MAXIMIZE YOUR RESEARCH IMPACT: WHAT YOU NEED TO KNOW

PART 1: RESEARCH METRICS
Objectives

• At the end of this session, participants will be able to:
  • Define what scholarly metrics are
  • Name commonly used scholarly metrics
  • Identify strengths and weaknesses of using different scholarly metrics
  • Use metrics responsibly
Impact is usually demonstrated by pointing to a record of the active consultation, consideration, citation, discussion, referencing or use of a piece of research.

http://blogs.lse.ac.uk/impactofsocialsciences/introduction/
Impact Metrics are…

…calculations/algorithms that quantify the impact of research or scholarly activity.
Basic Premise

Number of citations

Impact
Reach and significance
Examples of Metrics

Images from Metrics Toolkit: http://www.metrics-toolkit.org/
• San Francisco Declaration on Research Assessment: DORA (2012)
  https://sfdora.org/

• Leiden Manifesto (2015)
  http://www.leidenmanifesto.org/

• Metric Tide (2015)
  https://responsiblemetrics.org/the-metric-tide/
Three main providers

- Web of Science
- Scopus
- Google Scholar
<table>
<thead>
<tr>
<th>Weaknesses</th>
<th>Web of Science</th>
<th>Scopus</th>
<th>Google Scholar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Does not cover books, chapters, dissertations, etc.</td>
<td>• Does not cover chapters, dissertations, etc.</td>
<td>• Extent of coverage is cryptic</td>
</tr>
<tr>
<td></td>
<td>• Limited coverage of non-English material</td>
<td>• Covers many low-impact journals and trade publications</td>
<td>• Time coverage is inconsistent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Three Levels

- Journal Level
- Article Level
- Author Level
JOURNAL
LEVEL
METRICS

WHERE TO PUBLISH
<table>
<thead>
<tr>
<th><strong>Journal Level Metrics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Web of Science/JCR</strong></td>
</tr>
<tr>
<td>Impact Factor (2 &amp; 5 year)</td>
</tr>
<tr>
<td>Scopus</td>
</tr>
<tr>
<td>CiteScore</td>
</tr>
<tr>
<td>Google Scholar</td>
</tr>
<tr>
<td>h5-index</td>
</tr>
</tbody>
</table>
Average number of times articles published in a two year (or five year) period have been cited

A = total number of times ALL articles published in 2 (or 5) year period were cited in WofS indexed journals during the next year

B = total number of "citable items" (usually articles, reviews, proceedings or notes; not editorials and letters-to-the-editor) published in 2 (or 5) year period

Impact factor = A/B


\[
\text{Journal Impact Factor} = \frac{53103}{670} = 79.258
\]

How is Journal Impact Factor Calculated?

\[
\text{JIF} = \frac{\text{Citations in 2017 to items published in 2015 (32543) + 2016 (20560)}}{\text{Number of citable items in 2015 (342) + 2016 (328)}} = \frac{53103}{670}
\]
Activity #1

1. Using the JCR, select “Browse by Category”

2. Select your category of research interest

3. Make a note of the top three journals sorted by JIF
Used inappropriately
- Often used as a surrogate measure for quality of articles, researchers, etc., (only evaluates journals in conjunction with other criteria)

Not comparable
- Vary across disciplines
  - e.g., variants in time-to-publication
- Review journals have higher impact
  - fewer articles per journal, cited more
Journal characteristics
• Includes retracted articles
• Mostly English language journals
• Not all journals indexed by Web of Science
• Linked to higher APCs

Data/calculations
• Calculations easily skewed/gamed
• Data not transparent nor available to public
• Mean, not a median value; distribution can be skewed
• Not a predictive measure
### Journal Impact Factor Debate

<table>
<thead>
<tr>
<th>Field</th>
<th>Criteria</th>
<th>Outcome</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedicine</td>
<td>Image duplications</td>
<td>Higher ranking journals show a lower incidence of image duplications</td>
<td>Blake et al. (2016)</td>
</tr>
<tr>
<td>Crystallography</td>
<td>Quality of computer models</td>
<td>Five high-ranking journals significantly below average quality</td>
<td>Brown and Ramaswamy (2007)</td>
</tr>
<tr>
<td>Molecular psychiatry</td>
<td>Sample sizes and effect sizes</td>
<td>Higher ranking journals overestimated</td>
<td>Munafò et al. (2009)</td>
</tr>
<tr>
<td>Neuroscience, psychology</td>
<td>Statistical power</td>
<td>Either no correlation of journal rank with statistical power or a negative correlation</td>
<td>Brembs et al. (2013)</td>
</tr>
<tr>
<td>Ex vivo animal experimentation in disease models</td>
<td>Reporting of randomization and blinded assessment of outcome</td>
<td>Lower reporting of randomization in higher ranking journals and no correlation with reporting of blinded assessment of outcome</td>
<td>Szucs and Ioannidis (2017)</td>
</tr>
<tr>
<td>Genomics, cognitive neuroscience and psychology</td>
<td>Gene name and p-value errors</td>
<td>More errors in higher ranking journals</td>
<td>Ziemann et al. (2016)</td>
</tr>
<tr>
<td>Medicine</td>
<td>Criteria for evidence-based medicine</td>
<td>Two studies found that higher-ranking journals met more criteria, while two failed to detect such an effect</td>
<td>Szucs and Ioannidis (2016)</td>
</tr>
<tr>
<td>Psychology</td>
<td>Three reliability metrics: P-Curve, TIVA and R-index</td>
<td>All three metrics indicate that the higher ranking of two journals publishes less reliable work</td>
<td>Obermeyer et al. (2005) and Lau and Somman (2007)</td>
</tr>
<tr>
<td>Biomedicine</td>
<td>Reproducibility of experiments</td>
<td>Reproducibility is low, not even “top” journals stand out</td>
<td>Scott et al. (2008), Prinz et al. (2011) and Begley and Ellis (2012)</td>
</tr>
</tbody>
</table>

Applying criteria such as peer-review, methodology and spread of journal rank covered, the studies cited in the top six rows would be considered as better supported than the bottom three rows.

Source: Brembs, B. Prestigious science journals struggle to reach even average reliability. Front. Hum. Neurosci. 20 February 2018

[https://doi.org/10.3389/fnhum.2018.00037](https://doi.org/10.3389/fnhum.2018.00037)
Using the Journal Impact Factor wisely

Clarivate Analytics does not depend on the Journal Impact Factor alone in assessing the usefulness of a journal, and neither should anyone else. The Journal Impact Factor should not be used without careful attention to the many phenomena that influence citation rates, as for example the average number of references cited in the average article. The Journal Impact Factor should be used with informed peer review. In the case of academic evaluation for tenure it is sometimes inappropriate to use the impact of the source journal to estimate the expected frequency of a recently published article. Again, the Journal Impact Factor should be used with informed peer review. Citation frequencies for individual articles are quite varied.

Declared Intent
CiteScore

- average number of citations received in a calendar year by all items published in that journal in the preceding three years
- Does not include articles in press or abstracts
- Three year publication window
- Includes all document types in both the numerator and denominator
A = number of citations received in 2017 by any of the content published in the 3 previous years, 2014, 2015 and 2016

B = ALL documents indexed in Scopus in 3 previous years (original research articles, reviews, conference papers, letters, editorials, errata...)

CiteScore 2017 value = \( \frac{A}{B} \)
CiteScore is one of a family of related metrics
<table>
<thead>
<tr>
<th></th>
<th>Journal Impact Factor</th>
<th>CiteScore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>Web of Science</td>
<td>Scopus</td>
</tr>
<tr>
<td>Sources</td>
<td>Approx. 11,000</td>
<td>Approx. 22,000</td>
</tr>
<tr>
<td>Document Types</td>
<td>“Citable items” – articles &amp; reviews</td>
<td>All document types in denominator</td>
</tr>
<tr>
<td>Free/subscription-based</td>
<td>Subscription to Journal Citation Reports</td>
<td>Freely available but data requires subscription to Scopus</td>
</tr>
<tr>
<td>Timeframe</td>
<td>2 years or 5 years</td>
<td>3 years</td>
</tr>
<tr>
<td>Remove self-citations?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>JIF</th>
<th>JIF – self cites</th>
<th>5 Yr JIF</th>
<th>CiteScore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature</td>
<td>40.137</td>
<td>39.533</td>
<td>43.769</td>
<td>13.33</td>
</tr>
</tbody>
</table>
Activity #2

Take the top three journals by JIF from the first activity and enter the title or ISSN into the compare journals box in Scopus to compare their CiteScore values.
• Source normalized impact per paper
• Contextual citation impact
• Corrects for differences in frequency of citation across different research disciplines
2 stages to calculate SNIP

1. IMPACT
2. CITATION
   POTENTIAL
Citations received by journal X in 2017 from Articles, Reviews & Proceedings published in 2014-2016

Articles, Reviews & Proceedings published in journal X in 2014-2016
Average number of references to any papers in the subject field from 2014-2016
2 stages to calculate SNIP
• Scopus data (CiteScore and SNIP) vs. Web of Science data (JIF).
• Correction for discipline differences (SNIP) vs. no correction for discipline differences (CiteScore and JIF).
• Three years of cited publications (CiteScore and SNIP) vs. two (or five) years of cited publications (JIF).
• Based on h-index
• h-median = median of the citation counts in the h-core; measure of distribution of citations to the articles in the h-core
• Published in last 5 complete years
Activity #3

1. Look up the h5-median value in scholar.google.ca metrics for the three journals you have looked up already.

2. How do the metrics compare?
## Top 5 Journals

### Category: Information Science & Library Science; Library & Information Science(s)

### By Impact Factor (2017)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Journal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MIS QUARTERLY</td>
</tr>
<tr>
<td>2</td>
<td>JOURNAL OF INFORMATION TECHNOLOGY</td>
</tr>
<tr>
<td>3</td>
<td>INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT</td>
</tr>
<tr>
<td>4</td>
<td>JOURNAL OF STRATEGIC INFORMATION SYSTEMS</td>
</tr>
<tr>
<td>5</td>
<td>JOURNAL OF THE AMERICAN MEDICAL INFORMATICS ASSOCIATION</td>
</tr>
</tbody>
</table>

### By SNIP (2017)

<table>
<thead>
<tr>
<th>Journal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Journal of Information Management</td>
</tr>
<tr>
<td>Information Processing and Management</td>
</tr>
<tr>
<td>Journal of Information Technology</td>
</tr>
<tr>
<td>Journal of Academic Librarianship</td>
</tr>
<tr>
<td>European Journal of Information Systems</td>
</tr>
</tbody>
</table>

### By h-5 index (2013-2017)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Journal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Journal of the Association for Information Science and Technology</td>
</tr>
<tr>
<td>2</td>
<td>Scientometrics</td>
</tr>
<tr>
<td>3</td>
<td>Journal of Informetrics</td>
</tr>
<tr>
<td>4</td>
<td>The Journal of Academic Librarianship</td>
</tr>
<tr>
<td>5</td>
<td>Online Information Review</td>
</tr>
</tbody>
</table>
ARTICLE LEVEL METRICS
TRACKING, USING, CITING
## Article Level Metrics

<table>
<thead>
<tr>
<th>Traditional metrics</th>
<th>Altmetrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• # of citations</td>
<td>• Viewed/Usage</td>
</tr>
<tr>
<td>• Highly cited</td>
<td>• Cited</td>
</tr>
<tr>
<td>• Hot papers</td>
<td>• Discussed</td>
</tr>
</tbody>
</table>

- **Traditional metrics**
  - # of citations
  - Highly cited
  - Hot papers

- **Altmetrics**
  - Viewed/Usage
  - Cited
  - Discussed
Altmetrics

... are emerging or newer data sources, e.g. Wikipedia, Mendeley, Twitter, Facebook, blogs.

... report the impact of a wider range of research outputs, e.g. presentation slides, data sets, articles, code.

... represent diverse, often complex engagements with research outputs.
Facebook Use Predicts Declines in Subjective Well-Being in Young Adults

Ethan Kross, Philippe Verduyn, Emre Demiralp, Jiyoung Park, David Seungjae Lee, Natalie Lin, Holly Shabiack, John Jonides, Oscar Ybarra

Published: August 14, 2013  •  http://dx.doi.org/10.1371/journal.pone.0068841

Article Level Metrics

604 Save  129 Citation
408,635 View  1,674 Share
Durvalumab after chemoradiotherapy in stage III non–small-cell lung cancer (Article)


New England Journal of Medicine
Volume 377, Issue 20, 16 November 2017, Pages 1919-1929

Citation Count
237
• Citations do not decline (e.g., dormant researcher, death)

• Time frame – some new tools cannot search old mentions, tweets, etc.

• Doesn’t distinguish positive vs. negative attention

• Can these tools be easily manipulated to raise significance of an article? E.g. gaming?
• North American, Western European, and English-language titles dominate

• Limited data for books, book chapters, dissertations, working papers, reports, and conference papers

• Different coverage among disciplines

• Citing errors, e.g. inconsistency in use of initials and in spelling non-English names
Activity #4

1. Look up a topic in Web of Science or Scopus
2. Sort by Times Cited
3. What do you notice?
AUTHOR LEVEL METRICS

YOUR STORY
<table>
<thead>
<tr>
<th>Author Level</th>
<th>Metrics</th>
<th>Web of Science</th>
<th>Scopus</th>
<th>Google Scholar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>h-index</td>
<td>h-index</td>
<td>h-index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total # cites</td>
<td>Total # cites</td>
<td>i10-index</td>
</tr>
</tbody>
</table>
The number of articles $N$ in a group that have $N$ or more citations. For example, an $h$-index of 15 means that there are 15 articles that have 15 or more citations.

“gives an estimate of the importance, significance and broad impact of a scientist’s cumulative research contributions”

### $h$ index is NOT perfect

<table>
<thead>
<tr>
<th>Author</th>
<th>Paper 1</th>
<th>Paper 2</th>
<th>Paper 3</th>
<th>Paper 4</th>
<th>Paper 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author A</td>
<td>3 cites</td>
<td>6 cites</td>
<td>100 cites</td>
<td>4 cites</td>
<td>1 cite</td>
</tr>
<tr>
<td>Author B</td>
<td>3 cites</td>
<td>6 cites</td>
<td>100 cites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author C</td>
<td>400 cites</td>
<td>150 cites</td>
<td>3 cites</td>
<td>6 cites</td>
<td></td>
</tr>
</tbody>
</table>

$h$ index = 3
<table>
<thead>
<tr>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Balance of quality &amp; quantity of research output</td>
<td>• Order of authors</td>
</tr>
<tr>
<td>• More accurate than total # papers or # citations</td>
<td>• Multi-author papers</td>
</tr>
<tr>
<td></td>
<td>• Status of journals</td>
</tr>
<tr>
<td></td>
<td>• Self-citations</td>
</tr>
<tr>
<td></td>
<td>• Retracted articles</td>
</tr>
<tr>
<td></td>
<td>• Excludes non-article outputs</td>
</tr>
</tbody>
</table>
Activity # 5

Compare $h$ index values for a researcher using:

- Google Scholar User Profile
- Scopus
- Web of Science
<table>
<thead>
<tr>
<th>Name</th>
<th>ORCID ID</th>
<th>Scopus ID</th>
<th>Total publications(^1)</th>
<th>Publication years</th>
<th>Total citations</th>
<th>h-index</th>
<th>Highest number of citations</th>
<th>Number of media mentions(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Academia-industry collaboration
• Initiated in UK
• Owned by research-intensive universities
• Goal is to ensure outputs are of practical use and not imposed on them by other groups, e.g. funders
<table>
<thead>
<tr>
<th>Snowball Metrics shared in original Recipe Book, November 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snowball Metrics shared in this edition of the Recipe Book, November 2017</td>
</tr>
</tbody>
</table>
RESPONSIBLE USE OF METRICS
Research impact in context

Research impact in context

51% of respondents said that they have changed their behaviour because of the way they are evaluated.

"It discourages me from doing important research work that may be of null association."

"I am more likely to accept an article for review if I want to verify that it is citing a paper of mine that is near the cusp of being counted for my h-factor."

71% of respondents said that they are concerned their colleagues can ‘game’ or ‘cheat’ the systems for evaluation in their institutions.

"These metrics can be skewed by people if they know that their performance will be evaluated on metrics alone."

"A great deal of politics are involved and a focus on numbers over quality with regard to publications."

Responsible Metrics Guidelines

- Inappropriate indicators create perverse incentives
- Quantitative evaluation should support & not replace qualitative, expert assessment
- Keep data collection and analytical processes open and transparent, so those being evaluated can test and verify the results
- Suite of indicators is preferred – reduces gaming
• One size does not fit all: different fields/disciplines have different publication & citation practices

• Encourage responsible authorship practices & provision of information about specific contributions of each author.

• Cite primary literature in favour of reviews in order to give credit to author(s) who first reported a finding.

• Value all research outputs: articles, data, policy, code, etc.
Research impact: to consider

• Eye of the beholder
• Impact stories
• Quantitative & qualitative
• Context, background, caveats
• Academic, societal, economic
• Time delay
RESEARCH IMPACT

PRACTICAL TIPS FOR PERSONAL STORY
President’s Impact Awards and President’s Impact Academy

About the U of T President’s Impact Awards

The University of Toronto President’s Impact Awards (PIA) celebrate and honour faculty members whose research has led to significant impact beyond academia, including, for example, on society, culture, public policy or law, practices or services, education, the development of products, processes or services from inventions, the economy, health, a profession, the environment, quality of life, or through public engagement.

U of T President’s Impact Award winners receive a monetary award of $10,000 per year for five years to be used toward their research. Recipients will be invited to the annual U of T Salutes! awards event celebrating research and innovation excellence. Recipients are determined by a process of nomination and internal review and selection by a committee chaired by the Vice President, Research & Innovation.

Nominees for the President’s Impact Award whose research impact is related to public policy may also be considered as candidates for the Carolyn Tuohy Impact on Public Policy Award, a separate award that is presented annually under the banner of the U of T Awards of Excellence (AWEX).
Checklist of research impact

• Becker Model (Medical)

• Approaches to Assessing Impacts in the Humanities and Social Sciences
Any thoughts or ideas or observations on research impact that you would like to share?
PART 2: RESEARCHER IDENTITY

1. The importance of a researcher identifier (e.g. ORCID ID, author profiles, etc.) to distinguish you and your work from others;

2. Taking ownership of and managing your researcher identity (e.g. Impactstory, Google Scholar Profiles, ResearcherID)
EVALUATION

THANK-YOU FOR FILLING OUT
Thank you!

Mindy Thuna, M.Sc., MISt
Head, Engineering & Computer Science Library
mindy.thuna@utoronto.ca

Heather Cunningham, M.Sc., MLIS
Assistant Director for Research & Innovation Services
Gerstein Science Information Centre
h.cunningham@utoronto.ca