadth of expertise and anticipated synergy resulting from long-term collaboration in translational or basic science study designs. On the other hand, articles without cross-disciplinary collaborators had a greater proportion of case series and educational study designs. Although it may be expected that case series would likely involve findings from smaller patient populations within specific subspecialties, research with educational study designs may benefit from greater cross-disciplinary collaboration to improve training methods in otolaryngology. Our finding that articles with cross-disciplinary collaborators had a significantly greater proportion of prospective observational studies (level 2), as opposed to retrospective (level 3) or case series (level 4) compared to articles without cross-disciplinary collaboration, echoes findings from previous studies that teams with diverse content expertise have capacity to produce higher LOE research.

Our findings aligned with our hypothesis that articles with cross-disciplinary collaboration have a higher proportion of funded studies compared to articles without cross-disciplinary collaboration. This finding may be explained by the costs associated with cross-disciplinary research. Conversely, cross-disciplinary research, which could reflect higher-quality research methodology, could reflect itself in higher success rates in obtaining research funding. Furthermore, prior work suggests that interdisciplinary collaboration may improve the likelihood of publication among studies that are grant-funded. For example, in a study comparing transdisciplinary research center grants with traditional investigator-initiated grants, the transdisciplinary research center grants had higher overall publication rates. The transdisciplinary research center grant-funding mechanism differed from traditional grants in its explicit requirements and structures that facilitated greater collaboration. This finding highlights the benefits of collaboration in scientific productivity among funded studies. Interestingly, fewer than 10% of published articles in *Laryngoscope, Otolaryngology–Head & Neck Surgery*, and *JAMA Otolaryngology–Head & Neck Surgery* reported a funding source. At any rate, future studies examining the characteristics of funded studies would increase opportunity to better promote and leverage funding opportunities and identify areas where there is a greater need for funding.

Our study should be viewed in light of several limitations. First, this study was focused on three otolaryngology journals (*Laryngoscope, Otolaryngology–Head & Neck Surgery*).

![Fig. 5. Level of evidence in articles with cross-disciplinary collaboration versus no collaboration. Articles with cross-disciplinary collaborators had a significantly greater proportion of articles with level of evidence 2. *P = 0.0004. RCT = randomized controlled trial. [Color figure can be viewed at www.laryngoscope.com]](image-url)
Surgery, and JAMA Otolaryngology–Head & Neck Surgery) based on their recognized influence in the field, and thus may not be representative of all journals in the discipline. Teams may publish in higher impact journals with broader readership. We chose non–subspecialty-specific otolaryngology journals with characteristics that may not be generalizable to research trends observed in specific subspecialties. Articles published in high-impact journals may have more complex study design, requiring more collaboration, whereas subspecialty specific journals may also be more defined in scope and contain less overlap with other disciplines. Secondly, we used author departmental affiliations to imply author disciplines. Although we extracted specialty information from department websites with thorough review, we recognize that department listings may not accurately reflect the discipline-specific contributions of each author. We also did not have insight into the seniority or role of each listed author and did not examine cross-institutional authorship. Furthermore, we acknowledge that although co-authorship may be a reasonable proxy for collaboration, it may not necessarily indicate collaboration in the sense of working interdependently to combine and integrate knowledge, skills, and perspectives. For example, individuals with affiliations in pathology and radiology who contribute patient data or images may be awarded authorships.\textsuperscript{5} However, author lists and affiliations were the most reasonable sources currently available to begin quantifying the degree of cross-disciplinary collaboration. Lastly, we found that studies with cross-disciplinary collaboration had a higher proportion of funded studies, but only 9\% of articles reported a funding source. Further insight into funding sources would provide greater clarity on the degree of funding opportunities available for cross-disciplinary research.

Our study expands on the existing literature about authorship trends and is the first study to quantify the degree of cross-disciplinary collaboration in otolaryngology. Although there exists a large degree of cross-disciplinary authorship in otolaryngology producing high-quality research with greater potential for funding, research training in medical fields tends to be discipline-specific with heightened emphasis on specialization.\textsuperscript{13} There is increasing evidence supporting the belief that scientific research training must incorporate a meaningful interprofessional perspective in order for collaborative research efforts to have long-term impact.\textsuperscript{1,13} Although specialization is a necessity, offering transdisciplinary research awards or cross-discipline fellowships may benefit otolaryngology research in training individuals with the ability to integrate findings across disciplines.\textsuperscript{13} Identifying subspecialties or study designs that would benefit from greater cross-disciplinary collaboration provides an opportunity to design training programs that will enhance the effectiveness of collaboration. As medicine becomes increasingly specialized, research training opportunities embracing collaborative research bridges the gap between medical specialties and allows for greater dissemination of clinically meaningful findings.

CONCLUSION

The majority of articles published during a 3-year period in three influential otolaryngology journals had cross-disciplinary collaboration, with the greatest representation from other medical subspecialties. Furthermore, articles with cross-disciplinary collaboration had a greater proportion of funded studies than those without cross-disciplinary collaborators. There is potential opportunity for further leveraging expertise, funding opportunities, and dissemination of key findings through collaborative research.

BIBLIOGRAPHY