

A RETROSPECTIVE AUDIT OF THE OUTCOMES OF
THE FELLOW OF COLLEGE OF SURGEONS (FCS)
(GENERAL SURGERY) FINAL EXAMINATIONS

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CONTENTS

1.	Declaration.....	3
2.	Acknowledgements.....	4
3.	List of figures.....	5
4.	List of tables.....	6
5.	Abbreviations.....	7
6.	Abstract.....	8
7.	Chapter 1: Literature review.....	10
	a. References.....	24
8.	Chapter 2: Manuscript for submission.....	26
	a. References.....	34
	b. List of figures.....	35
	c. List of tables.....	36
9.	Appendices.....	54

Declaration:

I, Miriam Kahn, hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

I empower the university to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

Signed by candidate

MIRIAM KAHN

Date: 07 June 2018

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List of Figures:

1. Miller's hierarchical model of clinical competence
2. Number of candidates per year
3. Number of candidates per cohort
4. Pass rate per year
5. Invitation rate per year
6. Averages for Paper 1
7. Averages for Paper 2
8. Averages for both Papers
9. Averages for Oral 1
10. Averages for Oral 2
11. Averages for the OSCE
12. Averages for both Cases
13. Correlation between Paper 1 and Paper 2
14. Correlation between Oral 1 and Oral 2
15. Correlation between Case 1 and Case 2
16. Correlation between Papers and Orals
17. Correlations between Papers and OSCE

List of Tables:

1. Candidate numbers per examination
2. Invitation and pass rate
3. Examination component results

Abbreviations:

FCS	Fellowship of College of Surgeons
OSCE	Objective structured clinical examination
VIVA VOCE	Oral rather than written
MCQ	Multiple choice questions
SAQ	Short answer question
MEQ	Modified essay question
CCS	Computer-based case simulation
MIST-VR	Minimally invasive surgical trainer
ES3	Endoscopic sinus surgery simulator
OSATS	Objective Structured Assessment of Technical skills
CbD	Case-based discussion
mCEX	Mini-Clinical Evaluation Exercise
DOPS	Direct Observation of Procedural Skills
mPAT	Mini-Peer Assessment tool
CMSA	The College of Surgeons of South Africa
HPCSA	Health professions council of South Africa
CE	Certifying exam
QE	Qualifying exam
CSSA	College of Surgeons of South Africa

Abstract:

A RETROSPECTIVE AUDIT OF THE OUTCOMES OF THE FELLOW OF COLLEGE OF SURGEONS (FCS) (GENERAL SURGERY) FINAL EXAMINATIONS

Dr Miriam Kahn

Background and aim:

An audit of the Fellowship of the College of Surgeons FCS (SA) Final Examination results has not been previously performed. The purpose of this study was to review and determine any predictors of outcome.

Methods:

The results of the FCS (SA) Final Examinations from October 2005, to and including, October 2014, were retrieved from the College of Medicine of South Africa database. The current format of the examinations consists of: two written essay question papers, an OSCE, two clinical cases and two vivas. These were retrospectively reviewed and analyzed. Predictors of failure or success were determined. Analysis was performed using *IPython* for scientific computing. Assumptions for the normal distribution of numerical values were made based on the Kolmogorov-Smirnov test and quantile-quantile plots. Normally distributed variables were analyzed by parametric tests. In all other cases nonparametric tests were employed. An alpha value of 0.05 was chosen to indicate statistical significance, using a confidence level of 95%.

Results:

During the 10-year study period, 472 candidates attempted the examinations. A total of 388 (82,2%) candidates were successful in the written component of the examination and were subsequently invited to participate in the oral/clinical component of the examinations.

Overall, 296 (62,7%) of candidates passed and 176 (37,3%) failed. A total of 19 candidates achieved less than 50% for both papers, yet still managed an average of more than 45%. A total of 15 (79%) of these candidates went on to fail the examination. There were 51 candidates who were invited to the oral examinations despite an average of less than 50% in the two papers, and 34 (67%) failed the overall examination. Similarly, 126 candidates were invited having failed one of the two papers of which 81 (64.3%) ultimately failed. A total of 49 candidates failed the OSCE, 82% of these candidates failed overall. There was strong correlation between paper one and paper two ($r = 0.56$, $p\text{-value} < 0.01$), oral one and oral two ($r = 0.41$, $p\text{-value} < 0.01$) and case one and case two ($r = 0.38$, $p\text{-value} < 0.01$). Similar correlations were seen between the averages of the papers versus the orals ($r = 0.52$, $p\text{-value} < 0.01$), the papers versus the cases ($r = 0.5$, $p\text{-value} < 0.01$) and the papers versus the OSCE ($r = 0.54$, $p\text{-vale} < 0.01$).

Conclusion:

The written papers are the main determinant of invitation to the second part of the examination. Candidates with marginal scores in the written component had an overall failure rate of 67%. Failing one paper and passing the other, resulted in an overall failure rate 64,3%. Failing the OSCE resulted in an overall 82% failure rate. With the high failure rate of candidates with marginal scores and with the inter-examination variability of the papers, it might be prudent to revisit both the process of invitation selection and the decision to continue with the long-form for the written component.

CHAPTER ONE

Literature Review

Introduction:

In the past, assessment methods in Medicine, at both undergraduate and postgraduate levels, included both written and oral examinations. The written examinations usually involved open-ended essay-type questions. The oral examinations included both clinical and VIVA VOCE and required a student to present to an assessor who decided on the quality of the performance. Unfortunately, these forms of assessment were very subjective and lacked reliability and reproducibility.

Furthermore, other core competencies of a doctor have been identified and thought to be important, including communications skills, surgical technical skills for surgeons and professionalism, which could not be adequately assessed using the traditional methods of assessment of written and oral examinations. This was a further stimulus for the development of new assessment methods.

The last several decades have seen extensive development in assessment methods in medical education with the introduction and implementation of several new methods of assessment. There has also been a critical appraisal of the assessment methods to ensure that they achieve the desired goals.

Changing Concepts in Assessment Methods:

In the past examinations processes for medical education focused almost entirely on the assessments of knowledge and clinical skills. However, there is now greater appreciation that other competencies of a doctor are important and need to be assessed. These core

competencies include the ability to communicate, perform technical skills, and professionalism.¹

a) Miller's Hierarchical Model:

In 1990, George Miller, a medical educationalist, described a hierarchical model to be used in the assessment of clinical competence. The pyramidal framework for assessing clinical competence is shown in Figure 1. ¹

- I. **“Knows”**: At the base of the pyramidal framework is the importance of acquiring and assessing knowledge i.e. the student has to know what is required of him/her to perform the professional functions adequately. Methods to assess knowledge are commonly based on objective methods of assessment. The most common method for the assessment knowledge is the written method. Clearly there is more to clinical competence than just having the knowledge.
- II. **“Knows how”**: In the next level of the pyramidal framework the student is required to demonstrate the ability to use the knowledge which has been accumulated. This involves the collection of clinical and laboratory information, to analyze and interpret the data, and to reach a diagnostic and management plan. The assessment of “knows how” also involves objective test methods. This includes various types of written methods, ranging from multiple choice type questions to essay questions.⁶
- III. **“Shows how”**: In this level of competence the student needs to demonstrate the ability to perform the various objectives i.e. the student not only “knows” and “knows how” but can also “show how” it is done. This can be assessed using patient cases or objective structured clinical examinations (OSCE).⁶ The assessment of performance objectively remains a challenge.

- IV. **“Does”**: At the apex of the pyramid is the assurance that the graduate will be competent when functioning independently as a clinician. This aspect of professional behavior is extremely difficult to assess accurately.

There are a variety of methods to assess each level of the pyramidal framework, and each has its own strengths and limitations.

b) Psychometric Properties of Assessment:

The psychometric characteristics of an assessment method defines whether an assessment method achieves what it was designed to do i.e. whether it evaluates what it is meant to evaluate. Typically, the psychometric properties include validity and reliability. ²

- I. **Validity**: Validity defines how well a particular assessment method tests what it is meant to test. Validity can be divided into different categories. *“Face validity”* describes the functionality of the assessment method. *“Content validity”* is an indication of the assessment method to measure what it is designed to test. *“Construct validity”* refers to whether the test is successful in assessing what is meant to assess. *“Incremental validity”* refers to the comparison of various assessment methods which test the same traits. *“Predictive validity”* refers to the capacity of a particular assessment method to predict the performance of a test in the future. ³
- II. **Reliability**: The reliability of an assessment method refers to whether the test is consistent in its results with regard to the reproducibility of the test and the ability to discriminate. *“Inter-test reliability”* refers to whether the test achieves the same outcomes when repeated. *“Inter-rater reliability”* is a measure of the level of agreement of the scores given by different examiners on the same subject. *“Internal*

consistency” describes the correlation of the different components of the examination with the outcome and their contribution to the outcome. ⁴

- III. *Educational effect*: Assessment methods also have an important educational effect. The type of assessment will often determine how the student prepares for the examination. For example, if the focus of the assessment is to test knowledge using a written examination, then the student will be motivated to mainly study from textbooks. In contrast if the focus is an assessment of clinical skills, the student will be motivated to spend more time interacting with patients. ⁵
- IV. **Feasibility**: Another important psychometric property of an assessment method is the affordability of the test. It is important to ensure that the costs of the examination are reasonable. ⁵
- V. **Acceptability**: Assessment methods also have to be acceptable to all stakeholders, including not only the students and faculty, but the patients as well. The stakeholders have to endorse both the methodology of the assessment and associated interpretation of scores. ⁵

c) Formative versus Summative Assessment:

Assessment methods can also be classified as formative or summative. Formative assessment can be used to guide future learning and is especially useful in providing feedback and reassurance to the student. It is also meant to promote reflection and shape values in the student. ³

Summative assessments are used to make an overall judgment about the competence of the student and the fitness of the student to practice. Summative assessments are often used for the professional self-regulation and accountability. ³

In selecting an assessment method, it is important to draw distinction between assessments which have good psychometric properties for summative use.

Assessment Methods:

All forms of assessment are associated with certain strengths and certain weaknesses. The intrinsic flaws of an assessment method can be compensated for by using both multiple observations over time and also different types of assessments.

a) Essay Questions:

Written examinations are still the most widely used form of assessment of knowledge.

Written examinations can be either open-ended essay type questions or multiple choice questions.

Although the College of Surgeons of South Africa still use open-ended essay type examinations, this has to a large extent gone out of fashion. This type of examination has many flaws including the lack of objectivity, poor inter-rater reliability, it is labor intensive, and its applicability in a diverse multi-lingual society.⁴ However, essay type questions are said to be better at testing problem solving skills.

b) Multiple Choice Questions (MCQ):

MCQ examinations are the most widely used written examinations and are specifically used as an assessment of knowledge.⁴

There are several types of MCQs. The A-type or “one best answer” format requires the student to choose the single best answer from three to five options. These questions are easy to construct, have high reliability, and can be used to test a broad content domain.⁴

Although this type of examination is thought to test problem solving ability.⁶

The R-type of extended matching questions (EMQ) are made up of short clinical vignettes and a list of options related to one aspect i.e. all diagnoses, investigations, or treatment etc. The list of options can be used for more than one clinical vignette. ⁶

MCQ examinations are widely used because it involves a large number of questions embracing many content areas and has high reliability. The questions are relatively easy to construct and it is easy to mark by computer. It is very cost efficient and high acceptability amongst stakeholders.

c) Key Feature Questions:

Key feature questions consist of a short clinical scenario and a list of questions directed at key features or critical decisions in the management of the patient. This type of examination is a good test of clinical decision-making skills with proven reliability and validity. It has also been shown to be predictive of future performance on oral examinations. ⁶

d) Short Answer Questions (SAQ):

SAQ are open-ended questions. The examinee is required to produce a short answer consisting of a few words. Because it takes longer to answer the questions compared to MCQs, fewer questions can be asked, making it less reliable. It is also more labor intensive because the scripts have to be marked by an expert. Usually multiple assessors have to be used, increasing the risk of poor inter-rater reliability. ⁶

e) Modified Essay Questions (MEQs):

MEQs are essay questions which consist of a short case study and a list of sequential questions i.e. there is question interdependency. The problem is that an incorrect answer for the first question will result in incorrect answers to the following questions. MEQs are particularly useful at assessing problem solving skills and reasoning skills. ⁶

f) Objective Structured Clinical Examinations (OSCE):

The OSCE is designed to assess performance i.e. clinical skills. The examination consists of several stations which focus on different activities representing clinical competence. Ideally each station should involve a standardized patient. The latter can be a real patient or a simulator. The number of stations included in the OSCE can vary, as well as the duration spent at each station. The scoring of the examinee is undertaken by an observer who is usually a faculty member. The scoring is usually done according to a checklist. The reliability of an OSCE examination depends on the number of stations and which competencies are tested. ⁷

g) Short Cases:

Short cases are commonly used to assess clinical competence. The trainee is required to undertake a specific focused examination in the presence of an observer. The aim is to assess the ability to assess physical signs. ⁶

h) Long Cases:

The long case is also used to assess clinical competence. The examinee is required to take a history and examine a patient, usually unobserved, and to present his/her findings to usually more than one examiner. The latter then interrogates the student on various aspects of the diagnosis and management of the patient.

The challenge with the long case is the lack of standardization of cases and lack of inter-rater reliability. ⁶ There are also major logistic challenges in trying to find sufficient patients with good physical signs for a large number of students.

i) Portfolios:

The portfolio is a collection of the student's activities during period of training. It includes a list of all the clinical attachments, lists of practical procedures/operations performed, various project reports, as well as regular assessment reports from various supervisors.

Portfolios are a particularly useful type of formative assessment.⁶

j) Newer Forms of Assessment:

Newer forms of assessment have now become available as a result of an advancement in technology. An example of this is Computer-based simulations. There are a variety of simulations ranging from computer programs, model-driven simulations and virtual reality devices. An example of the computer programs is the computer-based case simulation (CCS).⁵ This program provides the student with a scenario and allows the student to manage the patient by taking a history, examination and ordering tests, while the computerized patient can respond appropriately. The advantages of this type of assessment is that patients can be more acutely ill, and more complicated skills can be assessed. Research has shown that these forms of assessment have reasonable validity and feasibility.

Computerized mannequins such as the MedSim-EagleSim simulator is an example of the model-driven simulations. These mannequins allow for assessments to be made in more of a lifelike acute setting and allow for assessment of clinical procedures. Although these assessments are fairly reliable, especially if more scenarios are used, there is a cost issue. Virtual reality devices have just been introduced into the medical field. These advanced devices provide an excellent form of assessing complicated skills, that are without risks to patients, which may not be achieved in other settings. Not much research has been done with regards to assessment, however costs are an issue. Examples of these devices are the

Minimally invasive surgical trainer (MIST-VR) and the endoscopic sinus surgery simulator (ES3). These devices have the ability to assess certain surgical skills.⁵

k) Assessment of Technical Skills:

The assessment of surgical trainees is further compounded by the fact that surgery is a practical technical discipline and the appreciation that technical surgical skills forms one of the important fundamental core clinical competencies of a surgeon. Most assessment processes in the past did not include assessment of surgical skills. Therefore, an assessment of technical surgical skills is an important form of assessment in surgical training. However, it is still not commonly formally assessed. Currently, new forms of assessment have been introduced, such as Objective Structured Assessment of Technical skills (OSATS). It is similar to the OSCE, as multiple stations are used, using either bench simulation models or live animals. At each station the resident demonstrates certain surgical skills that are assessed by the examiners. These types of assessment are usually formative and can provide feedback as well as identify problems with in the training program. This form of assessment is still new and there is little literature on this subject. A study by Martin, demonstrates that OSATS can reliably and validly assess technical surgical skills in surgical residents. The main issues in this form of assessment includes costs and feasibility, especially if live animal models are used.⁸

The assessment of surgical technical skills is probably best undertaken as part of the formative assessment and can easily be included as part of the portfolio.

l) New Domains of Assessment:

There are several clinical competencies which are regarded as important but where assessment is in its infancy. For example, effective teamwork has been shown to impact

clinical outcomes, and teamwork training is emphasized in most training programs, and yet assessment of teamwork is not included in current assessments.

Another problematic area is the assessment of professionalism. There is agreement that the latter is an important clinical competency, but the universal definition of professionalism remains unresolved.

An assessment of communication skills can easily be included in an OSCE examination.

However, the rating scales for assessing communication skills vary considerably.

Work-Based Assessment:

In contrast to conventional education programs the training of doctors is centered around the care of patients. This difference offers a series of opportunities for assessment. Of particular significance is the fact that the problems encountered as a trainee are the same as those encountered in practice. Therefore, assessment in this environment should correlate with future performance.

With this in mind, several methods involve a stimulus (either an actual patient or a patient's medical record) and an encounter with a faculty member. The various work-based assessments include (a) case-based discussion, (b) the mini-clinical evaluation exercise, (c) the direct observation of procedural skills, and (d) the mini-peer assessment test.⁵

a) Case-based discussion (CbD):

The student submits two patient records in which they have been involved, and the faculty member chooses one for discussion. There is an assessment of both clinical decision-making as well as the application of knowledge. Several such encounters are scheduled during the year ensuring that an appropriate sample of patient problems are selected. The CbD has been shown to correlate with other measures of performance.⁵

b) Mini-Clinical Evaluation Exercise (mCEX):

In this form of assessment, the assessor observes a student-patient encounter in various settings. In this relatively short encounter the student has to take a focused clinical history and/or undertake a physical examination. The student has to reach a diagnosis and formulate a treatment plan. Again, several such encounters with different assessors take place in a year and spectrum of topics should be covered. These assessments can be included in the portfolio as part of a formative assessment.^{5,6}

c) Direct Observation of Procedural Skills (DOPS):

DOPS is similar to the mCEX in that the faculty member observes the student performing various procedures and rates the performance using a standardized scoring sheet. Again, several encounters take place in a year.⁵

d) Mini-Peer Assessment tool (mPAT):

In this form of assessment, the student chooses several assessors (up to eight) from amongst his/her peers, including staff and other healthcare workers, to complete a questionnaire about both technical skills and interpersonal skills. The questionnaires are then evaluated by a team of assessors from a central office.⁵

Summary:

The last several decades have seen many changes in the way assessment takes place in medical education. Many new forms of assessment have been introduced and researched.

In addition, much has been done to define the goals of assessment, and to identify challenges facing assessment. Several core competencies not previously assessed have been noted and not included.

None of the assessment methods are perfect and the best way to overcome these flaws is to use more than one type of assessment.

Fellowship Examination of the College of Surgeons:

The College of Medicine of South Africa (CMSA) has recently been appointed by the Health Professions Council of South Africa (HPCSA) as the designated examining body for surgeons.

The training of surgeons (registrars) is the responsibility of the Eight medical universities.

Besides the FCS Final examination, the CMSA is also responsible for setting the FCS (SA)

Primary and FCS (SA) Intermediate examinations.

The final fellowship examination of the College of Surgeons of South Africa FCS (SA) consists of several components – written papers, OSCE, VIVA VOCE, and clinical cases. The trainee is also required to maintain a portfolio and produce a research dissertation.⁹

a) Portfolio:

The portfolio is a summary of the registrar's training and clinical experience, and consists of a logbook of clinical activities, procedures and operations, clinical rotations assessment, projects and presentations. The portfolio and training time has to be rectified by the Head of Department.

The portfolio is a requirement in order to write the FCS Final examination and has to be submitted to the College for evaluation. If the portfolio is deemed satisfactory, the student may proceed to write the examination. The portfolio does not contribute to the final mark.

Evidence of completion of the research report is also a requirement to write the examination.

b) Written Papers:

The written part of the examination consists of two papers, each three hour long and each made up of four 100 mark essay-type questions. Each question will have a minimum of 5 sub-questions with marks ranging from 10-40%. The first paper is based on General Surgery and Surgical Pathology, and the second paper includes questions on Surgical Anatomy and

Operative Surgery. The aims of the written examination are to assess knowledge, insight, application, analysis and integration, synthesis and evaluation.

The written examination serves as a screening mechanism to determine who gets invited to the oral/clinical part of the examination. The pass mark for each paper is 50%. However, a mark of 45% in one paper can be compensated for if the mark in the other paper is greater than 50%. Therefore, all candidates with an average mark of over 50% in the two papers will be invited to the oral/clinical component.

c) OSCE:

The OSCE part of the examination consists of 18 stations which are each 5 minutes long. Some of the stations are manned by a faculty member who interacts with the candidate. Other stations are unmanned, and may require the candidate to interpret an x-ray/scan, comment on an image, or discuss laboratory investigations etc.

d) VIVA VOCE:

The oral component of the examination consists of two 20 minute orals, one related to General Surgery and Surgical Pathology, and the second related to Surgical Anatomy and Operative Surgery. During the oral examinations the candidate is questioned by two assessors. The marks from the oral examinations are combined with the marks from the relevant paper.

e) Clinicals:

The candidates are expected to examine two long cases. The candidate is required to present the clinical history and physical findings, the diagnosis, and a management plan to a pair of examiners. Clinical decision making is assessed and the candidate is expected to function at a specialist level.

In recent years, two paper cases have been added to the clinical component of the examination. The candidate is presented with the clinical history and physical findings and is then expected to formulate a management plan.

Outcome:

The pass mark is 50%. The candidate has to pass each component of the examination as well as pass overall. The written paper marks and the VIVA VOCE marks are combined and some degree of compensation is allowed. There is no compensation in the clinical and OSCE parts of the examination.

International General Surgery Final Examinations:

In other parts of the world, the General Surgery final examinations are conducted in a different manner, with some similarities. In Canada, the Royal College of Physicians and Surgeons of Canada are responsible for regulating the examinations. The final examination consists of a written component and an oral/clinical component. The written examination is based on a two MCQ papers of a mix SBA and R-type questions.¹⁰ The oral component consists of eight stations, during each station the candidate will be presented with two clinical scenarios of either 5 or 10 minutes duration in similar fashion to a consultation with a colleague. In the UK, the final examination consists of two parts.¹¹ Part A is a written examination consisting of two MCQ papers, which include single best answer questions and extended matching item questions. On passing Part A, candidates may then apply for Part B, which is an 18 station OSCE. In the United States, the final examination is the Certifying Exam (CE). The candidate first has to pass the Qualifying exam (QE) which is a 300 MCQ examination.¹² On passing this the candidate may apply for the CE, which is an oral examination. It consists of three 30-minute oral discussions based on clinical scenarios.

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CHAPTER TWO

Manuscript for Submission

**AN AUDIT OF THE OUTCOMES OF
THE FELLOW OF COLLEGE OF SURGEONS (GENERAL SURGERY) FINAL EXAMINATIONS**

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Abstract

An audit of the Fellowship of the College of Surgeons FCS (SA) examination results has not been previously performed. The purpose of this study was to review and determine any predictors of outcome (pass or fail).

Methods:

The results of the FCS (SA) Final Examinations from October 2005, to and including, October 2014, were retrieved from the College of Medicine of South Africa database. The current format of the examinations consists of: two written essay question papers, an OSCE, two clinical cases and two vivas. These were retrospectively reviewed and analyzed. Predictors of failure or success were determined.

Results:

During the 10-year study period, 472 candidates attempted the examinations. A total of 388 (82,2%) candidates were successful in the written component of the examination and were subsequently invited to participate in the oral/clinical component of the examinations. Overall, 296 (62,7%) of candidates passed and 176 (37,3%) failed. A total of 19 candidates achieved less than 50% for both papers, yet still managed an average of more than 45%. A total of 15 (79%) of these candidates went on to fail the examination. There were 51 candidates who were invited to the oral examinations despite an average of less than 50% in the two papers, and 34 (67%) failed the overall examination. Similarly, 126 candidates were invited having failed one of the two papers of which 81 (64.3%) ultimately failed. A total of 49 candidates failed the OSCE, 82% of these candidates failed overall. There was strong correlation between paper one and paper two ($r = 0.56$, $p\text{-value} < 0.01$), oral one and oral two ($r = 0.41$, $p\text{-value} < 0.01$) and case one and case two ($r = 0.38$, $p\text{-value} < 0.01$).

Similar correlations were seen between the averages of the papers versus the orals ($r = 0.52$, $p\text{-value} < 0.01$), the papers versus the cases ($r = 0.5$, $p\text{-value} < 0.01$) and the papers versus the OSCE ($r = 0.54$, $p\text{-value} < 0.01$).

Conclusion:

The written papers are the main determinant of invitation to the second part of the examination. Candidates with marginal scores in the written component had an overall failure rate of 67%. Failing one paper and passing the other, resulted in an overall failure rate 64,3%. Failing the OSCE resulted in an overall 82% failure rate. With the high failure rate of candidates with marginal scores and with the inter-examination variability of the papers, it might be prudent to revisit both the process of invitation selection and the decision to continue with the long-form for the written component.

Introduction:

The manner in which both undergraduate and postgraduate medical graduates are assessed has been subjected to extensive scrutiny and review in recent years.¹⁻⁵ The traditional format of examination with written essay-type papers, clinical cases and oral viva voce examinations have been criticized by educationalists and found to be significantly flawed.^{6;7} These formats of examination are unfortunately extremely subjective and lack the psychometric properties of a good examination such as reliability, validity, applicability and acceptability.

The Colleges of Medicine of South Africa (CMSA) has been appointed by the Health Professions Council of South Africa (HPCSA) to be the sole examining body for postgraduate medical specialists. The College of Surgeons of South Africa (CSSA), is one of the Colleges within the CMSA, is responsible for the assessment of surgical trainees. Graduates need to pass the FCS (SA) Final Examination of the CSSA to be awarded the Fellowship of College of Surgeons (FCS) in order to practice independently as a specialist in general surgery. In this study we undertook an analysis of the success and failure rates in the final fellowship examination and attempted to determine predictors of either outcome.⁸

Methods:

The results for all components of the FCS (SA) Final Examination were made available by the CMSA for the period 2005 to 2014. The component results included individual percentage scores for two written papers, two oral examinations, two clinical cases and an OSCE.

Invitees to the clinical component of the examination were indicated by the presence of results for these components.

Analysis was performed using *IPython* for scientific computing. Assumptions for the normal distribution of numerical values were made based on the Kolmogorov-Smirnov test and quantile-quantile plots. Normally distributed variables were analyzed by parametric tests.

In all other cases nonparametric tests were employed. An alpha value of 0.05 was chosen to indicate statistical significance, using a confidence level of 95%.

Results:

Data point values were available for a total of 19 examinations for the period July 2005 to October 2014. This comprised 472 instances of candidates taking the examination (some candidates attempted the examination more than once). **Table 1**

The number of candidates writing the examination each year is shown in **Figure 2**. The number of candidates writing remained fairly constant each year at approximately 40 per year, with the exception of 2010 and 2011 when these were almost double the usual number ($n = 76$ and $n = 79$, respectively). The College of Surgeons examinations take place in May and October each year. The number of candidates writing each examination is shown in **Figure 3**. The number of candidates in May and October were usually similar, except in 2008; 2009 and 2011 when there were significantly more candidates writing in October, and in 2007 when there were more candidates in May.

A total of 296 (62.7%) of the 472 candidates successfully completed the examination and 176 (37.3%) failed. The pass rate for each year is shown in **Figure 4**. The average pass rate remained fairly constant at 60% (range 45-76%) each year.

A total of 388 (82%) candidates were successful in the written component of the examination and were subsequently invited to participate in the oral/clinical component of the examinations (**Table 2**). The proportion of candidates invited to participate in the oral/clinical component of the examinations each year is shown in **Figure 5** and has remained constant at 80% (range 66-100%).

The mean mark achieved in Paper I was 55 ± 8 %. The average mark achieved in Paper I each year is shown in **Figure 6** and has remained fairly constant during the study period (range: 51

$\pm 8\%$ to $57 \pm 6\%$). The mean mark achieved in Paper II was $55 \pm 9\%$. The average mark achieved in Paper II each year has also remained fairly constant during the study period (range: $50 \pm 8\%$ to $58 \pm 7\%$) (**Figure 7**).

The mean mark for Papers I and II together was $55 \pm 7\%$ and has remained fairly constant each year during the study period (range: $50 \pm 8\%$ to $57 \pm 5\%$) (**Figure 8**).

The mean mark in the General Surgery/Surgical Pathology Oral (Oral I) was $56 \pm 10\%$ and remained very constant each year during the study period (range: $54 \pm 10\%$ to $57 \pm 8\%$) (**Figure 9**).

The mean mark in the Surgical Anatomy/Operative Surgery Oral (Oral II) was $56 \pm 10\%$ and remained very constant each year during the study period (range: $55 \pm 9\%$ and $58 \pm 9\%$) (**Figure 10**).

The marks achieved in the OSCE examination are shown in **Figure 11**. The mean mark in the OSCE was $59 \pm 9\%$ and remained fairly constant each year during the study period (range: $57 \pm 9\%$ to $64 \pm 9\%$).

The marks achieved in the Clinical Cases each year during the study period are shown in **Figure 12**. The mean mark for the Clinical Cases was $58 \pm 8\%$. The marks achieved for the Clinical Cases each year also remained fairly constant during the study period (range: $55 \pm 6\%$ to $60 \pm 8\%$).

The College regulations stipulate that candidates who achieve less than 50% in the papers may still be invited to the orals/clinical if the combined mark in the two papers is greater than 50%. Seventy-four candidates who achieved less than 50% in Paper I were invited to the orals and 41 (55%) failed the overall examination. A total of 56 candidates who achieved less than 50% in Paper II were invited to the orals and 41 (64%) failed the overall examination. There were 51 candidates who were invited to the oral examinations despite an average of less than

50% in the two papers, and 34 (67%) failed the overall examination. Similarly, 126 candidates were invited having failed one of the two papers of which 81 (64.3%) ultimately failed. A total of 49 candidates failed the OSCE, 40 (82%) of these candidates failed overall. Descriptive results for all the sections of the examination are given in **Table 3**.

We undertook a comparison of the marks achieved in the various components of the examination. There was a positive correlation between the marks achieved in Paper I and Paper II ($r = 0.56$; **Figure 13**). Similarly, there was a positive correlation between the marks achieved in Oral I and Oral II ($r = 0.41$; **Figure 14**). There was also a positive correlation between the marks awarded in the Clinical Cases i.e. case I versus case II ($r = 0.38$; **Figure 15**). The comparison between the average marks achieved in the papers and the average marks achieved in the orals is shown in **Figure 16**. There was a positive correlation between the marks achieved in the papers and orals ($r = 0.52$).

There was also a positive correlation between the average marks achieved in the papers and the average marks achieved in the clinical cases ($r = 0.5$; **Figure 17**). Similarly, there was a positive correlation between the average marks for the papers and the average marks in the OSCE examination ($r = 0.54$; **Figure 18**).

Discussion:

There was a total of 472 attempts spanning 19 examinations. The period 2010 and 2011 saw a significant number of entries (76 and 79 respectively). This number has seen a decline since, with only 45 candidates entering in 2014. With an overall pass rate of 62.7% this tendency of decline is also seen in the actual number of individuals qualifying as surgeons, with only 25 doing so in 2014.

Of the 472 attempts at the examination by completing two long-form papers, 388 (82.2%) were invited to the second part of the examination comprising two oral exams, the clinical

cases and an OSCE. The invitations are based on performance in the written papers and the rate of invitations were quite variable (minimum 54.5% in 2006, maximum 100% in 2012). Of those invited, the minimum score for paper one was 40%, for paper two was 45% and the minimum for the average of the papers was 45.5%. The maximum for those not invited for paper one was 58%, for paper two 60% and for the average of the two papers was 53.5%.

The decision to invite candidates with low scores for their papers resulted in a high failure rate. Twenty-eight candidates failed both papers but scored more than 45% and were still invited. Twenty-four (85.7%) of these ultimately failed. There were 51 candidates who were invited to the oral examinations despite an average of less than 50% in the two papers, and 34 (67%) failed the overall examination. Similarly, 126 candidates were invited having failed one of the two papers of which 81 (64.3%) ultimately failed. A total of 49 candidates failed the OSCE, 82% of these candidates failed overall.

The correlation between the various components of the examination showed excellent consistency throughout, with an average range of 19.7% (SD 6.2%, 95% CI 19% to 20.3%). There was a statistically significant difference between the 19 examinations for both papers, the first case and the OSCE. This was more so for the two papers, suggesting inconsistency in the difficulty of the papers. This is out of keeping with the results for the orals and case two, further suggesting that lack of consistency in the papers.

Conclusion:

The written papers are the main determinant of invitation to the second part of the examination. Candidates with marginal scores in the written component had an overall failure rate of 67%. Failing one paper and passing the other, resulted in an overall failure rate 64,3%. Failing the OSCE resulted in an overall 82% failure rate. With the high failure

rate of candidates with marginal scores and with the inter-examination variability of the papers, it might be prudent to revisit both the process of invitation selection and the decision to continue with the long-form for the written component.

The number of trainees qualifying as surgeons in South Africa might not be meeting the needs of the country. An assessment of this requirement is absolutely necessary.

Furthermore, strategies should be developed to increase trainee posts.

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List of Figures:

1. Number of candidates per year
2. Number of candidates per cohort
3. Pass rate per year
4. Invitation rate per year
5. Averages for paper 1
6. Averages for paper 2
7. Averages for both papers
8. Averages for oral 1
9. Averages for oral 2
10. Averages for the OSCE
11. Averages for both cases
12. Correlation between paper 1 and paper 2
13. Correlation between oral 1 and oral 2
14. Correlation between case 1 and case 2
15. Correlation between papers and orals
16. Correlation between case averages and paper averages
17. Correlations between papers and OSCE

List of Tables:

1. Candidate numbers per examination
2. Invitation and pass rate
3. Examination component results

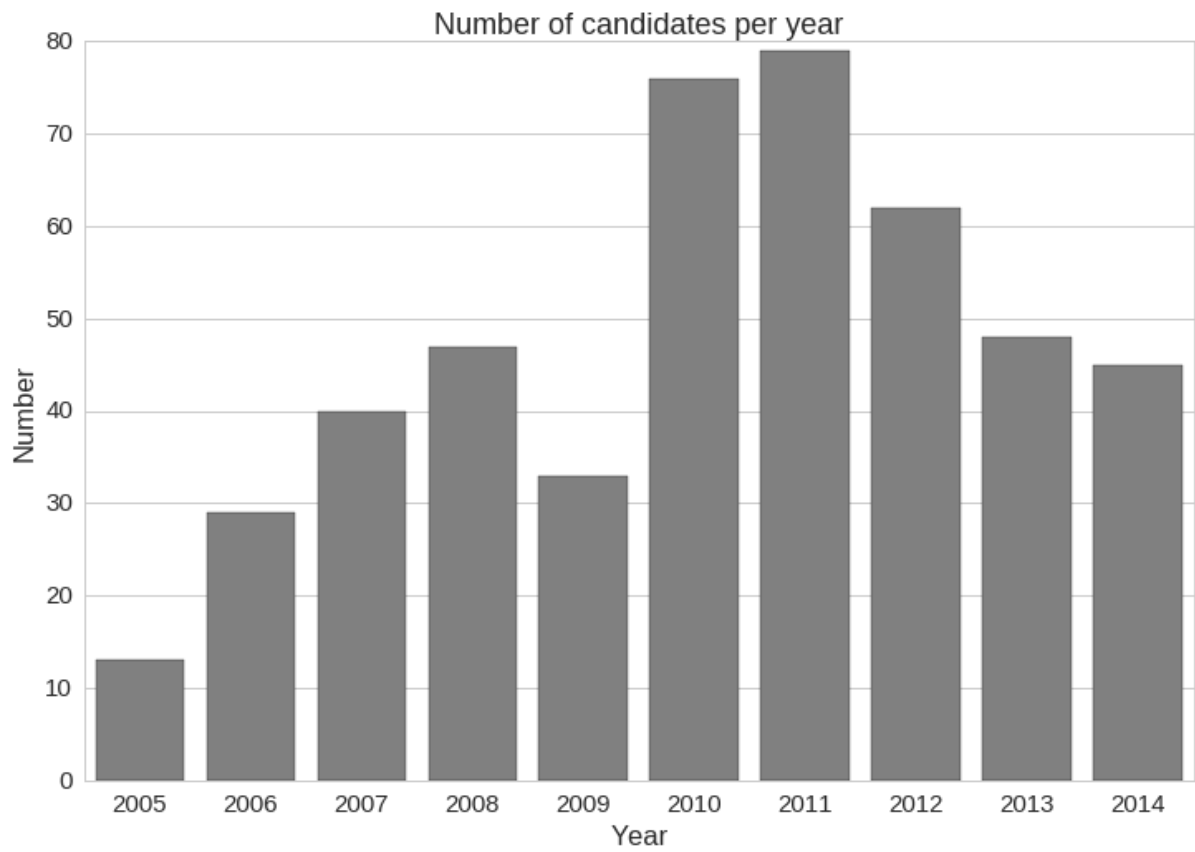


Figure 1
Number of candidates who wrote FCS (SA) Final Examination yearly from 2005 to 2014

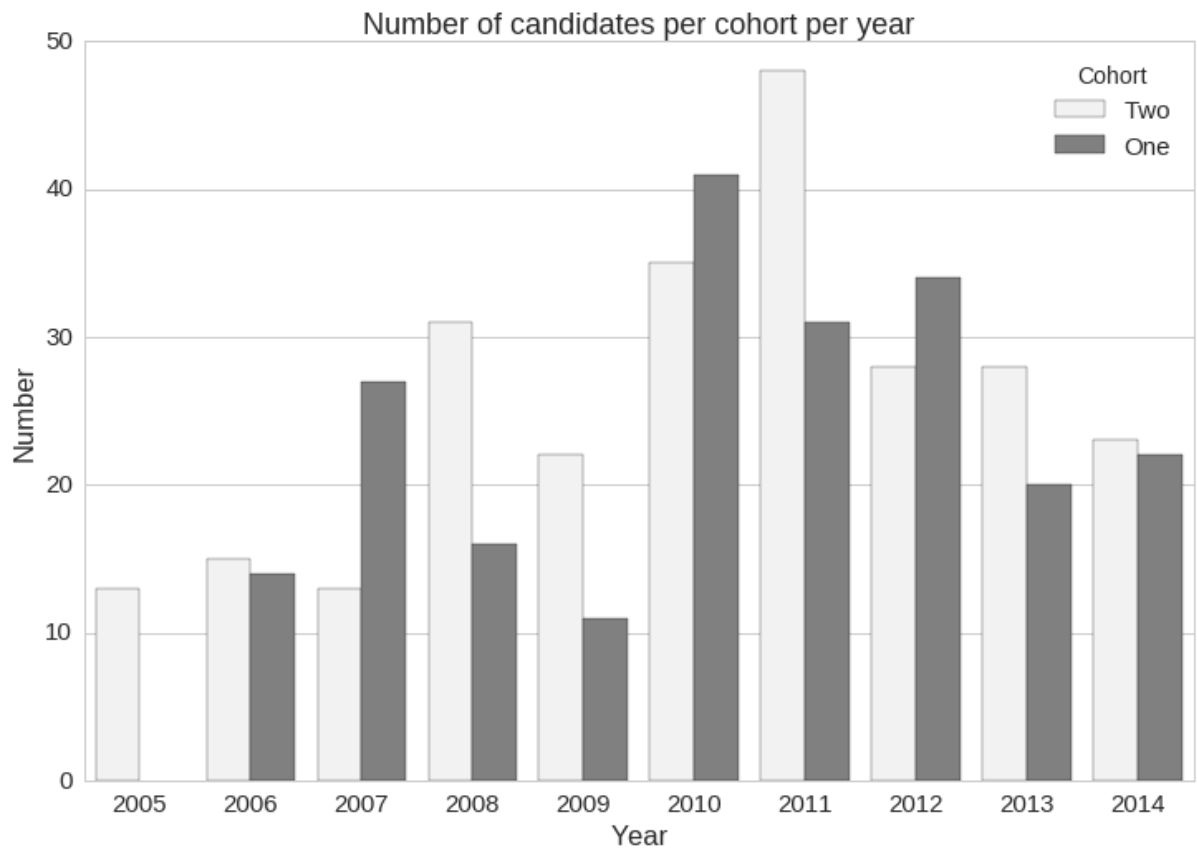


Figure 2
Number of candidates who wrote FCS(SA) Final Examinations per cohort per year

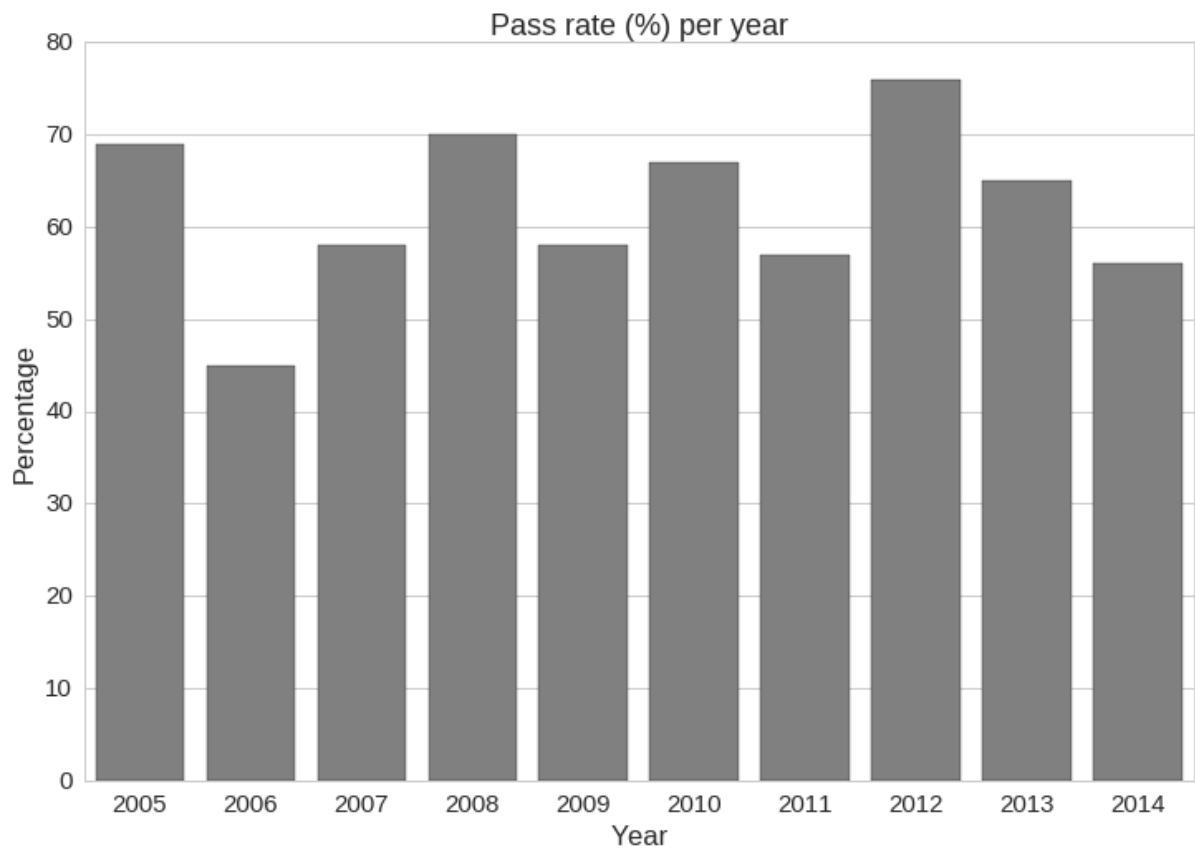


Figure 3 Percentage of candidates that passed per year

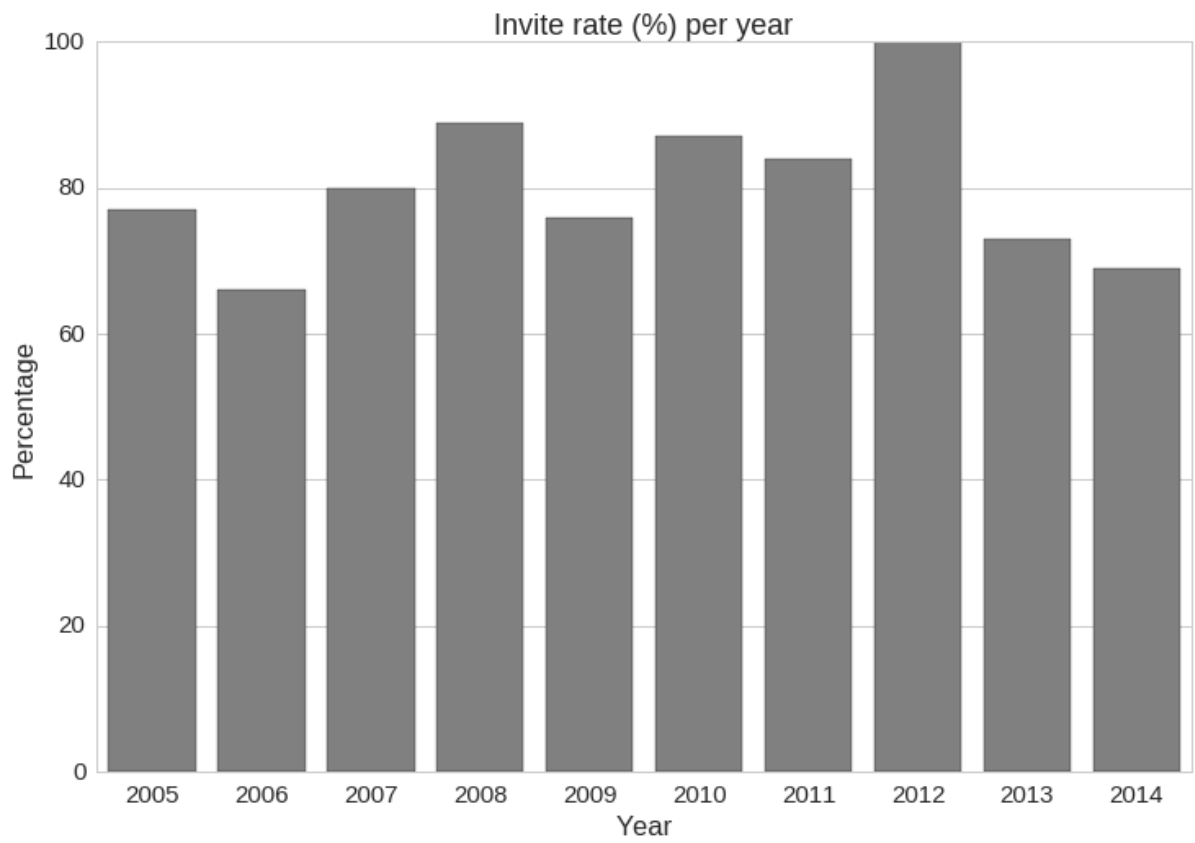


Figure 4 Percentage of candidates that were invited per year

Figure 5

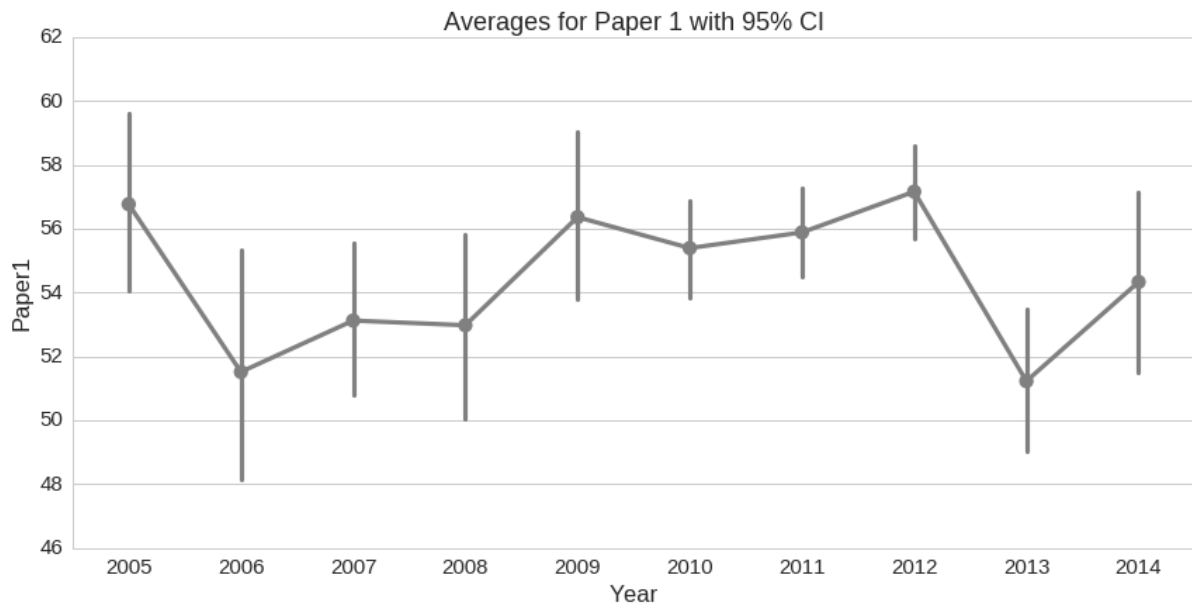


Figure 6

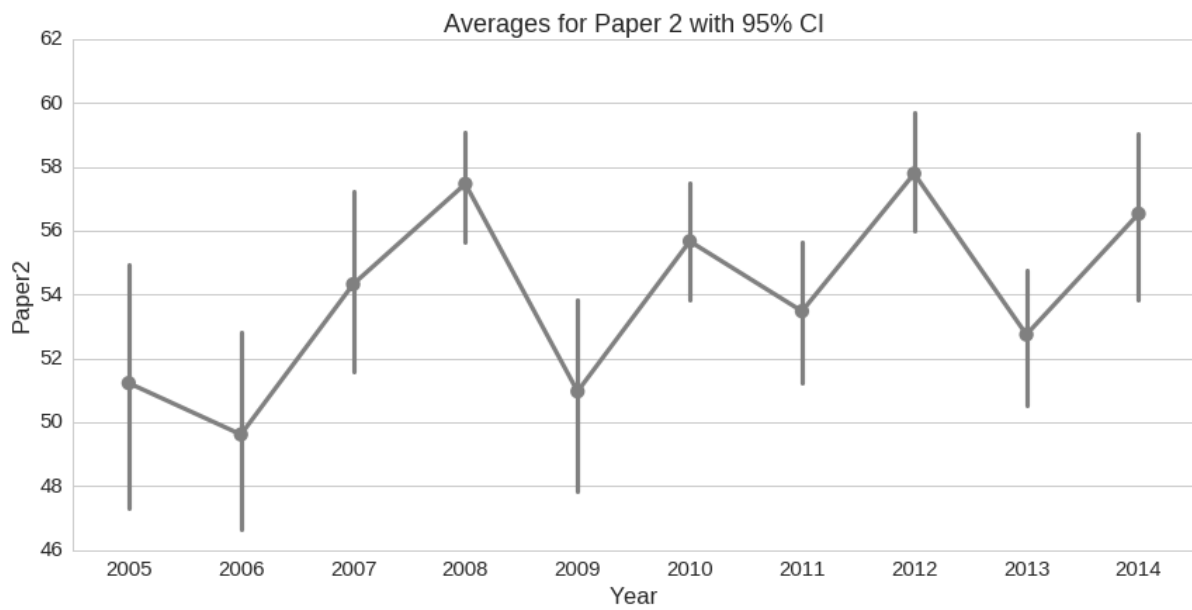


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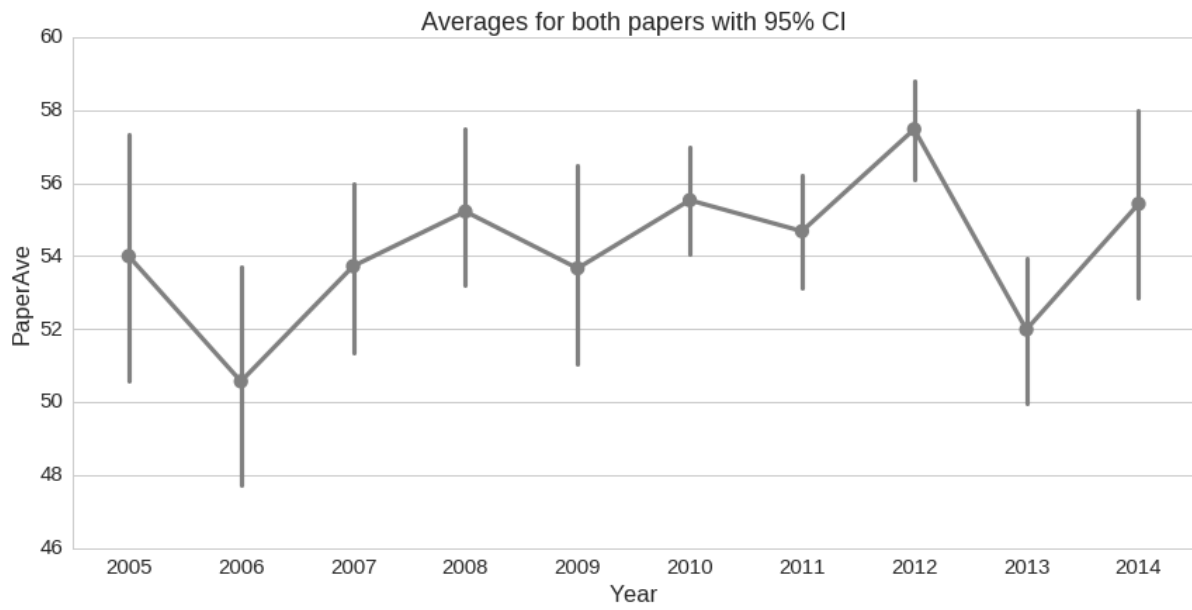


Figure 8

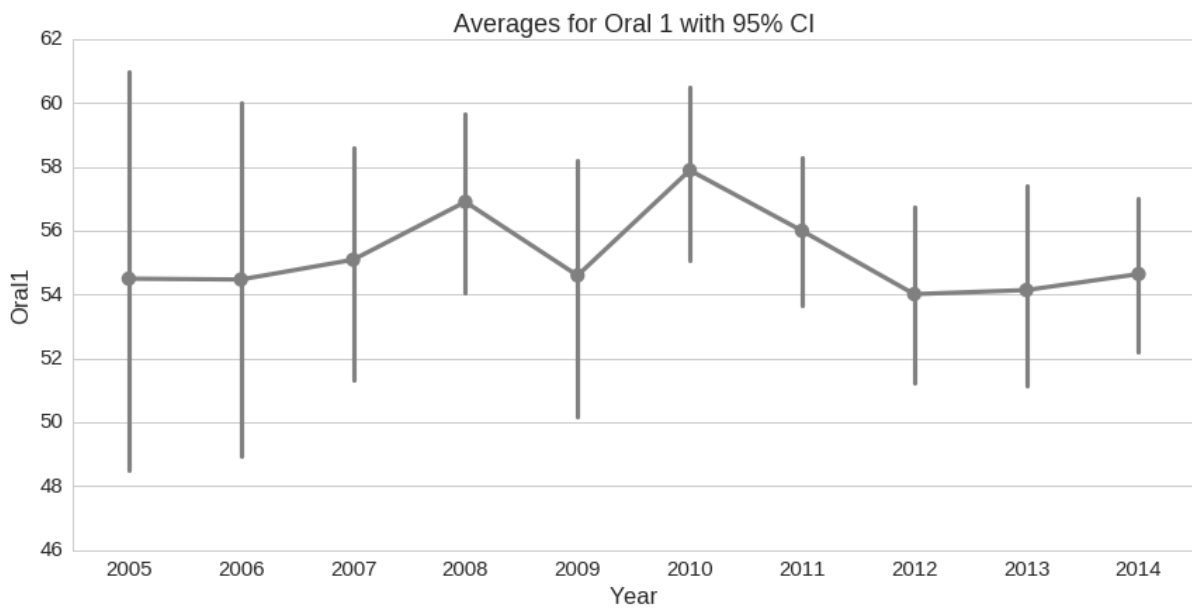


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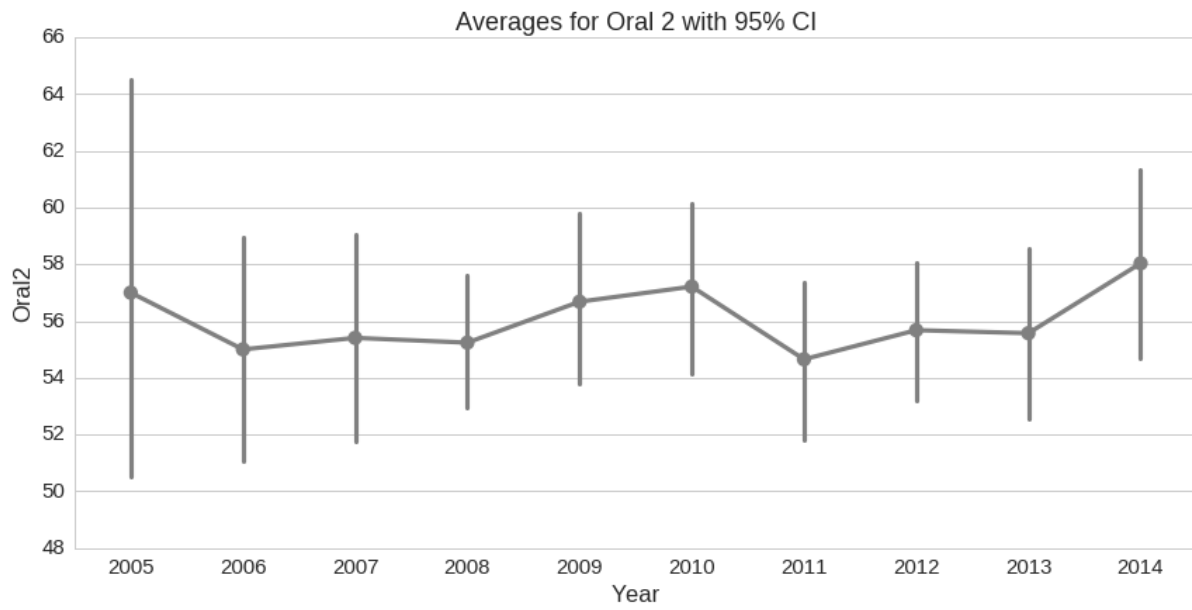


Figure 10

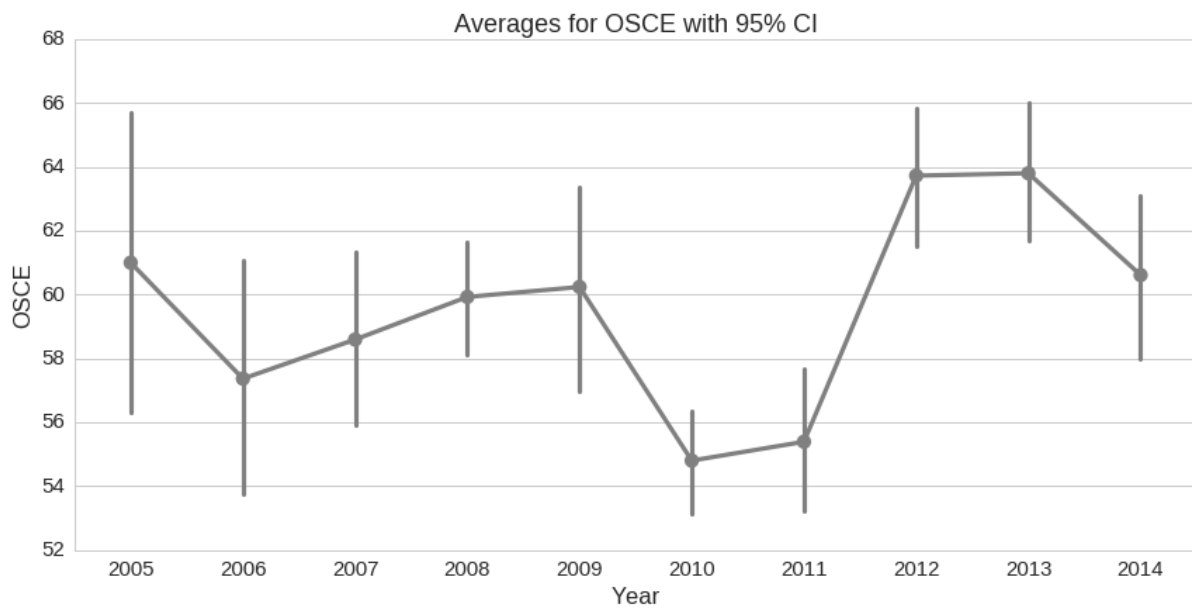


Figure 11

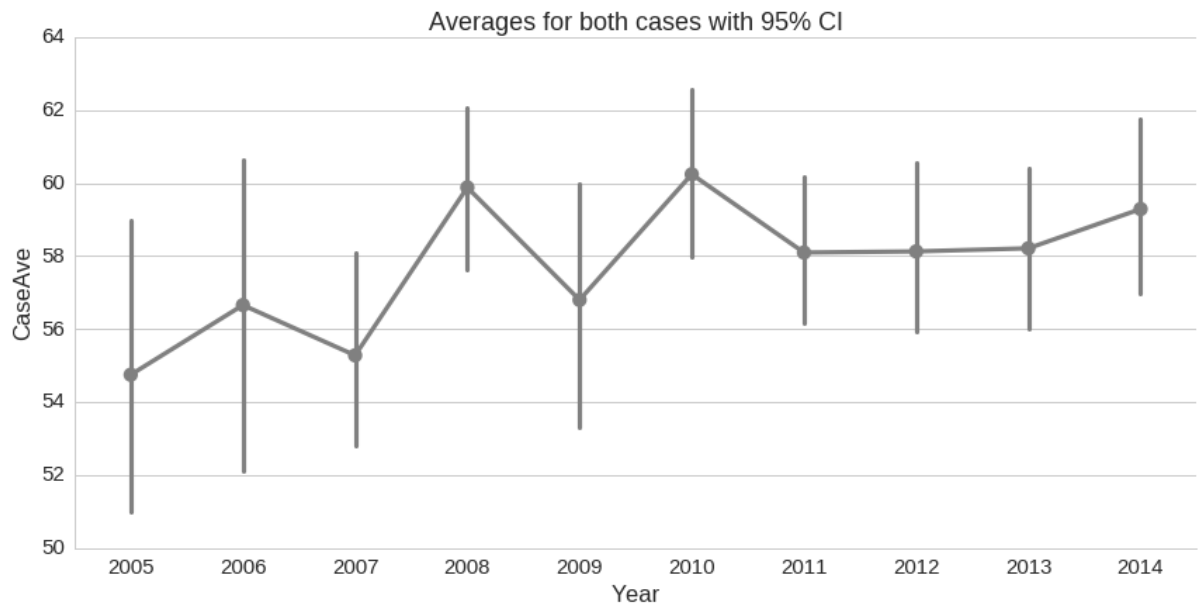


Figure 12 Correlation between paper 1 and paper 2

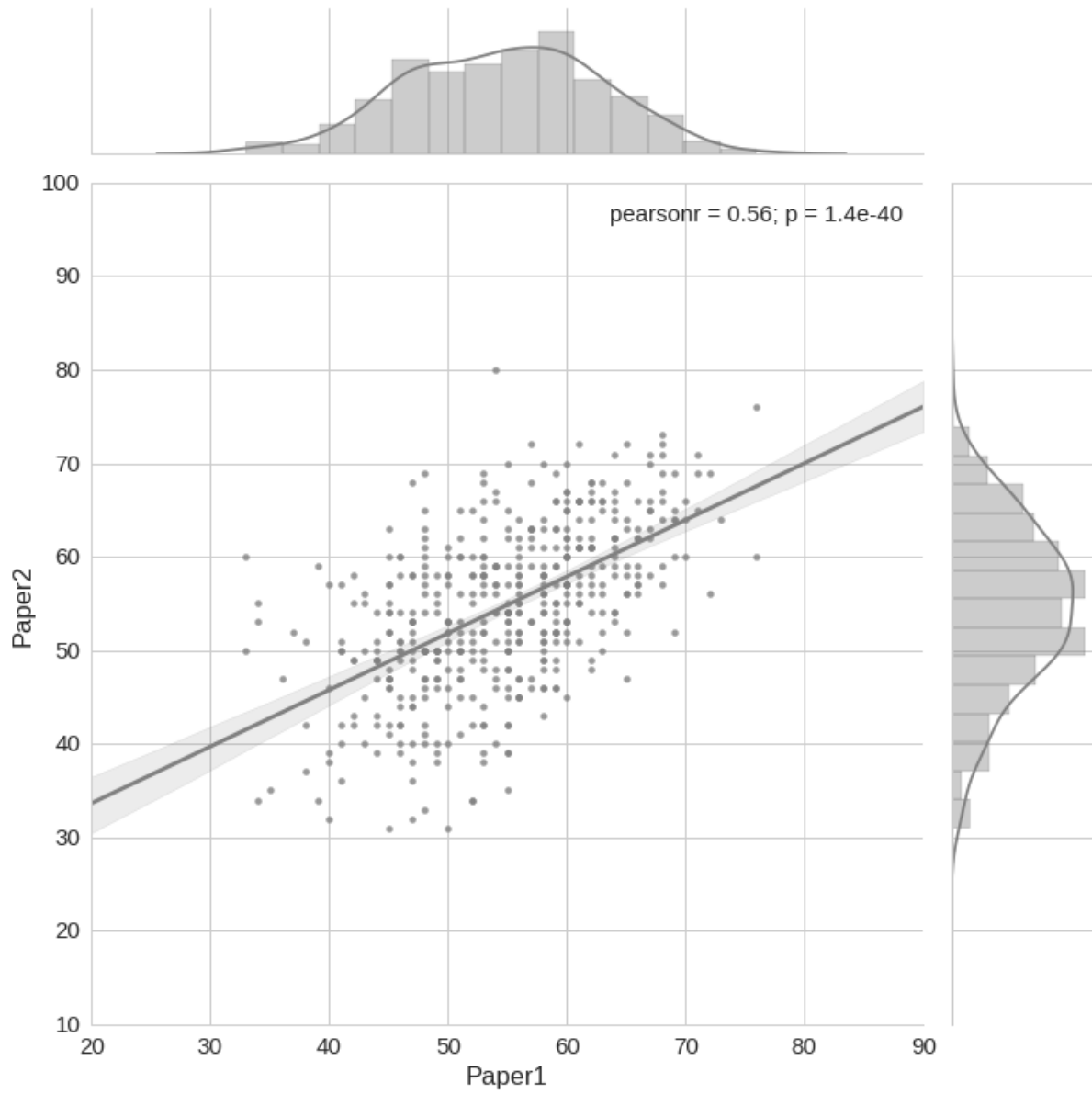


Figure 13 Correlation between oral 1 and oral 2

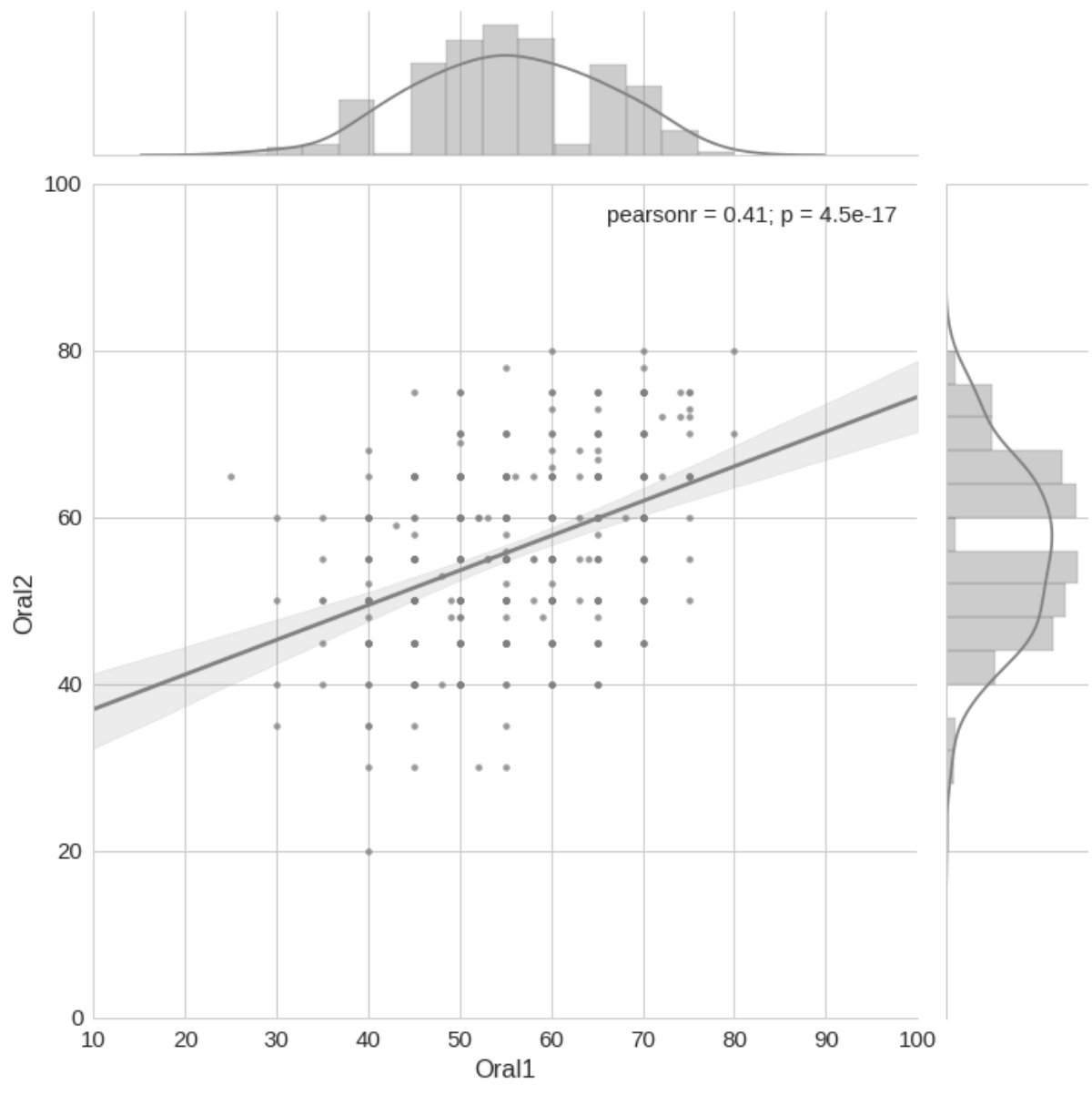


Figure 14 Correlation between case 1 and case 2

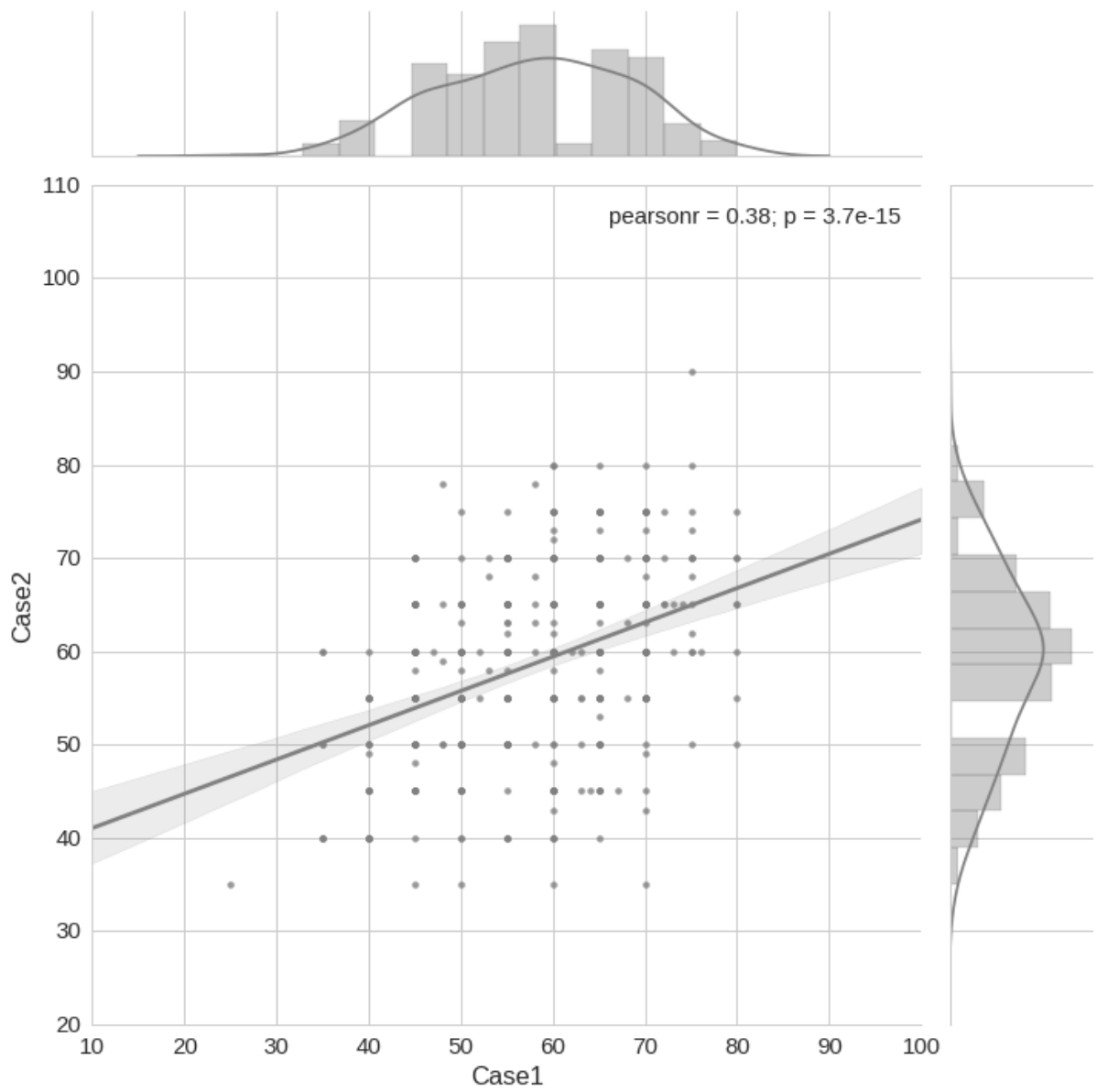


Figure 15 Correlation between papers and orals

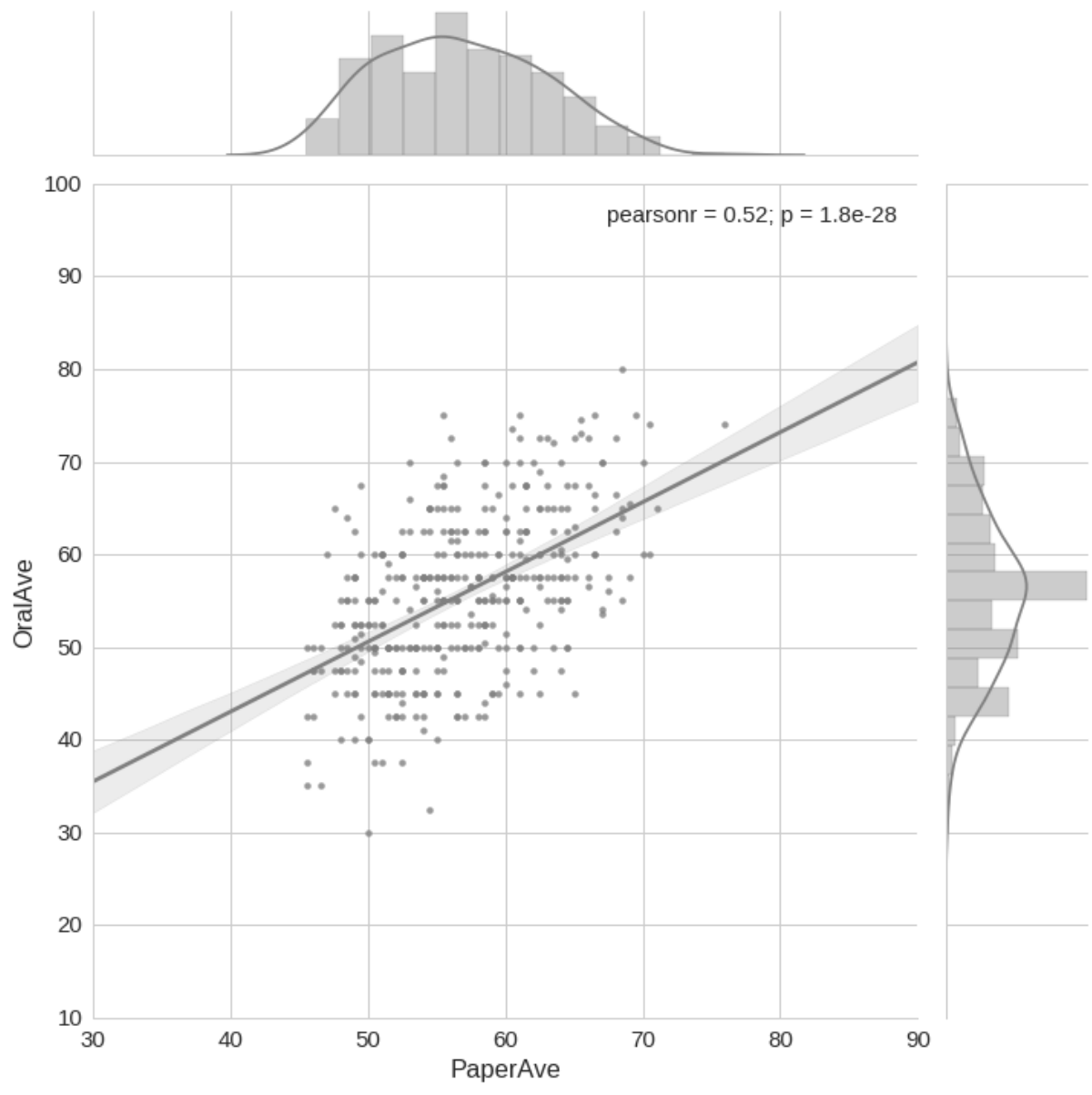


Figure 16

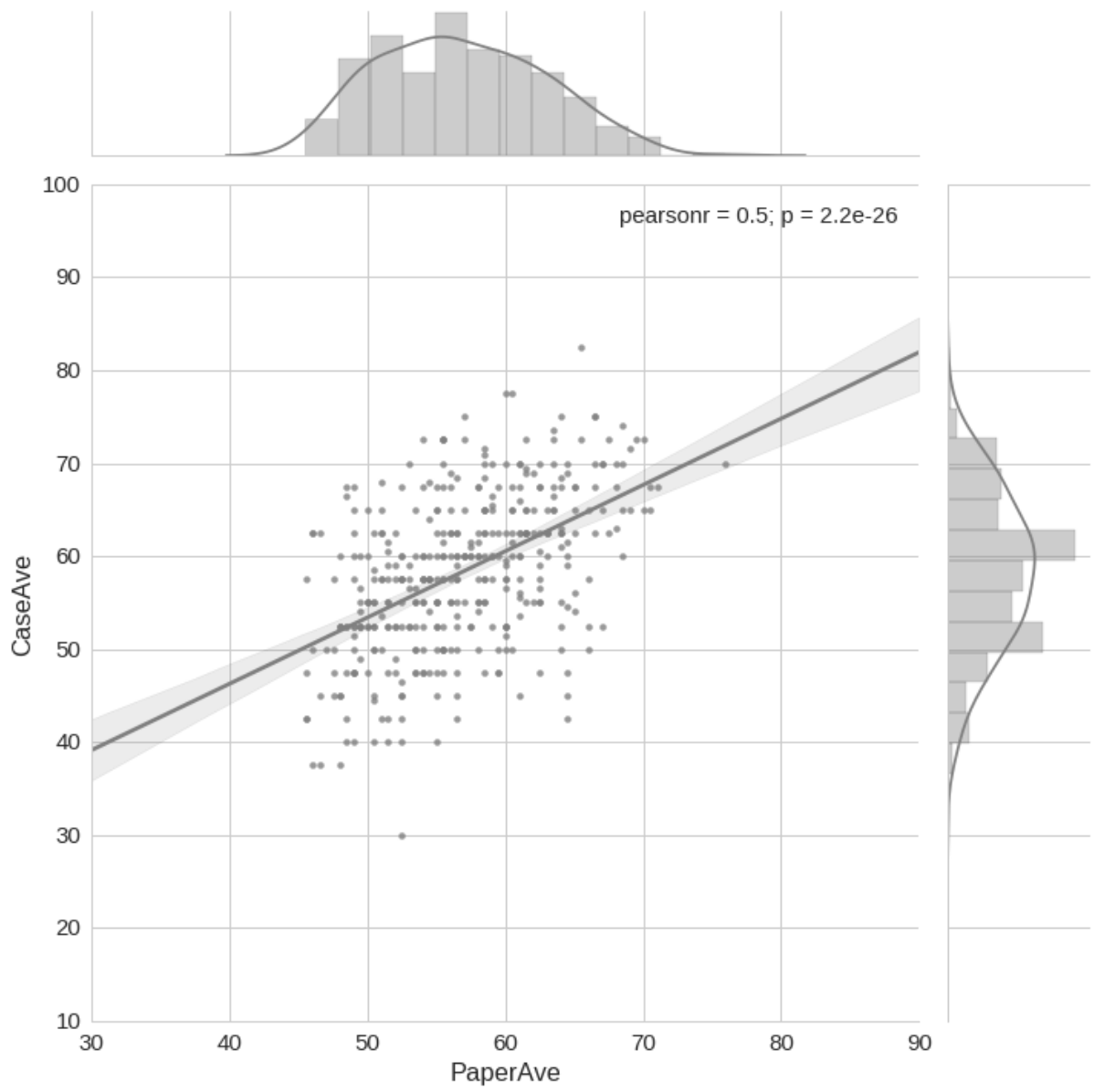


Figure 17 Correlations between papers and OSCE

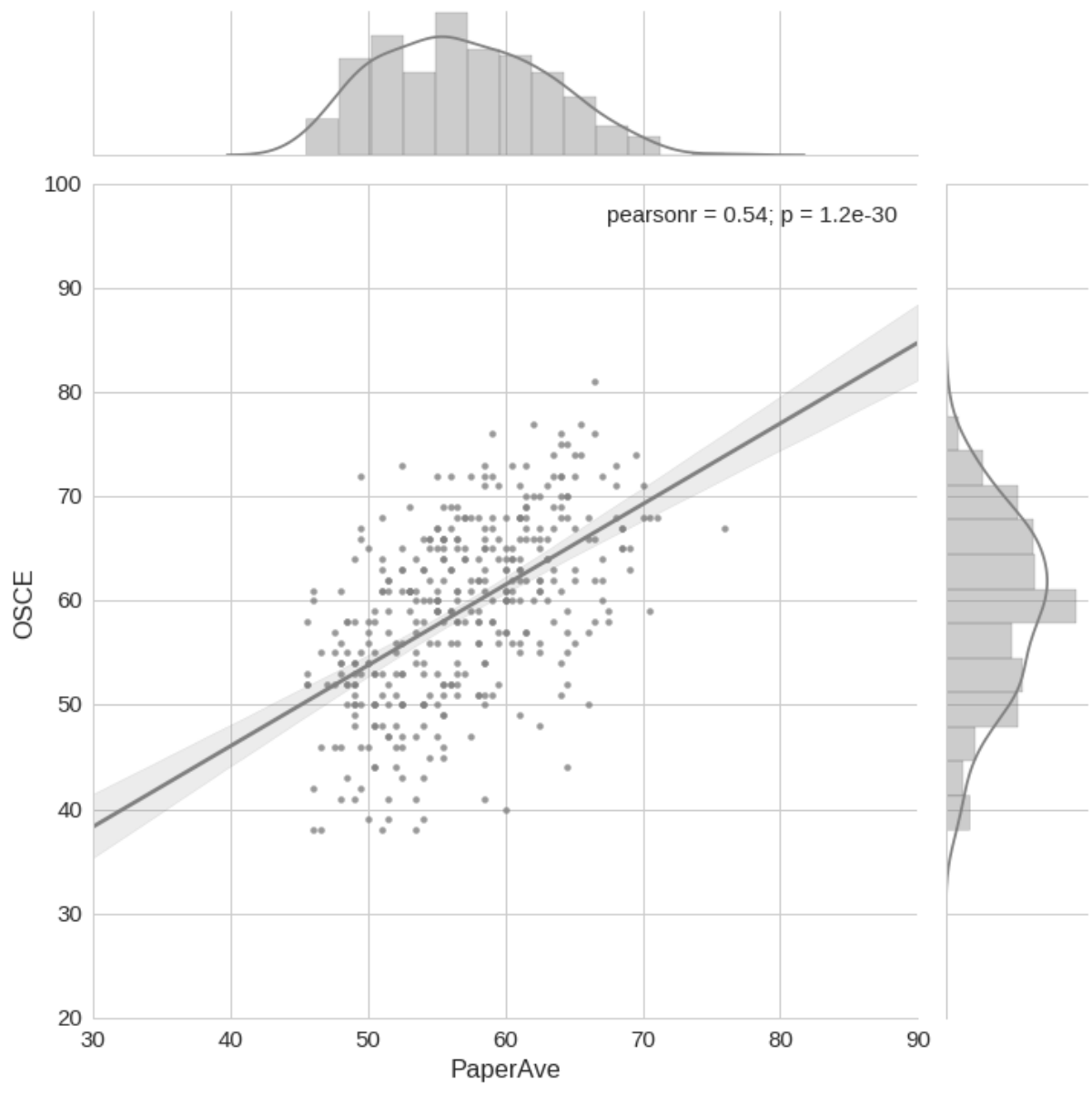


Table 1 Candidate numbers per examination

Year	Cohort	Number
2005	One	13
2006	One	14
2006	Two	15
2007	One	27
2007	Two	13
2008	One	16
2008	Two	31
2009	One	11
2009	Two	22
2010	One	35
2010	Two	41
2011	One	31
2011	Two	48
2012	One	28
2012	Two	34
2013	One	20
2013	Two	28
2014	One	22
2014	Two	23

Examinations are held twice a year. This table indicates the absolute number of candidates who entered each exam.

Table 2 Invitation and pass rate

Year	Invited (n of total)	Pass (n of total)	Pass (n of invited)
2005	10 (76.9%)	9 (69.2%)	90%
2006	19 (65.5%)	13 (44.8%)	68.40%
2007	32 (80%)	23 (57.5%)	71.90%
2008	42 (89.4%)	33 (70.2%)	78.60%
2009	25 (75.8%)	19 (57.6%)	76%
2010	66 (86.9%)	51 (67.1%)	77.30%
2011	66 (83.5%)	45 (57.0%)	68.20%
2012	62 (100%)	47 (75.9%)	75.80%
2013	35 (72.9%)	31 (64.6%)	88.60%
2014	31 (68.9%)	25 (55.6%)	80.60%

This table indicates totals for each year. The first column indicates the year. The second column indicates the total number (and percentage) of candidates that were invited to the examination after completing the written section. The third column indicates the total number of candidates who passed the exam (together with the percentage of total candidates who passed). The last column indicates the percentage of candidates who were invited.

Table 3 Examination component results

	2005Two	2006One	2006Two	2007One	2007Two	2008One	2008Two	2009One	2009Two	2010One	2010Two	2011One	2011Two	2012One	2012Two	2013One	2013Two	2014One	2014Two	p-value
Paper1(SD)	56.8(5.7)	46.4(6.1)	56.3(10.4)	54.3(7.5)	50.6(9.3)	47.8(8.6)	55.7(10.7)	57.1(8.8)	56(7.2)	57.5(5.4)	52.9(8)	55.7(6.4)	56(6.4)	57.9(6)	56.3(5.6)	52.2(9)	50.5(7.2)	52.5(10.9)	56(8.4)	<0.01
Paper2(SD)	51.2(7.2)	46.9(10.6)	52.2(5.2)	54.3(9.3)	54.5(7.6)	57.5(6.1)	57.6(6.2)	52.5(12.3)	50.2(7)	53(7.6)	58.7(7.9)	54.9(6.8)	52.6(11.6)	56.2(7.6)	59.7(6.4)	53.1(7.8)	52.5(7.9)	58.9(8.3)	54.3(9.7)	<0.01
Oral1(SD)	54.5(10.4)	50.7(16.2)	56.7(10.1)	57.2(7.5)	51.7(14.7)	53.9(9.6)	58.4(9.6)	46.4(15.5)	57.8(5.7)	58.3(11.6)	57.5(10.7)	56.3(9.2)	55.7(10)	56.4(10.2)	51.2(10.7)	56(9.5)	52.8(9)	57.6(5.6)	52.5(7.9)	0.1
Oral2(SD)	57(11.4)	50(5.8)	57.9(9.9)	55.7(11)	55(11.1)	50.7(8.1)	57.5(7)	53.6(9)	57.9(7.6)	57.6(10.9)	56.8(13.9)	52.6(12.7)	56.5(9.6)	58.1(9.9)	52.7(11)	56.7(9.8)	54.8(9)	60.4(11.4)	56.3(7.9)	0.35
Case1(SD)	53.5(7.8)	47.9(7.6)	63.6(11.8)	53(9)	55.8(7.9)	57.5(10.7)	59.3(8.5)	56.4(12.1)	55.8(9.6)	60.3(10.7)	61.8(13.8)	55.8(10)	60.3(10.2)	59.2(9.6)	55.6(11.3)	57.7(9)	57.3(9.1)	57.3(10)	58.9(9.5)	0.04
Case2(SD)	56(8.1)	55(14.1)	55.8(8.2)	55.4(7.7)	58.3(11.7)	57.9(11.6)	62.7(9.1)	53.6(10.3)	59.2(10.2)	58.4(10.9)	60.7(11)	57.3(9.9)	58.7(9.3)	59.7(10)	57.5(10.4)	63(9.4)	56(8.3)	62.3(8.1)	58.9(9.4)	0.32
OSCE(SD)	61(8.1)	57.3(9.6)	57.4(8.3)	58.2(7.9)	59.3(8.1)	55.7(4.2)	62(5.5)	61.6(9.9)	59.7(7.9)	54.1(6.8)	55.6(6.6)	53.3(10.1)	57.3(9.5)	63.4(8.6)	64.1(8.7)	64.9(7.5)	63(6.1)	63.5(7)	58.5(7.5)	<0.01

Appendices:



UNIVERSITY OF CAPE TOWN

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Departmental Research Committee

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29th September 2016

Dr M Kahn

Department of Surgery
Groote Schuur Hospital
University of Cape Town

Dear Dr Khan

RE: PROJECT 2016/073

PROJECT TITLE: A retrospective audit of the outcomes of the FCS Final examination

The above proposal has been reviewed by the Department of Surgery Research Committee. I am pleased to inform you that the committee approved the scientific merit of the study, and endorse the protocol for submission to the relevant ethics committee.

Please use the above project number in all future correspondence.

Yours sincerely

A handwritten signature in black ink, appearing to read 'T Pennel'.

DR TIMOTHY PENNEL

CHAIRMAN: RESEARCH COMMITTEE

*"OUR MISSION is to be an outstanding teaching and research university,
educating for life and addressing the challenges facing our society."*



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07 JUN 2018
HEALTH SCIENCES FACULTY
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Human Research Ethics Committee



FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
<input checked="" type="checkbox"/> Approved	Annual progress report	Approved until/next renewal date	30.6.2019
<input type="checkbox"/> Not approved	See attached comments		
Signature Chairperson of the HREC		Date Signed	2/6/2018

Comments to PI from the HREC

Principal Investigator to complete the following:

1. Protocol Information

Date (when submitting this form)	07/06/2018		
HREC REF Number	840/2016	Current Ethics Approval was granted until	30/11/2017
Protocol title	A Retrospective Audit of the Arcanely of the FCS Final Examinations		
Protocol number (if applicable)			
Are there any sub-studies linked to this study?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
If yes, could you please provide the HREC Ref's for all sub-studies? Note: A separate FHS016 must be submitted for each sub-study.			
Principal Investigator	Prof D Kahn		
Department / Office Internal Mail Address	delawir.kahn@uct.ac.za mir1984k@gmail.com		



1.1 Does this protocol receive US Federal funding?		<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
1.2 If the study receives US Federal Funding, does the annual report require full committee approval?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
<p>Note: Any annual approvals for Full Committee review MUST be submitted on the monthly HREC submission dates.</p> <p>(Please send electronic copy for full committee review to hrec-enquiries@uct.ac.za)</p>			
If yes in 1.2 please complete section 1.3 below for invoicing purposes			
1.3 Annual Approval for full committee review		- R 3420 (inclusive of vat)	
For invoicing purposes, please provide:			
Sponsor's name			
Contact person			
Address			
Telephone number			
Email Address			

2. List of documentation for approval

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3. Protocol status (tick ✓)

<input type="checkbox"/>	Open to enrolment
<input type="checkbox"/>	Closed to enrolment (tick ✓)
<input type="checkbox"/>	Research-related activities are ongoing
<input type="checkbox"/>	Research-related activities are complete, long-term follow-up only
<input type="checkbox"/>	Research-related activities are complete, data analysis only
<input type="checkbox"/>	Main study is complete but sub-study research-related activities are ongoing
<input type="checkbox"/>	Study is closed → Please submit a Study Closure Form (FHS010)

4. Enrolment

Number of participants enrolled to date	
Number of participants enrolled, since last HREC Progress report (continuing review)	

South African Journal of Surgery

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- (ii) drafting or critical revision for important intellectual content; and
- (iii) approval of the version to be published. These conditions must all be met (uniform requirements for manuscripts submitted to biomedical journals; refer to www.icmje.org).

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Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160...

Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'
Round **brackets** (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.

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Book references: Jeffcoate N. Principles of Gynaecology. 4th ed. London: Butterworth, 1975:96-101. *Chapter/section in a book:* Weinstein L, Swartz MN. Pathogenic Properties of Invading Microorganisms. In: Sodeman WA jun, Sodeman WA, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974:457-472.

Internet references: World Health Organization. The World Health Report 2002 - Reducing Risks, Promoting Healthy Life. Geneva: World Health Organization, 2002. <http://www.who.int/whr/2002> (accessed 16 January 2010).

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