

## E Index

The [h index](#) has already been used by major citation databases to evaluate the academic performance of individual scientists. Although effective and simple, the h-index suffers from some drawbacks that limit its use in accurately and fairly comparing the scientific output of different researchers. These drawbacks include information loss and low resolution: the former refers to the fact that in addition to h<sup>2</sup> citations for papers in the h-core, excess citations are completely ignored, whereas the latter means that it is common for a group of researchers to have an identical h-index.

To solve these problems, the e-index, where e<sup>2</sup> represents the ignored excess citations, in addition to the h<sup>2</sup> citations for h-core papers. Citation information can be completely depicted by using the h-index together with the e-index, which are independent of each other. Some other h-type indices, such as a and R, are h-dependent, have information redundancy with h, and therefore, when used together with h, mask the real differences in excess citations of different researchers.

Although simple, the e-index is a necessary h-index complement, especially for evaluating highly cited scientists or for precisely comparing the scientific output of a group of scientists having an identical h-index <sup>1)</sup>.

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Sonig et al., published the first study that has used departmental [h index](#)-and [e index](#)-based matrices to assess the academic output of [neuroendovascular intervention fellowship](#) programs across the continental US.

Fellowship program listings were identified from academic and organization websites. Details for 37 programs were available. Bibliometric data for these programs were gathered from the Thomson Reuters [Web of Science](#) database. Citations for each [publication](#) from the fellowship's parent department were screened, and the h and e indices were calculated from non-open-surgical, central nervous system vascular publications. Variables including "high-productivity" centers, fellowship-comprehensive stroke center affiliation, fellowship accreditation status, neuroendovascular h index, e index (h index supplement), h10 index (publications during the last 10 years), and departmental faculty-based h indices were created and analyzed.

A positive correlation was seen between the neuroendovascular fellowship h index and corresponding h10 index ( $R = 0.885$ ;  $p < 0.0001$ ). The mean, median, and highest faculty-based h indices exhibited positive correlations with the neuroendovascular fellowship h index ( $R = 0.662$ ,  $p < 0.0001$ ;  $R = 0.617$ ,  $p < 0.0001$ ; and  $R = 0.649$ ,  $p < 0.0001$ , respectively). There was no significant difference ( $p = 0.824$ ) in the median values for the fellowship h index based on comprehensive stroke center affiliation (30 of 37 programs had such affiliations) or accreditation (18 of 37 programs had accreditation) ( $p = 0.223$ ). Based on the quartile analysis of the fellowship h index, 10 of 37 departments had an neuroendovascular h index of  $\geq 54$  ("high-productivity" centers); these centers had significantly more faculty ( $p = 0.013$ ) and a significantly higher mean faculty h index ( $p = 0.0001$ ).

The departmental h index and analysis of its publication topics can be used to calculate the h index of an associated subspecialty. The analysis was focused on the neuroendovascular specialty, and this methodology can be extended to other neurosurgical subspecialties. Individual faculty research interest is directly reflected in the research productivity of a department. High-productivity centers had significantly more faculty with significantly higher individual h indices. The current systems for neuroendovascular fellowship program accreditation do not have a meaningful impact on academic

productivity<sup>2)</sup>.

1)

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0005429>

2)

Sonig A, Shallwani H, Levy BR, Shakir HJ, Siddiqui AH. Academic impact and rankings of neuroendovascular fellowship programs across the United States. J Neurosurg. 2017 Jan 13:1-9. doi: 10.3171/2016.9.JNS161857. [Epub ahead of print] PubMed PMID: 28084907.

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