Session 3: How key normalised indicators are calculated

SNIP, JNCI,SJR; FWCI, CNCI, MNCS, MNLCS; Output/Documents in top x%

Part 1: Normalised versus non-normalised indicators

- What is the difference between the two types of indicator (% and 1.00)?
- What do we 'normalise' on (i.e. year, subject area, document type - why these?)
- Some examples of the two types of metrics (e.g. JIF, h-index, citation count versus MNCS, % of output in top 10% journals, SNIP)
- Why do we normalise?
- Why non-normalised metrics are extra problematic from a responsible metrics point of view

What do we 'normalise' on?

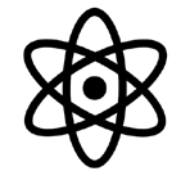
- Year: older articles are more cited but not better
- Subject area: Some fields are more cited but not better
- Document type: Reviews are more cited but not better; editorials, book reviews are irrelevant for citation analysis

Examples of indicators

Indicator	Field	Year	Publication type	Warning
JIF, CiteScore	X	˜√	˜X	Don’t compare between fields. DORA: Avoid.
H-index	X	X	X (can be)	Gender biased
MNCS, MNLCS	√	√	√ (should be)	
RCR	√	√	√ (should be)	
SNIP	√	˜√	˜X	
Total citations	X	X	X (can be)	Gender biased
Average citations	X	X	X (can be)	
% in top 1% cited of field and year	√	√	√ (should be)	
% of output in top 10% JIF journals of field	√	√	˜X (?)	Inherits some JIF problems

X: not (usually) normalised for this; √: usually normalised for this

Non-normalised metrics are irresponsible



Researchers can be penalised for (e.g.):

- Not writing reviews
- Applied research, humanities, arts
- Being female
- Being young
- Having any kind of hope in their lives

Normalised indicators can be irresponsible too because…

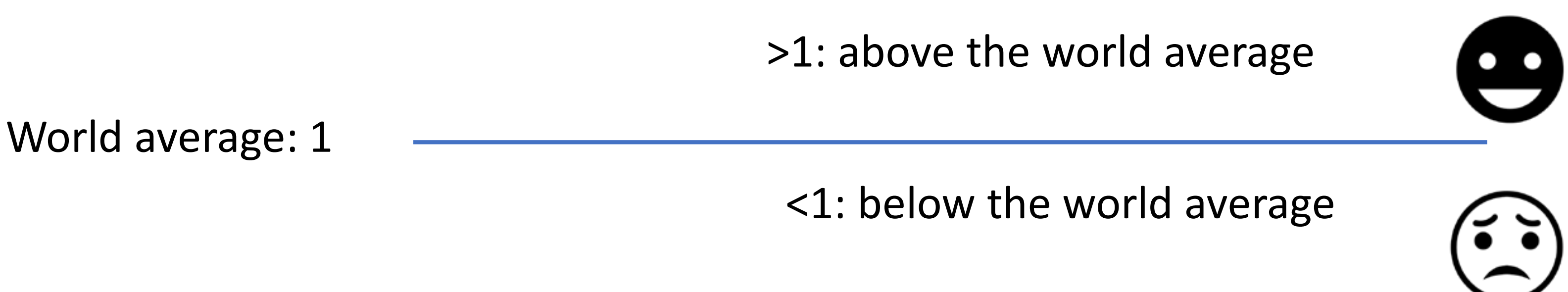
- Research can have valuable non-academic impacts and be uncited.
- Small sample sizes can lead to unreliable values.

- Quantifying uncertainty (e.g., with confidence intervals) can help.

Part 2: Normalised indicators

World average 1.00 indicators

- Many indicators are normalised so that the world average score is 1, irrespective of the field and year.
  - A group scores >1: better than the world average
  - A group scores <1: worse than the world average
  - Lowest 0, highest ∞
  - e.g., FWCI, SJR, SNIP, MNCS, MNLCS, EMNPC, JNCS
- Usually normalised to 1 by dividing each citation count by the world average for its field and year.



MNCS (Mean Normalised Citation Score)

- MNCS divides each citation count c_i by the world average citation count l_i for its field and year.

$$\text{MNCS} = (\frac{1+c_1}{l_1} + \frac{1+c_2}{l_2} + \cdots \frac{1+c_n}{l_n})/n$$

- The arithmetic mean is not good here because the data is skewed. This can be solved with logs.
- MNLCS divides each logged citation count $\ln(1 + c_i)$ by the world average logged citation count l_i for its field and year.

$$\text{MNLCS} = (\frac{\ln(1+c_1)}{l_1} + \frac{\ln(1+c_2)}{l_2} + \cdots \frac{\ln(1+c_n)}{l_n})/n$$

Percentile indicators

- These integers are presented as %s
- Not all %-based indicators are normalised
  - SciVal's % of output in top 10% most cited worldwide has normalised and non-normalised forms
  - % of collaborative outputs not normalised because collaboration is normal in some areas (physics) but rare in others (philosophy).
- %-based metrics use a cut off point rather than dividing by the world average

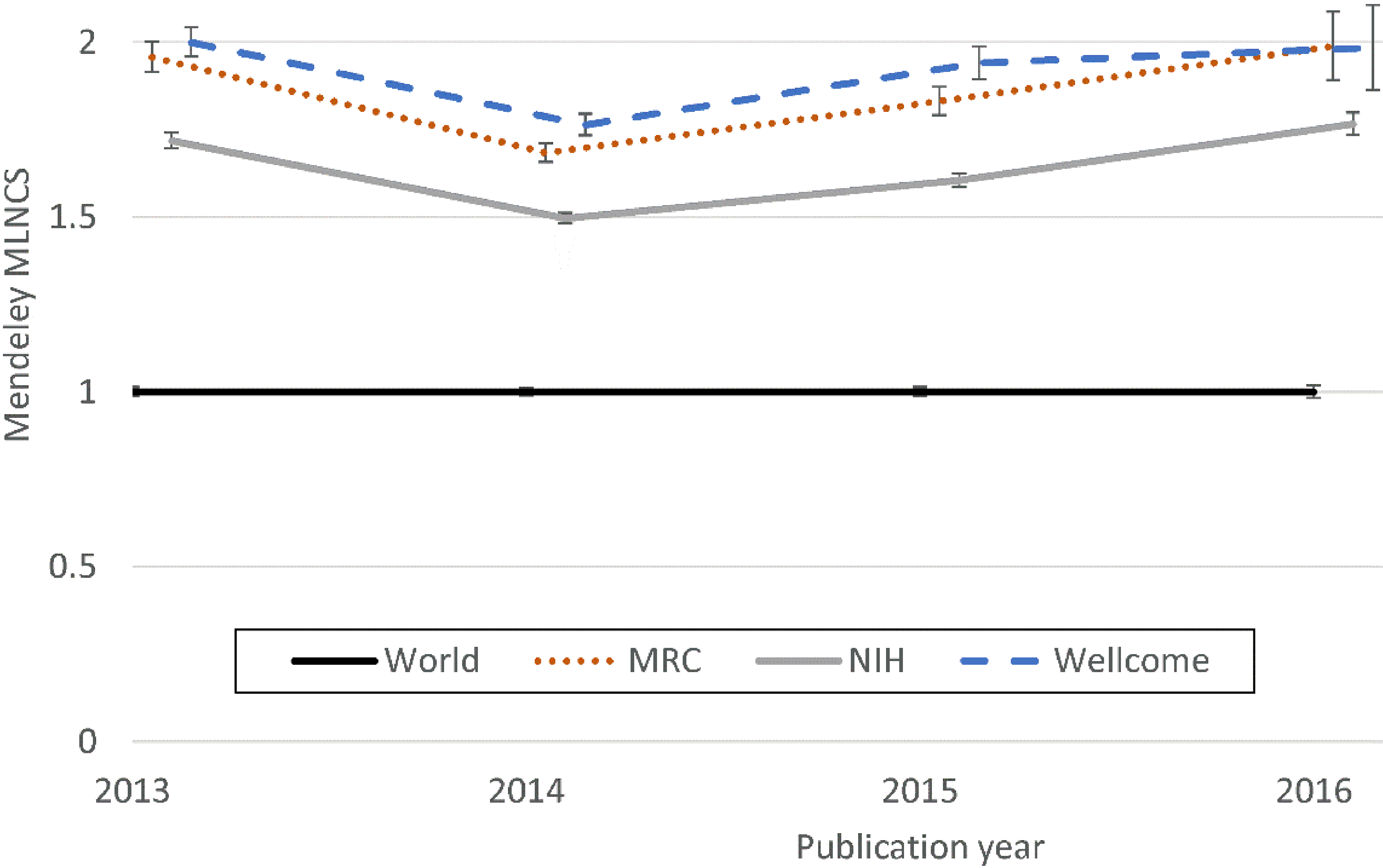
Percentile indicators

- Percentage of articles in the top 10% for the field and year is field/year normalised
  - Getting in the top cited 10% of any field/year is equally difficult (?)
- If a group has more than 10% of their publications in the top 10% then this is better than the world average (10%).
- Common percentiles used are 50%, 10%, 1%
- Binary cut-offs are a disadvantage for small groups and lose information

Applications

- Compare entities or over time, e.g.,
  - FWCI for institution x vs. institution y, even if they produce different numbers of publications in different subject areas.
  - MNLCS between Nursing research groups, even though they have different specialisms
  - % in the top 10% between all research groups in a university
- There are always practical considerations:
  - Sample size issues and levels of confidence in our point estimate
- Fields and national differences in Scopus and WoS coverage.
  - If 100% of Department X's publications are in Scopus but only the best 25% of Department Y's publications then this might be an advantage to Department Y – or a disadvantage because its citations are less well indexed
- At the university level, within a country, coverage issues might not have a big influence overall.

MNLCS to compare funded research



Part 3: The two categories: some calculation examples

Calculations for the 1.00 type

- Field categories
  - Indicators are specific to either WoS (usually MNCS) or Scopus (FWCI)
  - Work poorly if the categorisation is poor
- Indicator details
  - JNCS and SNIP (category versus source normalisation)
  - FWCI and MNCS (FWCI is time-restricted while MNCS is not)
- Unusual types
  - EMNPC (Mike’s) proportion cited, compared to the world average.

https://www.elsevier.com/__data/assets/pdf_file/0020/53327/scival-metrics-guidebook-v1_

Example R commands (MNCS)

```
# Create a column vector with all the citation counts
Citations <- c(   1,  0,  1,  0, 14,  1,  2, 22,  3,  2,  0)
# Create a column vector with the world average for each field corresponding to each citation count
FieldAver <- c(2.1,2.1,2.1,2.1,2.1,3.5,3.5,3.5,  4,  4,  4)
#Field normalise the citation counts by dividing them by the corresponding world field average
FieldNormalised <- Citations / FieldAver
#MNCS is the arithmetic mean of the field normalised values
mncs <- mean(FieldNormalised)
```

Example MNCS calculations in R

- In 2012 the chemistry department has published
  - 5 organic chemistry papers with 1,0,1,0,14 citations (the world average is 2.1)
  - 3 analytic chemistry papers with 1,2,22 citations (the world average is 3.5)
  - 5 chemical engineering papers with 3,2,0,0,0 citations (the world average is 4)
- Its MNCS is 1.23

Analytic

```
> Citations <- c(  1,   0,   1,   0, 14,  1,   2, 22,   3,   2,   0,   0,   0)
> FieldAver <- c(2.1,2.1,2.1,2.1,2.1,3.5,3.5,3.5,   4,   4,   4,   4,   4)
> FieldNormalised <- Citations/FieldAver
> FieldNormalised
 [1] 0.4761905 0.0000000 0.4761905 0.0000000 6.6666667 0.2857143 0.5714286
6.2857143 0.7500000
[10] 0.5000000 0.0000000 0.0000000 0.0000000
> mncs <- mean(FieldNormalised)
> mncs
[1] 1.231685
```

Example R commands (MNLCS)

```
# Create a column vector with all the citation counts
Citations <- c(    1,   0,   1,   0,  14,   1,   2,  22,  3)
# Log transform
CitationsLog <- log(1+Citations)
# Create a column vector with the world average log  for each field corresponding to each citation count
FieldAverLog <- c(1.1,1.1,1.1,1.1,1.1,3.1,3.1,3.1,  2.9)
#Field normalise the citation counts by dividing them by the corresponding world field average
FieldNormalisedLog <- CitationsLog / FieldAverLog
#MNLCS is the arithmetic mean of the field normalised values
mnlcs <- mean(FieldNormalisedLog)
```

Example MNLCS calculations in R

- In 2012 the chemistry department has published
  - 5 organic chemistry papers with 1,0,1,0,14 citations (the world average log is 1.1)
  - 3 analytic chemistry papers with 1,2,22 citations (the world average log is 2.5)
  - 5 chemical engineering papers with 3,2,0,0,0 citations (the world average log is 2.9)
- Its MNLCS is 0.50

Analytic

```
> Citations <- c(  1,   0,   1,   0, 14,  1,   2, 22,  3,   2,   0,   0,   0)
> CitationsLog <- log(1+Citations)
> CitationsLog
 [1] 0.6931472 0.0000000 0.6931472 0.0000000 2.7080502 0.6931472
 [7] 1.0986123 3.1354942 1.3862944 1.0986123 0.0000000 0.0000000
[13] 0.0000000
> FieldAverLog <- c(1.1,1.1,1.1,1.1,1.1,2.5,2.5,2.5,2.9,2.9,2.9,2.9,2.9)
> FieldNormalisedLog <- CitationsLog / FieldAverLog
> FieldNormalisedLog
 [1] 0.6301338 0.0000000 0.6301338 0.0000000 2.4618638 0.2772589
 [7] 0.4394449 1.2541977 0.4780325 0.3788318 0.0000000 0.0000000
[13] 0.0000000
> mnlcs <- mean(FieldNormalisedLog)
> mnlcs
[1] 0.5038383
```

1.00 type journal indicators

- "SNIP Source-Normalized Impact per Paper is a ratio between [] Citations per Publication [] received by the journal, compared to [] expected Citations per Publication, of that journal's field."
- SJR's "weights the value of a citation depending on the field, quality and reputation of the journal that the citation comes from" (using a PageRank matrix approach)

Calculations for the % type

- % indicators are bounded by range (0-100%) and the sample size.
  - Given a sample size of 4, the answer can only be 0%, 25%, 50%, 75%, or 100.
  - Comparing group A with 4 and group B with 5 publications, they can never be equal.
- Example
  - Leticia's 4 cell biology papers were rated as being in the top 1%, 2%, 5% and 55% of WoS papers for citations.
  - 75% of her papers were in the top 10%
  - 25% of her papers were in the top 1%

R commands

```r
#Create a column vector with the citation percentile of each article
Percentiles <- c(1,3,6,2,10,55,22,33,3,5)
#Count the number of articles in the 10% percentile
Top10 <- sum(Percentiles <= 10)
#Calculate the proportion of articles in the 10% percentile
Top10 / length(Percentiles)
```

Example

- In 2012 the Biology department recorded the top percentile for the citations to all its articles, getting:
  - 1,3,6,2,10,55,22,33,3,5
  - E.g., its second article was in the top 3% for its field and year
- It has 70% of its articles in the top cited 10%
- It has 10% of its articles in the top cited 1%

```
> Percentiles <- c(1,3,6,2,10,55,22,33,3,5)
> Top10 <- sum(Percentiles <= 10)
> Top10
[1] 7
> Top10 / length(Percentiles)
[1] 0.7
> Top1 <- sum(Percentiles <= 1)
> Top1
[1] 1
> Top1  / length(Percentiles)
[1] 0.1
```

Summary

- Normalisation allows fairer comparisons between indicator values
- Normalise for field, year and publication type (usually by restricting to a single publication type)
- Can be 1.00 type or percentile (some)
- Is the more responsible approach
- Many well known indicators (e.g., JIF, h-index, total citations) are not field normalised