

# Assessment of the Adequacy of Non-Emergency Computed Tomography Scan Request Forms in a Tertiary Hospital in South Africa

---

Dr Morontshe Maureen Kgalaeng

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 Radiology

Johannesburg, 2018

## **Declaration**

I, Morontshe Maureen Kgalaeng, 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 MORONTSHE MAUREEN KGALAENG

On this \_\_\_\_th day of \_\_\_\_\_ 2018.

## **Dedication**

Thank you to my husband Tlameo and our kids for their constant support. To my mother and sisters for always believing that I can do it.

## **Publications and presentations**

This work has never been published.

It has never been presented at a congress.

## **Abstract**

Radiology request forms are vital information sharing platform between doctors and the radiology department (radiologists and radiographers). However, their significance has not been appropriately valued. The clinician is requested to provide the clinical reason for imaging as it assists the radiologist to understand the patient's medical condition.

**AIM:** The purpose of this study was to assess the adequacy of filling of non-emergency CT request forms at our institution.

**METHOD:** There were 579 non-emergency CT request forms which were retrospectively reviewed. These CT request forms originated from four departments- neurosurgery, general surgery, internal medicine and paediatrics, as ward and outpatients, from January to June 2015.

**RESULTS:** Only 9.3% of the forms were fully completed. Seventy-two percent of the forms were deemed adequate as they met the criteria for the minimum information required for a radiological request form. The most frequently omitted fields (less than 60% completed) were mobility and previous X-rays with 57.5% and 17.3% respectively.

**CONCLUSIONS:** Radiology request forms are commonly incomplete and inadequately filled. There is a need to educate referring doctors of the importance of providing adequate clinical history as this can improve the quality of the radiological report.

## Acknowledgements

- My supervisors Dr Lara Goldstein, Head of Emergency Department, Helen Joseph Hospital and Professor Victor Mngomezulu, Academic Head of Diagnostic Radiology and Director of Interventional Neuro Radiology at the University of the Witwatersrand, for their enormous assistance in making this project happen.
- Dr Susan Lucas, Research co-ordinator, Radiology department, University of Witwatersrand, for her contribution to the project.
- My mentor Professor Solomon Magano, Director of school of Agriculture and Life Sciences Science campus of University of South Africa.
- The Chief Executive Officer of the Charlotte Maxeke Johannesburg Academic Hospital for allowing the study to take place at this institution.
- The CT scan filling clerk.
- Statistician Petra Gaylard

# Table of Contents

|                                                                                             |     |
|---------------------------------------------------------------------------------------------|-----|
| Declaration .....                                                                           | ii  |
| Dedication.....                                                                             | iii |
| Publications and presentations .....                                                        | iv  |
| Abstract .....                                                                              | v   |
| Acknowledgements .....                                                                      | vi  |
| List of Figures.....                                                                        | x   |
| List of Tables .....                                                                        | xi  |
| Abbreviations.....                                                                          | xii |
| 1. Introduction .....                                                                       | 1   |
| 1.1 Motivation and rationale.....                                                           | 1   |
| 1.1.1 Importance of adequate filling of radiology request forms.....                        | 1   |
| 1.1.2 How to assess adequacy of filling CT (computed tomography) scan request<br>form ..... | 2   |
| 1.1.3 Departments and rank of doctors .....                                                 | 3   |
| 1.1.4 Role of the Radiologist and the radiology request forms .....                         | 4   |
| 1.1.5 Impact of omitted components of the request form on the report .....                  | 5   |
| 1.1.6 Impact of omitted components on the radiologist/radiology department .....            | 5   |
| 1.1.7 Summary of introduction .....                                                         | 6   |
| 1.2 Aim and objectives .....                                                                | 7   |
| 1.2.1 Aim.....                                                                              | 7   |
| 1.2.2. Objectives .....                                                                     | 7   |

|                                                                                      |    |
|--------------------------------------------------------------------------------------|----|
| 2. Materials and Methods .....                                                       | 8  |
| 2.1 Study Sample .....                                                               | 9  |
| 2.2 Inclusion criteria .....                                                         | 9  |
| 2.3 Exclusion criteria.....                                                          | 10 |
| 2.4 Statistical analysis.....                                                        | 10 |
| 2.5 Ethics.....                                                                      | 11 |
| 3. Results.....                                                                      | 12 |
| 3.1 Individual items .....                                                           | 12 |
| 3.2 Completeness status: .....                                                       | 12 |
| 3.3 Adequacy status: .....                                                           | 13 |
| 3.4 Effect of omitted items on final radiological diagnosis: .....                   | 13 |
| 3.5 Comparison of the four departments with regards to outcomes.....                 | 15 |
| 3.5.1 Completeness status: .....                                                     | 15 |
| 3.5.2 Completeness score .....                                                       | 15 |
| 3.5.3 Adequacy status .....                                                          | 16 |
| 3.5.4 Each of the 9 items making up the adequacy score.....                          | 17 |
| 4. Discussion .....                                                                  | 18 |
| 4.1 Comparison with other studies .....                                              | 18 |
| 4.2 Could inadequate clinical information affect final radiological diagnosis? ..... | 23 |
| 4.3 Discussion summary .....                                                         | 25 |
| 4.4 Limitations of the study.....                                                    | 25 |
| 4.5 Ways to ameliorate poorly completed forms .....                                  | 26 |
| 4.6 Future projects .....                                                            | 27 |

|                                                           |    |
|-----------------------------------------------------------|----|
| 5. Conclusion .....                                       | 28 |
| 6. References .....                                       | 29 |
| Appendix A: Ethics Clearance Certificate .....            | 32 |
| Appendix B: how to assess the radiology request form..... | 33 |
| Appendix C: Note on referencing style.....                | 34 |
| Appendix D: Turn-it-in Report .....                       | 35 |

**List of Figures**

Figure 3.1: Level of completeness of each 17 items. .... 12

Figure 3.2: Adequacy status ..... 13

Figure 3.3: Completeness status per department..... 15

Figure 3.4: Association between departments and adequacy status ..... 16

## **List of Tables**

Table 3.1: Effects of omitted items on final radiological diagnosis..... 14

Table 4.1: Comparison of bio-data with the study by Irurhe et al. and Abubakar et al. .... 19

## Abbreviations

|           |                                                                    |
|-----------|--------------------------------------------------------------------|
| CMJAH     | Charlotte Maxeke Johannesburg Academic Hospital                    |
| CT        | Computed tomography                                                |
| CXR       | Chest x-ray                                                        |
| eGFR      | Estimated glomerular filtration rate                               |
| HOD       | Head of department                                                 |
| IAEA-HHS4 | International Atomic Energy Agency Human Health Series<br>number 4 |
| IT        | Information technology                                             |
| LMP       | Last menstrual period                                              |
| MRI       | Magnetic resonance imaging                                         |
| PACS      | Picture archiving and communication system                         |

# **1. Introduction**

## **1.1 Motivation and rationale**

There is a tendency among both junior and senior clinicians not to complete the clinical information required when filling the radiology request forms. This practice may lead to inaccurate diagnosis thus compromising the patient (1, 2). The ultimate purpose of this study was to highlight the need for adequate completion of the radiology request forms by the referring doctors, which will in turn facilitate better reporting by the radiologist and hopefully better management of the patient.

### **1.1.1 Importance of adequate filling of radiology request forms**

Radiology request forms are vital information sharing platform between clinicians and the radiology department (radiologists and radiographers) (2-4). The request form contains the information that states what investigation/procedure is to be done, on whom it is to be performed and the reason why it is important to be performed (5). However, their value is not adequately appreciated (2, 4).

“Request forms should be completed accurately and legibly to avoid any misinterpretation” (2, 3, 6). It is the responsibility of the referring doctor to supply the radiology department with full and correct clinical information of the patient, as well as, previous imaging and the results, in order to justify the requested radiological examination (2, 7, 8). The imaging physician should then assess the requisition form and give the final word on the appropriateness of the request (9). This assist in choosing the appropriate imaging modality and prevents repeating the examinations that have already been performed, which may

expose the patient to unnecessary radiation (1, 7, 9). In the majority of patients, the radiology requisition forms make a major impact in both diagnosis and management of the patient, and this is facilitated by adequate completion of radiology request forms (1, 4). It is therefore imperative that the correct radiological image interpretation is dependent on the history and clinical information provided on the request form (4).

### **1.1.2 How to assess adequacy of filling CT (computed tomography) scan request form**

“There is no standard format of radiology request forms” (3, 4). Different organisations use their own personalised versions (2-4). International Atomic Energy Agency-Human Health Series No.4 (IAEA-HHS4) developed minimum contents/information required in the radiological request forms to regard it as adequate. This minimal information is the following: “patient’s name, date of birth, address, and contact details, such as hospital ward or phone number; study requested; clinical indication for examination; date of request; referring medical practitioner’s signature, printed name and contact details and pregnancy status” (9).

Each patient must be identified by their name. In instances when patients share the names and surnames, hospital number helps to identify which is the correct patient. Hospital number is therefore as important to document as it only belongs to one patient.

Clinical findings and indications for the request of the study helps the radiologist to advise the clinicians if the requested examination is the most appropriate study or modality.

Pregnancy status of the patient must be known to avoid the risk of radiation to the foetus, especially CT scans due to the high radiation dose (7, 10, 11). Doctors must legibly provide

their names, as well as providing their contact details. This helps the radiologist to contact them where there is ambiguity on the information provided on the radiological request form and also to report any findings that need urgent attention (1, 12).

The location of the patient needs to be documented in order to identify the destination of the report (1, 9). This also helps porters to know the location of the patient in terms of fetching patients that are admitted. Failure to document the ward will result in delay of performing the study, and subsequently the management of the patient.

Mobility of the patient helps to know what form of transportation to use when fetching the patient, whether a wheel chair, stretcher or a bed is required. It is important to document the part of the body that is to be imaged, to avoid wrong examination been performed. A sample of radiology request form highlighting required fields is seen in Appendix B.

### **1.1.3 Departments and rank of doctors**

In a tertiary hospital, there are different disciplines and ranks of doctors. Medical interns do block rotations in the main disciplines during their training and registrars do rotations within their speciality. There are no regulations on the appropriateness of requesting the radiological examinations/investigations, in terms of level of experience of the doctor. This means all doctors are eligible to request radiological examinations (10).

Commonly, the radiology request forms are completed by the least experienced member of the clinical team (intern), and frequently it is without much knowledge about the medical condition of the patient, and occasionally having not even examined the patient (5-7, 10). Some of the reasons are due to varying shift working patterns and block rotations (6). The

radiology report, however, is usually read and understood by the head of the clinical team who makes the patient management decisions (4, 6, 10, 11). Accurate communication within the team is thus important. While senior members of the clinical team are greatly depended on for continuous patient's medical treatment, imaging requisitions by junior doctors – without sufficient knowledge of the patient – is a missing learning opportunity and potentially puts patient's life at risk (6).

#### **1.1.4 Role of the Radiologist and the radiology request forms**

Radiologists form part of a multi-disciplinary team. Their role is to help clinicians in reaching the diagnosis and, since the advent of interventional radiology, provide treatment for various conditions. This can only be fulfilled if the referring clinician provides comprehensive and accurate medical background and the clinical question required to be answered by the radiological investigation. This is transmitted through the request form (3, 13). “In the hospital environment radiologists are clinical imaging clinicians. Before accepting the radiological investigation, the radiologist should be aware of the clinical status of the patient in order to plan for the examination or to advice clinicians on the appropriate modality” (3).

The adequacy of the information contained in the request form may lead to good planning of the examination which will indirectly reduce scan time, facilitate proper and potentially quicker patient management (4). This will result in the reduction of the costs and the time spent in the hospital (5).

Inadequate clinical history on the other hand may be misleading, resulting in inappropriate examinations being carried out, erroneous interpretation of the results or unnecessary repeat of examinations thereby prolonging patient radiological examination time and

consequently the management (5). The radiologist should answer the questions directed to them by clinicians, however without adequate information this will be difficult to achieve (1).

#### **1.1.5 Impact of omitted components of the request form on the report**

The radiology report is the main vehicle of communication from the radiologist to the clinician (14, 15). For the radiologist to make a good and optimal interpretation of images, the referring doctor needs to provide the radiologist with accurate clinical information. In turn, the radiology report must also resolve the clinical question directed to them by clinicians (15-17).

Sufficient clinical information increases the accuracy of the radiology report, while incorrect data increases the inaccuracy of the report (5, 16). Better medical services could be rendered if various medical teams involved in patient management adopt a more multidisciplinary approach (2, 13). Lack of adequate medical background information may lead the radiologist to give priority to the findings that are not crucial and this will impede the best possible management of the patient (17).

#### **1.1.6 Impact of omitted components on the radiologist/radiology department**

The use of radiological services for both diagnostic (10, 18) and therapeutic reasons have risen worldwide (17). The report issued by the radiologist is influenced by many factors, among them is the quality of clinical information provided on the radiology request form. As a result there is an increasing level of medical litigation involving radiologists due to the fact

that the health of the patient is being compromised. It is therefore crucial to improve exchange of information between different medical disciplines and the radiologists (17, 19). “Radiographers/radiologist technologists perform the radiological examinations, and therefore also use the information provided on the request form. They hand over radiological images to the radiologist to report them or release the images” (17). It is therefore important to provide accurate and legible information on the radiology requisition form to avoid wrong part of the body being imaged inter alia (14, 17).

### **1.1.7 Summary of Introduction**

Radiological services are a pillar in the diagnosis and management of the patient. Currently, there is increase in demand of radiological investigations and they are greatly relied-upon. Some of specialities like neurosurgery and orthopaedics cannot treat the patients without prior imaging. It is therefore crucial for doctors to provide required patient’s medical information in order for the correct study to be performed and subsequently optimal management of the patient.

## **1.2 Aim and objectives**

### **1.2.1 Aim**

The aim of the study was to assess the adequacy of filling of non-emergency CT request forms at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH).

### **1.2.2. Objectives**

- To determine the adequacy of filling of non-emergency CT request forms.
- To determine the frequency of omitted components of the request forms.
- To compare the adequacy of filling CT scan request forms between the referring departments.
- To determine whether omitted components would affect the final radiological diagnosis.

## 2. Materials and Methods

This was a retrospective quantitative study design assessing non-emergency CT scan request forms at CMJAH, from 1 January – 30 June 2015 from four departments viz. Neurosurgery, General Surgery, Internal Medicine and Paediatrics.

The CT request forms assessed, were reports that have already being finalised by the consultant radiologist. The radiology request form available at CMJAH was used to assess the completeness of the fields/components of the request form (Appendix B).

The following data was also collected from the request forms:

- Whether or not each of the 17 items on the request forms was completed (half-points were allowed in certain cases for partially completed information).
- Completeness status (whether or not all 17 items had been completed)
- The completeness score (number of completed items, out of 17)
- Adequacy status (whether or not a specific subset of 9 of the 17 items had all been completed)
- Whether or not omitted items affected the final radiological diagnosis.

*[In order to assess whether omitted items affected the final radiological diagnosis, the initial history provided by the referring doctor was compared to the final diagnosis made by the radiologist in conjunction with any additional history that was documented on the report form after the CT scan had been performed].*

Data was collected manually and anonymously. The patient's name, the hospital number and the referring doctor's name were not written on the data collection sheet to maintain their confidentiality.

Each request form was evaluated for the completeness of the fields. Following the approach by Triantopoulou et al., “for each request form, the answers “yes/fully completed”, “no/not completed” and inadequately/partly completed was used to grade the filling of the fields in the radiological request forms” (7). “Fully completed field was given a score of one, blank field zero and inadequately/partly completed field was given a score of 0.5”, thus each form had a total score of 17 (4, 20). The form was regarded as adequate if it met the minimum contents/information required for the radiological request forms in the available hospital radiology request form (9).

According to World Health Organization, “women of reproductive age refers to all women aged 15-49 years” (21). Therefore the pregnancy field was taken as not completed/zero score if nothing was written in the request forms of women aged 15-49 years, and was given a score of 1 (one) in males and in women who do not fall within 15-49 years. However, there are studies that revealed that there are women aged below 15 years (22) and above 49 years (23) who gave birth, therefore the possibility of pregnancy must always be excluded, especially examinations that involve radiation like computed tomography scan.

## **2.1 Study Sample**

A sample size estimation was based on a prevalence of 1.5%, with a 1% precision and a 95% confidence interval. This required a minimum sample size of 568 forms.

## **2.2 Inclusion criteria**

- Legible radiology request forms available at CMJAH that contained the ward/department.

- Request forms from four departments - both wards and outpatient departments.

## 2.3 Exclusion criteria

- Forms from referral hospitals.
- Illegible radiology request forms

The radiology department *Picture Archiving and Communication System* (PACS) was implemented on 1 April 2016. Prior to this (and during the study period), all radiology reports were handwritten and duplicated using carbon paper. The patient was given the original report, and the duplicates were filed. “Illegibility of the forms” in this study did not refer to the handwriting per se, but rather because the carbon copy was not clear.

## 2.4 Statistical analysis

The descriptive analysis of data was carried out as follows: Categorical variables were summarised by frequency and percentage tabulation, and illustrated by means of bar charts. Continuous variables were summarised by the mean, standard deviation, median and interquartile range, and their distribution illustrated by means of histograms.

The  $\chi^2$  test was used to assess the relationships between department and completeness status, adequacy status, whether or not omitted items affected the final radiological diagnosis, and each of the 9 items making up the adequacy score. Fisher’s exact test was used where requirements for the  $\chi^2$  test could not be met. The strength of associations was measured by Cramer’s V and the phi coefficient respectively. The following scale of interpretation was used:

|                |                           |
|----------------|---------------------------|
| 0.50 and above | high/strong association   |
| 0.30 to 0.49   | moderate association      |
| 0.10 to 0.29   | weak association          |
| below 0.10     | little if any association |

Relationship between department and the completeness score was assessed by one-way Analysis of Variance (ANOVA). The strength of associations was measured by the Cohen's d.

The following scale of interpretation was used:

|                |                  |
|----------------|------------------|
| 0.80 and above | large effect     |
| 0.50 to 0.79   | moderate effect  |
| 0.20 to 0.49   | small effect     |
| below 0.20     | near zero effect |

Data analysis was carried out using SAS. The 5% significance level was used.

## 2.5 Ethics

The approval of Ethics was obtained from Human Research Ethics Committee of the University of Witwatersrand. Ethics Clearance certificate number M150910 is attached (Appendix A). Permission to perform the study at CMJAH was obtained from the hospital CEO. Permission to collect data was also obtained from the head of the Radiology department.

### 3. Results

There were 584 radiology request forms available for the study period, however, 5 were excluded due to illegibility. Therefore 579 forms were analysed.

#### 3.1 Individual items

Figure 3.1 below shows the level of completeness of each of the 17 items, ranked in descending order of completeness.

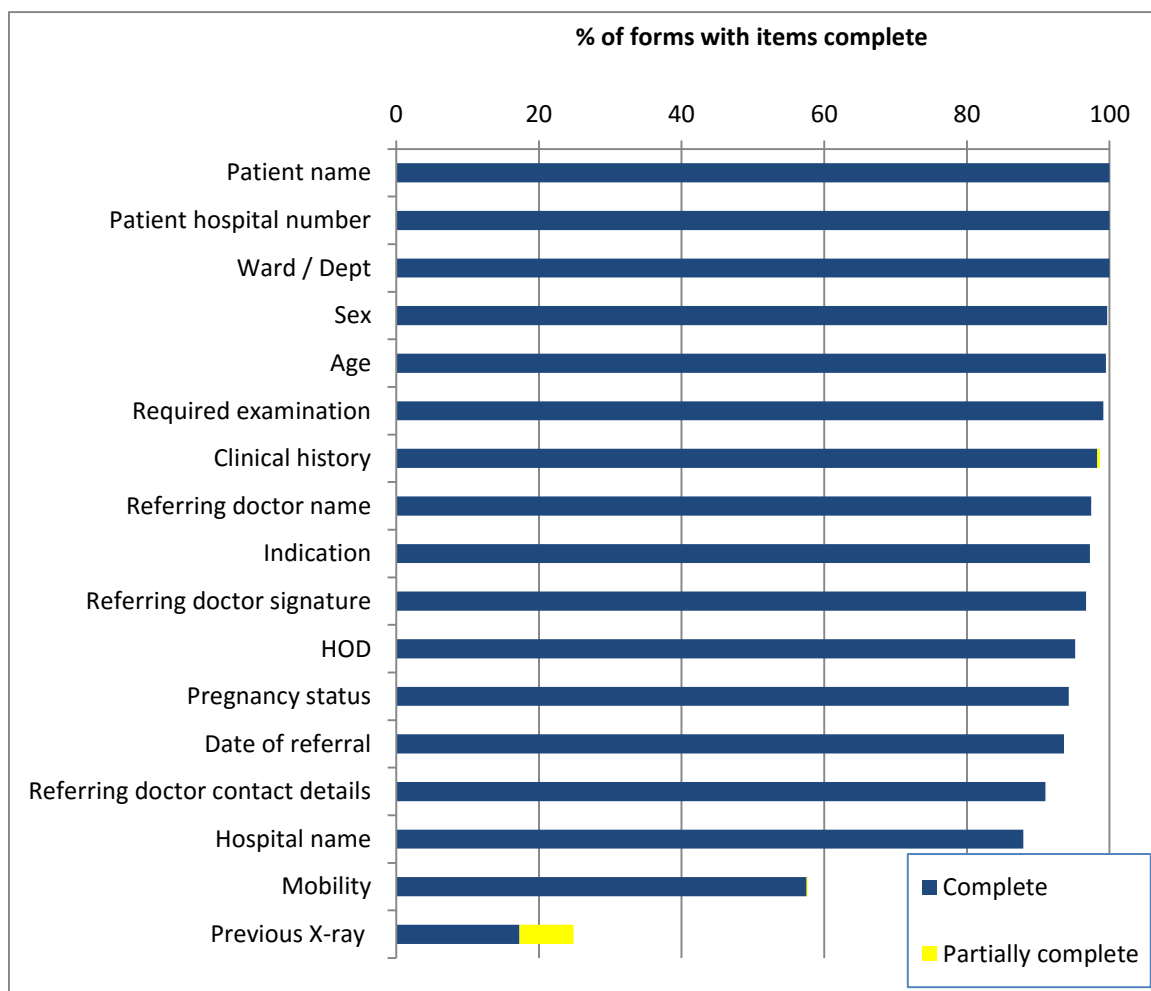


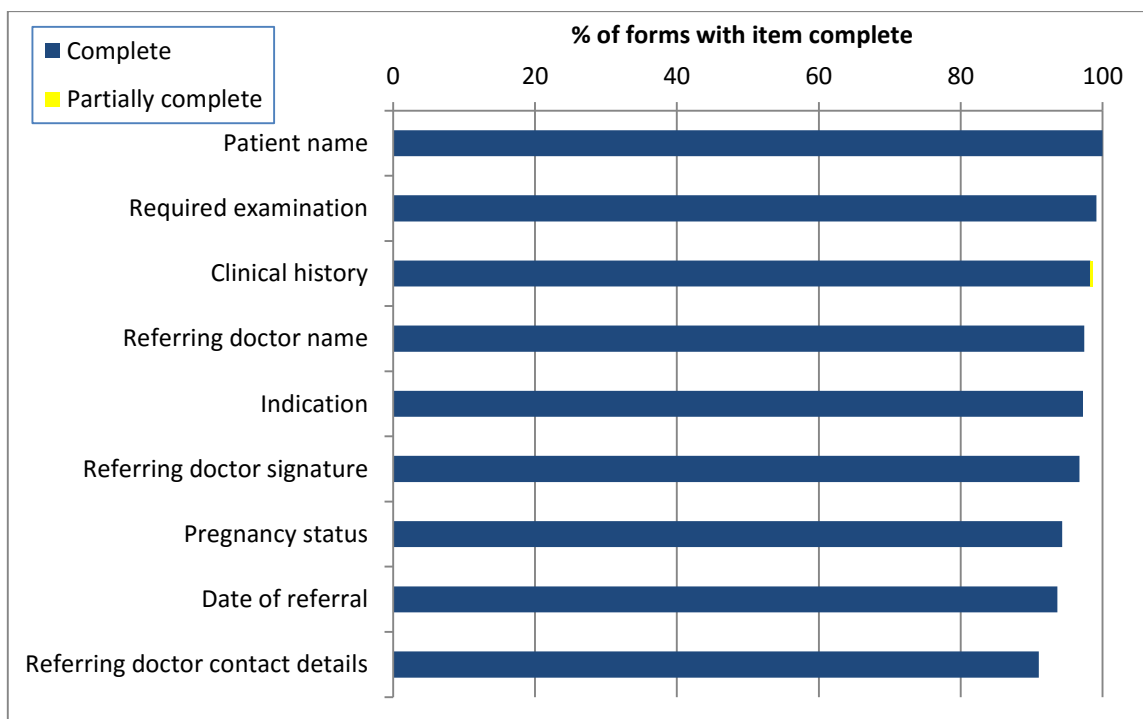
Figure 3.1: Level of completeness of each 17 items.

#### 3.2 Completeness status:

Overall, only 9.3% of the forms had all 17 items complete.

### 3.3 Adequacy status:

Overall, 72.0% of the forms were deemed to be adequate. Figure 3.2 below shows that the lowest-ranking adequacy item, viz. referring doctor contact details, still had a high level of completion at 91.0%.



**Figure 3.2: Adequacy status**

### 3.4 Effect of omitted items on final radiological diagnosis:

In only 0.7% (n=4) of the forms it was found that omitted items affected the final radiological diagnosis.

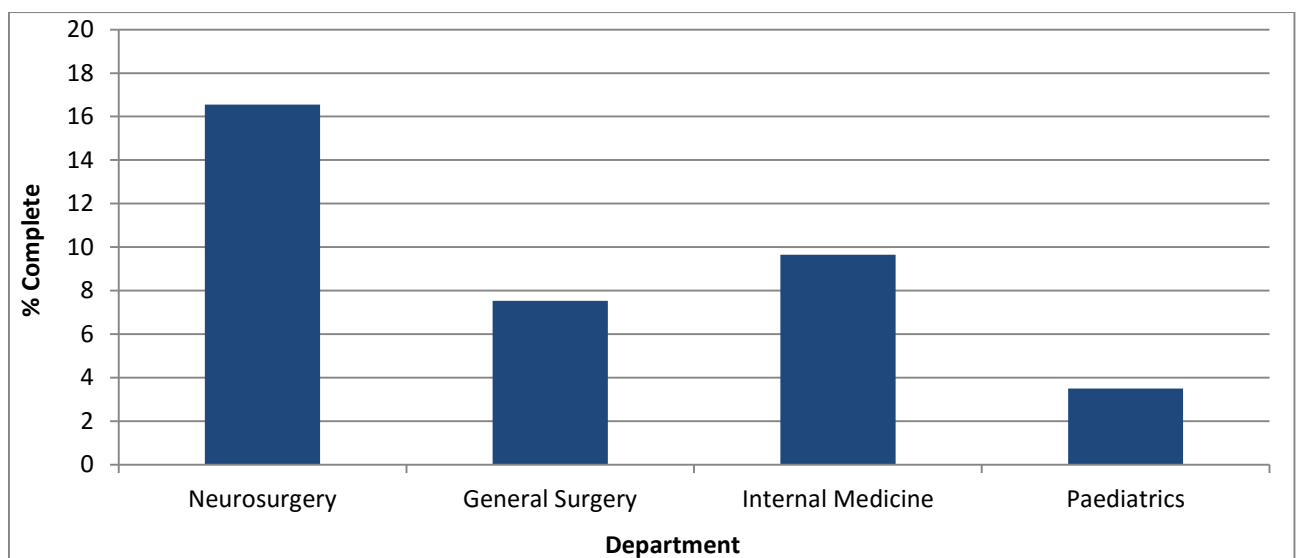
**Table 3.1: Effects of omitted items on final radiological diagnosis**

| Case                                                                                                                                                                                                                                                                                                                                                                                        | Effect                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1: 46 year old male with chest pain. Chest radiograph showed ill-defined rounded opacity in both lungs with no other additional information provided. CT scan of the chest showed cavitating pulmonary nodules bilaterally.                                                                                                                                                                 | The radiologist listed 5 potential diagnosis which could have been narrowed down substantially had the clinical history been adequate.                                                                                                         |
| 2: 50 year old female for workup for persistent mediastinal lymphadenopathy on CXR, which were confirmed on CT scan.                                                                                                                                                                                                                                                                        | The radiologist listed 3 differential diagnoses starting with the most common. However it was discovered later that the first possibility had already been excluded, both clinically and via the laboratory. The report was therefore amended. |
| 3: 52 year old female seen at the medical outpatient clinic with chronic headache, now admitted for workup. CT scan showed post-surgical changes and adjacent radiologically benign-appearing brain tumour, and suggested MRI for further characterisation. Additional history of previous removal of malignant brain cancer in the same location was given after the report was finalised. | The final diagnosis was changed to “likely malignant tumour” in view on past history provided.                                                                                                                                                 |
| 4: 50 year old male with chronic abdominal pain – ultrasound was normal. CT scan showed few small cystic liver lesions and evidence of previous bowel resection.                                                                                                                                                                                                                            | The radiologist listed two possibilities: benign liver cysts and malignancy given that reason for bowel resection was not known. Further imaging was suggested.                                                                                |

### 3.5 Comparison of the four departments with regards to outcomes

#### 3.5.1 Completeness status:

There was a significant, weak, association between the department and the completeness status (chi-square test;  $p=0.0016$ ; Cramer's  $V=0.16$ ). The completeness status of paediatric department was lower than average, and that of neurosurgery department higher than average, shown in figure 3.3 below.



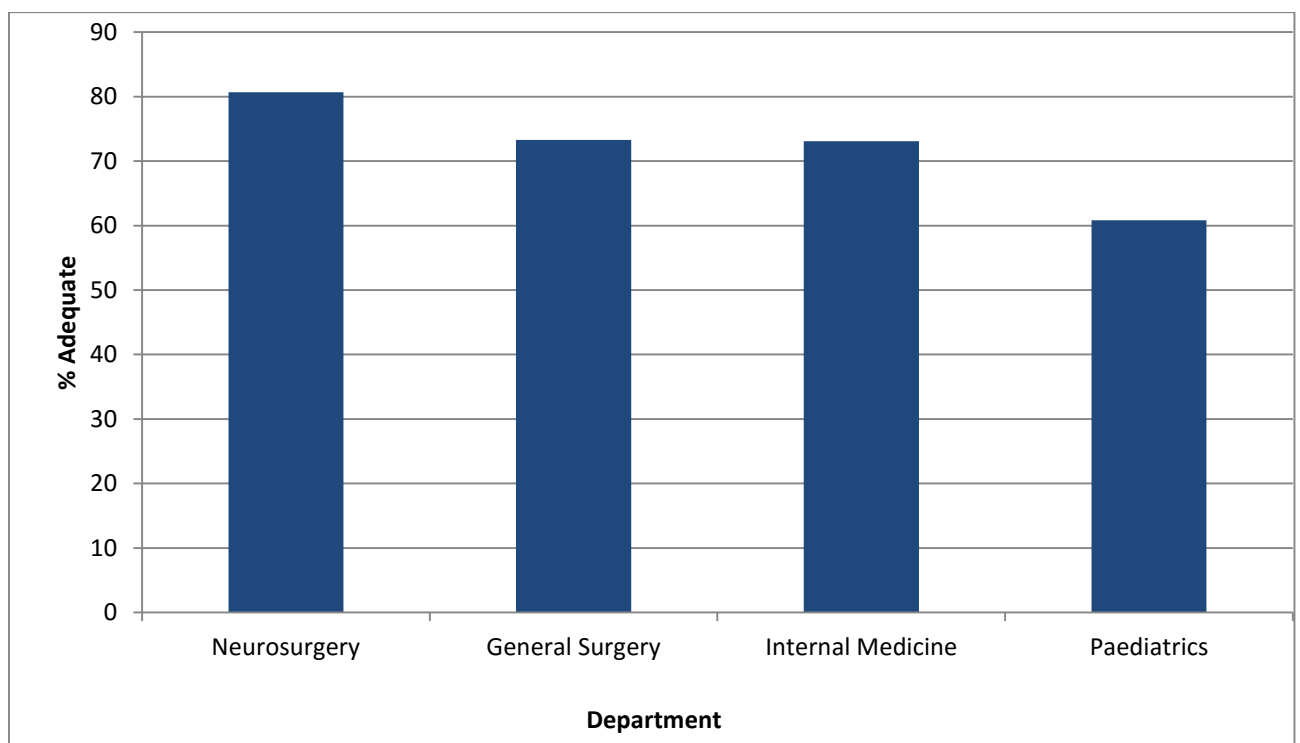
**Figure 3.3: Completeness status per department**

#### 3.5.2 Completeness score

There was a significant difference between the departments (one-way ANOVA;  $p<0.0001$ ). Post-hoc tests showed that the mean score for paediatric department (86.8%) was significantly lower than that for neurosurgery, general surgery and internal medicine departments (90.9, 90.3, and 90.9% respectively). The effect sizes were moderate (Cohen's  $d=0.62$  to  $0.71$ ).

### 3.5.3 Adequacy status

There was a significantly weak association between department and the adequacy status (chi-square test;  $p=0.0023$ ; Cramer's  $V=0.16$ ). The adequacy status of paediatric department was lower than average, and that of neurosurgery department higher than average, shown in figure 3.4.



**Figure 3.4: Association between departments and adequacy status**

### **3.5.4 Each of the 9 items making up the adequacy score**

There were significant differences between departments for the five of nine items making up the adequacy status. The effect sizes were all small (Cramer's V 0.11 to 0.20).

For 'clinical history', paediatric department performed lower than average, and general surgery and internal medicine departments higher than average.

For 'referring doctor signature', paediatric department performed lower than average, and neurosurgery department higher than average.

For 'pregnancy status', internal medicine department performed lower than average, and neurosurgery and paediatric departments higher than average.

For 'date of referral', paediatric department performed lower than average, and internal medicine department higher than average.

For 'referring doctor contact details', paediatric department performed lower than average, and neurosurgery and general surgery departments higher than average.

## **4. Discussion**

Defective completion of radiology request forms is a worldwide problem (1, 2, 4, 5). Some of the reasons could be that doctors, especially juniors – due to their limited clinical experience – are not fully aware of the impact that the information on radiology request forms has in the management of the patient (5, 6). However, when in doubt, the radiologist and the radiographer can obtain more information prior to the procedure, by enquiring the patient or by directly contacting the referring doctor (2, 7, 11, 14).

### **4.1 Comparison with other studies**

This study revealed a very high percentage of radiology request forms that are not fully completed (90.7%). The study is similar with that of the findings by Depasquale et al., which stated that “only 4% of the forms were completely filled” (3). It is however slightly different from the findings of Irurhe et al., Abubakar et al., Oswal, Sapherson and Rehman which all stated that none of the radiology request forms evaluated were completely filled (4, 11, 20). This difference could be the fact that these studies assessed radiology request forms of all modalities and different departments, while our study only assessed non-emergency CT scans from four departments. Adequate forms were 72.0 % in this study. Fully completed forms were regarded as adequate in the above mentioned studies, however in our study the form was regarded as adequate if it met the criteria for minimal information required in the radiological request forms according to IAEA-HHS4, appearing in our radiological request form. The adequacy status ranged from 60.8 to 80.7% per department with paediatric department being the only department below 70%.

The most filled fields were bio-data information of the patient. Name and hospital number were 100% filled. This is in line with Irurhe et al., and Abubakar et al., where the name was completed in 100 % and 99.7% respectively (4, 11). The rest of the biodata information of the same studies were also compared to our study (table 4.1), where it shows a slight difference.

**Table 4.1: Comparison of bio-data with the study by Irurhe et al. and Abubakar et al.**

| Fields on the form | Our study | Irurhe et al. (4)<br>radiology request<br>forms (n=300) | Abubakar et al. (11)<br>conventional X-ray<br>forms (n=339) |
|--------------------|-----------|---------------------------------------------------------|-------------------------------------------------------------|
| Hospital number    | 100 %     | 92.3%                                                   | 71.4%                                                       |
| Sex                | 99.7 %    | 99.7%                                                   | 95.9%                                                       |
| Age                | 99.5 %    | 98.0%                                                   | 92.9%                                                       |

It must be noted that address comparison was not done as it is not contained in our hospital form. In their studies, each field was considered complete when the information related to it was filled in, and was given a score of one (1) while a blank field was given zero (0). The administration clerks make all outpatient CT bookings in our hospital. They ensure that all the outpatient CT request forms have a patient bio-data sticker. The same system does not apply to inpatient bookings which are administered by the radiologist. Therefore all outpatients had 100 % of their demographic data filled in whereas the inpatient bookings had missing data as they all did not have stickers on their forms. The absence of demographic data can lead to the wrong patient being imaged, delaying

imaging and further management of the relevant patient (14). This was not a factor for our study analysis of outpatient forms.

Sex and age guide the radiologist on some diseases when reporting (5). Age is of great importance in the paediatric population where CT scanner technical parameters need to be adapted as children are more radio-sensitive compared to adults (24). The ward was 100% filled in our study due to the fact that it was an inclusion criteria.

The most common blank slots were mobility and previous X-rays. This is in line with studies by Irurhe et al., and by Abubakar et al., where mobility was not filled in 79.3% and 87.0 % respectively (4, 11). The study by Afolabi et al., demonstrated low completion of previous X-rays field (35.6%), which is slightly different from our study (2). This could be the fact that the study assessed all departments and the forms from the local health facility.

Previous imaging/X-rays guide the radiologist and the radiographers on which protocols to use in terms of planning the current study. This also informs the radiologist if there is any study to compare the new findings with during reporting, to assess if there is resolution, disease stability or worsening of the condition. This is very important in cancer patients monitoring during post treatment. Availability of previous studies also prevent repeating studies that have already being done, exposing the patient to unnecessary radiation (5). These can be done through proper hand-over between clinicians.

Leonard Berlin, demonstrated the importance of asking for and reviewing available previous imaging in his study “comparing new radiographs with those obtained previously” (25).

He utilised an actual example where by the adult female presented with recurrent respiratory symptoms and consulted radiology practice on three occasions. Her second radiograph was reported by different radiologist from the original, and neither looked for previous imaging nor the report to have been able to diagnose lung cancer at earlier stage than when it was advanced on the third consultation, after which the patient demised.

This emphasises how crucial and important it is to look for and review previous studies, including enquiring about the background medical history whether acute or chronic can have a huge impact on the radiological report. “Reviewing previous radiology reports in addition to reviewing the radiographs themselves, or in the absence of those radiographs, is also recommended” (25).

Mobility prepares the radiographer of what technique to use and also the porters on what mode of transportation to prepare in terms of fetching ward/admitted patients (11). Clinical history, indication for the study and requested examination were completed in 98.7 %, 97.2 % and 99.1 % respectively. Clinicians request radiological examinations, so that it can address or answer their clinical question (4, 15, 16). However if this is not adequately transmitted on the request form, an inappropriate examination might be performed, causing delay in the investigation of the patient. There is evidence from other

studies of the availability and the adequacy of clinical information and the clinical question to be answered improve the outcome of the report (26, 27).

Examination/part of body requested was provided in 99.1%. This is in line with Afolabi et al., and Mohammad et al., where it was 100% completed (2, 5). The examination requested helps the radiologist and the radiographer on which part of the body is to be imaged as patients can present with a combination of the diseases and it should be documented which part is of most concern.

The referring doctor's name, signature and date of referral were missing in 2.6%, 3.3% and 6.4% respectively. These findings are similar to the findings by Irurhe et al., where these were missing in 1.3%, 2.3% and 8.0% respectively (4). The doctors should take responsibility of asking for radiological examinations (4, 20). The date of referral may be relevant for medico-legal reasons if the patient or the referrer complains of the delay in performing the examination(7). The contact details of the referring doctor were missing in 9.0%. This shows a large disparity comparing with Oswal et al. where contacts details of the referring doctor were missing in 42% of the cases (20). This is necessary to contact the doctor if there is a need to verify any relevant information about the patient and to report any findings from the report that need urgent attention (1). The HOD name was not completed in 4.8% of the cases. As the head of the clinical team, the consultant is also responsible for the management of the patient in making final decisions, including requesting radiological investigations (20).

The pregnancy status was omitted in 5.6% of forms. This is contrary to the study by Yousef et al., at the College of Medical Radiologic Sciences in Khartoum, where this field was ignored/not filled in more than 70% of cases in the study in five state hospitals and one private hospital. This could be the lack of knowledge of ionising radiation effects of the referring doctors to the unborn foetus (14). This large discrepancy to our study also could be due to the fact that the paediatric department was among the four departments that we assessed, and the possibility of being pregnant field was regarded as completed if the female patient was less than 15 years and in male patients.

Documenting the hospital name helps the radiology department to recognise different referral hospitals that refer to our institution for radiological investigations/procedures. If the name of the hospital and the contact details of the referring doctor are not documented, it will be difficult to contact the hospital/doctor if the radiologist consultant makes any changes on the after-hours registrar report.

#### **4.2 Could inadequate clinical information affect final radiological diagnosis?**

Interpreting radiologic studies is not a process where the conclusion will always give a direct answer (19). There are situations where the clinicians provide a clear question to be answered and instances where there is no clear question asked not even written clinical history on the radiological request form. The reporting radiologist must therefore make great effort to interpret the study and make a good conclusion (19).

Leslie et al., evaluated the influence of clinical information on the reporting of CT by radiologists, where they reported that 19% of CT reports were changed after clinical information was known, with over half the changes being major ones (27). They also reported that when clinical information was correct, 83% of reports became more accurate and 17% became less accurate after the clinical information was known (27). This shows how clinical information can influence the accuracy of the radiological report and subsequently the final diagnosis.

Various studies also have evaluated the influence of clinical history on plain radiographs (27). Doubilet and Herman, found that the provided accurate clinical information increased the true-positive readings in chest radiograph (27, 28), and Test et al., evaluated chest radiograph from two academic children hospital with a spectrum of respiratory disease and demonstrated that the availability of clinical information improved the detection of pneumonia, however it did not improve the detection of other findings (29).

CT scan involves the interpretation of large volumes and many images by the reporting radiologist compared to plain radiographs and also covers number of systems that require detailed interpretation (27). “The range of possible pathologies and the list of differential diagnoses are greater than when imaging a single system” (27). Clinical information is therefore vital to direct the focus of the reporting radiologist in order to narrow the differential diagnoses which happens mostly when the provided information is deficient (27).

Our study found that omitted components on the request form affected the final radiological diagnosis in 0.7% of cases. Although this is a low percentage, it does not excuse clinicians from providing adequate clinical information as this can have a significant impact on the individual patients' health.

### **4.3 Discussion summary**

Inadequate completion of radiology request forms is a global problem (1, 2, 4, 5), as observed in our study and other studies mentioned above in the literature. It is crucial that medical professionals take into consideration previous radiological studies as they offer important information that can be utilized in conjunction with the results of the current study. Background medical history of the patient cannot be ignored as it improves the outcome of the report that the radiologist give-out (30, 31).

### **4.4 Limitations of the study**

- Patient's demographic data completeness for outpatients CT scan request forms, could not be accurately assessed as the administration clerks ensure that stickers with the information are present on all of those patient's forms.
- The study was only limited to four departments and a single radiological modality.
- Only non-emergency forms were evaluated where time was perhaps not an influencing factor

#### **4.5 Ways to ameliorate poorly completed forms**

- Structured lectures and an induction programs should be implemented for the yearly intake of new interns. This will help familiarise them to the system in the radiology department. Regular audits also must be done once the induction programme is in place to assess if there is improvement in filling of requests forms (3). These could minimise unnecessary requests that can cause economic burden to the hospital, that also take slots for patients who truly need imaging and reduction of potential radiation.
- Modification/addition of important clinical information to the current existing radiology request form e.g. history of allergies, previous surgical history and urea and creatinine results. This could help highlight the importance of providing previous medical history including known allergies that could endanger patient's health.
- Registrars and consultants taking care of the patient should fill the radiology request forms and interns should do so with guidance of their seniors as they might not have complete insight into the patient's condition.
- Troude et al., have identified that standardisation and computerisation of radiology requisitions improves the quality of information provided on the request form (7, 32). Due to the availability of PACS in our institution, this could also be implemented to improve the quality of our services. Our IT department could be requested to incorporate e-requesting radiological studies to the system. This will

assist in rejecting the submission of forms that are not adequately completed to enforce the standard practice (7, 31).

#### **4.6 Future projects**

- Assessment of other radiological modalities, e.g. MRI, fluoroscopy, in our institution.
- CMJAH is one of the four academic hospitals in our circuit. A separate audit is required to evaluate radiology departments of the remaining three hospitals in order to compare their findings with our study.

## **5. Conclusion**

This study revealed that the filling of radiology request forms is poor, as only 9.3% were fully completed. This affects the overall service provided by the radiology department at large and more importantly could potentially compromise the health of patients. While the outcomes of the patients were not evaluated and the effects of missing data was seemingly minimal in this study; with larger number of patients, it has the potential to have a detrimental effect on many patients. Each non-emergency CT scan request should probably be evaluated by the radiologist before being booked, to avoid delays in imaging and unwarranted radiation.

## 6. References

- (1) Cohen MD, Curtin S, Lee R. 2006. Evaluation of Quality of Radiology Requisitions for Intensive Care Unit Patients. *Academic Radiology*, 13(2):236-40.
- (2) Afolabi OA, Fadare JO, Essien EM. 2012. Audit of completion of radiology request form in a Nigerian specialist hospital. *Annals of Ibadan Postgraduate Medicine*, 10(2):48-52.
- (3) Depasquale R, Crockford MP. 2005. Are Radiology Request Forms Adequately Filled In? An Audit Assessing Local Practice. *Malta Medical Journal*, 17(4):36-38.
- (4) Irurhe NK, Sulaymon FA, A. OO, *et al.* 2012. Compliance Rate of Adequate Filling of Radiology Request Forms in a Lagos University Teaching Hospital. *World Journal of Medical Sciences*, 7(1):10-12.
- (5) Mohammad H, Iortile JT, Ogbeifu OJ, *et al.* 2016. An Assessment of The Adequacy of Filling of Radiology Request Cards in A Teaching Hospital in Makurdi , North Central Nigeria. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 15(6):71-74.
- (6) Bosanquet DC, Cho JS, Williams N, *et al.* 2013. Requesting radiological investigations – do junior doctors know their patients? A cross-sectional survey. *Journal of the Royal Society of medicine*, 4(1):1-6.
- (7) Triantopoulou C, Tsalafoutas I, Maniatis P, *et al.* 2004. Analysis of radiological examination request forms in conjunction with justification of X-ray exposures. *European Journal of Radiology*, 53(2005):306-11
- (8) The Royal College of Radiologists. 2006. Standards for the reporting and interpretation of imaging investigations. Available: [https://www.rcr.ac.uk/sites/default/files/bfcr061\\_standardsforreporting.pdf](https://www.rcr.ac.uk/sites/default/files/bfcr061_standardsforreporting.pdf) [Accessed on 1/11/2017].
- (9) International Atomic Energy Agency. 2010. Comprehensive Clinical Audits of Diagnostic Radiology Practices: A Tool for Quality Improvement. Available: [http://www-pub.iaea.org/MTCD/publications/PDF/Pub1425\\_web.pdf](http://www-pub.iaea.org/MTCD/publications/PDF/Pub1425_web.pdf) [Accessed on 2/11/2015].

- (10) Hagi S, Khafaji M, Ahmed N, *et al.* 2014. Current Trends in Computed Tomography Referral Practice Experience at a Large Academic Hospital. *Life Science Journal*, 11(11):842-48.
- (11) Abubakar MG, Ivor CN, Waziri A, *et al.* 2015. Evaluation of the Adequacy of Completion of Radiology Request Forms in a Tertiary Hospital, Northeast, Nigeria. 16(2):219-24.
- (12) Royal College of Radiologists. 2016. Standards for the communication of the Radiological reports and safe-fail alert notification. Available: <https://www.rcr.ac.uk> [Accessed on 1/11/2017].
- (13) Danfulani M, Musa MA. 2015. Radiology request forms (Rrf) inadequately completed; The case of Tertiary Health Center in Northwest Nigeria. *International Journal of Clinical and Biomedical Research*, 1(2):1-4.
- (14) Yousef MO, Ayad CE, Elzaki AAE, *et al.* 2011. Evaluation of radiology request forms in diagnostic centers in Khartoum state. *Sudan Medical Monitor*, 6(3):201-10.
- (15) Doğan N, Varlıbaş ZN, Erpolat ÖP. 2010. Radiological report: expectations of clinicians. *Diagn Interv Radiol*, 16:179-85.
- (16) Bosmans JML, Peremans L, De Schepper AM, *et al.* 2011. How do referring clinicians want radiologists to report? Suggestions from the COVER survey. *Insights into Imaging*, 2(5):577-84.
- (17) Auka J, Mberia HK. 2015. Seminar Paper on Narrowing the Communication Gap between Clinicians and Radiologists. *The International Journal Of Humanities & Social Studies*, 3(12):130-37.
- (18) DeVries A, Young PC, Wall E, *et al.* 2013. CT Scan Utilization Patterns in Pediatric Patients With Recurrent Headache. *Pediatrics*, 132(1):1-8.
- (19) Brady A, Laoide RÓ, McCarthy P, *et al.* 2012. Discrepancy and Error in Radiology: Concepts, Causes and Consequences. *Ulster Medical Journal*, 81(1):3-9.
- (20) Oswal D, Sapherson D, Rehman A. 2009. A study of adequacy of completion of radiology request forms. *The Society and college of Radiographers*, 15:209-13.
- (21) Rutstein SO, Iqbal HS. 2004. Infecundity, Infertility, and Childlessness in Developing Countries. (9):1-16.
- (22) Phipps MG, Sowers M. 2002. Defining Early Adolescent Childbearing. *American Journal of Public Health*, 92(1):125-28.

- (23) Johnson JA, Tough S. 2012. Delayed child bearing. *Journal of Obstetricians and Gynaecologists of Canada*, 34(1):80-93.
- (24) Ogbole GI. 2010. Radiation Dose in Paediatric Computed Tomography: Risks and Benefits. *Annals of Ibadan postgraduate medicine*, 8(2):118-26.
- (25) Berlin L. 2008. Comparing New radiographs With Those Obtained Previously. *Radiology Today*, 9(23):48-53.
- (26) Mullins ME, Lev MH, Schellingerhout D, *et al.* 2002. Influence of Availability of Clinical History on Detection of Early Stroke Using Unenhanced CT and Diffusion-Weighted MR Imaging. *American Journal of Roentgenology*, 179:223-28.
- (27) Leslie A, Jones AJ, Goddard PR. 2000. The influence of clinical information on the reporting of CT by radiologists. *The British Journal of Radiology*, 73(874):1052-55.
- (28) Doubilet P, Herman PG. 1981. Interpretation of Radiographs: Effect of Clinical history. *American Journal of Roentgenology*, 137:1055-8.
- (29) Test M, Shah SS, Monuteaux M, *et al.* 2013. Impact of Clinical History on Chest Radiograph Interpretation. *Journal of Hospital Medicine*, 8(7):359-64.
- (30) Rajanikanth RV. 2014. Audit of radiology request forms-"Are they adequately filled?". *Journal of medical and scientific research*, 2(1):41-44.
- (31) Abbas M, Omer A, Hamad M. 2016. Adequacy of clinical information on radiology request cards from medical assessment unit. Clinical Audit. *Nuclear Medicine and Biomedical Imaging*, 1(1):5-6.
- (32) Troude P, Dozol A, Soyerb P, *et al.* 2014. Improvement of radiology requisition. *Diagnostic and Interventional Imaging*, 95:69-75.

## Appendix A: Ethics Clearance Certificate



R14/49 Dr Morotshe Maureen Kgalaeng et al

### HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

#### CLEARANCE CERTIFICATE NO. M150910

**NAME:** Dr Morotshe Maureen Kgalaeng et al  
**(Principal Investigator)**

**DEPARTMENT:** Radiology  
Charlotte Maxeke Johannesburg Academic Hospital  
University of the Witwatersrand

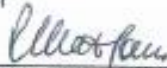
**PROJECT TITLE:** Assessment of the Adequacy of Non-Emergency Computed Tomography Scan Request Forms in a Tertiary Hospital in South Africa

**DATE CONSIDERED:** 02/10/2015

**DECISION:** Approved unconditionally

**CONDITIONS:**

**SUPERVISOR:** Dr Lara Goldstein

**APPROVED BY:**   
Professor P Cleaton-Jones, Chairperson, HREC (Medical)

**DATE OF APPROVAL:** 09/12/2015

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

#### DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. I agree to submit a yearly progress report.

  
Principal Investigator Signature

Date 15/12/2015

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

## Appendix B: how to assess the radiology request form

| G.P.-S. 06/12                                                                                                        |  |                      |  |                                            |  |                                                          |  |                                                                       |  | 81/508181<br>TPH 62D                         |  |
|----------------------------------------------------------------------------------------------------------------------|--|----------------------|--|--------------------------------------------|--|----------------------------------------------------------|--|-----------------------------------------------------------------------|--|----------------------------------------------|--|
| DEPARTEMENT RADIOLOGIE / DEPARTMENT OF RADIOLOGY                                                                     |  |                      |  |                                            |  |                                                          |  |                                                                       |  |                                              |  |
| MAQ SLEGS DEUR GENEESHEER VOLTOOI WORD / MAY ONLY BE COMPLETED BY A DOCTOR                                           |  |                      |  |                                            |  |                                                          |  |                                                                       |  |                                              |  |
| ① HOSPITAL/HOSPITAAL                                                                                                 |  |                      |  |                                            |  | R6 No                                                    |  |                                                                       |  |                                              |  |
| PASIËNT/PATIENT ②                                                                                                    |  |                      |  |                                            |  | LOPEND WALKING <input type="checkbox"/>                  |  | BED VERVOER BED TRANSPORT <input type="checkbox"/>                    |  | DRAAGBAAR STRETCHER <input type="checkbox"/> |  |
| HOSP NO ①                                                                                                            |  |                      |  |                                            |  | STOEL CHAIR <input type="checkbox"/>                     |  | DOEN IN SAAL DO IN WARD <input type="checkbox"/>                      |  | ②                                            |  |
| GESLAG/SEX ①                                                                                                         |  | OUDERDOM/AGE ①       |  | INDELING/CLASSIFICATION                    |  | AFDELING/WARD ①                                          |  | VOORHEEN GERADIOGRAFFEER/PREVIOUSLY RADIOGRAPHED                      |  | JA/YES ①<br>NEE/NO                           |  |
| VORIGE R6 ONDERSOEK MET DATUMS / PREVIOUS R6 EXAMS WITH DATES                                                        |  |                      |  |                                            |  |                                                          |  |                                                                       |  |                                              |  |
| VOLLEDIGE KLINIESE BEVINDINGS EN INDIKASIE VIR AANVRAAG / COMPLETE CLINICAL FINDINGS AND INDICATIONS FOR REQUEST ② ② |  |                      |  |                                            |  |                                                          |  |                                                                       |  |                                              |  |
| ONDERSOEK AANGEVRA / EXAMINATION REQUESTED ①                                                                         |  |                      |  |                                            |  |                                                          |  |                                                                       |  |                                              |  |
| IS PASIËNT MOONTLIK SWANGER? IS PATIENT POSSIBLY PREGNANT?                                                           |  |                      |  | JA/YES <input checked="" type="checkbox"/> |  | NEE/NO <input type="checkbox"/>                          |  | DEPARTEMENTSHOOF HEAD OF DEPARTMENT ①                                 |  |                                              |  |
| VERSLAG/REPORT                                                                                                       |  | JA/YES               |  | NEE/NO                                     |  | PRIVAAT PASIËNT: RADIOLOOG PRIVATE PATIENT: RADIOLOGIST  |  |                                                                       |  |                                              |  |
| VERWYSENDE GENEESHEER (Drukskrif) REFERRING DOCTOR (Please Print) ①                                                  |  |                      |  |                                            |  | HANDTEKENING EN DATUM SIGNATURE AND DATE ① ①             |  |                                                                       |  |                                              |  |
| KONTAK NOMMER / CONTACT NUMBER ①                                                                                     |  |                      |  |                                            |  | VIR DEPARTEMENT RADIOLOGIE / FOR DEPARTMENT OF RADIOLOGY |  |                                                                       |  |                                              |  |
| AANKOMS ARRIVAL (A)                                                                                                  |  | VERTEK DEPARTURE (D) |  | VAN PASIËNT OF PATIENT (D)                 |  | (A) (D)                                                  |  | DATUM VAN ONDERSOEK DATE OF EXAMINATION STUDENT: VOLLE NAAM/FULL NAME |  |                                              |  |
| RADIOGRAAF / RADIOGRAPHER                                                                                            |  |                      |  |                                            |  |                                                          |  |                                                                       |  |                                              |  |
| DEURLIGTINGSTYD/SCREEN TIME AANTAL BELIGTINGS/NO OF EXPOSURES                                                        |  |                      |  |                                            |  | FILMS: GROOTTE EN GETAL/FILMS: SIZE AND NUMBER           |  |                                                                       |  |                                              |  |
|                                                                                                                      |  |                      |  |                                            |  | 18 X 24                                                  |  | 24 X 30                                                               |  | 35 X 35                                      |  |
|                                                                                                                      |  |                      |  |                                            |  | 18 X 43                                                  |  | 30 X 40                                                               |  | 35 X 43                                      |  |
| KONTRAS TOEGEDIEN EN STERKTE/ CONTRAST ADMINISTERED AND STRENGTH                                                     |  |                      |  |                                            |  | HOEEVEELHEID EN STERKTE/ AMOUNT AND STRENGTH             |  |                                                                       |  |                                              |  |

## **Appendix C: Note on referencing style**

Please note that the referencing in this thesis is a modification of the Vancouver Referencing style, done according to the Faculty of Health Sciences Style Guide as set out by the Wits Health Sciences Library.

The information on this WHSL Vancouver Citation Style Guide for Theses, Dissertations and Research Reports is available from <http://libguides.wits.ac.za/whsl-vancouver> updated on 30 January 2017.

**Appendix D: Turn-it-in Report**

# 1239711:The\_Research\_ Report

## Dr\_Kgalaeng.docx

*by* Morontshe Kgalaeng

---

**Submission date:** 09-Jan-2018 09:38AM (UTC+0200)

**Submission ID:** 901166155

**File name:** 88ae-47aa-b8d0-7ea2bbb24d4d\_The\_Research\_Report\_Dr\_Kgalaeng.docx  
(63.43K)

**Word count:** 3565

**Character count:** 19350

# 1239711:The\_Research\_Report\_Dr\_Kgalaeng.docx

## ORIGINALITY REPORT

2%

SIMILARITY INDEX

2%

INTERNET SOURCES

1%

PUBLICATIONS

0%

STUDENT PAPERS

## PRIMARY SOURCES

1

[www-pub.iaea.org](http://www-pub.iaea.org)

Internet Source

1%

2

Oswal, D.. "A study of adequacy of completion  
of radiology request forms", Radiography,  
200908

Publication

1%

3

[uir.unisa.ac.za](http://uir.unisa.ac.za)

Internet Source

1%

Exclude quotes

Off

Exclude matches

Off

Exclude bibliography Off