

Review article

Medical Imaging Literature in MyCite

Nurul Husna Kamarudin¹, Nor Azlina A. Rahman² and
Zainul Ibrahim Zainuddin^{1*}

¹*Department of Diagnostic Imaging and Radiotherapy, Kulliyah of Allied Health Sciences, International Islamic University Malaysia, Kuantan, Pahang, Malaysia*

²*Department of Physical Rehabilitation Sciences, Kulliyah of Allied Health Sciences, International Islamic University Malaysia, Kuantan Pahang, Malaysia*

ABSTRACT

The presence of imaging technologies in Malaysia needs to be supported by homegrown research to optimize and tailor their usage for local benefits. Research done elsewhere may not be applicable to local situations. This study investigates the contribution of researches by Malaysian academicians and service providers to the field of medical imaging, as evident in the Malaysian Citation index (MyCite) database. Bibliometric and thematic analyses were performed on publications featured in the database from 2006 to 2016. The bibliometric analysis provided information on the affiliation of the authors, their professional backgrounds, types of studies, and the journals involved while the thematic analysis identified the themes and sub-themes of identified articles. The study found that Malaysians contributed 54.1% of the publications, followed by non-Malaysians (41.8%) and collaboration authors (4.1%). Researchers were mostly from university-based and hospital university-based institutions. The thematic analysis presented that 42.9% of articles were classified under clinical themes. The results also suggested that the current trends of research in medical imaging are focused on topics involving clinical and modality, and

only a few patient-centered researches. This is an indication that more researches that are relevant to local practices and needs are required as this will strengthen the medical imaging practice in the country.

Keywords: Academicians, bibliometric study, medical imaging, MyCite, Scopus, service providers, thematic analysis, web of science

ARTICLE INFO

Article history:

Received: 06 January 2018

Accepted: 23 April 2019

Published: 21 October 2019

E-mail addresses:

husnataqwa@gmail.com (Nurul Husna Kamarudin)

nazara71@gmail.com (Nor Azlina A. Rahman)

zainul@iium.edu.my (Zainul Ibrahim Zainuddin)

* Corresponding author

INTRODUCTION

Recent technological developments in medical imaging underline the significance of research in the profession. Research is needed to provide the evidence for its practices as research is a means by which a profession defines its own knowledge base and successfully differentiates itself from others (Reeves, 2008). The importance of research and the dissemination of the findings could facilitate the growth of the discipline. Research in medical imaging is further dictated by the concept of evidence-based practice (EBP), a concept that is aimed to enable healthcare practitioners to deliver optimal healthcare services. It is important for medical imaging practitioners to embrace this concept to remain relevant in the healthcare industry.

Malaysia is a rapidly progressing nation that aims to be a fully developed country by the year 2020. The country embarks on efforts to strengthen the industry and research collaboration in order to achieve a fully developed country standard (Economic Planning Unit, 2010). While those aspirations have been formulated, an important undertaking to determine whether the current status of locally grown knowledge and researches are in line with the aspirations of the nation. Homegrown research is significant as researchers will conduct their research based on the needs of the nation. Research conducted elsewhere may not be directly applicable to the local needs due to sociobiological, socioeconomic, cultural and religious factors. Thus, it is felt that the researchers need to support the government's outlook in prioritizing their research interests and undertakings.

Scientific writings through journal publications are the more commonly accepted mode of disseminating research findings. In 2011, the Ministry of Education Malaysia (MOE) established the Malaysian Citation Centre (MCC) that serves to collate, monitor, coordinate and improve the standards of journal publications in Malaysia (MyCite, 2017). This was followed by the setting up of the Malaysian Citation Index, MyCite. This online database provides access to bibliographic, as well full-text contents of scholarly journals, conference proceedings, book chapters and theses in science, technology, medicine, social science and humanities published in Malaysia. To date, it has more than 34,000 documents. The MyCite Journal Selection criteria have to be met before any journal can be considered for a MyCite indexation. An important selection criterion for MyCite database is international diversity, indicated by 40% international authors and 60% local (regional) authors. Priority is also given to a journal if it has achieved a reasonable degree of influence as a result of its indexation status in Web of Science (WoS) or Scopus, or any discipline-based databases.

The trends and priorities of research play an important role to reap the optimum benefits to the service and education of any given profession. Thus, the importance of research in medical imaging field among its academicians and service providers cannot be sidelined. It would be beneficial to determine how these researches are seen within the context of meeting the expectations of the overall medical imaging field in Malaysia. It is felt that

MyCite is a significant database to be investigated in order to determine the current research trends in medical imaging in Malaysia. Thus, the objective of this study is to examine the trend of publications in medical imaging as indexed in the database. This study is hoped to convince future researchers to acknowledge the trends of research in medical imaging in Malaysia and guide them towards making informed decisions about future researches in the discipline.

MATERIALS AND METHODS

There are ample literatures that suggest the use of bibliometric method as a tool in the assessment of research initiatives and performances in basic scientific disciplines and medicine. The bibliometric method is a qualitative study of publication that is used to describe the patterns of publications within the given field (Clarke et al., 2007). The method is also useful to map the literature in a given field by identifying patterns of authorship and productivity in providing a direction for future development of the respective field. It can also provide an in-depth analysis of the connections between authors, publications and research topics (Snaith, 2012).

Several medical imaging related terms were used as search terms in this study. These included radiography, medical imaging, radiology, radiation, X-ray, neuroimaging, ultrasound, magnetic resonance imaging (MRI), computed tomography (CT) scan, nuclear imaging, mammography, intravenous urogram (IVU), and fluoroscopy. The researchers caution that these terms are not exhaustive, yet they were felt to be sufficient for the purpose of the study.

The MyCite database (<http://www.mycite.my>) was accessed. The Advanced Search tab was chosen to accommodate more than one search term. Using the Boolean operator "OR" and additional search tabs, the medical imaging terms mentioned above were individually entered into the search tabs. A general survey involving 'All Field' was done. The search was limited to articles and published in English and Malay language. The search covered a 10-year period from 2006 to 2016. This time frame was chosen to depict the recent publications that complemented the changes experienced by the field of medical imaging and was not restricted towards the authors' countries of origin. The total number of articles that resulted from the Advanced Search was noted. Information that included the authors' names, titles of articles, journal titles, year of publication and abstracts were manually tabulated in an Excel file.

The titles of the articles were arranged alphabetically. The titles of articles were checked for duplication before it was analysed by researchers. The "filter" tab in the Excel file was used to recognize those titles and duplications were removed from the data. The filtered data was further focused to articles related to medical imaging. Since the titles of the articles represented the main idea, they were used as indicators to determine whether the articles

were related to medical imaging or otherwise. Titles that were not related Medical imaging such as computer science, physics and astronomy were excluded from the data. There were some titles that did not represent medical imaging. But, they were included after reviewing the abstract of the articles due to the issues discussed in the articles were strongly related to medical imaging. The final data was used for bibliometric and thematic studies.

Fulfilling the characteristics of a bibliometric study, the affiliations of the authors, types of studies, and professional background of the authors was included in this study. The affiliations determined whether the articles were contributed by authors from Malaysia, or collaborations between Malaysian and non-Malaysian authors. The data was also used to classify the publications into review, comparative study, survey and empirical study. Special emphasis had been given to publications by Malaysian researchers. The determination of the background of the authors served to indicate whether the authors were from hospitals, universities, hospital universities, government bodies, private bodies or non-governmental organizations (NGOs). Further classification divided the authors into those who were from the clinical, academia or industry related to medical imaging. For the purpose of this study, a clinical provider is one who works in a clinical field in medical imaging, whereas an academician relates to an academic staff at a higher educational institution in Malaysia. Meanwhile, an industry worker is a person who works with any industrial company that is related to the medical imaging field.

Thematic analysis, a part of qualitative research is used to identify, analyse, and report patterns (themes) within the data (Braun & Clarke, 2006). The analysis provides a robust, systematic framework for coding qualitative data and for using the coding to define patterns across the dataset in researches. It is a pragmatic qualitative approach for those doing applied research and has been used widely for health and well-being research (Braun & Clarke, 2014). For the present study, thematic analysis was used to define the significant themes and sub-themes based on the titles of articles. This was done for the themes denoted the major issues being discussed, while the sub-themes denoted the related themes to the main issues within the titles.

RESULTS AND DISCUSSIONS

The General Report

Data was collected on 29th November 2016. Although there were 32,926 documents indexed in MyCite, the number of journals that fulfilled the MyCite Journal Selection Criteria stood at 138. MyCite estimated that more than 500 Malaysian journals can benefit from being indexed in the database in terms of global visibility and enabling Malaysian researchers to identify expertise, areas of possible collaboration, stimulate use and citations (MyCite, 2017). These estimation is credible since it was presented in 2012 that there were 424 traceable journal titles that were published in Malaysia (Zainab et al., 2012). In the same

work, the authors reported a finding in 1999 that there were 284 titles. This means there was a 52% increase in journal titles within 13 years. Thus, with only 138 journals indexed in MyCite, from a possible of 500 Malaysian journals, the 27% indexation rate in the database shows much support is needed to ensure more journals to be cited in the database. With MyCite providing access to bibliographic as well full-text contents of scholarly journals published in Malaysia in the various fields, practitioners should optimise the presence of the database. Primarily, “homegrown” research, translated into scientific writings indexed in MyCite can be benefitted by other local practitioners since MyCite provides the necessary access to those researches. Thus, the two important issues; support for local journals to be indexed in MyCite and the accessibility of publications in the database could have their impact upon practitioners in all fields, including medical imaging, in managing their research and disseminating the findings for local practitioners.

Report for Medical Imaging Literature

The study found the number of articles that were related to medical imaging in MyCite was 268. This represents 0.8% of the total number of articles. 156 articles were contributed by Malaysians while 112 were from non-Malaysians. The results show that the 268 articles were published in 32 journals. This represents 23% of the total number of journals indexed. The top 5 journals that published articles related to medical imaging are listed in Table 1.

Only 40% of the journals indexed in MyCite addressed the science, technology and medical fields. Being a sub-discipline in the Medicine field, the low number of articles related to medical imaging is expected. However, this study does not represent an overall true picture of the contributions of Malaysian medical imaging practitioners to their field in terms of research. It is believed that there are articles by Malaysian practitioners being indexed in some other databases such as Scopus, WoS or even in other non-indexed journals. The lower output of researches related to medical imaging in MyCite could be attributed to the inclination of researchers to publish their work in journals indexed in Scopus, WoS or other databases. However, the accessibility to those mentioned databases may be limited and subjected to subscriptions requirements as it is often confined to academic institutions. Thus, it is important to reiterate that “homegrown” researches should be made readily

Table 1
Top five journals that published articles related to medical imaging

No.	Name of Journal	Total articles (%)
1.	Biomedical Imaging Intervention Journal	107 (40%)
2.	Medical Journal of Malaysia	27 (10%)
3.	Malaysian Journal of Medical Science	27 (10%)
4.	Jurnal Teknologi	16 (6%)
5.	Neurology Asia	10 (4%)

accessible to local practitioners and is provided by MyCite. It is to be appreciated that there are nearly 25% of the journals in MyCite that had published articles related to medical imaging. This is translated into available avenues and opportunities for Malaysian medical imaging practitioners to publish their findings for the benefits of other local practitioners.

The study also identified 15 out of 32 journals being indexed in Scopus, while 4 out of 15 journals were indexed in WoS. They are shown in Table 2.

The results should be seen within the context of dispelling the conflict among academicians, especially in publishing their works in high impact journals in databases compared to Malaysian-based journals. It is a common knowledge that academicians are encouraged to publish in journals in the above databases for personal promotion and self-development, as well as for the rating and ranking of the university. There is a hidden element of “patriotism” if one were to consider publishing in any one of the 15 journals given in Table 2. This element should be seen within the context of supporting local journals to remain in the two mentioned databases. This support is needed for those journals to fulfil the criteria set by these databases in order to preserve the indexation. By preserving the indexation by the said journals in WoS and Scopus, the opportunity to further publish in journals indexed in the latter databases is simultaneous achieved.

Table 2
List of Journals that are indexed in Scopus and Web of Science

No.	Name of Journals	Scopus	Web of Science
1.	Biomedical Imaging Intervention Journal	√	
2.	International Medical Journal Malaysia	√	
3.	Journal of Mechanical Engineering	√	
4.	Malaysian Family Physician	√	
5.	Malaysian Journal of Analytical Sciences	√	
6.	Malaysian Journal of Computer Science	√	√
7.	Malaysian Journal of Mathematical Science	√	
8.	Malaysian Journal of Medical Sciences	√	
9.	Malaysian Journal of Medicine and Health Sciences	√	
10.	Malaysian Journal of Nutrition	√	
11.	Malaysian Journal of Public Health Medicine	√	
12.	Medical Journal of Malaysia	√	
13.	Neurology Asia	√	√
14.	Pertanika Journal of Science and Technology	√	√
15.	Sains Malaysiana	√	√

Country of Origin of Authors

The articles were classified into three groups: Malaysian authors, non-Malaysian authors and collaboration works. The total number of articles that were contributed by Malaysian authors was 145 articles (54.1%). Non-Malaysian authors contributed 112 articles (41.8%),

while collaborative works between Malaysian and non-Malaysian authors were represented by 11 articles (4.1%). It can be expected that the total number of articles contributed by Malaysian authors to be higher than non-Malaysian authors as MyCite is a Malaysian online database. Thus, the contributions of Malaysian researchers to these journals are expected.

The national aspirations within the Malaysian academic environment lies in Malaysian authors are encouraged to publish in the higher impact journals. On a positive note, the presence of non-Malaysian authors in Malaysian scholarly journals is by itself a recognition to these local journals. Collaborations that are evident between Malaysian and non-Malaysian authors further enhance the position of the journals in MyCite. These collaborations can also increase the chances of these journals to be indexed in either WoS or Scopus later as the selection criteria are similar.

Affiliations of Malaysian Authors

The results show that affiliations of the authors are from universities (60), university hospitals (19), hospitals (5), government bodies (4) and private body (1). Contributions from academicians are prominent. This is expected since academicians are expected to not only publish, but also to simultaneously publish in high quality journals (Suryani et al., 2013). The affiliations of those representing university hospitals could still be from those within the academic circle, thus the expectations upon them to publish remains. An important note is the low numbers of authors from the hospitals. The term hospitals here refer to the hospitals that are not affiliated to any particular institute of higher learning. They are represented by the practitioners who are service providers. For 2016, Malaysia has about 140 public hospitals and 209 private hospitals (Ethnographic Medical Research Group, 2016). With only 5 authors representing hospitals, the results triggered further work, being undertaken by the present authors, to determine the reasons behind the low numbers.

Collaboration

A number of collaboration works by the authors were recognized. There were collaborations between universities (20), universities and government bodies (9), universities and hospital universities (7), universities and hospitals (7), and hospitals and hospital universities (3). Collaborations between universities and hospitals could be seen in areas where the hospitals provide the modalities or research subjects that are not available in the universities. These can be the case when clinical studies are involved. An example of a collaboration study between a university and hospital is the determination of the role of computed tomography (CT) scan in the assessment of parametrial involvement in early stage cervical carcinoma (Mohamad et al., 2012).

The study also took note of collaborations between local universities with non-local universities. For example, a collaborative study conducted by University of Nottingham,

Malaysia campus with University of Cairo on brain magnetic resonance image lateral ventricles deformation analysis and tumour prediction (Kai et al., 2007). Though the number is small, there were also collaborations between universities with government bodies, private bodies or Non-Governmental Organisations (NGOs). Private body is an all for-profit business and not operated and funded by any governmental body. NGO refers to a non-profit organization which is independent from states and international governmental organization. The NGO is usually funded by donations and run primarily by volunteers. Universiti Kebangsaan Malaysia (UKM), Hospital Tengku Ampuan Rahimah and an NGO, The National Cancer Society of Malaysia conducted a study that determined tube output (kVp) and exposure mode for breast phantom of various thickness/glandularity for digital mammography (Kamal et al., 2015).

The results show that there are about 10 collaboration works involving hospitals with universities or university hospitals. This suggests that the contributions of those in the service are still low. With more than 300 hospitals several questions regarding the involvement of those in the service of medical imaging research can be raised. This can further be argued based on the fact that medical imaging graduates are now employed in both government and private hospitals. The authors wish to highlight that the education on a degree level in Medical imaging in Malaysia began in 2000 at UKM. This was followed by other public universities, namely Universiti Teknologi MARA (UiTM), International Islamic University Malaysia (IIUM) and two private universities; MAHSA University College and Masterskills. Top-up programmes from diploma to degree qualifications have also been introduced and graduates from these programmes have been produced. Modules involving research were introduced to these students, where the students were to conduct simple research to fulfil graduating criteria. Taking into consideration the number of students that have graduated since 2004, the number of researches that are translated into publications is expected to increase. The position of those who had graduated, in relation to the expected applications of research skills, will need to be examined in terms of their interest, as well as obstacles. Work is being undertaken by the authors to determine the involvement of these graduates in post-graduation research initiatives.

Thematic Analysis

The articles were categorized based on their types of studies. The result were tabulated in the Table 3.

A review helps authors to review published literature or data (Philip, 2009), thus establishing recent progress in a particular field. An example of a review is Bone health status and lipid profile among post-menopausal Malay women in Cheras, Kuala Lumpur by UKM and Universiti Putra Malaysia (UPM) (Hasnah et al., 2012). Meanwhile, an empirical study reports the results of a study that derived data from actual observation

Table 3
Thematic analysis of types of studies in MyCite

Type of study	Total (%)
Review studies	175 (65.2%)
Empirical studies	34 (12.7%)
Case studies	30 (11.2%)
Comparative studies	19 (7%)
Surveys	9 (3.4%)
Others	1 (0.4%)

or measured phenomena from experimentation (Bruns, 2010). This type of study helps academicians and clinical services to incorporate the new findings into practices in medical imaging field. One such study is the application of Computer Tomographic (CT) data and additive manufacturing technologies in Prosthetic ear reconstruction involving SIRIM Berhad Malaysia and Universiti Sains Malaysia (USM) (Nor & Zainul, 2015). Surveys are used to compile data on a wide range of issues for different units of analysis (Rose et al., 2015). The main purpose of the survey research was to obtain information that describes the characteristics of a large sample of individuals of interest relatively (Ponto, 2015). A survey on physical factors and compressed breast thickness in voluntary mammography screening using FFDM system in Malaysia involving Malaysian Nuclear Agency, College of Radiology and IIUM is one of the examples for survey study as indexed in MyCite database (Noriah et al., 2013).

The thematic analysis for each title of the articles concentrated on the themes and sub-themes. The five most significant themes and subthemes were tabulated in Table 4.

The clinical-diagnosis, modality-technical and safety-radiation safety being the most significant themes and sub-themes for Malaysian authors. The clinical-diagnosis denoted that the function of medical imaging is to rule out any clinical disease. An example of a research title with the theme of clinical-diagnosis is Computed Tomography Perfusion Imaging on Traumatic Cerebral Contusion: A Preliminary Report by Universiti Sains Malaysia (USM) (Abdul et al., 2010). The clinical-health technology assessment represents the research in medical imaging that is involved in innovation in technology to improve the

Table 4
Top five themes and subthemes for thematic analysis

Themes	Subthemes	Total (%)
Clinical	Diagnosis	59 (22%)
Clinical	Health Technology Assessment	28 (10.5%)
Modality	Technical	27 (10%)
Safety	Radiation safety	24 (9%)
Clinical	Modality	14 (5.2%)

effectiveness in clinical area such as combined ultrasound and IVU for the management of childhood urolithiasis: a case report by Fathinul and Abdul (2012). Meanwhile, the modality-technical is a research involved in technical aspects on modalities in medical imaging. An example of a research in modality-technical is Tomotherapy as a Tool in Image-guided Radiation Therapy (IGRT): Theoretical and Technological Aspects (Yartsev et al., 2007). For safety-radiation safety, the research is focused on the safety aspects involving radiation in medical imaging. The IAEA's Activities on Radiation Protection in Interventional Cardiology by Madan (2007) is one of the examples for safety-radiation safety research title. For clinical-modality, the research area is focused on the modalities in medical imaging that is used in clinical area. An example of the research is Carcinoma of stomach detected by routine transabdominal ultrasound (Wong et al., 2010)

For non-Malaysian authors, the significant themes and sub-themes were clinical-diagnosis, clinical-health technology assessment and modality-technical. For collaboration works, the most significant theme and sub-theme was clinical-health technology assessment. Thus, it can be concluded that most authors focus on clinical themes in their researches.

The issue associated with safety is among the important themes being discussed by researchers with 33 articles out of 268 articles (12.3%). Radiation safety was the most frequent topic to be discussed by authors. According to Ploussi and Efstathopoulos (2016), the higher usage of ionization radiation for diagnostic and therapeutic purposes has raised significant safety and health concerns for patients and medical imaging practitioners. As the number of medical imaging procedures performed continues to rise each year, there should be a precaution to keep radiation dose as low as reasonably achievable (Marshall & Keene, 2006). Thus, the safety aspect in medical imaging field is considered as a significant area as it can contribute to other related risks of radiation such as cancer. The needs of safety aspect to be constantly observed cannot be denied. Hence, aspects that involves radiation safety is an important aspect to be continuously researched.

The results suggest that the themes that have the lowest frequencies from both Malaysian and non-Malaysian authors were economy and quality. In medical imaging, cost considerations, quality and patient-centered researches would also be highly relevant. It was also observed that no research based on patient-centered has been done such as patient safety, patient preparation, patient education and patient care. In order to deliver the optimal service, attention should also be given to these aspects.

CONCLUSION

This study established the trend of research in medical imaging as featured in the MyCite database. It can be deduced that the contributions by medical imaging practitioners, both academicians and service providers as indexed in MyCite, is low. Practitioners should also take note of the presence of journals indexed in MyCite that are also indexed in Scopus

and WoS. This is to reduce the conflict between publishing in high impact foreign journals and those local journals indexed in the two renowned databases. Most of the authors are of university-based and hospital university-based background while the involvement of authors from the hospital background is low. The thematic analysis showed that clinical studies formed the main preference among researchers. This study suggests that researchers should also pay attention to non-clinical themes such as economic, safety, and education. Studies need to be conducted to determine the status of involvement in research by graduates in medical imaging who are now serving the hospitals. Furthermore, the involvement in research among medical imaging practitioners and academicians should be directed to preferences of research that can address the local needs. This particular work can be a guideline to future researchers in order to decide on their future research undertakings.

ACKNOWLEDGEMENT

A bundle of thanks to those who contribute to this research paper directly and indirectly. It is hoped that this research paper may benefit researchers and students in research preferences.

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