

Evaluating Impact of Primary Care Research Programs

A Computational Scientometric Methodology

Christopher Meaney

Biostatistician
Department of Family and Community Medicine
University of Toronto
&
PhD Candidate
Division of Biostatistics
Dalla Lana School of Public Health
University of Toronto

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Project Leadership, Collaborators & Team Members



Section 0: Learning Objectives and Major Ideas

- Research knowledge products (papers, conference proceeding, books, etc.) as digital assets.
- Unique persistent identifiers for querying digital assets computationally using APIs.
 - ORCID-ID
 - Scopus ID
 - Web of Science (ResearcherID)
 - Google Scholar ID
 - PubMed/NLM??
- Curation of scientometric databases (bibliometric-, altmetric-, webometric-KPIs, etc.).
- Secondary use publicly available data for institutional benchmarking (responsible/ethical).
- Demo: comparative evaluation DFCM research pgm vs. several international institutions.
- Current use of metrics at DFCM (AAS, Res Pgm Review, Promotions Committee, etc.).
 - Transparent, reproducible, reliable, passive, cost-effective, etc.

Section 1: Background and Research Objectives

- Motivation/Context: DFCM research program environmental scan.
- Background
 - Research program impact assessment and evaluation.
 - Quantitative performance indicators for assessment/evaluation (i.e. metrics).
 - Review of the scientometric research landscape.
- Research Objectives
 - Characterize DFCM research outputs, cites, attention, network/thematic structure.
 - Compare DFCM versus leading international primary care research institutions.

Motivation/Context: Research Program Evaluation at DFCM

DFCM Research Program Environmental Scan: Project Questions

- What are organizational models for high impact research?
- What factors are associated with high impact research?
- What structures, functions, and processes create a high impact research department?

DFCM Environmental Scan: A Balanced/Mixed Methodology

- Key stakeholder consults, focus groups, QL interviews.
- Scoping review of peer-reviewed academic literature.
- Document review of internal DFCM reports and grey literature.
- Review of primary care research institutional web content.
- Computational scientometric characterization/comparisons

Australia-RQF: Research Impact

"Research impact' denotes the benefits or returns from research which flow beyond the academic realm to 'end users' of research. These 'end users' are traditionally defined as industry, business, government, or, more broadly, the taxpayer."

UK-REF: Research Impact

"an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia"

MAKING AN IMPACT

A Preferred Framework and Indicators to Measure Returns on Investment in Health Research



Report of the Panel on the Return on Investments in Health Research
January 2009

Research Evaluation 23 (2014) pp. 21–32
Advance Access published on 9 October 2013

doi:10.1093/reval/rvt021

Assessment, evaluations, and definitions of research impact: A review

Teresa Penfield¹, Matthew J. Baker¹, Rosa Scoble² and
Michael C. Wykes^{1,*}

¹University of Exeter, Innovation Centre, Rennes Drive, Devon EX4 4RN, UK and

²Bond University, Kedron Lakes, Gold Coast, QLD 4226, Australia

*Corresponding author. Email: m.c.wykes@exeter.ac.uk

This article aims to explore what is understood by the term 'research impact' and to provide a comprehensive assimilation of available literature and information, drawing on global experiences to understand the potential for methods and frameworks of impact assessment being implemented for UK impact assessment. We take a more focused look at the impact component of the UK Research Excellence Framework taking place in 2014 and some of the challenges to evaluating impact and the role that systems might play in the future for capturing the links between research and impact and the requirements we have for these systems.

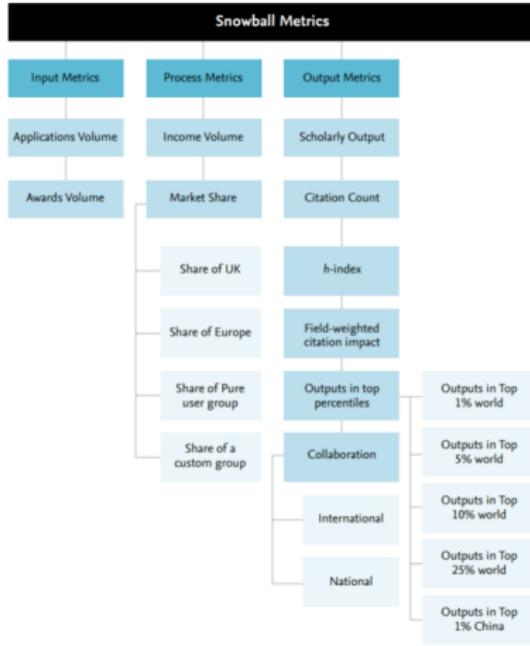
Keywords: impact; research evaluation; assessment; evidence.





Rivera et al. (2017). Assessing the impact of healthcare research: A systematic review of methodological frameworks. PLoS Medicine.

S	<i>Research Inputs</i>	<i>Research Process</i>	<i>Research Outputs</i>
Research Grants	Research applications Research awards <ul style="list-style-type: none"> ▪ Price / overhead recovery ▪ Philanthropy 	Research income <ul style="list-style-type: none"> ▪ Space utilisation ▪ Staff recruitment ▪ Start/ end date slippage 	Publications & citations Collaboration (co-authorship) Esteem measures <ul style="list-style-type: none"> ▪ Socio-economic impact
Post-Graduate Education	PGR volumes <ul style="list-style-type: none"> ▪ PGT volumes ▪ International PGT volumes ▪ UG to PG conversion rates 	Post-graduate experience <ul style="list-style-type: none"> ▪ Contact time ▪ Facilities 	Completion rates <ul style="list-style-type: none"> ▪ Alumni / destination of leavers ▪ Skills development (impact)
Enterprise Activities	Industrial income <ul style="list-style-type: none"> ▪ Industry engagement 	<ul style="list-style-type: none"> ▪ Contract turnaround times ▪ Industry research income 	Patenting Licensing income Spin-out generation / income <ul style="list-style-type: none"> ▪ KTPs numbers ▪ Consultancy income
Denominators	<ul style="list-style-type: none"> ▪ "Slice and dice" ▪ Normalise for size 	(Number of) People <ul style="list-style-type: none"> ▪ Researcher, authors ▪ Principal / co-investigators ▪ Academic staff by category ▪ Research assistants ▪ PGR Students ▪ UG / PGT Students ▪ Post doctoral staff ▪ Support staff 	Organisations <ul style="list-style-type: none"> ▪ Institution ▪ Faculty / department ▪ Cost Centre ▪ Unit of Assessment ▪ Groups / clusters ▪ Funders by type ▪ Centres / Institutes
			Themes / Schemes <ul style="list-style-type: none"> ▪ Standard grants ▪ Strategic initiatives (Calls) ▪ Grand Challenges ▪ Subject areas ▪ Keywords



NEWS FEATURE

NATURE Vol 465/17 June 2010



Do metrics matter?

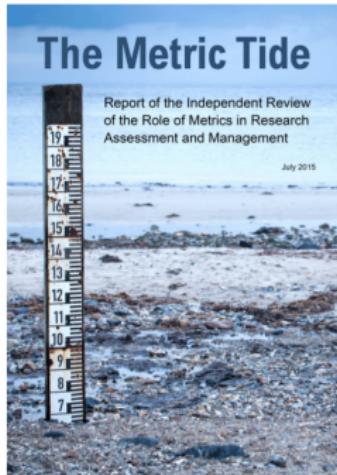
Many researchers believe that quantitative metrics determine who gets hired and who gets promoted at their institutions. With an exclusive poll and interviews, *Nature* probes to what extent metrics are really used that way.

METRICS PERCEPTIONS

Q: At your institution or department are metrics of scientific performance used to any degree in any of the following?



Responsible Use of Scientometric Indicators: DORA, Leiden, Metric Tide



UK Progress towards the use of metrics responsibly

Three years on from The Metric Tide report



The Leiden Manifesto for research metrics



Russell et al. (2019). Cambridge University DORA Tutorial. [Download Here.](#)

Whilsdon et al. (2015). The Metric Tide. [Download Here.](#)

Hicks et al. (2015). The Leiden Manifesto. [Download Here.](#)

Cagan et al. (2013). The SF Declaration of Research Assessment. [Download Here.](#)

Research Objectives

- Characterize DFCM research outputs, impact, attention, network/thematic structure.
- Compare DFCM versus leading international primary care research institutions.

Section 2: Scientometric Methodology

- Design, Data Curation, and Metrics.
- Research Questions and Statistical Methods.

Design, Inclusion Criteria and Data Extraction

- Retrospective cohort design (2000-2021).
- Bottom-up scientometric framework.
- Expert consensus building exercise identified 18 institutions for inclusion.
- Two extractors (SM, JY) extract researcher names from institutional URL.
- Two extractors (SM, JY) query ScopusID associated with researcher.
- Set-based methods quantify concordance/agreement with respect to data extraction.

Institution	Departmental Name	Country	Number of Staff/Faculty	URL
University of British Columbia	Department of Family Practice	Canada	34	https://research.familymed.ubc.ca/category/profiles/
University of Toronto	Department of Family and Community Medicine	Canada	132	https://www.dfcm.utoronto.ca/researchers
University of Ottawa	Department of Family Medicine	Canada	20	https://med.uottawa.ca/family/research/researcher-profiles
Laval University	Department of Family Medicine	Canada	37	https://www.fmed.ulaval.ca/recherche/repertoire-des-professeurs/
McGill University	Department of Family Medicine	Canada	31	https://www.mcgill.ca/familymed/people
Dartmouth University	Division of Community and Family Medicine	USA	52	https://geiselmed.dartmouth.edu/faculty/fac_dept.php?search_query=Community+and+Family+Medicine
University of Michigan	Department of Family Medicine	USA	27	https://medicine.umich.edu/dept/family-medicine/faculty/faculty/researchers
University of California San Francisco	Department of Family and Community Medicine	USA	14	https://fcm.ucsf.edu/centers-programs
Oregon Health Sciences University	Department of Family Medicine	USA	19	https://www.ohsu.edu/school-of-medicine/family-medicine/meet-our-researchers-0
Duke University	Department of Family Medicine and Community Health	USA	14	https://fmch.duke.edu/research-scholarship/faculty-researchers
Harvard University	Department of Primary Care	USA		https://primarycare.hms.harvard.edu/about-us/faculty-and-affiliates
University of Oxford	Primary Care Health Sciences	UK	159	https://www.phc.ox.ac.uk/team?tab=research-research-support-teaching
University of Cambridge	Population Health and Primary Care	UK	10	https://www.phpc.cam.ac.uk/pchu/research/research-overview/
University College London	Primary Care and Population Health	UK	36	https://www.ucl.ac.uk/epidemiology-health-care/research/primary-care-and-population-health/people
University of Erasmus	General Practice	Netherlands	10	https://www.erasmusmc.nl/en/research/group/general-practice
University of New South Wales	Primary Health Care	Australia		https://spn.med.unsw.edu.au/research/primary-health-care/key-staff
Monash University	Department of General Practice	Australia		https://www.monash.edu/medicine/sphm/general-practice/research
Hong Kong University	Department of Family Medicine and Primary Care	Hong Kong		https://www.fmpc.hku.hk/en/Research/Research-Themes

Computational Scientometrics, Data Curation, and Data Structures

- Input: Data array (First Name, Last Name, ScopusID, Institution).
- Query Scopus API using unique persistent author ID (name disambiguation).
- Extract: Publication title, date, journal, keywords, abstract, OA, funding, IDs, etc.
- Use EID to query Scopus co-author/affiliation information.
- Use DOI to query Altmetrics.com API.
- Use ISSN/eISSN to query journal metrics (Scimago).
- Data structures: research abstract DTM, network adjacency matrices, etc.

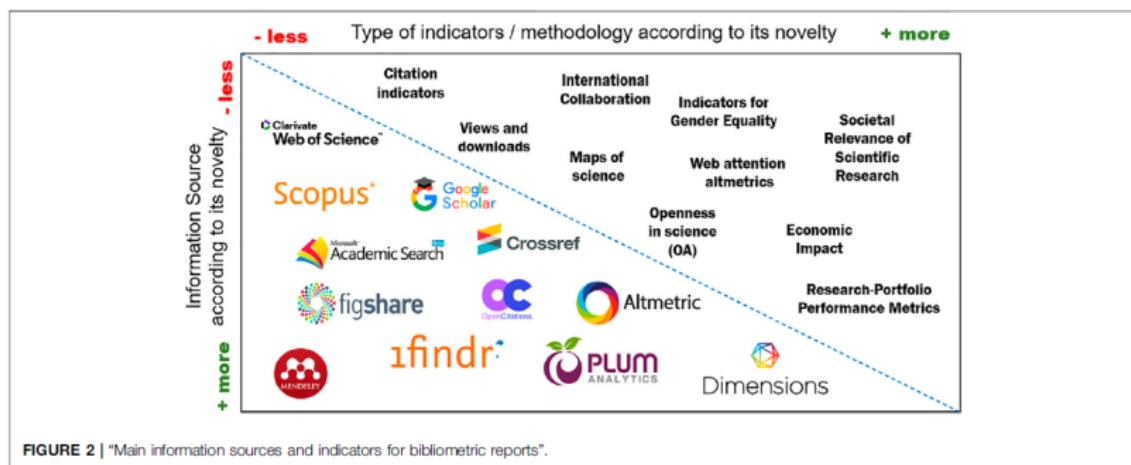
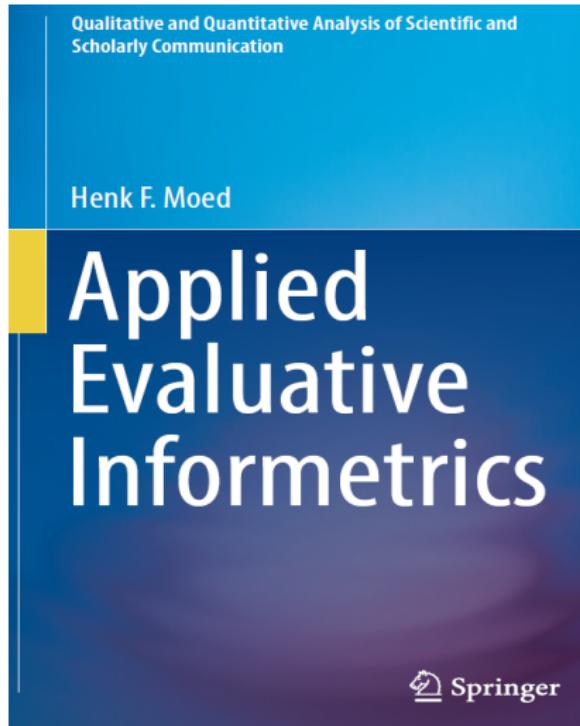


FIGURE 2 | "Main information sources and indicators for bibliometric reports".

Clavijo et al. (2020). Bibliometric Reports for Institutions: Best Practices in a Responsible Metrics Scenario. *Frontiers in Research Metrics and Analytics*.

Scientometric Indicators of Research Impact



- Publication-based Indicators
- Citation-based Indicators
- Journal Metrics
- Patent-based Indicators
- Usage-based Indicators
- Altmetrics
- Webometric Indicators
- Economic Indicators
- Reputation and Esteem-based Indicators
- Indicators of Research Collaboration
- Indicators of Research Infrastructure

Research Questions and Statistical Methods

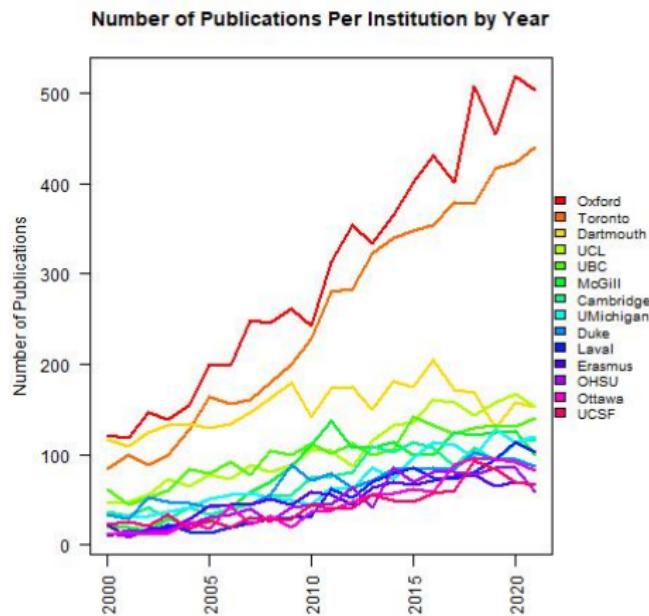
- Project 1: Bibliometric and Altmetric/Webometric Indicators.
 - Count of publications.
 - Count of citations.
 - Count of Twitter/FB posts, Wikipedia citations, media releases, policy references.
 - Stratified counts by time/institution.
- Project 2: Network Scientific Indicators of Research Collaboration.
 - Construction network adjacency matrices.
 - Linear algebraic decompositions for indicators.
 - Counts of collaborations (total, unique, local/national/international).
- Project 3: Characterizing Primary Care Research Themes.
 - Keyword/N-gram mining and frequency counting.
 - Construction of abstract DTM and topic modelling.

Section 3: Scientometric Results

- Bibliometric Indicators of Output, Impact.
- Altmetric Indicators of Social Attention.
- Network Indicators of Research Collaboration.
- Keywords, N-Grams and Topic Models Characterizing Research Themes.

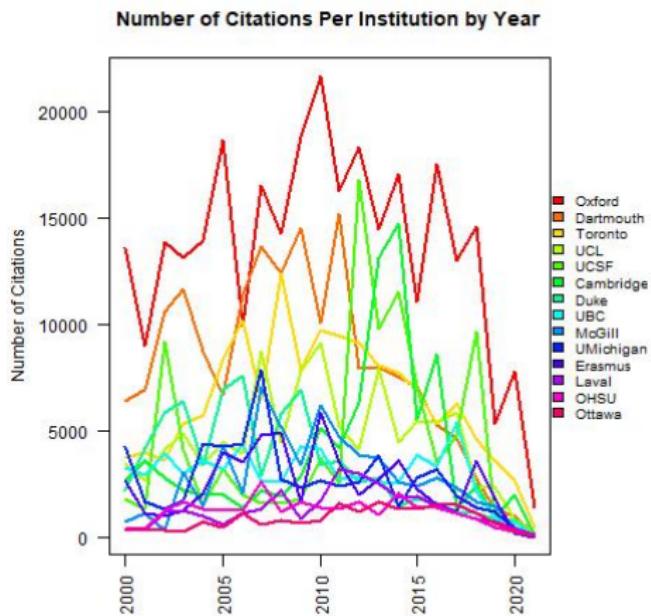
Bibliometric Indicators: Number of Publications

- 14 unique institutions.
- 529 research staff/faculty.
- 41,048 total publications from 2000-2021.
- 32,316 unique publication titles.



Bibliometric Indicators: Number of Citations

- 14 unique institutions.
- 529 research staff/faculty.
- 41,048 total publications from 2000-2021.
- 32,316 unique publication titles.



Bibliometric Indicators: Journal Titles

- 14 unique institutions.
- 529 research staff/faculty.
- 41,048 total publications from 2000-2021.
- 32,316 unique publication titles.

Rank	Top-10 Journal Titles for DFCM Researchers	Top-10 Journal Titles for Canadian Researchers	Top-10 Journal Titles for American Researchers	Top-10 Journal Titles for UK/EU Researchers	Top-10 Journal Titles for AUS/Asian Researchers
1	Canadian Family Physician (N=640)	Canadian Family Physician (N=920)	Journal of the American Board of Family Medicine (N=153)	British Journal of General Practice (N=500)	
2	CMAJ (N=240)	CMAJ (N=377)	Annals of Family Medicine (N=148)	BMJ Open (N=494)	
3	PLoS ONE (N=118)	PLoS ONE (N=239)	Spine (N=128)	BMJ (Online) (N=326)	
4	Journal of Obstetrics and Gynaecology Canada (N=100)	BMJ Open (N=180)	Journal of General Internal Medicine (N=120)	PLoS ONE (N=213)	
5	Canadian Journal of Emergency Medicine (N=97)	Journal of Obstetrics and Gynaecology Canada (N=155)	Family Medicine (N=117)	British Medical Journal (N=183)	
6	Canadian family physician Medecin de famille canadien (N=96)	Canadian Journal of Emergency Medicine (N=153)	American Journal of Preventive Medicine (N=112)	BMJ (N=176)	
7	BMJ Open (N=80)	British Journal of Sports Medicine (N=149)	Health Affairs (N=112)	Cochrane Database of Systematic Reviews (N=163)	
8	Canadian Journal of Public Health (N=70)	Canadian Journal of Public Health (N=139)	Pediatrics (N=98)	The Lancet (N=153)	
9	Academic Medicine (N=55)	BMC Health Services Research (N=137)	Annals of Internal Medicine (N=81)	BMC Public Health (N=145)	
10	BMC Health Services Research (N=55)	Canadian family physician Medecin de famille canadien (N=112)	New England Journal of Medicine (N=79)	Trials (N=136)	

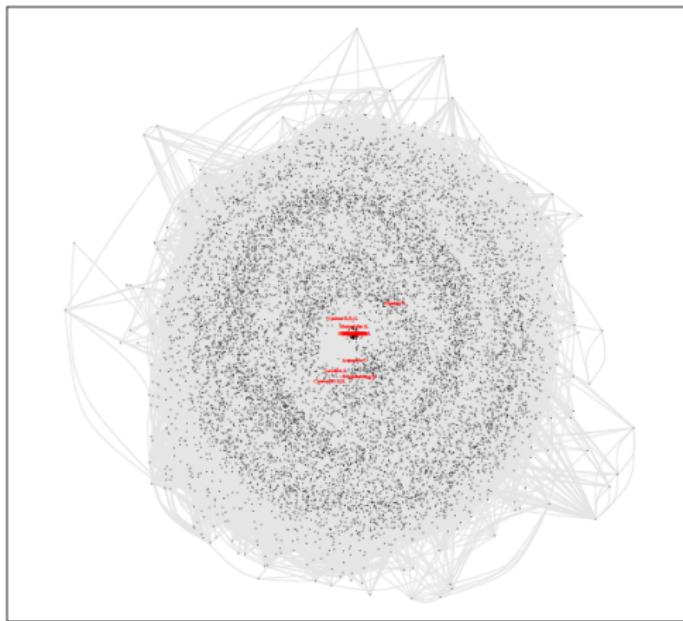
Altmetric Indicators: Social Media, News Media, Web, Policy

- 14 unique institutions.
- 529 research staff/faculty.
- 41,048 total publications from 2000-2021.
- 32,316 unique publication titles.

Institution	Number of Publications	Number of Citations	Number of Twitter Tweets	Number of Media Releases/Briefing	Number of Wikipedia Citations	Number of References in Policy Documents
Oxford	6711	296709	375362	13777	717	1785
Toronto	5621	142470	71567	4499	238	657
Dartmouth	3341	172584	33449	4902	190	911
UCL	2332	98663	43949	3237	97	467
UBC	2264	68084	32981	2234	135	278
McGill	1864	65870	16738	959	76	264
Cambridge	1672	90199	32951	2691	87	508
UMichigan	1556	59586	21672	2421	85	223
Duke	1495	74545	7749	1464	84	402
Laval	1190	32567	18884	332	74	128
OHSU	1132	29486	6378	872	19	175
Erasmus	1107	55497	20815	1213	129	197
Ottawa	1063	19735	9287	619	40	115
UCSF	968	99841	28354	2523	141	353

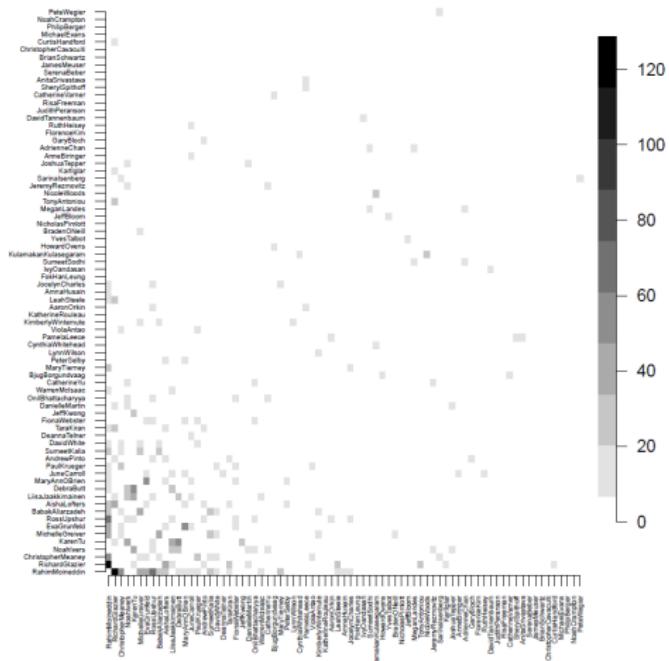
Collaboration Indicators: DFCM Co-Authorship Network

- 123 DFCM researchers.
- 5621 unique research publications (2000-2021).
- 245,268 pair-wise collaborations between co-authors.
- 10,608 unique co-author relationships (unique edges between vertices).
- Can estimate network centrality measures of researcher "importance".



Local/National/International Collaboration Indicators

- 5621 unique publications.
- 1931 publications included only Toronto-based researchers.
- 1371 publication included at least one non-Canadian collaborator.
- DFCM researchers have research collaborations in 92 unique countries
- Most frequent collaborators: USA, UK, Australia, France, Malawi.



Primary Care Research Themes: Keywords/N-Grams

- Identification of clinical themes.
- Identification of methodological themes.

Rank	Frequently Occurring Keywords	Frequently Occurring Title Bigrams	Frequently Occurring Title Trigrams	Frequently Occurring Abstract Bigrams	Frequently Occurring Abstract Trigrams
1	primary care (N=1140)	primary care (N=2452)	randomised controlled trial (N=466)	primary care (N=8799)	main outcome measures (N=929)
2	primary health care (N=523)	systematic review (N=1409)	randomized controlled trial (N=453)	health care (N=4524)	licensee biomed central (N=836)
3	qualitative research (N=446)	controlled trial (N=973)	prospective cohort study (N=151)	physical activity (N=3108)	randomized controlled trial (N=665)
4	systematic review (N=436)	cohort study (N=834)	retrospective cohort study (N=140)	confidence interval (N=2868)	randomised controlled trial (N=578)
5	epidemiology (N=403)	health care (N=710)	populationbased cohort study (N=126)	risk factors (N=2292)	randomized controlled trials (N=541)
6	physical activity (N=383)	randomised controlled (N=560)	coronary heart disease (N=112)	blood pressure (N=2141)	primary care physicians (N=508)
7	obesity (N=377)	randomized controlled (N=552)	primary health care (N=104)	mental health (N=2093)	primary care practices (N=436)
8	general practice (N=332)	qualitative study (N=549)	primary care physicians (N=94)	breast cancer (N=1922)	randomised controlled trials (N=420)
9	depression (N=330)	physical activity (N=529)	colorectal cancer screening (N=87)	outcome measures (N=1855)	adjusted odds ratio (N=418)
10	dementia (N=295)	breast cancer (N=406)	mixed methods study (N=86)	public health (N=1824)	coronary heart disease (N=395)
11	public health (N=283)	blood pressure (N=344)	chronic obstructive pulmonary (N=85)	odds ratio (N=1702)	retrospective cohort study (N=388)
12	hiv (N=262)	smoking cessation (N=343)	obstructive pulmonary disease (N=84)	logistic regression (N=1674)	prospective cohort study (N=347)
13	pregnancy (N=260)	mental health (N=324)	randomized clinical trial (N=83)	cohort study (N=1595)	health care providers (N=336)
14	hypertension (N=254)	family medicine (N=315)	chronic kidney disease (N=77)	primary outcome (N=1518)	systolic blood pressure (N=336)
15	screening (N=240)	study protocol (N=306)	primary care patients (N=65)	systematic review (N=1505)	national health service (N=326)
16	canada (N=239)	risk factors (N=286)	severe mental illness (N=65)	controlled trials (N=1478)	primary care providers (N=311)
17	children (N=238)	mixed methods (N=270)	primary care practices (N=60)	controlled trial (N=1354)	health care professionals (N=306)
18	diabetes (N=236)	cancer screening (N=267)	respiratory tract infections (N=60)	family physicians (N=1333)	primary health care (N=298)
19	cancer (N=234)	cardiovascular disease (N=241)	outofhospital cardiac arrest (N=59)	randomized controlled (N=1316)	controlled trials (N=285)
20	palliative care (N=225)	emergency department (N=239)	electronic health records (N=58)	smoking cessation (N=1284)	oxford university press (N=285)
21	exercise (N=219)	ontario canada (N=222)	spinal cord injury (N=58)	main outcome (N=1247)	logistic regression models (N=269)
22	mental health (N=210)	colorectal cancer (N=220)	british columbia canada (N=57)	increased risk (N=1245)	multivariable logistic regression (N=254)
23	diagnosis (N=202)	public health (N=220)	cluster randomised controlled (N=57)	usual care (N=1175)	obstructive pulmonary disease (N=253)
24	smoking (N=202)	heart failure (N=217)	clinical practice guidelines (N=50)	clinical practice (N=1123)	chronic obstructive pulmonary (N=250)
25	smoking cessation (N=199)	crosssectional study (N=207)	randomized controlled trials (N=49)	randomised controlled (N=1076)	cardiovascular disease cost (N=230)

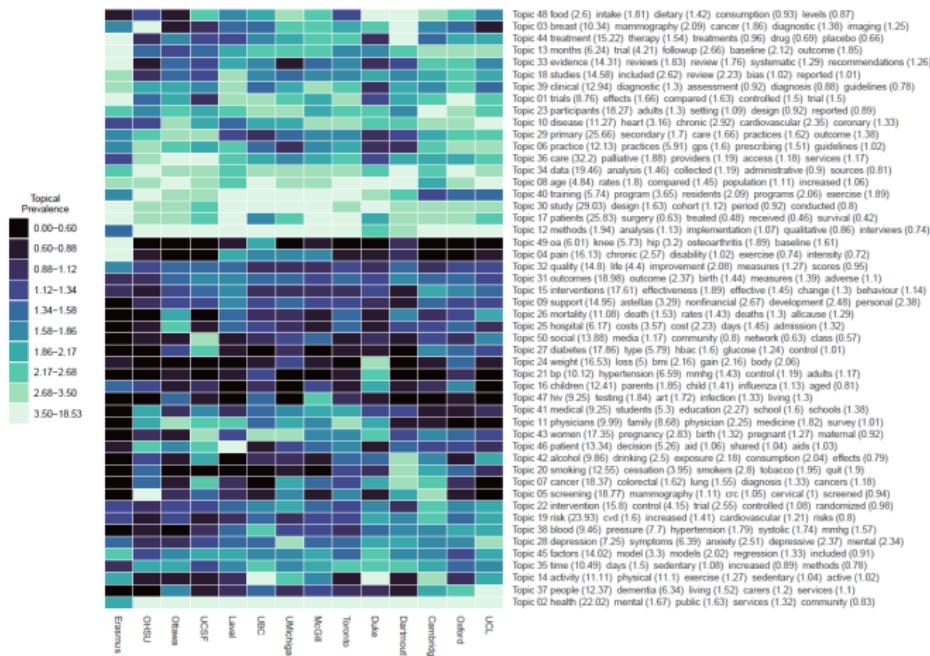
Primary Care Research Themes: Keywords/N-Grams

- Identification of niche/emergent themes.
- Identification of under-researched themes.

Query	Bigram/Trigram Occurrence in Publication Abstracts	Publication Keyword Occurrences
1	quality improvement (N=580)	quality improvement (N=168)
2	medical education (N=674)	medical education (N=98)
3	emergency medicine (N=168)	emergency medicine (N=65)
4	palliative care (N=1059)	palliative care (N=225)
5	sports medicine (N=61)	sports medicine (N=7)
6	global health (N=227)	global health (N=42)
7	equity diversity (N=1)	equity (N=39)
8	indigenous health (N=32)	indigenous health (N=17)
9	social determinants (N=204)	social determinants of health (N=90)
10	clinical informatics (N=5)	clinical informatics (N=6)
11	medical informatics (N=30)	medical informatics (N=66)
12	electronic health record (N=212)	electronic health record (N=28)
13	electronic medical record (N=128)	electronic medical record (N=8)
14	artificial intelligence (N=29)	artificial intelligence (N=20)
15	machine learning (N=49)	machine learning (N=33)
16	deep learning (N=13)	deep learning (N=7)
17	causal inference (N=16)	causal inference (N=8)

Primary Care Research Themes: Topic Model of Research Abstracts

- Unsupervised characterization of latent themes/topics.
 - Topics represented as clusters of semantically correlated words/tokens.
 - Topical prevalence estimates vary by institution.



Section 4: Interpretation and Discussion of Scientometric Findings

- Interpretation of findings.
- Feasibility and Strengths of Methodology.
- Limitations of the Methodology.
- DFCM/UT Applications Beyond Environmental Scan.
- Conclusions.

Interpretation of Scientometric Findings

- Scientometrics indicators characterized aspects of the DFCM research program.
 - DFCM researchers (N=123) produced 5621 unique publications (2nd rank).
 - DFCM publications cited 142,470 times (3rd rank).
 - DFCM could improve re: social/policy impact indicators?
 - DFCM researchers make 10,608 unique collaborations with peers (92 countries).
 - DFCM research publish across wide range of clinical/methodological topics.

Does the Scientometric Methodology Answer Project Questions?...No

- Goal was to identify "factors" associated with "high impact" research programs.
- We have proposed measuring "impact" using a basket of scientometric indicators.
- We need meta-data on outputs/authors/institutions to identify correlates of "impact".

BMJ

RESEARCH

Research output on primary care in Australia, Canada, Germany, the Netherlands, the United Kingdom, and the United States: bibliometric analysis

Julie Glanville, project director;¹ Tony Kendrick, head of primary care;^{2,4} Rosalind McNally, outreach librarian;³ John Campbell, head of primary care;⁴ FD Richard Hobbs, head of primary care;^{5,6}

Open Access

Research

BMJ Open Evolution of primary care databases in UK: a scientometric analysis of research output

Paraskevas Vezryidis, Stephen Timmons

ORIGINAL
ARTICLES



The Scholarly Output of Faculty in Family Medicine Departments

Winston Liaw, MD, MPH; Stephen Pettersson, PhD; Vivian Jiang, MD; Andrew Bazemore, MD, MPH;
James Pescos; Daniel McCorry, MD; Bernard Ewigman, MD, MSPH

Glanville et al. (2010). Research output on primary care in Australia, Canada, Germany, the Netherlands, the United Kingdom, and the United States: bibliometric analysis. *BMJ*

Liaw et al. (2019). Scholarly output of faculty in Fam Med departments. *Family Medicine*.

Vezryidis et al. (2016). Evolution primary care DB in UK: scientometric analysis. *BMJ Open*.

Feasibility and Strengths of Methodology.

- Passive mining of scientometric indicators possible at organizational level.
- Transportable/adaptable methodology relying on open source tools (R/Python).
- Structured/reliable scientometric data available via API (for UT subscribers).
- Computational methodology is transparent, auditable and reproducible.
- Computational methodology is scalable/cost-effective.
- Access to raw data permits bespoke analysis.
- Reflexive methodology permits opportunities for improvement to align with values.

Limitations of the Methodology

- Metrics present single lens "high impact" research, balance QL methods and experts needed.
- Determination of what/who counts?
 - What primary care research institutions included?
 - Who counts as a "researcher" on institutional URL?
- Decisions regarding indicator data sources.
 - Bibliometric data: Scopus/Elsevier, WoS (Clarivate), PubMed, Google Scholar, etc.
 - Altmetric data: Altmetrics.com, Plum Analytics, Dimensions API, etc.
 - Journal Data: JCR, Scimago SJR, Eigenfactor, etc.
- Decisions regarding indicators themselves.
- Choice of denominator (Number ppl, number ppl-years, number FTE, etc.).
- Time biases (different time under observation).

Applications for Methodology at DFCM/UT

- DFCM environmental scan and strategic plan.
- Annual DFCM Academic Activity Survey.
- Annual DFCM research program funded investigator review.
- DFCM junior/senior promotions committee (research track).
- Bench-marking academic departments in Temerty Medicine.
- Bench-marking academic departments at UT.
- Complement indicators in Discover Research, Web CV, etc.

Conclusions: Characterizing the Impact of the DFCM Research Program

- Computational methodology for impact evaluation is passive, scalable, cost-effective.
- Characterize DFCM research impact and assess within/between differences in metrics.
- YoY DFCM improves in metrics (productivity growth vs. organization growth?).
- DFCM is leader in generation of research outputs, citations, social attention, collaboration.
- DFCM produces primary care research across diverse clinical topical domains.

Future Work & Potential Opportunities for Improvement?

- (Mining) additional indicators (e.g. grants, infrastructure, students, teaching, etc.).
- Reflection on other data sources and use at DFCM (AAS, surveys, reviews, etc.).
- Compare bottom-up vs. top-down methodology (institutional IDs: [GRID](#), [ROR](#), etc.)
- Embedded KTE, meaningful integration comms/media for improved research impact?
- Collaboration with other institutions (organization structure) to identify correlates impact?
- ML/DL approaches to identify/predict "impact"?

Questions for Audience

- Have we identified the correct metrics for impact assessment? What is missing?
- How measure long-term impact (policy, social, clinical, etc.)?
- How measure input/process measures impact (e.g. grants, trainees, infrastructure, etc.)?
- Is secondary use public data ethical for bench-marking publications/authors/institutions?
- How can/should these metrics be used at DFCM/UT?

Thank You for Listening...Any Questions??