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A comparison of examination outcomes in the Part 1 of FC Rad Diag (SA) before and after 2012

Sihlangu, Siphamandla Cedric

2021

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A comparison of examination outcomes in the Part 1 of FC Rad Diag (SA) before and after 2012

Dr. Siphamandla Cedric Sihlangu

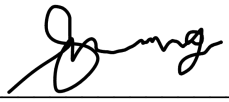
A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in Diagnostic Radiology

Johannesburg

24th February, 2021

Declaration

I, Dr Siphamandla Cedric Sihlangu, declare that this research report is my own work. It is being submitted for the degree of MMed (Diagnostic Radiology) at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.



Dr Siphamandla Cedric Sihlangu

Signed: On this 24th day of February 2021

Dedication

I would like to dedicate this to my beautiful wife, for being my pillar of strength and to my parents for their unwavering support.

Publications and presentations

This work has never been published.

It has never been presented at a congress.

Abstract

INTRODUCTION:

The fourth industrial revolution brings with it many changes in the way we do things. The vast knowledge expectation in the field of Radiology places a spotlight on the radiology teaching and learning curricula in postgraduate programs. Teaching and learning among radiology registrars, and practitioners seeking continuing education credits is changing with advances in technology. The College of Radiologists (CR) of the Colleges of Medicine of South Africa (CMSA) in 2012 decided to allow candidates entry to the Part 1 examination from either within a formal registrar program or prior to entering such a program. This was a departure from the previous rules, which matched those of the Fellowship of the Royal College of Radiologists (FRCR). There is currently no data, which addresses the impact of this decision on the examination outcomes of candidates.

AIM:

This study aimed to compare the FC Rad Diag (SA) Part 1 examination outcomes five years prior to 2012, i.e. from 2007 to 2011 and five years after 2012, i.e. from 2012 to 2016.

METHOD:

This descriptive quantitative study describes the outcomes of the FC Rad Diag (SA) Part 1 from 2007 to 2016. A total number of 717 candidates took the exam during the study period. Descriptive statistics were used to describe the examination outcomes in the two periods under study (pre and post 2012). Inferential statistics were then applied to establish the relationship between the two periods.

RESULTS:

The mean pass rate from 2007 to 2011 and 2012 to 2016 were 54.6% (± 13.9%) and 44.8% (± 10.6%) respectively. The mean difference between the overall pass rates of the two time periods is 9.8% and is not significant ($p = 0.0924$). For the 2012 to 2016 period there was no significant difference in the mean pass rates of candidates not in formal training (34.6%) and the mean pass rates of all the candidates in formal training (44.8%), ($p = 0.0828$).

CONCLUSION:

This study revealed that candidate performance in the FC Rad Diag (SA) Part 1 is similar for candidates in University training posts to those candidates writing outside a formal training post.

Acknowledgements

I would like to thank Prof. Green-Thompson for being the principal supervisor and assisting with the project design, review and analysis.
Dr Ajith and Dr Mutshutshu my co-supervisors for conceptual and editorial contributions.
Mrs. Ann Vorster for access to the CMSA database and seeing value in the study.
Mrs Maryn Viljoen for assistance with the statistical analyses.

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List of Abbreviations and Terminology

CMSA……Colleges of Medicine South Africa

CR…….College of Radiologists

FC Rad Diag (SA)……Fellowship of the College of Diagnostic Radiologists of South Africa

FRCR……Fellow of the Royal College of Radiologists

HPCSA…….Health Professionals Council of South Africa

PACS……Picture Archiving and Communication System

1. Introduction

1.1. Background

The fourth industrial revolution brings with it many changes in the way we do things. The vast knowledge expectation in the field of Radiology places a spotlight on the radiology teaching and learning curricula in postgraduate programs. Teaching and learning among radiology registrars, and practitioners seeking continuing education credits is changing with advances in technology. Andronikou (2012) noted that the College of Radiologist's application to extend radiology training to a 5-year programme was not approved by the Health Professionals Council of South Africa (HPCSA). The college then decided to allow for a Part 1 examination to be taken prior to entry into the registrar programme. This, they believed allowed for prospective registrars an opportunity to prepare themselves for the registrar programme and provided universities with candidates who are ready to start preparing for Part 2 over a full four years.The College of Radiologists (CR) of the Colleges of Medicine of South Africa (CMSA) in 2012 decided to allow candidates entry to the Part 1 examination from either within a formal registrar program or prior to entering such a program. This was a departure from the previous rules, which matched those of the Fellowship of the Royal College of Radiologists (FRCR).

The structure of the Fellowship of the Royal College of Radiologists (UK) has always been similar to the Fellowship of the College of Diagnostic Radiologists of South Africa. Both fellowships entailed training within certified training post, wherein two examinations would have to be completed, namely Part 1 (physics and anatomy) and Part 2 (rapid reporting, long cases and oral component). The Part 1 examination for both fellowships was only undertaken once a candidate was within a formal training registrar post.

There is currently no data, which addresses the impact of the decision of the College of Radiologists of South Africa, on the examination outcomes of candidates following the change of rules and the departure from the rules which matched the Fellowship of the Royal College of Radiologists (FRCR).

1.2. Literature Review

Traditional ways of doing things, especially in radiology, are adapting to modern advances. Hibbert et al, 2012 notes that the modern day radiologist has an understanding of anatomy integrated with insight in medical imaging equipment, physics and pathology across many organ systems. Hibbert(1) also suggests that the radiologist is then required to problem solve using a variety of analytical cognitive processes and to synthesize one or more probable diagnoses. He concludes that there is also a growing role for the radiologist as an interventionist and therapist and not only as a diagnostician.

Linaker (2) noted with regards to radiology education that studies indicate that teaching radiology as a form of problem solving skill appears to be improving learning outcomes. The approach where students are taught in a framework where there is no absolute right answer appears to result in better learning outcomes and improves the learning process. Advances in technology and the fourth industrial revolution being in the horizon, are changing the format of radiology teaching and learning. Technology provides a platform for faster and more efficient dissemination of information and also allows for learner-centered and driven education. Linaker suggests that research into relative effectiveness of educational formats is badly needed.

Linaker (2) reports that at the core of radiology education is independent, self driven learning. This, she believes, is achieved through the use of traditional textbook reading, web based videos, analogue film teaching files, picture archiving and communication system (PACS) and a multiplicity of web based radiologic resources.

Advances in technology have permitted radiology trainees to study radiology without the use of the traditional analogue films. The advances in technology has also created the perfect environment for practicing radiologist to continue to learn and keep up with the exponentially increasing body of knowledge in modern radiology. (2)

A fundamental question here is whether open distance learning for the Part 1 speciality examination is sufficient practice within medical training. Many Colleges of Medicine in South Africa do not allow their candidates to sit the college exams unless within a formal training program whilst other departments like internal medicine at the Witwatersrand University (WITS) require the candidate to have already completed the Part 1 examination before taking up a registrar post. The question is what informs those policy positions by some colleges while others seem relaxed in their rules by allowing Part 1 to be taken outside of formal training posts.

Below is a table outlining colleges of medicine in South Africa that do not allow candidates to sit Part 1 examination unless in formal training posts.

Table 1.1. Colleges of Medicine requiring formal training time before Part 1 exam[3]

College	Minimum time spent in accredited training post
Dermatologists	6 months
Forensic Pathologists	24 months
Nuclear Physicians	12 months
Anatomical Pathologists	18 months
Radiation Oncologists	6 months

The minimum requirement to be in a formal training post before qualifying to sit Part 1 exams and the scientific reasoning behind this is of interest to us. Perhaps the question is, is there some empirical reasoning to effect this minimum requirement, if so, what is it? And if indeed this empirical evidence exists, why should other colleges opt out from its implementation.

The regulations for the examinations of the Fellowship of the Royal College of Radiologists state that applicants must be in a formal clinical radiology training post or to have held such a post in the past, in order to be allowed take the Part 1 FRCR examination. Of interest is that there is no minimum period of clinical experience or clinical radiology training that is required in order to take the examination. (4)

In the many colleges of medicine websites, the requirements are merely stated without any attempt to justify. It is even more surprising that the regulations for the FRCR state that there is no minimum period of clinical experience or clinical radiology training required in order to take the Part 1 examination, meaning that even if you assume a post today, you may register to write the Part 1 examination the following month.

The FC Rad Diag(SA) has been aligned with the Fellowship of the Royal College of Radiologists (FRCR). CMSA representatives routinely observe the FRCR examination to ensure the South African assessment methods remain abreast of international trends. (5) The FC Rad Diag(SA) examination comprises of both a Part 1 and a Part 2 examination. The Part 2

component is the exit examination. In 2016 there was a delegation of the CMSA for an observership of the Part 2B Examination of the FRCR in London. The principal focus of the observership was the Part 2B examination, however the delegates also assessed aspects of the FRCR including the Part 1 examination.(6)

An overview and assessment of the two closely related radiology training programs i.e. the South African Fellowship (FC Rad Diag SA) and the Fellowship of the Royal College of Radiologists (FRCR) was conducted and presented in a report by the delegates who attended the 2016 observership in England.(6) The FC Rad Diag (SA) , Part 1 examination comprises of two components,. the first paper is a physics written and the second paper is an anatomy spot test. Table 1. 2 below presents the findings of the delegates.

Table 1.2. Comparison of FRCR and FC Rad Diag (SA) Part 1 Exam Structure[6]

PART 1	FRCR	FC Rad Diag SA
Requirements	Candidate must be in registrar training post	None – Any post internship practitioner may sit the exam
Physics format	2 hour exam with 40 MCQ's	3 hour exam with short written answers and some MCQs
Anatomy format	1 hour 30minute 100 image spot test	3 hour 60 image spot test

There is a lacuna in the literature regarding the rationale for some examination entrance criteria relating specifically to the Part 1 college examination. This study aimed to assess the outcomes of writing Part 1 exams when the examination is approached from within a formal training programme versus outside of a formal training programme. To do this, the recent change by the College of Radiologists of South Africa to enable candidates to sit the Part 1 FC Rad Diag (SA) outside of formal training posts presented us with a good opportunity to assess the effects of the two scenarios on examination outcomes.

1.2.1. Extended Literature Review

There is sparsity of information about formal postgraduate radiology education in the rest of Africa. However, most of the literature available has been described in Nigeria. In Nigeria, after completion of the medical degree and internship, doctors wanting to enter the formal radiology program as a resident must write a qualifying examination, referred to as the primary examination.(7) The primary examination comprises of multiple choice questions in the basic medical sciences (anatomy, physiology and pathology) and O-level physics. (8) On successful completion of the primary examination the candidate is eligible to apply for a formal radiology resident post. Once within the formal radiology training program, it is mandatory for candidate to spend a minimum of 24 months before writing the Part 1 (membership) examination. This examination is equivalent to the FC Rad Diag (SA) Part 1. It comprises of multiple choice questions, essays, image slide shows and image reporting sessions in radiologic anatomy, radiology physics and clinical radiology. Successful

candidates are recognized as senior residents and are required to rotate for another 24 months, carry out research and submit a dissertation during this period. Success at the Part 2 admits the candidate into the fellowship of the college.(7)

The requirement for the first part of the radiology examination to be undertaken within a formal training program is acknowledged abroad. The Royal Australian and New Zealand College of Radiologists requires its Part 1 candidates to be in the formal training program before sitting the Part 1 exam.(9) The American Board of Radiology has two examinations, the core exam and the certifying exam. The first examination, the core exam is written 36months into the residency program.(10)

1.3. Aim of Study

This study aimed to compare the FC Rad Diag(SA) Part 1 examination outcomes five years prior to 2012, i.e. from 2007 to 2011 and five years after 2012, i.e. from 2012 to 2016.

1.4. Study Objectives

1.4.1. Primary Objectives

- To determine the pass rate of candidates who took the FC Rad Diag(SA) Part 1 in the 5 years preceding 2012, i.e. 2007 to 2011 which only allowed candidates in formal registrar posts to sit the exam.

- To determine the pass rate of candidates who took the FC Rad Diag(SA) Part 1 in the 5 years following the 2012 decision, i.e 2012 to 2016 which allowed candidates not in formal registrar posts to sit the exam.

1.4.2. Secondary Objectives

- To compare the exam outcomes for these two cohorts.

2. Materials and Methods

2.1. Study Design

This study was a descriptive quantitative study that compared the outcomes of the FC Rad Diag (SA) Part 1 from 2007 to 2016. The database of the Colleges of Medicine of South Africa was accessed to retrieve the statistics of the examination outcomes (pass or fail) in the period defined in this study.

2.2. Study Population

The study population was all candidates who wrote the FC Rad Diag(SA) Part 1 during the period defined in the study (2007 to 2016). Any candidate falling outside of this parameter was excluded. A total number of 717 candidates took the examination during the study period.

2.3. Data Collection

The sensitivity regarding access to the CMSA database was acknowledged and prior authorization from the Management Committee of the CMSA was sought and obtained before embarking on the study. An Excel data sheet was used to capture the following information: 1) Number of exam candidates per semester 2) Number of successful candidates 3) percentage pass per semester 4) Candidates not in formal training posts during each semester and respective pass rate. The number of candidates who sat the examination were assessed against the percentage pass per semester and a comparison was made from candidates who sat the examination after 2012 between those who were in formal registrar posts compared to those who were sitting the examination for the first time outside of formal registrar post.

2.4. Data Analysis

Data was captured in Microsoft Excel® and analysed using SAS Version 9.2. Descriptive statistics namely frequencies and percentages were calculated for categorical data(such as if candidate was in a formal training program) and means and standard deviations were calculated for numerical data (such as the percentage pass rate). Independent t-test was used to compare mean values, of pass rates, between groups (2007-2011 versus 2012-2016). A significance level (α) of 0.05 was used.

2.5. Ethics

The number of successful candidates are published biannually by the CMSA and is accessible to the public. The University of the Witwatersrand protocol committee made a determination that the study should proceed and that no further ethical clearance was required. The CMSA management committee further approved the study.

3. Results

A total number of 717 candidates took the examination during the study period. The mean number of candidates for paper 1 from 2007 to 2011 and 2012 to 2016 are 26.3 (± 5.8) and 35.0 (± 6.3) respectively. The mean difference between the mean number of candidates of the two time periods is 8.7 and is significant (p = 0.0046). There is a significant increase in the number of candidates that wrote paper 1 after 2012 compared to before 2012.

Same was true for paper 2, mean number of candidates from 2007 to 2011 and 2012 to 2016 are 27.7 (± 5.7) and 37.8 (± 9.2) respectively. The mean difference between the mean number of candidates of the two time periods is 10.1 and is significant (p = 0.0087).
There is a significant increase in the number of candidates that wrote paper 2 after 2012 compared to before 2012**.** See Figure 3.1 below.

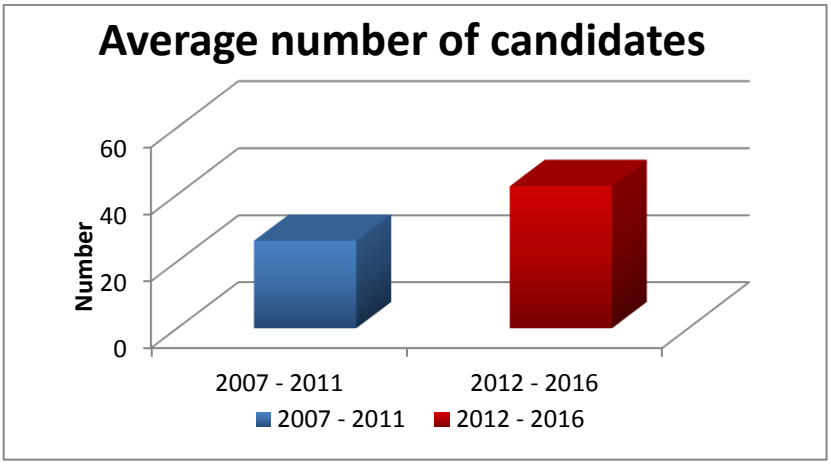


Figure 3.1. Average number of candidates in the two study groups

The mean performance of the candidates was compared for paper 1 and 2 in the two study groups. On average, the 2007-2011 group performed better in paper 1 while the 2012-2016 group did better in the paper 2, (p-value 0.8301 Not significant). See figure 3.2 and 3.3 below, where the minimum and maximum depict the range of examination scores in percentages.

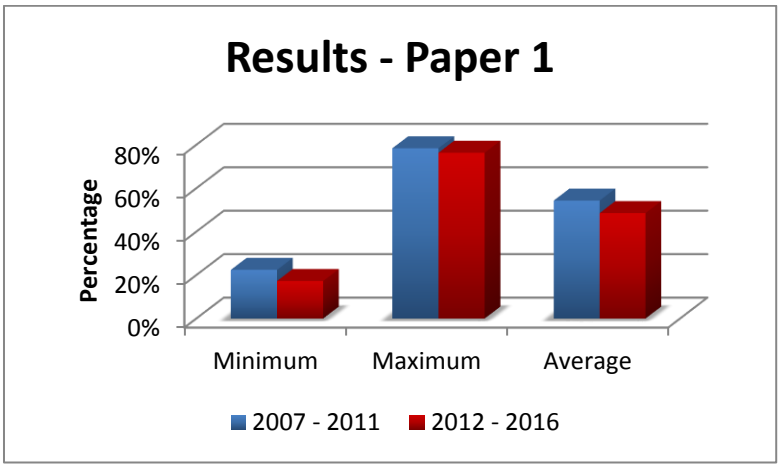


Figure 3.2. Candidate Performance in Paper 1

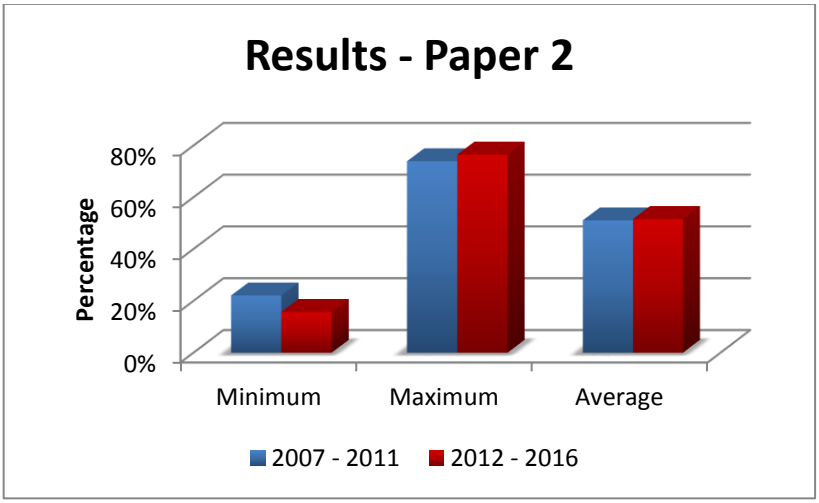


Figure 3.3. Candidate performance in Paper 2

The overall pass rates in figure 3.4 below are a combination of the results from paper 1 and 2. The mean pass rate from 2007 to 2011 and 2012 to 2016 are 54.6% (± 13.9%) and 44.8% (±10.6%) respectively. The mean difference between the overall pass rates of the two time periods is 9.8% and is not significant (p = 0.0924).

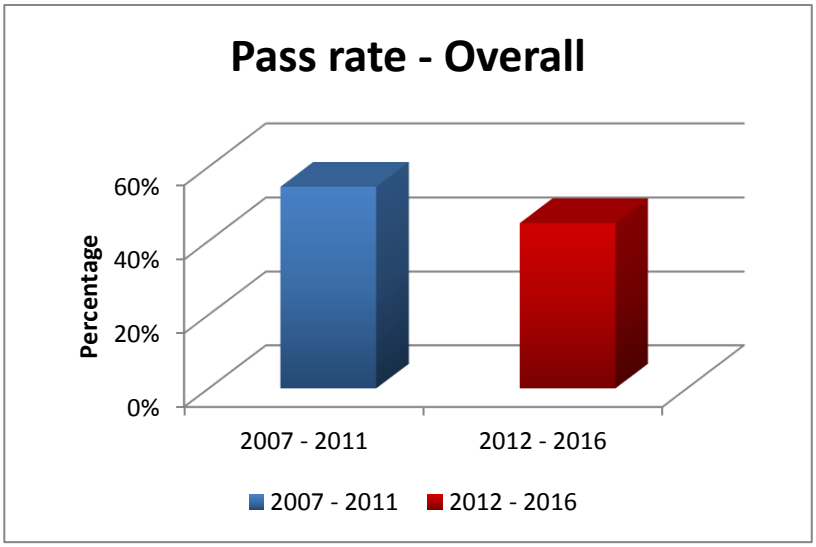


Figure 3.4. Overall pass rate

Lastly, the mean pass rate of candidates not in formal training program was compared to the pass rate of all candidates that completed the exams. The results are summarised in figure 3.5 below.

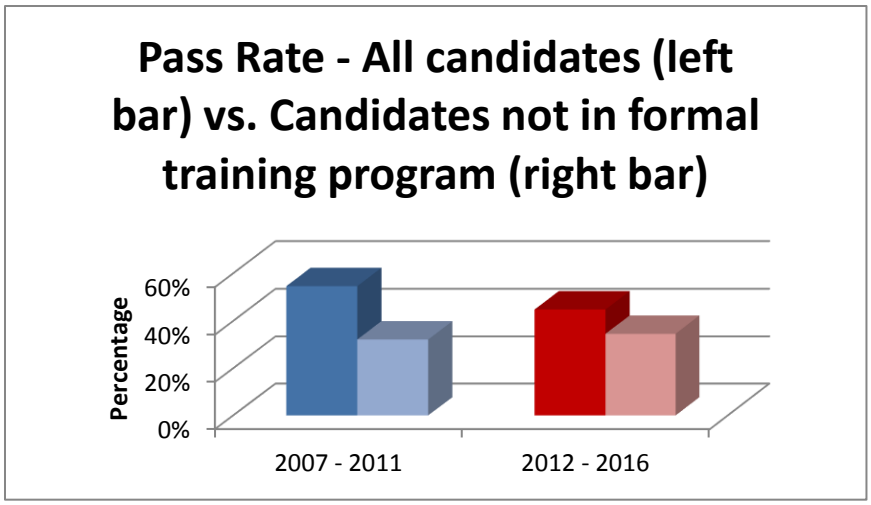


Figure 3.5. Pass rate of candidates not in formal training program

For the 2007 to 2011 period, it is important to note that the candidates not in formal training as reflected in the datasheet would have previously been in a formal training position to qualify to write the examination therefore this part of the data is negligible. For the 2012 to 2016 period, there was no significant difference in the mean pass rate of candidates not in formal training (34.6%) versus the mean pass rates of all the candidates in formal training. (44.8%), ($p = 0.0828$).

4. Discussion

4.1. Results in context

In this descriptive quantitative study, we found that there is no statistically significant difference in examination outcomes of the FC Rad Diag (SA) Part 1 following the introduction of the new rule in 2012 which allowed for candidates not in formal radiology training to be admitted to sit the exam.

Although there has been almost doubling of the number of candidates that take this examination, the overall performance in the two cohorts is comparable. The fundamental question for us was to determine if the new rules introduced by the College of Radiologists in 2012 had an impact on the overall examination outcomes for candidates. We suspected that the candidates in formal training would probably do better as they had first hand exposure to clinical radiology than the other group not in formal training.

The findings were intriguing in that in one of the papers, namely paper 2, the group not in formal training seems to have done better on average than those in formal training. For the 2012 to 2016 period there was no significant difference in the mean pass rates of candidates not in formal training (34.6%) and the mean pass rates of all the candidates (44.8%), ($p = 0.0828$).

This observation gives credence to what Linaker (2) attributes as tools of radiology training in modern day. She reported that the mainstay of radiology education is independent learning, or self-learning, achieved through the use of traditional textbook reading, videos, analogue film teaching files and a multiplicity of web based radiologic resources.

It can be extrapolated that candidates outside of formal training may not be at a complete disadvantage if technology today is seen to bridge the gap and aid seamless knowledge dissemination. This then would be regarded as levelling the playing field as all candidates would be deemed to have access to the same radiology material for the Part 1 exam. This topic however would have to be explored in a South African context.

The current rules of the Royal College of Radiologists not to allow candidates to the first part of the FRCR exam outside of a formal training post (or prior occupation of such a post), should probably be reviewed because there is no evidence to justify this practice, and the findings of

this study clearly show that candidates outside of formal training programs have the same prospects of passing the exam as their counterparts in formal training.

4.2. Limitations of the current study

The exam format of the FC Rad Diag (SA) Part 1 was modified during the study period by removing the oral component of the exam, this may have had an impact on candidate performance.

Some candidates may have taken the exam for the second or third time in the transition period, pre-2012 and post 2012. These candidates therefore belong to both cohorts and this may have slightly skewed the results.

The CMSA management committee had a resolution that only the following information would be supplied, namely, the number of examination candidates per semester, number of successful candidates, the percentage pass per semester, candidates not in formal training posts during the examination semester and their respective pass rate. This placed a limitation on the parameters that could be analysed from the data collection sheet as was envisioned on the protocol.

4.3. Recommendations

The findings of this study confirm that candidate performance in the FC Rad Diag (SA) Part 1 is similar for candidates in University training posts to those candidates writing outside formal training post. More research in this area is required to establish a concrete scientific base to the practice of allowing examination candidates to write Part 1 fellowship exams outside of formal training posts.

The data suggests that other disciplines examined by the CMSA such as Nuclear Medicine, Anatomical pathology, Dermatology etc. should reconsider the empirical bases for disallowing candidates from taking the Part 1 examination of the fellowship outside of formal training posts.

The advances in technology make it possible for all candidates to be exposed to the same radiology training material and therefore the Royal College of Radiologists should consider opening up their Part 1 FRCR exam to candidates outside of formal training posts.

5. Conclusion

This study is a comprehensive report critically evaluating teaching and learning in the postgraduate radiology space. It evaluates the practice of allowing candidates to write the Part 1 examination within formal training versus outside of formal training posts. It establishes that candidate performance in the FC Rad Diag (SA) Part 1 is similar for candidates in University training posts to those candidates writing outside formal training post. It therefore is a vindication for the 2012 decision of the College of Radiologists to allow candidates to be able to take this examination outside of formal training (registrar) posts.

6. References

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(3) List of Colleges of the CMSA: Exam Regulations.2018 [internet]Available: https://www.cmsa.co.za/view_college_list.aspx [Accessed on 15 September 2018].

(4) Regulations for the Examinations for the Fellowship of the Royal College of Radiologists in Clinical radiology,2018 [internet]. Available: https://www.rcr.ac.uk/sites/default/files/docs/radiology/pdf/CR_Fellowship_Regulations.pdf [Accessed on 16 September 2018].

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(10) Radiology ABo. 2020. Initial Certification for Diagnostic Radiology. Available: https://www.theabr.org/diagnostic-radiology/initial-certification [Accessed on 07 August 2020].

Appendix A: Data Collection Sheet

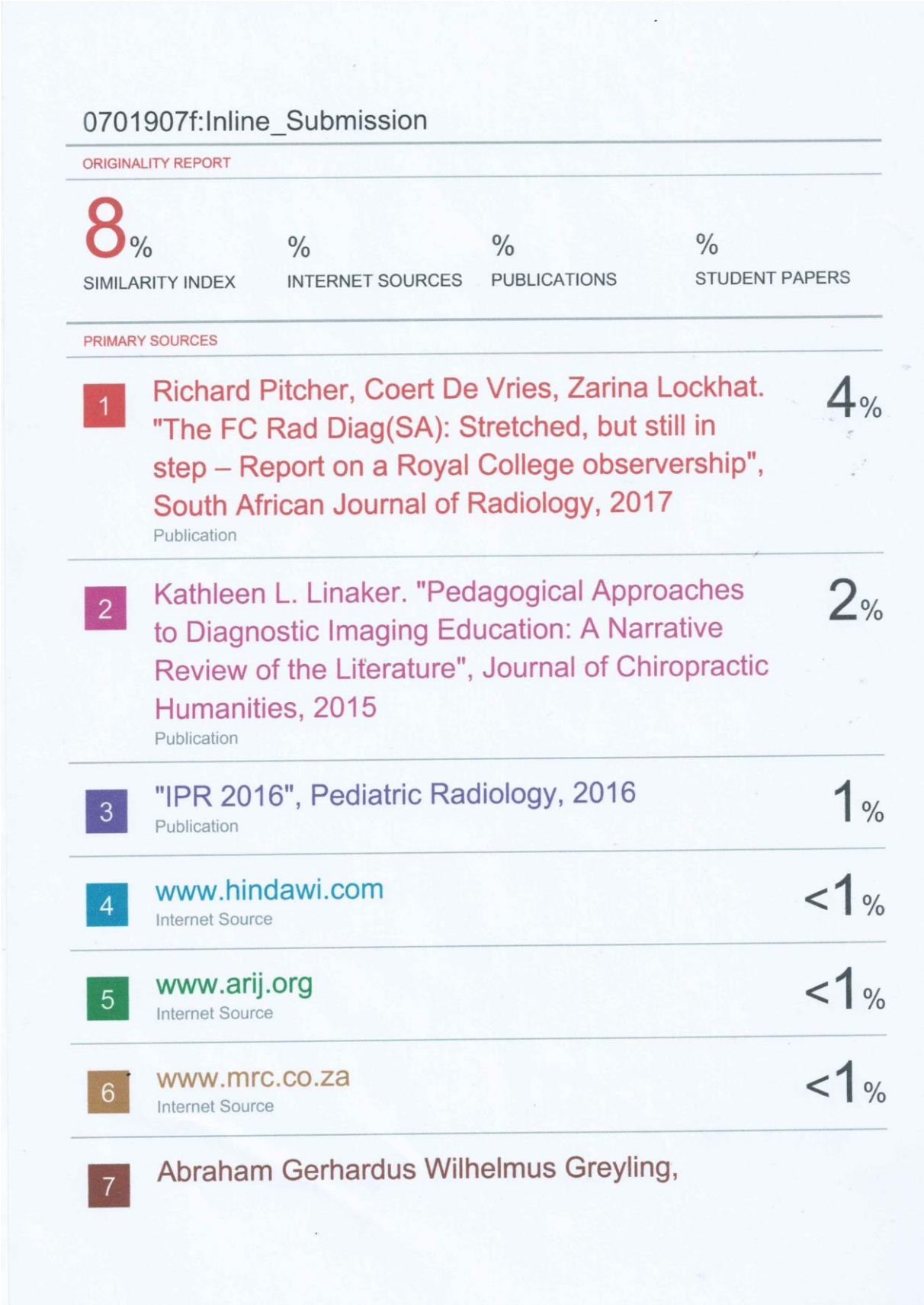
DATA SHEET

COMPARISON OF THE EXAMINATION OUTCOMES IN THE PART 1 FC RAD DIAG (SA) BEFORE AND AFTER 2012

YEAR_____ SEMESTER_____

	Student ID	Gender (M/F)	Race	Registrar Program (Y/N)	University	Number of Attempts	Outcome			
							Passed (%) Phys	Passed (%) ANAT	Fail (%) Phys	Fail (%) ANAT
1.										
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Appendix B: Turnitin Report



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ORIGINALITY REPORT

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SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Richard Pitcher, Coert De Vries, Zarina Lockhat. "The FC Rad Diag(SA): Stretched, but still in step – Report on a Royal College observership", South African Journal of Radiology, 2017 Publication	4%
2	Kathleen L. Linaker. "Pedagogical Approaches to Diagnostic Imaging Education: A Narrative Review of the Literature", Journal of Chiropractic Humanities, 2015 Publication	2%
3	"IPR 2016", Pediatric Radiology, 2016 Publication	1%
4	www.hindawi.com Internet Source	<1%
5	www.arij.org Internet Source	<1%
6	www.mrc.co.za Internet Source	<1%
7	Abraham Gerhardus Wilhelmus Greyling,	

Appendix C: Approved Research Protocol

A comparison of examination outcomes in the part 1 of FC Rad Diag (SA) before and after 2012

MMed (Diagnostic Radiology)

Dr Siphamandla Cedric Sihlangu

Student Number:

0701907F

Supervisors:

Professor Lionel Green-Thompson (Honorary Adjunct Professor)

Dr. Mutshutshu (Radiologist, CHBAH Radiology)

Dr. Anushka Ajith (PhD, Optics and Imaging)

Faculty of Health Sciences, University of the Witwatersrand, Johannesburg

April 2019

Introduction and background:

The fourth industrial revolution brings with it many changes in the way we do things. Traditional ways of doing things are adapting to modern advances. Hibbert et al, 2012 notes that the modern day radiologist builds an integrated intellectual framework of expertise based on a foundation of broad and deep anatomical knowledge integrated with a practical understanding of medical imaging instrumentation and physics. An understanding of matrix knowledge of diseases across most organ systems coupled with efficient region, imaging, and disease-specific search for abnormal findings, deductive and inductive reasoning and Integration with internal and external knowledge bases. Hibbert also suggests that the radiologist is then required to synthesize one or more probable diagnoses with an understanding of the impact of imaging and imaging-based diagnoses in clinical management and to use these competencies to guide, plan, and sometimes perform treatment of the patient. He concludes that medical expert radiologist therefore has many roles to fulfil as a diagnostician, a detective, a consultant, an advisor, and increasingly, as a therapist.[1]

The vast knowledge expectation in the field places a spotlight on the radiology teaching and learning curricula in postgraduate programs.

Linaker (2015) summarized the following regarding radiology education:
The literature suggests that teaching radiology as a problem-solving skill using a variety of methods that are grounded in cognitive psychology and learning theory shows promise in improving student learning outcomes. Providing opportunities for registrars/residents to experience cases where there is no right answer appears to improve learning outcomes. As expected, advances in technology are altering how radiology is taught and learned by students, residents, and practitioners seeking continuing education credits. Technology allows for faster dissemination of information but also needs to be used in a manner which allows for learner-centered education. She suggests that research into relative effectiveness of educational formats is badly needed.[2]

Linaker reports that the mainstay of radiology education is independent learning, or self-learning. This, she believes, is achieved through the use of traditional textbook reading, videos, analogue film teaching files, interactive games, digital/picture archiving and communication systems and digital Imaging and communications in medicine based teaching files, computer instruction, and handheld computers or personal digital assistants, to radiologic

web sites such as web-based tutorials, web-based teaching files, web-based radiology information sites, open-source, social network virtual learning environments, blended learning, and intranet-based assessment tools.[2]

It is believed that these advances in technology have allowed the student to be able to study radiology without the use of the traditional cut-film teaching files in medical schools and radiology residence programs. In addition, this technology has allowed the practicing radiologist to continue to learn and keep up with the exponentially increasing body of knowledge that represents modern radiology. [2]

A fundamental question here is whether open distance learning for the Part 1 speciality exam is acceptable practice within medical training. Many Colleges of Medicine in South Africa do not allow their candidates to sit the college exams unless within a formal training programme whilst other departments like internal medicine at Wits requires the candidate to have already completed the part 1/ primary exam before taking up a registrar post. The question is what informs those policy positions by some colleges while others seem relaxed in their rules by allowing part 1 to be taken outside of formal training posts. Below is a table outlining colleges of medicine in South Africa that do not allow candidates to sit part 1 exams unless in formal training posts.

Table 1: Colleges of Medicine requiring formal training time before Part1 exam[3]

College	**Minimum duration spent in accredited training post**
Dermatologists	6 months
Forensic Pathologists	24 months
Nuclear Physicians	12 months
Anatomical Pathologists	18 months

Radiation Oncologists	6 months

The minimum requirement to be in a formal training post before qualifying to sit Part 1 exams seems to be practiced in many countries and the scientific reasoning behind this is of interest to us. Perhaps the question is, is there some empirical reasoning to effect this minimum requirement, if so, what is it? And if indeed this empirical evidence exists, why should other colleges opt out from its implementation.

The regulations for the examinations for the Fellowship of the Royal College of Radiologists are as follows:
"Applicants need to hold a formal clinical radiology training post, in which they are actively receiving clinical radiology training, (or to have held such a post in the past) in order to enter the First FRCR Examination. No minimum period of clinical experience or clinical radiology training is required in order to enter." [4]

We find that in many colleges of medicine websites, the requirements are merely stated without any attempt to justify. We find it even more surprising that the regulations for the FRCR state that "No minimum period of clinical experience or clinical radiology training is required in order to enter…" the part 1 exam, meaning that even if you assume a post today, you may register to write the part 1 exam the following month.

Historically the FC Rad Diag(SA), the Fellowship of the College of Radiologists (CR) of the Colleges of Medicine of South Africa (CMSA), has been aligned with the Fellowship of the Royal College of Radiologists (FRCR). CMSA representatives have periodically observed the FRCR examination to ensure CR assessment methods remain abreast of international trends.[3] In 2016 there was a delegation of the CMSA for an observership of the Part 2B Examination of the FRCR in London. Although the principal focus of the observership was the Part 2B examination, the delegates also assessed broader aspects of the FRCR including the part 1 exam.

Andronikou (2012) noted that:

*"The College applications to extend radiology training to a 5-year programme have gone unrewarded by the governing body**. To compensate, the College has provided a Part I examination that can be taken prior to entry into the registrar programme (my emphasis)**. This allows prospective registrars an opportunity to prepare themselves for the registrar programme, gives successful registrar applicants added credentials for being selected into a programme, and provides universities with candidates with proven track records who are ready to start preparing for Part II over a full 4 years."*[6]

PART 1	**FCRC**	**FC Rad Diag SA**
Requirements	Candidate must be in registrar training post	None – Any post internship practitioner may sit the exam
Physics format	2 hour exam with 40 MCQ's	3 hour exam with short written answers and some MCQs
Anatomy format	1 hour 30minute 100 image spot test	3 hour 60 image spot test

An overview and assessment of the two closely related radiology training programs i.e. the South African Fellowship (FC Rad Diag SA) and the Fellowship of the Royal College of Radiologists (FRCR) was conducted and presented in a report by the delegates who attended the 2016 observership in England. [5] Table 2 below presents the findings of the delegates.

Table 2: Comparison of FCRC and FC Rad Diag (SA) PART 1 Exam Structure[5]

There is a lacunar in the literature regarding the rationale for some exam entrance criteria relating specifically to the part 1 college exams. This study aims to assess the outcomes of writing part 1 exams when the exam is approached from within a formal training programme vs outside of a formal training programme. To do this, the recent change by the College of Radiologists of South Africa to enable candidates to sit the part 1 FC Rad Daig (SA) outside of formal training posts presents us with a good opportunity to assess the effects of the two scenarios on examination outcomes.

Purpose of the study

The College of Radiologists (CR) of the Colleges of Medicine of South Africa (CMSA) in 2012 decided to allow candidates entry to the part 1 examination from either within a formal registrar programme or prior to entering such a programme. This was a departure from the previous rules which matched those of the FRCR. There is currently no data which addresses the impact of this decision on the outcomes of candidates.

Aim of study

This study aims to compare the examination outcomes for the Part 1 before and after the implementation of this decision in 2012.

Objectives

Primary Objectives

- To assess the pass rate of candidates who took the FC Rad Diag(SA) part 1 in the 5 years preceding 2012, i.e. 2007 to 2011 which only allowed candidates in formal registrar posts to sit the exam.

- To assess the pass rate of candidates who took the FC Rad Diag(SA) part 1 in the 5 years following the 2012 decision, i.e 2012 to 2016 which allowed candidates not in formal registrar posts to sit the exam.

Secondary Objectives

- To compare the exam outcomes for these two cohorts.

Study Design and Methods

This study is a descriptive quantitative study that will describe the outcomes of the FC Rad Diag(SA) part 1 from 2007 to 2016.

Setting

The database of the Colleges of Medicine of South Africa will be accessed to retrieve the statistics of the examination outcomes in the period defined in this study.

Study Population, Inclusion and Exclusion Criteria

The population for this study will be all candidates who wrote the FC Rad Diag(SA) part 1 during the period defined in the study (2007 to 2016).

Data Collection, Management and Administration

The sensitivity regarding access to the CMSA database is acknowledged and all ethical clearance will be obtained prior to embarking on the study from the faculty ethics committee and the Management Committee of the CMSA. A data sheet (Appendix I) will capture the following information: 1) Number of exam candidates per sitting 2) Number of successful candidates 3) percentage pass per sitting 4) Candidates not in formal training posts during exam sitting and respective pass rate. The number of candidates who sat the exam will be assessed against the percentage pass per semester and a further comparison will be made from candidates who sat the exam after 2012 between those who were in formal registrar posts compared to those who were siting the exam for the first time outside of formal registrar post.

Data Analysis

Descriptive statistics will be used to describe the examination outcomes in the two periods under study (pre and post 2012). Inferential statistics will then be applied to establish the difference, if any, between the two periods and to assign a statistical significance.

The two cohorts each comprise of approximately 500 candidates who sat the exam in either the first or second semester during the study period. The cohort before 2012 only comprises of candidates in formal training at the time of taking the exam. The pass rate between the two cohorts will be determined as follows: $P = (p \div t) \times 100$, where P is the pass rate, p is the number of candidates who passed the exam, and t is the total number of candidates who sat the exam. A comparison of the pass rate will give an indication if more or less students are passing the exam after the 2012 changes were effected.

Bias and Confounding Variables

The exam format of the FC Rad Diag (SA) Part 1 was modified during the study period by removing the oral component of the exam, this may have had an impact on candidate performance thus the researchers will consider this when analyzing the data.

Some candidates may have taken the exam for the second of third time in the transition period between 2011 and 2012. These candidates will therefore belong to both cohorts and this may skew the results.

Ethics

In order to ensure confidentiality, the following coding process will be used after engagement with the CMSA. Exam candidates per exam sitting will be allocated numbers which will be the only identifier of a candidate. These numbers will have no link to the actual candidate number given to the candidate at the time of that exam. A senior staff member at the CMSA will ensure separation of the researcher from the raw data. The data will remain securely controlled and only accessible to the core research team which will include the research supervisors and the MMed candidate conducting the research.

The information regarding past candidates of the FC Rad Diag(SA) part 1 is inherently sensitive and requires protection of the identity of those candidates. The researchers in this study have no interest in the biographical information of the candidates who sat the exam other than whether they were within a formal registrar post at the time of the exam or not.

The researchers will therefore not be dealing directly with individual candidate information and the data obtained will be assessed collectively without any potential prejudice to individual subjects. There are no external funders or sponsors for this study and there is no conflict of interest from the researchers.

Resource Requirements

This is a low budget study and costs associated with the study include:

1) Internet data which will be covered by utilizing University Student Internet access therefore no further funding will be necessary.
2) The services of a professional statistician will be sought and to further mitigate costs, the university provided research coordinator and statistician will be utilized.
3) A professional editor will be sought to make grammar corrections and to ensure that acceptable scientific language is used throughout the written research report. An appropriately qualified in-house editor will be sought at no further expense to the researchers.

Timing

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Literature review	■	■	■											
Preparing protocol	■	■	■											
Protocol Assessment				■	■									
Ethics application					■	■								
Collecting data							■	■	■					
Data analysis							■	■	■					
Write up – thesis										■	■	■		
Write up – paper										■	■	■		

Problems

The Colleges of Medicine of South Africa only began to keep electronic records from 2015 and most of the data before then was archived in paper form. Summary of candidates performance was however periodically electronically recorded. Due to staff constraints at the CMSA, basic demographic information regarding the population i.e. gender of a candidate, number of attempts, site from which examination was attempted, duration within training programme, number of years post internship will not be readily available in the sample preceding 2015. This however should not have a significant impact on our study.

Dissemination and Outcome

The outcomes of this study will be presented in a publishable research report.

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3) https://www.cmsa.co.za/view_college_list.aspx, Accessed on 15 September 2018.

4) https://www.rcr.ac.uk/sites/default/files/cr_fellowship_regulations-aug2017.pdf, Accessed on 16 September 2018.

5) Pitcher R, De Vries C, Lockhat Z. The FC Rad Diag(SA): Stretched, but still in step – Report on a Royal College observership. S Afr J Rad. 2017;21(1):a1092. Available from: https://doi.org/10.4102/sajr.v21i1.1092

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APPENDIX I: DATA SHEET FOR

OUTCOMES IN THE PART 1 FC RAD DIAG (SA)

YEAR_____ SEMESTER_____

	Student ID (CODE)	Registrar Program (Y/N)	University	Outcome			
				Passed (%) Phys	Passed (%) ANAT	Fail (%) Phys	Fail (%) ANAT
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2.							
3.							
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