

# Publication rate of 309 MMed dissertations submitted between 1996 and 2017: Can registrars fulfil HPCSA Form 57 MED amendments?

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**Background.** The recent amendment to the Health Professions Council of South Africa (HPCSA) Form 57 MED allows specialist registration on publication of the compulsory MMed research assignment in an accredited journal. No data exist on the conversion rate of MMed dissertations to publication.

**Objectives.** To establish conversion rates of MMed dissertations to accredited publications. Associated variables arising from the publishing exercise were also investigated.

**Methods.** A total of 309 MMed dissertations, submitted between 1996 and 2017, were downloaded from the public domain. Each dissertation was recorded as to format, submission year, awarding university and clinical discipline. Electronic searches determined publication outcomes. Journal title, accreditation status, year of publication, registrar position on author ranking and publication type were extracted for each output. Descriptive analysis was undertaken and, where appropriate, Fisher's exact test at  $p > 0.05$  was used to establish statistical significance.

**Results.** A total of 116 dissertations were published at an overall conversion rate of 37.5%, culminating in 136 outputs. Publication-ready dissertations had a significantly higher conversion rate (60.3%) than monographs (30.5%) ( $p > 0.0001$ ). All but 6 of the 80 publishing journals were accredited. *SAMJ* was the journal of choice for 13% of papers. The registrar was the first author in the majority of publications. In the case of monographs, 66% were published after dissertation submission compared with 50% of publication-ready formats.

**Conclusions.** Conversion of the South African MMed dissertation into a journal-accredited scientific article was achieved in 60.3% of publication-ready-format submissions, suggesting that the HPCSA amendment facilitating specialist registration is attainable. Retrospective reviews of dissertations provide valuable insights to improve understanding of the contentious issue of the registrar research requirement that permits specialist registration.

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Currently, the South African (SA) MMed dissertation may be submitted for examination in two broad formats: the traditional monograph of front matter, introduction, methods, results, discussion and conclusions followed by appendices. The publication-ready format includes the original research proposal, extended literature review and research written up according to the instructions for authors of a named journal, or the published article. The publication-ready format came into being when the Health Professions Council of South Africa (HPCSA) in 2011 made a research component mandatory for specialist registration. The HPCSA recently took a decision to clarify its position on what constitutes a completed research component, as follows: Form 57 MED: 'Minimum requirements for research component' (<https://www.hpcsa.co.za/Registrations/ApplicationForms>). Previously, Form 57 MED (KN 2015/12/22) read: '... a research component that complies with the HPCSA requirements.' The current Form 57 MED (updated on 21 February 2018) reads: 'Minimum requirements for research component: Basic research methodology component; relevant protocol finalized; discipline specific research assignment submitted for external assessment with pass as outcome and/or published in accredited journal', thereby endorsing publication as an outcome. For completeness, it must be mentioned that some faculties of health sciences have a third MMed option, which is awarded on the basis of an unexamined published journal article. Such publications are not recorded as electronic theses and dissertations (ETDs) in library repositories and do not form part of the current study.

Publishing unleashes a virtuous cycle of benefits: conversion of the research dissertation to a publication makes it more accessible and beneficent within its scientific context,<sup>[1]</sup> scientific activity and rankings of universities are, in part, measured by publications, journal metrics and citation rates,<sup>[2]</sup> while others highlight the grants and incentives available on publication.<sup>[3,4]</sup> The last is particularly relevant in view of the Department of Higher Education and Training (DHET) state subsidy for accredited publications, which forms a substantial part of SA university income.<sup>[5]</sup> Indeed, a peer-reviewed scientific research journal has recently been established to provide a forum for scientific research undertaken at a local school of clinical medicine (<https://journals.co.za/content/journal/wjcm>).

As the HPCSA directive has now been in force for 9 years, it is timeous to examine whether the last proviso of Form 57 MED, '... discipline specific research assignment ... published in accredited journal', is achievable. Therefore, past MMed dissertations were examined to establish publication conversion rates and whether these were published in accredited journals. Furthermore, associated variables arising from the publishing exercise were investigated to add to the knowledge pool on local registrar research-component outcomes.

## Methods

This is a retrospective record review of 309 SA MMed dissertations downloaded during November 2017 - June 2018 from

local ([www.netd.ac.za](http://www.netd.ac.za)) and global ([www.ndltd.org](http://www.ndltd.org)) ETD sites and library repositories of all 8 SA specialist training universities. The methods have been previously described<sup>[6]</sup> and for the current study the following variables were recorded from each dissertation: format, year of submission, graduating university and clinical discipline. Dissertations submitted after 2017 were excluded to allow for publication lag time.

### Search strategy for publications

From March to June 2019 searches were conducted using PubMed (<http://www.pubmed.gov>), Google Scholar (<http://scholar.google.com>) and Google (<http://www.google.com>). Keywords using the name of the registrar, title of the dissertation and graduating university served as search terms. The resulting retrieved items were compared with the dissertation content. If there was a complete or partial match, the item was downloaded (publication or abstract) for further scrutiny. A dissertation was considered published if there was congruence between the author(s), title and dissertation content and the journal article. In cases where the dissertation seemed unpublished, additional searches using the functions 'Related articles' and 'Cited by' were used to fully explore the web. In addition, social media sites (ResearchGate ([www.researchgate.net](http://www.researchgate.net)), LinkedIn ([www.linkedin.com](http://www.linkedin.com))), the journal intended for publication (as stated in publication-ready dissertations) and supervisor name(s) were accessed until these avenues were exhausted. Each output was recorded for journal of publication, journal locale, journal accreditation, registrar position in publication authorship list and year of publication.

### Confirmation of journal accreditation

DHET-accredited journal lists for publications in 2018 ([www.dhet.gov.za/SitePages/UniversityEducation.aspx](http://www.dhet.gov.za/SitePages/UniversityEducation.aspx)) were consulted to verify the journal status of each MMed publication.

### Data analysis

Data were entered into an Excel 2016 (Microsoft, USA) spreadsheet and analysed descriptively. Comparative analyses were undertaken using a Fisher's exact test ([www.graphpad.com](http://www.graphpad.com)), with statistical significance set at  $p < 0.05$ .

### Ethical approval

All dissertations are within the public domain, and ethical approval for the study was obtained from the Postgraduate Education, Training, Research and Ethics Unit: Human Research Committee, Faculty of Health Sciences, Walter Sisulu University (ref. no. 032/2019).

### Results

During the study, it became evident that there were differences between the monograph and publication-ready formats. The sample was subdivided along format lines, where necessary, to gain further insight regarding MMed outputs (Fig. 1). The year of submission for sampled MMed dissertations was between 1996 and 2017, with the newer publication-ready format first appearing in 2010. Publications span 1998 - 2019 and it is likely that some dissertation outputs are still in the publication pipeline. Historically, publications mirrored MMed submission, with a rise in numbers from 2009 onwards (Fig. 2). Of the 309 dissertations, 116 were published, giving an overall 37.5% conversion rate of dissertation to publication. When examined by dissertation format, 30.5% of monographs were published compared with 60.3% of publication-ready formats. This difference in conversion rate was highly significant ( $p > 0.0001$ ). Thirteen registrars published >1 output from their research, resulting

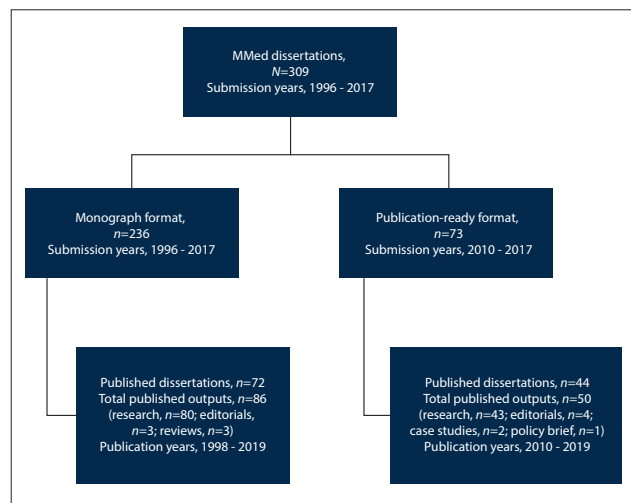


Fig. 1. Breakdown of the 309 MMed dissertations studied.

in 136 outputs, broken down by publication type (Fig. 1). Of interest was the policy brief on partner violence prepared for a provincial Department of Health and Social Development.

Table 1 shows that the University of Cape Town (UCT) dominated the sample and outputs, with a dissertation conversion rate of 53%. Although Walter Sisulu University (WSU) had a better rate (57%), this comes from a low base and 1 registrar's MMed producing 4 publications. Three colleges, the College of Otorhinolaryngologists (COOrl), College of Paediatricians (CPaed) and College of Orthopaedic Surgeons (COOrth), had the best conversion rates of 71%, 61% and 60%, respectively. However, COOrl publications are also from a very low base – this finding should be viewed with caution. More detailed data examination revealed further interesting findings. All 6 Sefako Makgatho Health Sciences University (SMU) publications came from the College of Family Physicians (CFP), illustrating the publication strength of that clinical department. Finally, publication-ready-format dissertations were absent in 3 universities: SMU, University of Pretoria (UP) and WSU.

Publications ( $n=135$ ) were published in 80 journals, almost equally divided between those of local and international origin (Table 2). SAMJ accounted for 17 publications, while 10 local journals published >1 paper (Table 3). All but 6 journals, with a single publication each, were accredited by DHET (92.5%).

The registrar was the first author in the majority of publications in both dissertation formats. Notably, the registrar was absent from the author list in 2 cases and was the sole author in 5 publications (Table 4). The total number of authors per article was generally  $\leq 4$ , although multiple authorships (5 - 10) were encountered. Co-authors mostly comprised supervisors and co-workers (as could be surmised from the dissertation title page and acknowledgement section).

When investigating publication year relative to dissertation submission year, monographs had the longest time to publication, with an interval ranging from 7 years presubmission to 9 years after submission, with 34% of papers published prior to and including the year of submission (Fig. 3). By contrast, publication-ready-format publications extended from 4 years presubmission to 3 years after submission, with 50% appearing before and including the year of submission. However, this difference was not significant ( $p=0.07$ ).

### Discussion

The primary finding of this study was that 60.3% of publication-ready dissertations were converted to publications, largely in accredited journals, thereby suggesting that the Form 57 MED proviso, viz. '...

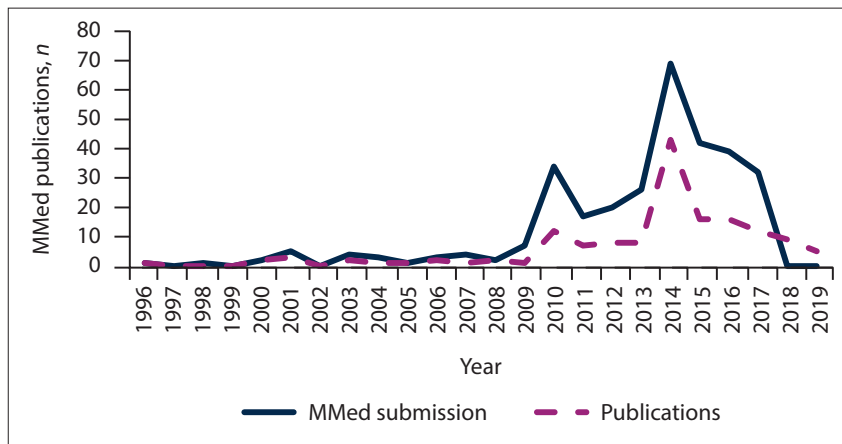


Fig. 2. MMed dissertation submissions and arising publications (n) tracked over time. It can be seen that publications formed part of dissertation outcomes, even in the early years.

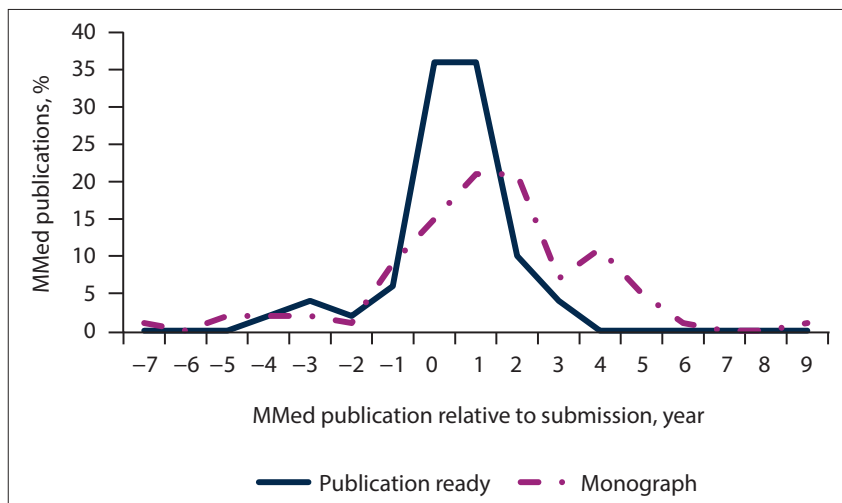


Fig. 3. Publications relative to MMed submission year broken down by submission format (%). Minus numbers show years prior to dissertation submission, indicated by a zero. Positive numbers denote years after submission.

discipline specific research assignment ... published in accredited journal, is readily achievable via this dissertation format. A further unexpected finding was that 50% of publication-ready dissertation research was published prior to or during the dissertation submission year. This is unusual, given the prolonged publication lag times. Finally, this study is the first to reveal SA MMed dissertation publication rates since 1996. All the abovementioned results have important corollaries in the wider arena, beyond that of future Form 57 MED compliance, which merit further discussion.

Historically, publication of MMed research is not a new phenomenon. It occurred well before the advent of the HPCSA decree of 2011, dispelling the notion that current registrars fulfilling research requirements via publication is a recent development.<sup>[7]</sup> The overall SA MMed publication rate compares favourably with international conversion

rates, where 3 references from the extensive literature on the topic should suffice. Master's health sciences-related research in low- and middle-income countries have a wide publication conversion rate of 6 - 41%.<sup>[8]</sup> In the Global North, 35.3% of French radiology resident research is published,<sup>[9]</sup> as is 15.7% of Japanese paediatric residents' research.<sup>[10]</sup> This suggests that, overall, SA registrar research publication rates are similar to those found elsewhere, with publication-ready dissertation conversion rates well above reported findings.

Post-submission time to publication of journal articles is highly variable, with a wide range of 1 - 7 years for Turkish general surgeon residents<sup>[11]</sup> and 16 - 21 months for Thai paediatric residents.<sup>[12]</sup> Comparisons are difficult, because of novel reporting in the current study of *presubmission* publication, which does not feature in the perused literature. Presubmission publication is advantageous: registrars, once their training

is concluded, have little interest in devoting time to writing an article and tackling ensuing journal submission procedures. This complicates and delays publication,<sup>[13]</sup> and it is often left to overburdened supervisors to finalise the writing-to-publication procedure (or not). It is therefore desirable to have the entire publication process finalised before MMed dissertation submission so that the registrar is involved throughout.

Research articles formed the bulk of published outputs, with a sprinkling of editorials, case studies and reviews. Of particular note was the policy brief arising from a dissertation on family violence. Obuku *et al.*<sup>[14]</sup> have noted the poor use of postgraduate research to inform policy or practice guidelines and suggest that this is an area deserving of further enquiry. Given the variety of disciplines and research topics among the dissertations sampled, it comes as no surprise that 80 journals were involved in publishing the 135 research articles. The way in which journals are rated or accredited varies among countries and makes comparisons difficult. Our finding of 92.5% accredited-journal usage is not atypical, where 3 studies report 100% publication in Medline-indexed,<sup>[9]</sup> PubMed-indexed<sup>[2]</sup> or peer-reviewed journals.<sup>[11]</sup> By way of contrast, others report lows of 18%<sup>[15]</sup> and 22%<sup>[11]</sup> in indexed and Science Citation Index (SCI) journals, respectively. Ultimately, local journals were responsible for just over half of all publications, higher than the national SA publication average of 33% for such journals.<sup>[5]</sup> SAMJ published the most research papers (13%), endorsing its status as an SA 'mega-journal'.<sup>[5]</sup>

Author ranking is ethically controversial; the orthodoxy is that the individual who conducts the study and has given the greatest input should be credited as the first author. Unfortunately, power imbalances may disrupt this order.<sup>[8]</sup> Ethical conduct appears to be upheld in SA, where the registrar undertaking the research was the first author in 92% of publication-ready dissertation academic papers and 86% of monograph publications. Elsewhere, figures of 23 - 99%,<sup>[8]</sup> 13%<sup>[16]</sup> and 78.9%<sup>[1]</sup> indicate variable practices when assigning first authorship to the registrar, trainee or resident.

### Study limitations

Not all SA specialty-training universities upload MMed dissertations onto repositories and ETD databases, and most universities experience delayed uploading, which limits dissertation availability. Other researchers have recounted similar obstacles

Table 1. Breakdown of MMed dissertations by university and college\*

	MMed dissertations, <i>n</i>	Published monograph format, <i>n</i>	Published publication-ready format, <i>n</i>	Published output, <i>n</i>	Conversion rate of dissertation to publication, %
University					
UCT	91	13	35	56	53
Wits	69	17	3	22	29
SU	45	13	2	15	33
UKZN	43	15	3	24	42
SMU†	30	6	-	6	20
UP	13	3	-	3	23
UFS	11	1	1	2	18
WSU	7	4	-	8	57
College‡					
COG	58	15	-	18	26
CPHM	36	7	6	16	36
CFP	36	12	1	16	36
CA	29	4	4	11	28
CPaed	23	10	4	17	61
CS	17	6	2	10	47
CP	15	-	2	2	13
COrth	15	2	7	11	60
CRO	16	4	2	6	38
CPath	12	2	3	6	42
CPsych	11	-	1	1	9
COPhth	7	2	1	3	43
COrl	7	1	4	5	71
CNeurosurg	6	1	-	1	17
CPlast	4	1	3	4	100
CForPath	3	-	-	0	0
CEM	3	-	2	2	67
CDerm	2	-	-	0	0
CNeurol	2	-	1	2	50
CNP	2	-	-	0	0
CPS	2	2	-	3	100
CMG	1	-	1	1	100
CR	1	-	-	0	0
CU	1	1	-	1	100

UCT = University of Cape Town; Wits = University of the Witwatersrand; SU = Stellenbosch University; UKZN = University of KwaZulu-Natal; SMU = Sefako Makgatho Health Sciences University; UP = University of Pretoria; UFS = University of the Free State; WSU = Walter Sisulu University; COG = College of Obstetricians and Gynaecologists; CPHM = College of Public Health Medicine; CFP = College of Family Physicians; CA = College of Anaesthetists; CPaed = College of Paediatricians; CS = College of Surgeons; CP = College of Physicians; COrth = College of Orthopaedic Surgeons; CRO = College of Radiation Oncologists; CPath = College of Pathologists; CPsych = College of Psychiatrists; COPhth = College of Ophthalmologists; COrl = College of Otorhinolaryngologists; CNeurosurg = College of Neurosurgeons; CPlast = College of Plastic Surgeons; CForPath = College of Forensic Pathologists; CEM = College of Emergency Medicine; CDerm = College of Dermatologists; CNeurol = College of Neurologists; CNP = College of Nuclear Physicians; CPS = College of Paediatric Surgeons; CMG = College of Medical Geneticists; CR = College of Radiologists; CU = College of Urologists.

\*Of the total of 309 dissertations, 236 were monographs and 73 were in publication-ready format. In certain cases, the total published outputs are greater than the sum of published dissertations (monograph or publication-ready format), as several registrars had >1 output per dissertation.

†Due to mergers, the numbers reported here are the totals obtained from adding MMed dissertations appearing in MEDUNSA, University of Limpopo and SMU repositories.

‡www.cmsa.co.za

Table 2. Local v. international journals for 135 publications emanating from 72 monographs and 44 publication-ready dissertations\*

	Published monographs, <i>n</i>	Published publication ready, <i>n</i>	Publications, <i>n</i> (%)
Local	41	29	70 (52)
Overseas	43	20	63 (47)
Unknown	2	-	2 (1)

\*Thirteen candidates published >1 article. Total publications: *n*=135, as 1 output was a policy brief.

to reviewing trainee/resident dissertations for study.<sup>[2,9]</sup> Obuku *et al.*<sup>[14]</sup> went one step further and calculated a median 3.8-year uploading delay to a Ugandan university repository. In keeping with these

authors, it is felt that such delays and omissions have not materially affected sampling strategy or detrimentally influenced current study findings.

**Table 3. Journals in which MMed dissertations were published**

Journal*	Local/ international	Publications, n
South African Medical Journal	L	17
South African Orthopaedic Journal	L	7
Southern African Journal of Anaesthesia and Analgesia	L	7
South African Journal of Surgery	L	7
African Journal of Primary Health Care and Family Medicine	L	7
Cardiovascular Journal of Africa	L	4
International Journal of Gynecology and Obstetrics	I	4
South African Journal of Obstetrics and Gynaecology	L	4
South African Journal of Child Health	L	4
African Journal of AIDS Research	L	2
PLoS ONE	I	2
South African Family Practice	L	2
Pediatric Infectious Disease Journal	I	2
Other journals (single publication)	L/I	66

L = local; I = international.

\*Thirteen journals were most frequently used (≥2) (n=80/135 publications). Total publications: n=135, as 1 output was a policy brief.

The number of journal articles retrieved probably under-report the dissertation conversion rate, firstly owing to protracted publication processes, and secondly, the 23-year span of this investigation possibly hampered the finding of earlier records. Similar problems have been described when extracting publications for a 1996 - 2010 review.<sup>[14]</sup> Therefore, publishing lag time and loss of dated records must be acknowledged when evaluating the current results. Finally, the contribution of unexamined journal publications (the third MMed option) has not formed part of this study. While this omission will contribute to an underestimation of overall MMed *publication outputs*, the *conversion rate* of dissertations to publications in this option cannot be established in the absence of journal rejection data, crucial to calculating conversion rates.

### Conclusions

Conversion of the SA MMed dissertation into a scientific-accredited journal article as per Form 57 MED has been achieved in 60.3% of publication-ready-format submissions, suggesting that this format would be the preferred option for future MMed research for specialist registration.

Production of research is a core business of universities globally. Apart from the production and dissemination of knowledge, publication is deemed as making the research ‘worthy’ and crucial in acquiring DHET research subsidies. This study highlights the handsome (and growing) contribution the MMed degree has made in both these aspects, more so since implementation of the HPCSA directive for specialist registration. However, there is a danger in using blanket statistics, such as provided in this article to remediate perceived research shortfalls, as these tend to obscure subtle nuances that motivate and foster MMed-based research.

Of interest are the minor findings in this study: the single WSU registrar who was responsible for 4 publications; the clinical department champion who accounted for the entire SMU output of 6 publications; and the 5 publications where the registrar was the sole author. The lesson here is that medical research is multifarious and has drivers unique to each discipline and department. A comprehensive understanding of the abovementioned instances is required to appreciate the dynamics accounting for the research success of registrars and the research environment within which this occurs. Our challenge lies in finding ways to best utilise the resources at hand to sustain and increase the publication of MMed dissertations. Further research at university, faculty and clinical

**Table 4. Registrar author ranking and listed authors (n) for the 136 outputs emanating from 72 monographs and 44 publication-ready dissertations**

	Publication ready, n*	Monograph, n*
Registrar position in author list		
Registrar not listed	0	2
1st author, n (%)	46 (92)	74 (86)
2nd author	3	7
3rd author	1	3
Authors listed		
1	0	5
2	12	28
3	16	25
4	7	16
5	5	3
6	3	3
7	5	3
8	-	1
9	1	1
10	-	1

\*Unless otherwise specified.

discipline level is merited to identify the drivers that fashion, form and mentor successful research environments.

It seems that retrospective reviews, such as this article, are admirably suited as publishable registrar research topics to examine issues on research productivity, dissertation quality, education outcomes and favoured research fields. Such inquiries could provide valuable insights as to the way forward to improve understanding of the contentious issue of the research requirement for registrars, which permits specialist registration.

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1. Yüksel M, İpekçi T, Tunçkiran A. Publication patterns and citation analysis of urology dissertations written at medical faculties from Turkey between 2008 – 2011: A cross sectional study. *Turk J Urol* 2018;44(4):341-345. <https://doi.org/10.5152/tud.2017.32042>
2. Koca K, Ekinci S, Akpancar S, Gemci MH, Erşen Ö, Akyıldız F. An analysis of orthopaedic theses in Turkey: Evidence levels and publication rates. *Acta Orthop Traumatol Turcica* 2016;50(5):562-566. <https://doi.org/10.1016/j.aott.2016.03.001>
3. Sharma JG. Journal articles based on the dissertations submitted in oncology discipline: A comparative study of India and China. *Ann Libr Inform Studies* 2018;65(3):160-169.
4. Abramson EL, Naifeh MM, Stevenson MD, et al. Scholarly activity training during residency: Are we hitting the mark? A national assessment of pediatric residents. *Acad Pediatr* 2018;18(5):542-549. <https://doi.org/10.1016/j.acap.2018.02.002>
5. Academy of Science of South Africa. Twelve years later: Second ASSAf report on research publishing in and from South Africa, 2018. Pretoria: ASSAf, 2019.
6. Grossman ES. How long does it take a registrar to complete the compulsory research project enabling specialist registration? *S Afr Med J* 2019;109(4):254-258. <https://doi.org/10.7196/SAMJ.2019.v109i4.13377>
7. Rodseth R, Wise R, Bishop D. Polluting the well. *South Afr J Anaesth Analg* 2017;23(6):5.
8. Obuku EA, Lavis JN, Kinengyere A, et al. A systematic review on academic research productivity of postgraduate students in low- and middle-income countries. *Health Res Policy Syst* 2018;16(1):1-8. <https://doi.org/10.1186/s12961-018-0360-7>
9. Chassagnon G, Dangouloff-Ros V, Vilgrain V, Ronot M. Academic productivity of French radiology residents: Where do we stand? *Diagn Interv Imaging* 2016;97(2):211-218. <https://doi.org/10.1016/j.diii.2015.08.001>
10. Ishiguro A, Nomura O, Michihata N, et al. Research during pediatric residency training: A nationwide study in Japan. *Japan Med Ass J* 2019;2(1):1-7. <https://doi.org/10.31662/jmaj.2018-0007>
11. Mayir B, Bilecik T, Çakır T, et al. Analysis of the publishing rate and the number of citations of general surgery dissertations. *Turk J Surg* 2017;33(1):33-36. <https://doi.org/10.5152/UCD.2016.3190>
12. Jaruratanasirikul S, Khotchasing W. Publication of pediatric residency research theses from Prince of Songkla University, Hat Yai, Thailand. *Asian Biomed* 2015;9(2):231-235. <https://doi.org/10.5372/1905-7415.0902.392>
13. Sansone RA, Wiederman MW, Sawyer RJ. Effective research strategies for trainees in internal medicine residency programmes. *Prim Care Companion CNS Disord* 2015;17(1):1-8. <https://doi.org/10.4088/PCC.14r01712>
14. Obuku EA, Lavis JN, Kinengyere A, et al. Academic research productivity of postgraduate students at Makerere University College of Health Sciences, Uganda, from 1996 to 2010: A retrospective review. *Health Res Policy Syst* 2017;15(1):1-10. <https://doi.org/10.1186/s12961-017-0194-8>
15. Arriola-Quiroz I, Curioso WH, Cruz-Encarnacion M, Gayoso O. Characteristics and publication patterns of theses from a Peruvian medical school. *Health Inform Libr J* 2010;27(2):148-154. <https://doi.org/10.1111/j.1471-1842.2010.00878.x>
16. Amgad M, Man Kin Tsui M, Liptrott SJ, Shash E. Medical student research: An integrated mixed-methods systematic review and meta-analysis. *PLoS ONE* 2015;10(6):e0127470. <https://doi.org/10.1371/journal.pone.0127470>

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