An Otolaryngologist's Guide to Understand the H-Index and How it Could Affect Your Future Career

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Abstract

Objectives: The h-index is a measure of research output and contribution that shows strong correlation with academic promotion in medicine. The purpose of this paper is to clearly explain how h-index scores are calculated and how otolaryngologists can effectively and advantageously use these scores for their career development. Design: We performed an up-to-date PubMed literature review describing the design of h-index and how to use it effectively along with its role in academic medicine including otolaryngology. Results: H-index scores are used as a metric for scientific output which considers the number of publications and the number of times each paper was cited. Search engines can automatically calculate h-index scores for one's work. Studies also revealed significant positive impacts h-index has from fellowship involvement which later translates to career advancement in academic medicine. Aspiring academic otolaryngologists should create a research profile to link and calculate h-index for publications, submit to well-read high impact journals for increased viewership and citations, and expand on foundational and personal research topics. Conclusions: Future studies should evaluate faculty and resident awareness of h-indices in the otolaryngology department to see how we can further address any underlying barriers. Otolaryngologists with the knowledge and tools necessary to maximize h-index scores and to produce high quality research in modern day medicine not only provides advantages in career development, but also brings significant contribution to the field of otolaryngology.

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Key Points

- As h-index use has grown in its utilization throughout academic medicine, its critical role in promotional career advancement has also become more important in all fields, including otolaryngology, which highlights the need for greater awareness and guidelines that should be provided.
- One should maintain their collaborative research profiles (ex. Scopus or ORCID ID) including all past institutions and relevant identifiers to improve the odds of identifying all publications linked to one's name.
- One should be familiar with research output metrics such as how h-index and other values determines productivity by focusing on the number of publications and times cited.
- When submitting original work to journals, one should opt for larger and more well-read journals as that increases viewership and further increases the times the work may be cited.
- Identifying areas of expertise and building on foundational and personal work is another way to increase the number of publications as well as citations.

1 Objectives

The H-index was created in 2005 by J.E. Hirsch in order to make a more holistic index for scientific output by a researcher. It can give a robust estimate of the broad impact of a scientist's cumulative research contributions.[1] Rather than focusing solely on the quantity of publications or number of citations, the H-index considers both and has shown strong correlation in career advancement within academic medicine. The purpose of this article is to clearly explain the calculation of the H-index, its role in advancing one's career in otolaryngology, as well as how to improve one's score.

2 Design

We performed a PubMed literature review to better understand the design, setbacks, and effective use of h-index scores as well as the role it plays in academic medicine with emphasis on otolaryngology. The search was performed using key terms 'h-index', 'academic medicine', 'research productivity,' and 'scholarly impact'. To target specific otolaryngology data, the additional terms 'academic otolaryngology' and 'fellowship training' were added to the search. Inclusion criteria were original articles in the English language. Articles were reviewed by multiple authors and relevant information was extracted to produce review of the subject. We present findings on the h-index score along with how it impacts academic medicine with emphasis on otolaryngology and fellowships within the field paired with guidelines in order to use h-index scoring effectively.

3 Results & Discussion

3.1 H-index Score

H-index score is used as a metric for scientific output which considers the number of publications and the number of times each paper was cited. For example, an h-index of 10 means that an author has published 10 papers, each of which has been cited at least 10 times.[1] All other papers that have not been cited by other literature are not included in the h-index score which means the total number of published works is not factored into this metric.

There are multiple academic search engines such as Scopus, Google Scholar, and World of Science, that automatically calculate an author's h-index alongside other publishing statistics. The most commonly used database, Scopus automatically calculates a researcher's h-index.[2] But this only considers indexable articles which are found online, thus some articles by professors prior to major internet indexing prior to 1996 are likely to vary.[2] Google Scholar is available to the public for free which is a major advantage, however, discrepancies in h-index calculation have been found. World of Science requires an author's last name and initials to search for publications which can lead to more time finding results. While Scopus links multiple

variations of names and institutions to consolidate the database, Google Scholar does not and thus the calculated scores vary by institution.[2]

The number of times cited is largely dependent on the journal in which the work was published. For many specialties and subspecialties, journals and magazines are often smaller and not cited as frequently as larger and higher impact journals. Submitting original work to higher impact journals increases the likelihood of being cited, thus influencing a h-index score. It is also important to consider the impact of review articles and meta-analyses as these types of studies would be more likely to be cited than other study designs.[3] In addition, keeping track of published work by linking variations of your name to an account on Scopus or ORCID ID would reduce the chance of a publication being missed by automated engines. Given that this metric identifies the greatest common factor between number of publications and number of times cited h-index scores can be inflated by citing one's own work in subsequent papers. For example, if an author had three publications with three, three, and two citations, respectively, by citing the third paper in the next work, the author's h-index would rise to three. Increasing one's h-index score in this way could serve as an incentive to continue expanding upon one's medical innovation.[4]

Lastly, although h-index is one of the most popular measures of research output, it is important to briefly discuss other measures that exist. In fact, the g-index and e-index were developed in response to limitations of the h-index score that may start playing a bigger role in the future. G-index was introduced in 2006 and it is defined as "the largest number such that the top 'g' articles received together with at least 2 citations".[5] For example, if you have 4 publications with citations of 12, 4, 3, and 0, you will have a g-index of 4 because the sum of citations is greater than 16 but not greater than 25, even though h-index would be 3. One can see how g-index is better at recognizing articles that have received considerably high citations, which shows the publication is valuable to the literature. E-index developed in 2009 is a metric used to be complementary to h-index but catches publications that are highly cited that were underestimated in the h-index.[5] Awareness of these measures can be useful as they begin to play potential roles in multi-faceted estimations of impactful research output.

The lack of awareness of one's personal h-index score or understanding of how the h-index score is calculated can hinder forward progress in academic output. In 2021, a study in Germany attempted to capture all university professors, including professors in medicine, and to measure their knowledge on self-estimating their h-index score. They found about 40% of their sample size of 1017 professors did not know the details of h-index or incorrectly estimated their h-index score when they thought they knew it.[6] There was no report on how professors in medicine specifically did on competency of their own h-index score, and to our knowledge, there are no studies in the literature that have evaluated h-index awareness in otolaryngology. Future studies should further investigate the awareness of the h-index score within members of the otolaryngology department including faculty and residents to help determine how much education may be needed.

Further, there appears to be a gender gap between the h-indexes of women and men. While this difference could be attributed to bias, studies have offered a variety of reasons, which could give insight to factors that affect the h-index. Women comprise an underrepresented proportion of academic surgical subspecialties and even less so in leadership positions.[7] One reason that women may have lower research productivity is due to the preexisting lack of women in the field and hence less availability of mentors.[8] Other factors include having greater roles in supporting family life, educational medicine, or clinical service.[8,9] Despite these obstacles, women are capable of raising their h-index to match or exceed their male peers.[8] This demonstrates that despite a late start or other obligations, one can still recover later on and achieve higher academic ranking. As mentioned later in our guidelines, however, researching and publishing earlier in the career allows for more exposure, influence, and citations to be made, thus increasing the h-index score.

In an ever increasingly competitive world, measures of aptitude often become more important than the content itself. Though the h-index provides great convenience, it may become a higher priority than actual scientific novelty. Although the h-index measures research productivity, research itself is very diverse in nature. From clinical to bench to case reports, the h-index does not account for the type of research conducted.[9,10] Impactful research stems from both basic science and clinical studies however the timeline of

each varies greatly. Generally, basic science research takes place over a greater amount of time than clinical studies resulting in less publications. Though the publication could have lasting impacts, it would generally not be able to greatly raise a researcher's h-index. Each research field has a different h-index compared to other fields so this could alleviate some of the disparity caused by research type. For example, a field focused on time-intensive basic sciences would have a relatively low h-index when compared to a field that mainly publishes fast-paced case reports frequently. While applying within a certain field, the disparity in h-index would likely not cause an issue however it could when translating to another field that has a higher relative h-index. Additionally, it is important to consider that the h-index score could underestimate quality work that is significantly valuable for the medical literature.[5] For example, one manuscript can be cited 300 times in the literature but have a collective h-index score of 1 if two other manuscripts only received 1 citation each. G-index and e-index were developed to help amend this flaw, but they have yet to gain as much utilization and popularity as h-index.[5]

3.2 Academic Medicine

A physician's contribution to medicine is more than just hands-on patient care; medical research led by physician-scientists have made lasting impacts in human advancements through discovery of new medicines, procedures, and mechanisms of immunity. Physicians continue to play a major role in scientific advancement. Currently of the 14,000 physician-scientists practicing in the U.S., roughly 8,000 have Research Project Grants from the NIH.[11] In the past 25 years, over 33% of Nobel Laureates in Physiology or Medicine had an MD degree. Roughly 66% of NIH Institute directors, pharmaceutical chief scientific officers, and National Academy of Sciences have an MD Degree.[12] The continuation of academic research throughout a medical career has yielded significant improvements on overall wellbeing and has led to scholarly achievement serving a major role in determining the academic advancement of physicians.

Scientific output also impacts personal career advancement opportunities. Using a measure of scientific output called the h-index, a variety of studies have shown that a higher h-index correlates with higher faculty rank.[10,13-20] Looking amongst academic rank among 14 surveyed medical specialties, assistant professors scored a h-index score between 2-5, associate professors 6-10, and full professors 12-24.[16] Amongst hand surgeons, though there are many factors that play into determining academic rank, the H-index was the most strongly correlated with academic rank.[15] Other studies have also shown positive correlation with h-index and academic rank within the fields of ophthalmology, urology and radiology.[14,17,18] As components of promotion become multifaceted and more diverse, the importance of h-index for rank advancement becomes seamlessly evident.

3.3 H-Index in Otolaryngology

Regarding promotion within otolaryngology based on h-indices, Svider et al. conducted a study showing statistical differences in h-indices among various academic positions.[10] Specifically, it was found that h-index scores trended positively as one went from assistant professor, to associate professor, and later professor positions thus further showing a correlated weight in academic promotion. Interestingly, there were no differences in h-index scores between chairpersons and professor positions, but this seems to be the case when compared to other academic specialties in the results of the same study.[10]

Additionally, in otolaryngology, studies have taken special interest on how fellowship training can later manifest with greater h-index impacts as well as in regard to research output and academic involvement. In 2012, Eloy et al found that the fellowships have statistically higher academic productivity based on h-index when compared to otolaryngology colleagues who did not pursue fellowship.[19] A study later on suggests that although this difference may be starting to become smaller, involvement in academic medicine was higher in fellowship trained otolaryngologists.[20] One can see how fellowships could be advantageous in increasing h-index score, which consequently would increase likelihood to acquire higher positions in academic medicine. Though this is merely a correlation and not causation, it could prove useful to participate in a fellowship as an investment in one's h-index. Perhaps these provide catalyst opportunities for research or dedicated mentors to guide and develop effective research skills, which has been shown to be key in academic development.[19]

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To expand on providing otolaryngologists further avenues in research involvement, it is important to consider variabilities in residency and fellowship programs regarding research opportunities that are provided by grant funding. Not only would this provide less hoops to jump through in moving research projects forward, but it would also bring great quality research increasing the likelihood of multiple citations. Throughout the last decade, for example, otolaryngologists who have completed head and neck cancer fellowship programs have reportedly higher h-indices among their peers in other subspecialities and non-fellowship trained colleagues.[19,20] It is important to take into account, however, that this subspeciality may be given the most extensive federal and institutional funding as research in cancer may be recognized as a more worthy cause than other otolaryngology related maladies. Future studies have yet to quantify how research funding is allocated among residencies and fellowships within otolaryngology, but a budding otolaryngologist wanting academic career advancement, or a higher h-index score may want to consider working in subspeciality or residency program that has the means to conduct meaningful research with minimal to no restrictions.

3.4 Guidelines

Several barriers to continuing research have been identified including time constraints from personal and professional duties, statistical knowledge deficits, and a lack of interest.[9]

Research requires dedication and planning; through the early development of time management skills and prioritization, potential otolaryngologists can prepare themselves to deal with time constraints. In a culture of research for the sake of building a competitive CV, it is important to consider one's motivation for research.[7] By finding mentors to spark interest or by searching earnestly, one can develop an interest in research and acquire the necessary skills to build a robust academic medicine career. Mentorship can help better understand why research is so important for patient care and how it impacts one's future practice as well.

It is also important to equip oneself with publishing strategies. In addition to the volume of produced works, other characteristics such as quality, availability, and accessibility should be considered when publishing.[21] A legible and well-written article attracts more attention and has a higher likelihood of being published in a visible and prestigious journal.[21] Due to the formula of the h-index, the longer a paper has been published and available, the more likely it will have been cited. The h-index also does not depreciate overtime, meaning the longer a researcher has been active, the higher the index value. In addition to this, residents who published as first authors before starting their program were more likely to continue publishing during their residency.[7]This shows that the earlier exposure one has with publications, even before residency, could help compound one's investment in their h-index scores overtime.

4 Conclusions

In summary, we hope that the guidelines suggested will help otolaryngologists have the knowledge and tools necessary to maximize h-index scores. Additionally, it may be necessary to conduct future studies to evaluate faculty and resident awareness of h-indices in the otolaryngology department to see how we can further address any underlying barriers. Lastly, it is important to continue the emphasis on producing high quality research in modern day medicine not only to provide advantages in career development, but also to bring significant contribution to the field of otolaryngology to maximize patient care.

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