



Main Bibliometrics Indicators for Science Assessment

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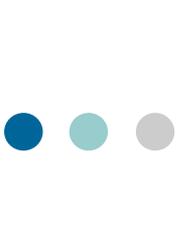
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Characterizing the Research Profile

1. Publications in JCR journals (bibliometrics indicators)
2. Books published or edited in prestigious editorials
3. Publications in conferences and book chapters
4. Competitive research projects (member or coordinators)
5. Industry research projects (member or coordinators)
6. Phd students
7. Patents developed
8. Stays in research centers
9. Level of scientific international collaboration
10. Academic positions in journals, conferences, scientific societies, and institutions.
11. Research awards and recognitions in conferences, journals, scientific societies and institutions.

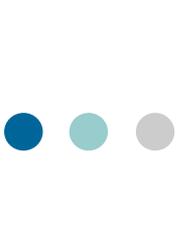
How to Characterize the Scientific Profile through Bibliometric Indicators

1. Scientific publications in JCR-indexed journals are one of the main indicators for evaluating science:

- ❖ produced by a research center
- ❖ produced by a university
- ❖ produced by a researcher
- ❖ published in a scientific journal

2. Bibliometrics/Bibliometric Indicators allow science to be evaluated on the basis of the binomial:

publications x citations



Outline

1. **Bibliometrics**
2. Bibliographic databases
3. Approaches for measuring scientific research
4. Bibliometric Indicators: JIF, H-index, HCP, HCR
5. Ranking of Researchers/Universities based on BI
6. Science Mapping: SciMAT
7. Strategies to improve scientific activity

1. Bibliometrics

- ◆ Definition: “*Science to evaluate and analyze Science*” (Price 1963).
- ◆ Goal: To evaluate and analyze the scientific research by means of the “**quantitative measures or indicators**” assessed on the **publications**, mainly in journals.
- ◆ Relevance: Bibliometric indicators are used to make important decisions in academic contexts on projects, policy, academic promotion.

1. Bibliometrics

- Aplicaciones
 - Herramienta de apoyo a la gestión bibliotecaria
 - Prospectiva científica y vigilancia tecnológica
 - Descripción y evaluación de la actividad científica y sus actores
 - Apoyo a la política científica
 - Evaluación institucional
 - Evaluación de la actividad del PDI
 - Análisis de la ciencia (campos, temáticas, líneas,...)
 - Autores y documentos más influyentes
 - Frentes de investigación
 - Estructura de la base intelectual

1. Bibliometrics

Criticisms:

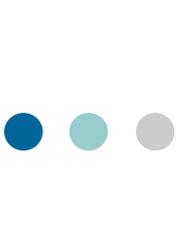
- ◆ use of quantitative techniques that are too elementary;
- ◆ lack of a prior approach justifying the use of a specific quantitative method;
- ◆ lack of assessment of the data used and of the data bases used
- ◆ abuse of the results of certain bibliometric studies as the only valid criterion used to evaluate or give meaning to scientific results
- ◆ erroneous assumptions that every scientific contribution leaves its mark in the scientific literature; that the information in the databases is sufficiently reliable; or that the number of citations a publication receives is an acceptable measure of its value.

Consensus: BIBLIOMETRY IS USEFUL for assessing scientific research activity and planning information units.

1. Bibliometrics

Importance of PUBLICATIONS/CITATIONS:

- ◆ Price (1963) defined Science as that which is published in scientific publications.
- ◆ Scientific publications provide the process of connection with the scientific community that can evaluate it and give or not its assent.
- ◆ Scientific publication constitutes the final product of scientific activity, and therefore, the scientific productivity of researchers can be evaluated by means of a quantitative description of their production.
- ◆ The scientific journal is, in most disciplines, the specialized medium where scientific research can be published. There it finds publicity and social existence, also allowing the preservation and archiving of knowledge.
- ◆ Peer review: process of evaluation of publications before they are accepted in journals.
- ◆ Citations: show the relationships between journal publications, a very powerful impact/quality metric.



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2. Bibliographic databases

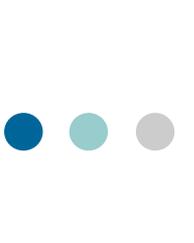
- ◆ **Bibliometric Studies:** They are possible thanks to the existence of bibliographic databases.



- DATA
++QUALITY
NON-FREE

+ DATA
+QUALITY
NON-FREE

++ DATA
- QUALITY
- FREE

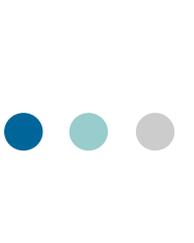


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3. Approaches for measuring scientific research

1. *Performance bibliometric indicators* for measuring the impact and visibility of publications/journals/authors from the citations:
 - ❑ *Journal Impact Factor (JIF)*
 - ❑ *H-index*
 - ❑ *Highly Cited Papers*
 - ❑ *Highly Cited Researchers* (**H-CLASSICS**)
2. *Relational bibliometric indicators* for measuring the conceptual structure of the publications by means of the *science mapping* and from the keywords or titles of the publications. (**SciMAT**)



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4. Journal Impact Factor (JIF)

Journal Impact Factor Calculation

$$\text{2019 Journal Impact Factor} = \frac{34,181}{566} = 60.390$$

How is Journal Impact Factor Calculated?

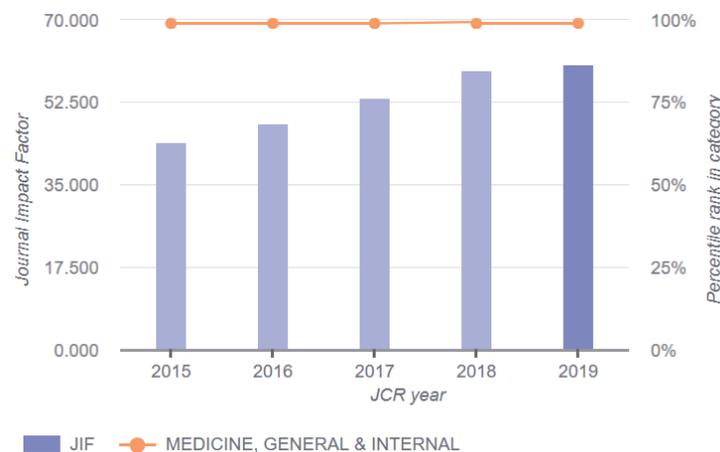
$$\text{JIF} = \frac{\text{Citations in 2019 to items published in 2017 (19,978) + 2018 (14,203)}{\text{Number of citable items in 2017 (302) + 2018 (264)}} = \frac{34,181}{566}$$

*Ranking of Journals:
percentile, quartil, decil*

“

60.390

2019 Journal Impact Factor



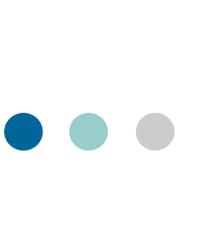
InCites Journal Citation Reports

4. Journal Impact Factor (JIF)

InCites Journal Citation Reports



- a) **Journal Citation Report:** El JCR nos da un ranking anual de revistas científicas por categoría en base al famoso *Factor de Impacto* definido por Eugene Garfield [44], que es uno de los indicadores bibliométricos basado en citación más popular diseñado para valorar la calidad de las revistas y que estudiaremos en la próxima sección. El JCR constituye un estándar de calidad de revistas científicas en la Ciencia y un referente para todos los investigadores. El JCR tiene dos bloques de índices de revistas, uno para las llamadas Ciencias (que incluye Ciencias Naturales, Matemáticas, Tecnologías, Ingeniería, Ciencias de la Salud, Física, Química, Informática,...) llamado *JCR Science Edition*, y otro para las Ciencias Sociales (Sociología, Antropología, Trabajo Social, Políticas, Derecho, Filología,..) llamado *JCR Social Science Edition*. No existe un JCR para la rama de Arte y Humanidades.



4. H-Index.

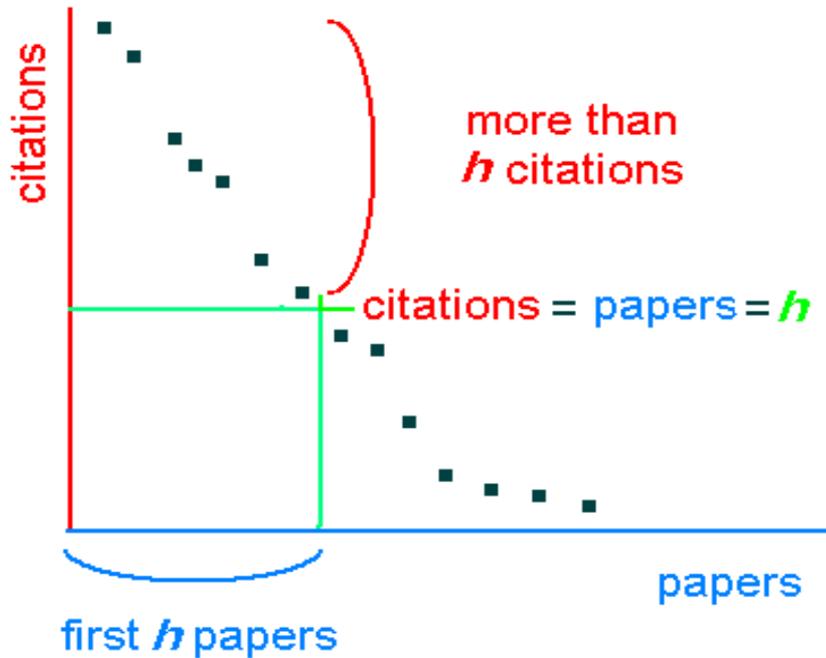
- ◆ *Definition: “An index to quantify an individual's scientific research output”*
Hirsch, Jorge (2005).

“A scientist has index H if H of his/her N papers have at least H citations each, and the remaining papers have no more than H citations each.”

4. H-Index



4. H-Index: Applications



1. Quantifies both, the scientific productivity (publications) and the scientific impact (citations) of a scientist
2. Simple computation

1	2	3	4	5	6	7	8	9	10	11
49	23	15	14	6	3	1	1	0	0	0

4. H-Index: Applications

- ◆ *To Rank Scientists*
- ◆ *To Rank Journals*
- ◆ *To Rank Research Groups*
- ◆ *To Rank Countries*
- ◆ *To identify Highly Cited Papers: H-Classics*

4. Highly Cited Papers

- **Definition 1:** Citation Classic is a bibliometric concept introduced by Eugene Garfield (1977) to designate those highly cited papers of a scientific field.



- **Definition 2:** Citation Classics or highly cited papers are considered as the “gold bullion of science”, because they help us to discover important information for the development of a discipline and understand the past, present and future of its scientific structure.

4. Highly Cited Papers

An analysis of highly cited papers:

- The recognition of major advances in the discipline, i.e., *to identify emergent or basis or hot topics* in order to inspire other works within the area.
- Historical perspective* on the scientific progress of the speciality.
- Identify the main intellectual markers* of the research field, which could be journals or researchers or countries or research groups or institutions.

4. Highly Cited Papers

Highly Cited Papers is a very popular tool:

Pacific Economic Review

Pacific Economic Review, 19: 1 (2014)
doi: 10.1111/1468-0106.12049

pp. 8–24

**CITATIONS OF MOST OFTEN CITED ECONOMISTS:
DO SCHOLARLY BOOKS MATTER MORE THAN
QUALITY JOURNALS?**

JANG C. JIN* *George Mason University – Korea Songdo Campus*
E. KWAN CHOI *Iowa State University*

Scientometrics (2013) 94:469–480
DOI 10.1007/s11192-012-0859-6

**Characterizing a scientific elite (B): publication
and citation patterns of the most highly cited scientists
in environmental science and ecology**

John N. Parker · Stefano Allesina · Christopher J. Lortie

Contents lists available at SciVerse ScienceDirect

Journal of School Psychology

journal homepage: www.elsevier.com/locate/jschpsyc



Commissioned Article

**Journal article citation classics in school psychology: Analysis
of the most cited articles in five school psychology journals** ☆

Katherine W. Price*, Randy G. Floyd, Thomas K. Fagan, Kelly Smithson

The University of Memphis, USA

Chinese Journal of Chemical Engineering, 20(3) 478–488 (2012)

**Top-cited Articles in Chemical Engineering in Science Citation Index
Expanded: A Bibliometric Analysis**

Yuh-Shan Ho*

Trend Research Centre, Asia University, No. 500, Lioufeng Road, Wufeng, Taichung County 41354, Taiwan, China

Childs Nerv Syst (2013) 29:2201–2213

DOI 10.1007/s00381-013-2228-z

ORIGINAL PAPER

Highly cited publications in pediatric neurosurgery

M. Angela Wilcox · Nickalus R. Khan ·

Joseph H. McAbee · Frederick A. Boop · Paul Klimo Jr.

Clin Oral Invest (2014) 18:699–706

DOI 10.1007/s00784-013-1017-0

ORIGINAL ARTICLE

The 100 most cited articles in dentistry

Javier F. Feijoo · Jacobo Limeres · Marta Fernández-Varela ·
Isabel Ramos · Pedro Diz



4. Highly Cited Papers

How to identify a Highly Cited Paper? (Garfield):

1. **Establishing citation rates or thresholds to be met by the published papers:** Publications cited more than 400 times. PROBLEM: ***citation rates differ for each discipline*** (*Computer Science is not equal than Social Work*)
2. **Choosing a specific number of papers placed in the top of the list of highly cited works:** Setting a concrete number of papers (100, 50, 25) or a percentage of papers (top 1%). PROBLEM: **arbitrariness**
3. **H-Classics:** H-Classics of a scientific field are the highly cited papers identified by means of the H-index. Advantage: **Adaptative to each scientific area.**

4. Highly Cited Papers: How to identify a HCP??



ISI Web of Knowledge™

Essential Science Indicators™

Citation Rankings:	- Scientists - Institutions - Countries/Territories - Journals
Most Cited Papers:	- Highly Cited Papers (last 10 years) - Hot Papers (last 2 years)
Citation Analysis:	- Baselines - Research Fronts

- Commentary:**
- IN-CITES
 - SPECIAL TOPICS
 - SCIENCE-WATCH

NOTICES TUTORIAL

The Notices file was last updated Thu May 15 07:11:41 2014

Essential Science Indicators was updated on May 16, 2014 to cover an 10-year plus 2-month period, January 1, 2004-February 28, 2014.

Percentiles
for papers published by field, 2004 - 2014

CLINICAL MEDICINE	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	All Years
0.01 %	1994	1944	1186	1266	1027	974	589	430	257	75	11	1102
0.10 %	659	599	560	450	373	322	223	141	84	23	5	376
1.00 %	207	195	167	142	120	97	72	48	26	8	2	115
10.00 %	57	53	47	40	34	28	21	14	8	3	1	29
20.00 %	35	32	29	24	21	17	13	9	5	2	1	16
50.00 %	12	12	11	9	8	6	5	3	2	1	1	5

ENGINEERING	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	All Years
0.01 %	559	548	510	487	248	246	169	141	64	31	10	319
0.10 %	239	189	184	171	135	107	87	56	31	12	4	134
1.00 %	86	76	70	66	54	48	37	25	14	5	2	50
10.00 %	25	23	22	20	18	16	12	9	5	2	1	14
20.00 %	15	14	13	12	11	10	8	6	3	1	1	8
50.00 %	5	4	4	4	4	4	3	2	1	1	1	2



4. Highly Cited Papers based on H-index

Step 1: Choose the bibliographic database to locate the scientific production and citations: WoS

Step 2: Set the research area under study by means of a query and retrieve the documents (JCR areas or names of journals)

Step 3: Compute the H-index of the research area.

Step 4: Retrieve the H-core of the research area.

4. Highly Cited Researchers

◆ *Thomson Reuters/Clarivate Analytics provides two important databases based on WoS:*

1. *Essential Science Indicators: To identify most cited individuals, institutions, countries, journals, and papers (“Highly Cited Papers”)*
2. *Highly Cited Researchers: Uses Essential Science Indicators to identify “Highly Cited Researchers” used to compute ARWU (Shangai Ranking of Universities)*



4. Highly Cited Researchers: How to identify???

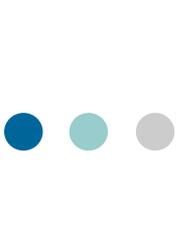
- ◆ Depending on the scientific category (22 scientific categories) a scientist is considered a HCR if he/she presents more than a threshold value of Highly Cited Papers

Example: in Engineering the threshold is 8 or 9 HCP

Indicators and Weights for ARWU

Criteria	Indicator	Code	Weight
Quality of Education	Alumni of an institution winning Nobel Prizes and Fields Medals	Alumni	10%
Quality of Faculty	Staff of an institution winning Nobel Prizes and Fields Medals	Award	20%
	Highly cited researchers in 21 broad subject categories	HiCi	20%
Research Output	Papers published in Nature and Science*	N&S	20%
	Papers indexed in Science Citation Index-expanded and Social Science Citation Index	PUB	20%
Per Capita Performance	Per capita academic performance of an institution	PCP	10%
Total			100%





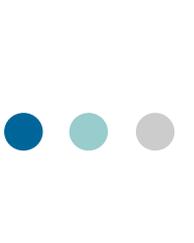
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- ● 5. Ranking of Researchers
- ◆ *Ranking of researchers based on h-index: Google Scholar*
- ◆ *Ranking of researchers based on h-index, publications and citations: Ranking of Stanford*
- ◆ *Ranking of researchers based on HCP: List of Highly Cited Researchers of Clarivate Analytics published in 2014, 2015,... and 2020: 6000 researchers indexed, HCP in the last 10 years*

5. Ranking of Universities

Ranking	Website	Weight of Bibliometric indicators	Bibliometric data source
Shanghai Ranking	http://shanghairanking.com	60%	Web of Science
THE World University Rankings	https://www.timeshighereducation.com/world-university-rankings/	38.5%	Scopus
US News Best Global Universities	https://www.usnews.com/education/best-global-universities/rankings	75%	Web of Science
NTU	http://nturanking.lis.ntu.edu.tw/	100%	Web of Science
CWUR Rankings	http://cwur.org/	20%	Web of Science
URAP	http://www.urapcenter.org/2017/	100%	Web of Science
Round University Rankings	http://roundranking.com/	26%	Web of Science



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6. Science mapping: SciMAT

- ◆ *SCIENCE MAPPING* is a bibliometric tool based on relational bibliometric indicators that allows us to discover conceptual and structural and dynamic aspects of a scientific research through time, delimiting a research field, and quantifying and visualizing the detected subfields by means of co-word analysis developed on the keywords of publications.

6. Science mapping: SciMAT

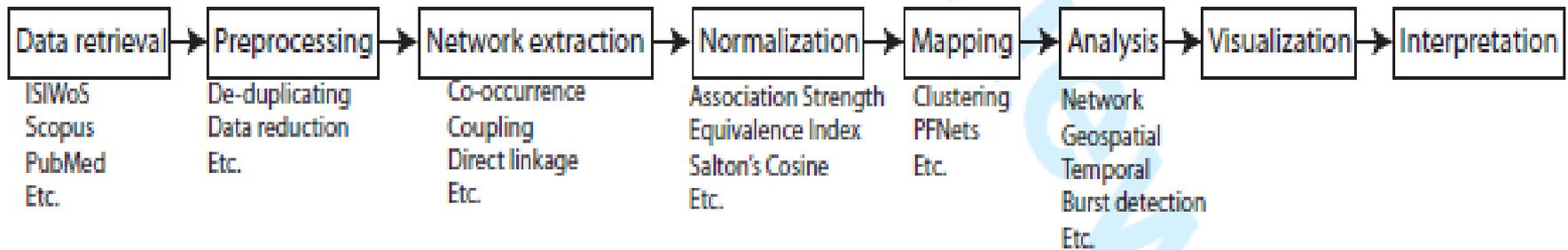
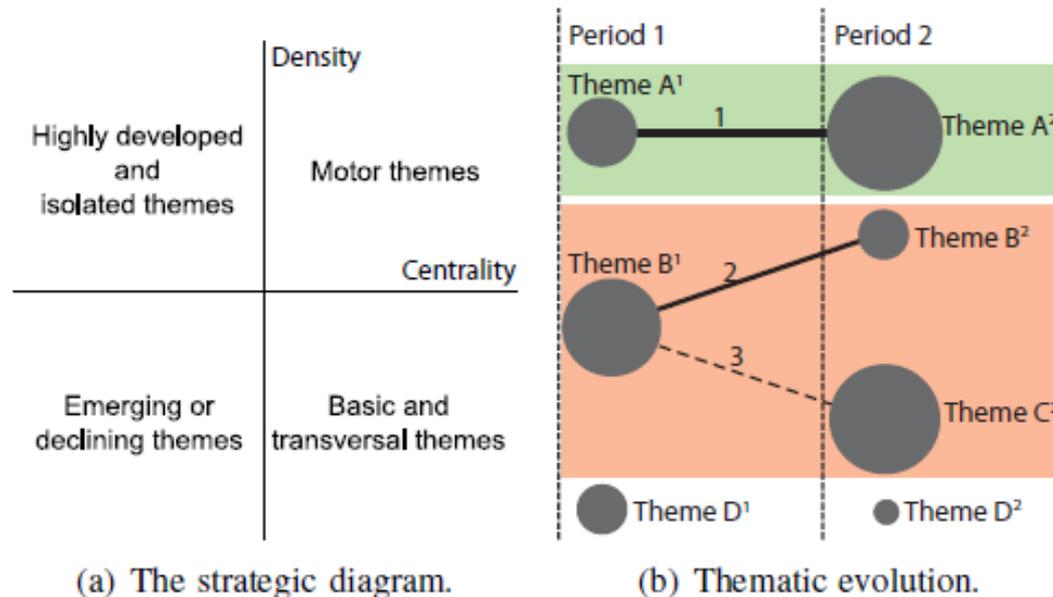


Figure 1: Workflow of Science Mapping.



6. Science mapping: SciMAT

- ◆ **SciMAT** Free Software tool to develop bibliometrics studies based on Science Mapping that incorporates some bibliometric performance indicators (h-index):

Publications + Citations

M.J. Cobo, A.G. López-Herrera, E. Herrera-Viedma and F. Herrera, SciMAT: A new Science Mapping Analysis Software Tool. Journal of the American Society for Information Science and Technology, 63:8 (2012) 1609-1630

<http://sci2s.ugr.es/scimat/>

6. Science mapping: SciMAT

- ◆ *Science mapping for Periodontics and Implant (2004-2013) using WoS with 30000 documents*

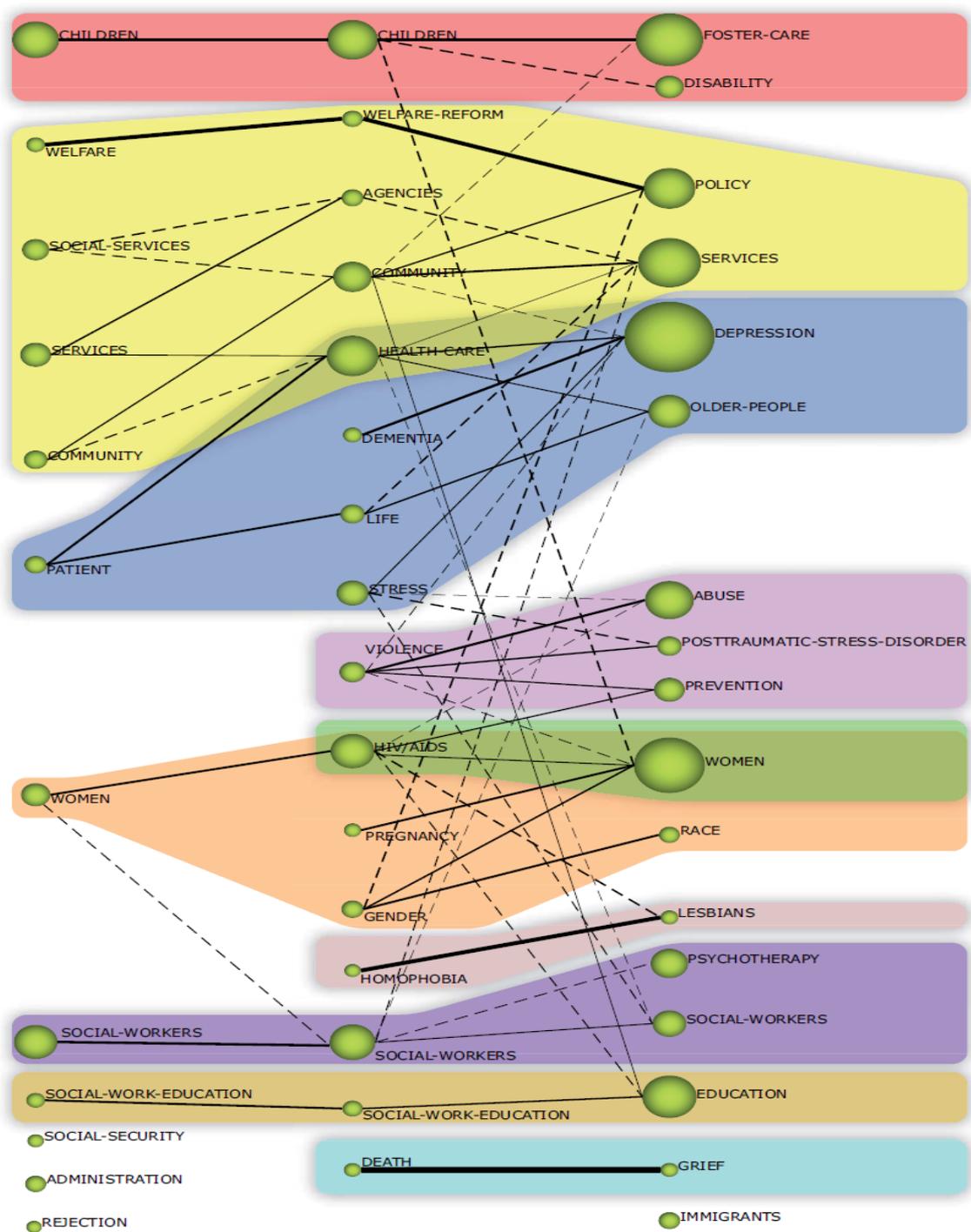
JOURNALS	CITATIONS	IF	RANK
Periodontology 2000	2648	4,012	1
Clinical Implant Dentistry Research	1875	3,821	3
Journal Clinical of Periodontology	9656	3,688	5
Clinical Oral Implant Research	8710	3,433	6
British Journal of Oral and Maxillofacial Surgery	3404	2,717	10
European Journal of Oral Implantology	258	2,571	13
Journal of Periodontology	11846	2,398	15
Journal of Periodontal research	3129	1,990	22
International Journal of Oral & Maxillofacial Implant	7047	1,908	23
Journal of Cranio-Maxillofacial Surgery	2310	1,610	29
International Journal of Oral & Maxillofacial surgery	5326	1,521	32
Oral Surgery Oral Medicine Oral Pathology Oral Radiology	11451	1,495	33
Implant dentistry	1297	1,404	36
Journal Oral Maxillofacial Surgery	11552	1,333	40
Journal Oral Implantology	859	1,148	46
International Journal of Periodontology and Restorative	2049	1,081	49
Oral Maxillofacial Surgery Clinical	336	0,727	67
Implantologie	48	0,169	81

Example: Map of conceptual evolution in Social Work Area:

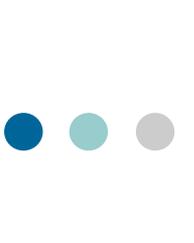
-1930-2012

-20.000 documents

-Three periods: 1930-1989;
1990-2002; 2003-2012



Thematic area	Documents	Citations	h-index
SOCIAL-SERVICES	4651	29183	49
HEALTH-CARE	3879	26335	48
CHILDREN	3295	19772	42
WOMEN	2800	16516	39
SOCIAL-WORKER	2534	14603	37
HIV/AIDS	2164	13355	38
VIOLENCE	1564	8003	31
EDUCATION	1239	5362	26
GRIEF	138	936	15
LGBT	115	858	16



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7. Strategies to improve the scientific activity

- ◆ *Read/publish the/in top journals*
- ◆ *Read highly cited papers*
- ◆ *Attend talks of scientific leaders*
- ◆ *Read scientific leaders' papers*
- ◆ *Invite scientific leaders to our centers*
- ◆ *Visit top research centers*
- ◆ *Increase international collaboration*
- ◆ *Identify emergent topics (**Scimat**)*



**That's all!!!
THANK YOU!!**