Completeness of radiology request forms in a Johannesburg Paediatric Hospital

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Declaration

I, Matondo Muyingi, declare that this research report is my own work. It is being submitted for the degree of MMed (RadD) 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 Matondo Muyingi

On the 09th day of September 2025

This project is dedicated to my wife and kids for their continuous physical and emotional support throughout this journey.

Publications and presentations

This work has never been published.

It has never been presented at a congress.

Abstract

INTRODUCTION:

Radiological request forms are currently the main written tool used for booking any imaging modality and are a vital communication tool between the clinicians and the radiology department. This not only gives information about the patient's biodata, clinical and medical history but also determines what imaging modality should be done, based on the case. Thus, the importance of complete and proper information from the booking clinician cannot be overemphasized as this may lead to unnecessary radiation, examination, and costs to name a few.

AIM: This research aims to evaluate the completeness of radiological request forms from Nelson Mandela Children Hospital

METHOD: Five hundred request forms were obtained and analysed retrospectively. The forms were derived from 4 different modalities. 200 Plain film; 100 MRI, 100 ultrasound and 100 CT. Participating departments included but were not limited to, Cardiology, Paediatrics, Paediatric surgery, Neurosurgery, ENT, Orthopaedic, etc.

RESULTS: Only 2,6 % (n13) of the forms were deemed fully completed by the stipulated standard.

The completeness rate analysis, however, revealed variability across departments and modalities.

Overall completeness rate was 75% on average across all modalities, with the highest overall completeness rate observed in Plain film (77%), while MRI showed the lowest (73%). Departments such as NICU, Cardiology, and PICU consistently exhibited higher completeness rates, while Neurosurgery and Orthopaedics had lower rates.

Patient's demographic scored the highest (100% average) amongst all modalities whilst 'previous relevant imaging' and 'additional relevant history' scored the lowest (21 % average) amongst all modalities.

CONCLUSIONS: Radiology request forms completion remains incomplete across various modalities and departments, and this may lead to miscommunication amongst radiologists and referring clinicians as this is the main tool for communication and a decisive factor for imaging. Potential consequences can include over scanning, thus over exposure to ionizing radiation, which is especially detrimental to the paediatric population.

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- Nelson Mandela Children's Hospital Academic committee MM research as well as clinical manager for allowing me to do this research at the institution.

- Stella Malapile, ASD: Head of Radiography for her assistance with sorting out the patient's request forms according to various modalities.

- Pathutshedzo Ramakhanya, the statistician.

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List of Abbreviations

AI:	Artificial Intelligence
ALARA:	As Low as Reasonably Achievable
CT:	Computed Tomography
HOD:	Head of Department
MRI:	Magnetic Resonance Imaging
NICU:	Neonatal Intensive Care Unit
NMCH:	Nelson Mandela Children's Hospital
PICU:	Paediatric Intensive Care Unit

1. Rationale

A sufficiently completed radiological request form is a very important document, as it serves as an interface between the Radiology Department and the clinician. The request form provides vital background information about the patient as well as the requested radiological examination.

The Radiology Department forms part of a multi-disciplinary team and as such adds value as well as contributes to the overall management of the patient, especially when the clinical data is mentioned on the request form. Many request forms are completed by junior clinicians and often omit important details about the medical condition of the patient, which could impact the outcome of the report. These discrepancies could be due to shift work or block rotations (1).

2. Introduction

Adequate filling of radiological request forms cannot be overstressed as this limits the number of unnecessary examinations, reduces investigation time, reduces the potential effects of possible unknown iodine allergies, and most importantly unnecessary exposure to radiation (2).

Incomplete radiological forms done by clinicians is a global problem (3). Various research perfomed around the globe show a staggering high percentage (up to 77%) of unjustified exposure to radiological exams (4). Also, up to 20% of examinations are deemed clinically redundant due to inappropriate requests (3, 5).

The Radiation Protection Regulation of the European Union Nations states that it is the responsibility of the referring clinician to collect a patient's previous exposures and diagnostic information in order to justify the radiological exam requested (3).
This is particularly important in the paediatric population where radiation exposure should be particularly limited to avoid potential future adverse effects.

2.1. Background

There is a general tendency for clinicians to submit incomplete radiological request forms (1). The request form serves as an essential tool of communication between the clinicians, the radiologist, and the radiographers (3). The request form assists the radiologist to better understand the patient's medical condition, and therefore aids in a more accurate diagnosis and treatment (5). Furthermore, clinicians should write legibly as this is helpful in case of any information ambiguity, which potentially reduces the need for duplication of studies, and therefore reduces radiation exposure to the patient, helps expedite report delivery, especially in the case of urgent radiological findings that require immediate attention (1).

Globally, various institutions use their own personalized request forms, and consequently there is no standardisation of request forms (3). However, the International Atomic Energy-Human Health Series N0.4 developed criteria for the minimum requirements that should be present on a request form (1). This includes a patient's personal details (name, age, address, phone number, and ward), the requested study, clinical indication, date of request, referring physician's details (name, contact number, signature), and finally, the patient's pregnancy status (3, 4). A patient's pregnancy status is of particular importance, as one would want to avoid unnecessary radiation exposure to the growing foetus. This is especially vital regarding Computed Tomography (CT) scans, as this offers a higher radiation dose (1). In addition, there are no regulations regarding the clinicians' experience when it comes to requesting a radiological exam (1). A request is often made by the least experienced clinician with limited knowledge about the patient's medical condition (6). The major factor influencing a radiological report is the patient's clinical information provided on the request form (1). Another factor to consider is the radiologists' level of experience.

2.2. Global studies

Internationally, the completeness of radiological request forms remains a major challenge and therefore some hospitals see it as part of ongoing Quality Improvement as indicated by Cohen et al in 2006 (7). They also showed that only 71% of request forms have clinical indications, 14 % of cases did not provide the clinician's name, and only 56% of the names provided were

legible (7). Another study by Triantopoulou C et al compared the completion of request forms across CT, ultrasound and plain film and , showed that there was greater omission of information such as age (omitted in 87,5% of forms) and clinical diagnosis (omitted in 46% of forms) in ultrasound and plain film imaging compared to CT (8). Moreover, a different study showed that in about 30% of radiological requests, the patients in question were not seen by the requesting clinician, most likely resulting from shift work. Also, 10 % of requests were listed as inappropriate (9).

2.3. African studies

An audit study done in a Nigerian specialist hospital in 2012 regarding the completeness of radiological request forms concluded that request forms are still largely incomplete and lack information such as request dates and names of referring doctors. This has a direct influence on the service delivered by both radiographers and radiologists, and also influences patient outcomes (2). Similarly, a study evaluating request forms from five different government hospitals and one private hospital in Sudan concluded that the information provided was inadequate and noted the importance of providing full patient data as well as clinical indications (5).

2.4. Study in South Africa

Only one study found in South Africa that was done in 2018 to assess the adequacy of radiological request forms in a tertiary hospital in Johannesburg, South Africa, specifically looking at nonemergency CT forms, showed that an overwhelming majority of forms (90,7%) were not fully completed. Furthermore, the study addressed the need for educating requesting doctors on the importance of adequately completing the request forms, once again reiterating the impact this has on patient reports and the outcome (1).

3. Aim

The aim of this study was to assess the completeness of radiological request forms at Nelson Mandela Children's Hospital (NMCH) in Johannesburg, South Africa.

4. Study objectives

The primary objective was to evaluate the completeness of the request forms.

The secondary objective was to compare completeness amongst the various radiological modalities (all modalities versus each other) as well as amongst the various referring departments.

5. Methods

5.1. Research paradigm

This study was an audit looking at the completeness of radiological request forms.

5.2. Sample

The study population was 500 paediatric radiological request forms from the various imaging modalities and departments from NMCH and referral hospitals if any and collected during a 6 month period or until the 500 forms have been collected. A sample size of 500 request forms were deemed significant based of a P value of less than 0.05. In Radiology, plain films are done much more so than the other modalities, as this is usually the most accessible imaging modality and this was also confirmed during the data collection process, and as such 200 forms were determined as this was a good reflection of the proportion of forms against the other modalities.

5.2.1. Inclusion criteria

Requests forms from various departments at NMCH.

Request forms from referral hospitals.

5.2.2. Exclusion criteria

Illegible request forms.

5.3. Materials and Methods

This was an audit of radiology request forms, evaluating the completeness of radiological request forms in NMCH in Johannesburg, South Africa.
The main investigator collected radiological request forms from the record database for the various modalities (MRI, CT, Ultrasound & Plain film (X-ray). Examples of these forms are included in Appendix B.

A total of 500 forms (200 plain radiography, 100 ultrasound, 100 MRI, and 100 CT forms) from all Outpatient as well as Inpatient Departments (including Neonatal ICU, Paediatric ICU, Cardiology, Neurology, Renal as well as Neurosurgery) as well as referral hospitals were included.

- We audited the adequacy by examining each of the required fields or ticks

- The forms were audited and sorted as either complete or incomplete based on their required field.
- We gave a general percentage of the completed forms

- We compared the completeness amongst various modalities (i.e. CT versus MRI).

Data was collected anonymously to protect the patient as well as the referring clinician's privacy. Patients were recorded as numbers. (I.e. Pt 001 etc.) Data
was captured electronically on an Excel spreadsheet.
The following data was assessed:

<u>The radiological request form (including MRI, plain film, ultrasound, and CT)</u>

- Patient's details (name, age, date of birth, gender, hospital number, as well as parents/guardian details.

- Whether the patient will remain still and cooperate.
- Examination requested
- Relevant previous imaging (if yes, if done in base hospital or other institution)
- History and indication for exam (This field should include all 3 aspects, which are: known or working diagnosis; symptoms and clinical findings)
- Additional relevant history and comments (this part involves a “yes “or “no” answer) and includes: cardiac anomaly, respiratory/airway problems, allergies, previous contrast reaction, diabetic, metabolic, renal disease, sickle cell disease, family history of malignant hyperthermia, and neck instability
- Preferred date of exam (elective or not, date of operation if applicable as well as follow-up date)
- Referring physician (this includes name, contact, department, signature, HOD physician, and date)

5.4. Bias

This audit specifically involves the paediatric population, and this could influence the adequacy of the request forms when compared to the general population. The clinicians and radiologists involved are hesitant when it comes to exposing children to radiation, and forms may might be filled in more completely to facilitate this.

Specific imaging requests such as MRI usually require prior imaging modalities as part of the patient’s work up and thus the MRI request forms may well be optimally completed especially in terms of history/clinical diagnosis compared to other modalities such as plain radiography.

Furthermore, requests from referral hospitals could be more complete compared to the base hospitals as they usually compete to get their studies done as soon as possible and often need substantial evidence to support their requests.

6. Data analysis and statistics

The completeness of the forms was expressed as frequencies and percentages of the information provided on the forms. Chi-Squared Test

- The Chi-Squared test looked at whether the distribution of completion rates (i.e., how often responses were made) is influenced by the department.

ANOVA Test

- The ANOVA test compared the average response rates across the four sheets (X-RAY, ULTRASOUND, CT, and MRI) to see if there are meaningful differences.

Tukey's HSD Post-Hoc Test

- The Tukey's test is a follow-up to the ANOVA. It identifies which specific sheets differ in their average response rates.

7. Ethics

Permission to do this study was granted by the research committee at NMCH before any data was collected and obtained from WITS HREC.

8. Results.

Of all 500 request forms collected, 496 forms were analysed, and 4 forms were excluded from the study due to illegibility.

Out of the 496 forms, only 13 (2,6 %) were fully completed. 7 of those were from MRI, followed by 5 from CT and 1 from X-ray/Plain film.

The completeness rate analysis, however, revealed variability across departments and modalities. The highest overall completeness rate was observed in Plain film (77%), while MRI showed the lowest (73%). Departments such as NICU, Cardiology, and PICU consistently exhibited higher completeness rates, while Neurosurgery and Orthopaedics departments had lower rates.

Chi-Squared Test:

- Test Statistic: 16.15- Degrees of Freedom: 12- p-value: 0.1844

Interpretation: If the p-value is less than 0.05, completeness rate distribution is not independent of departments.

ANOVA Test Results:

- ANOVA Test:- F-Statistic: 2.91- p-value: 0.0344

Interpretation: If the p-value is less than 0.05, mean completeness rates differ significantly across sheets.

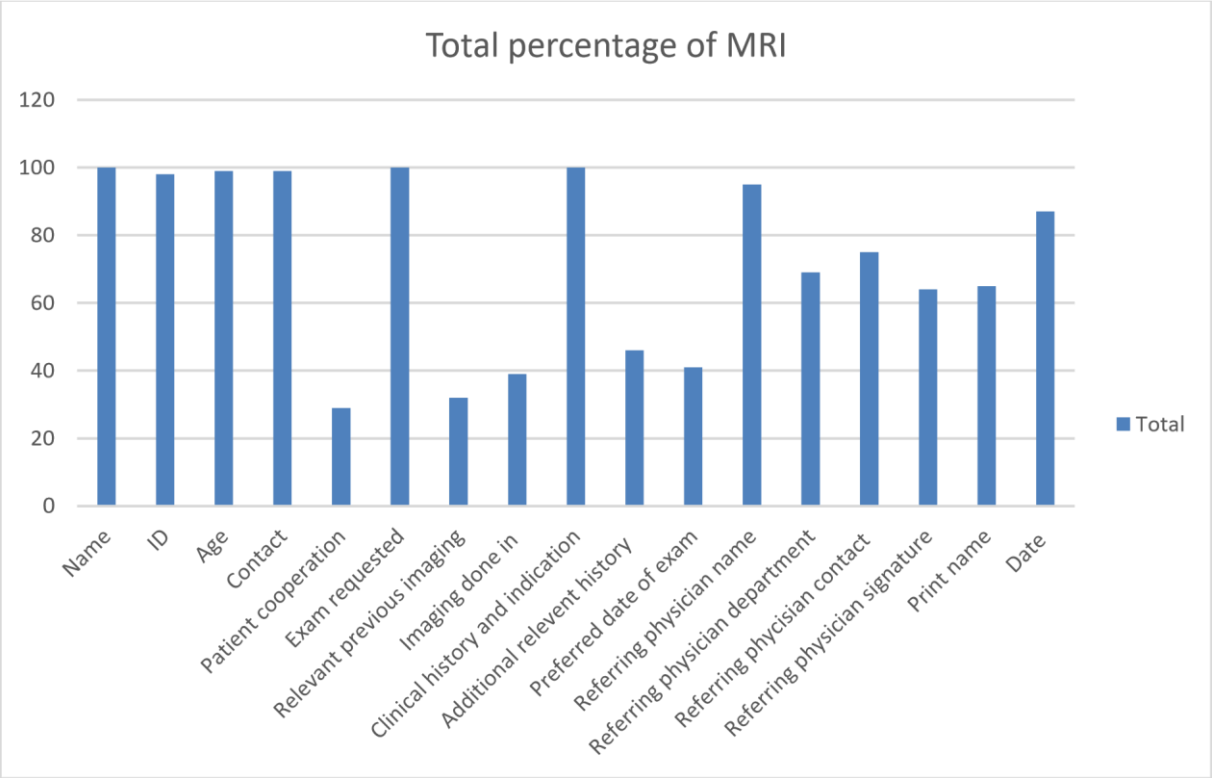
Tukey's HSD Post-Hoc Test Results:

- The Tukey's HSD test identified a significant difference in mean completeness rates between MRI and X-RAY, with no other significant differences between sheets.

MRI

100 radiological request forms were obtained during the study period, and forms were filled by various departments and wards, namely: Neurosurgery, Cardiac ward, Cardiology, Cardiothoracic, Renal ward, Nephrology, Ophthalmology, Paediatric, Paediatric surgery, PICU, and NICU. However, 3 were excluded due to eligibility. Thus 97 forms were analysed.

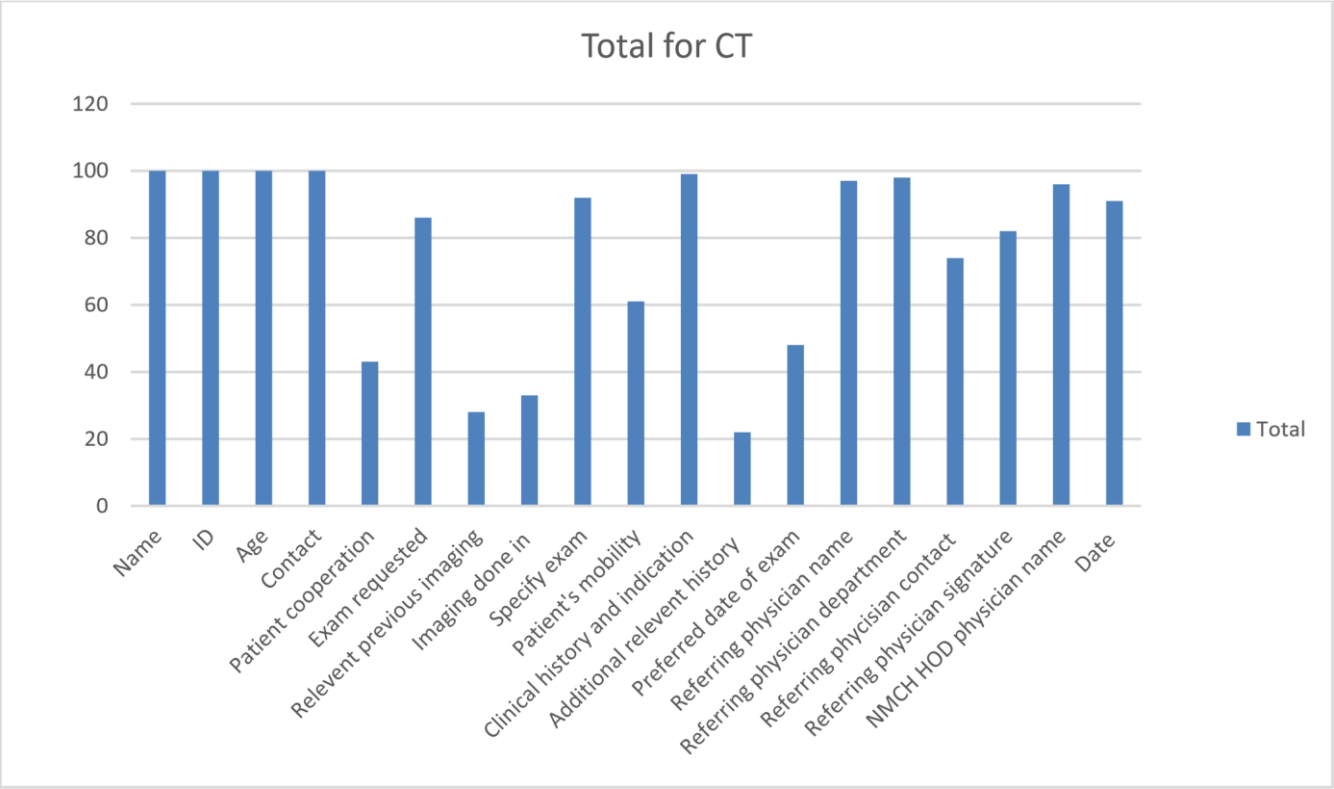
The most completed were names, exam requested, clinical history, and indication with a score of 100% (n97) each. The least completed were relevant previous imaging, and patient cooperation with a score of 32% and 29 % respectively.



CT

100 radiological request forms were obtained during the study period, and forms were filled by various departments and wards, namely, Oncology, ENT, General surgery, Neurosurgery, Cardiac ward, Cardiology, Cardiothoracic, Renal ward, Nephrology, Ophthalmology, Paediatric, Paediatric surgery, PICU and NICU.

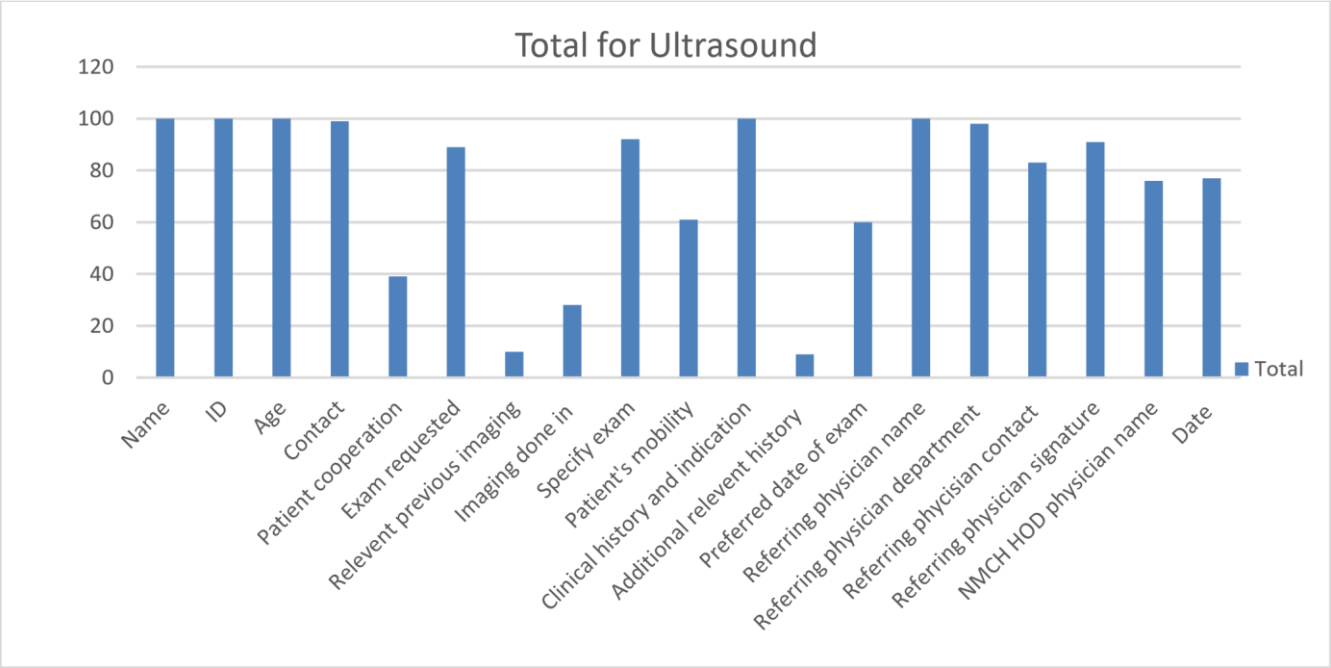
The most completed were names, ID, age, and contact numbers with a score of 100% each. The least completed were relevant previous images and additional relevant history with a score of 28 % and 22 & respectively.



Ultrasound

100 radiological request forms were obtained during this period, and forms were filled by various departments and wards, namely, Oncology, ENT, General surgery, Cardiology, Renal, Paediatric, Paediatric surgery, PICU, and NICU.

The most completed were names ID and age with a score of 100% each and the least completed were relevant previous images and additional relevant history with a score of 10% and 9% respectively.

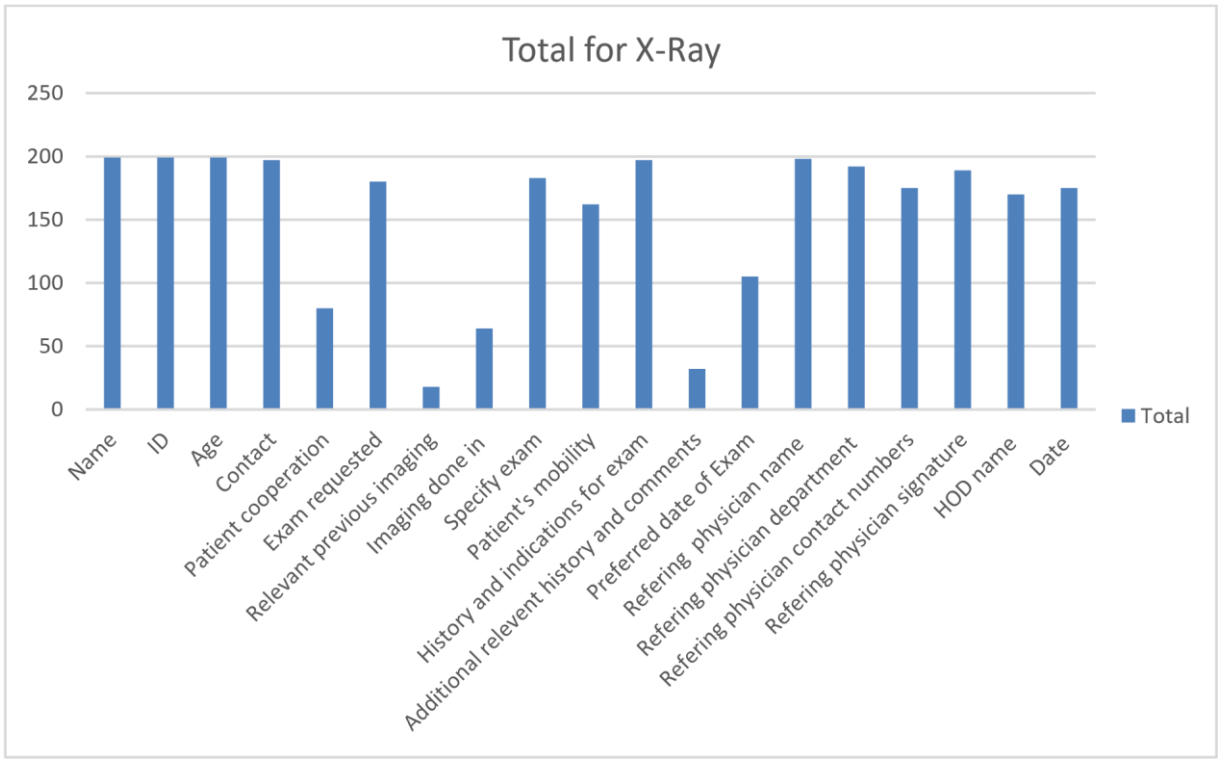


Plain Film

200 radiological request forms were obtained during this period, and forms were filled by various departments and wards namely, Oncology, ENT, General surgery, Cardiology, Renal, Paediatric, Paediatric surgery, PICU, and NICU.

However, only 199 of the forms were analysed. 1 form was excluded for illegibility.

The most completed were names, ID, and age with a score of 100% (n199) and the least completed was relevant previous imaging, with a score of 9% (n18)

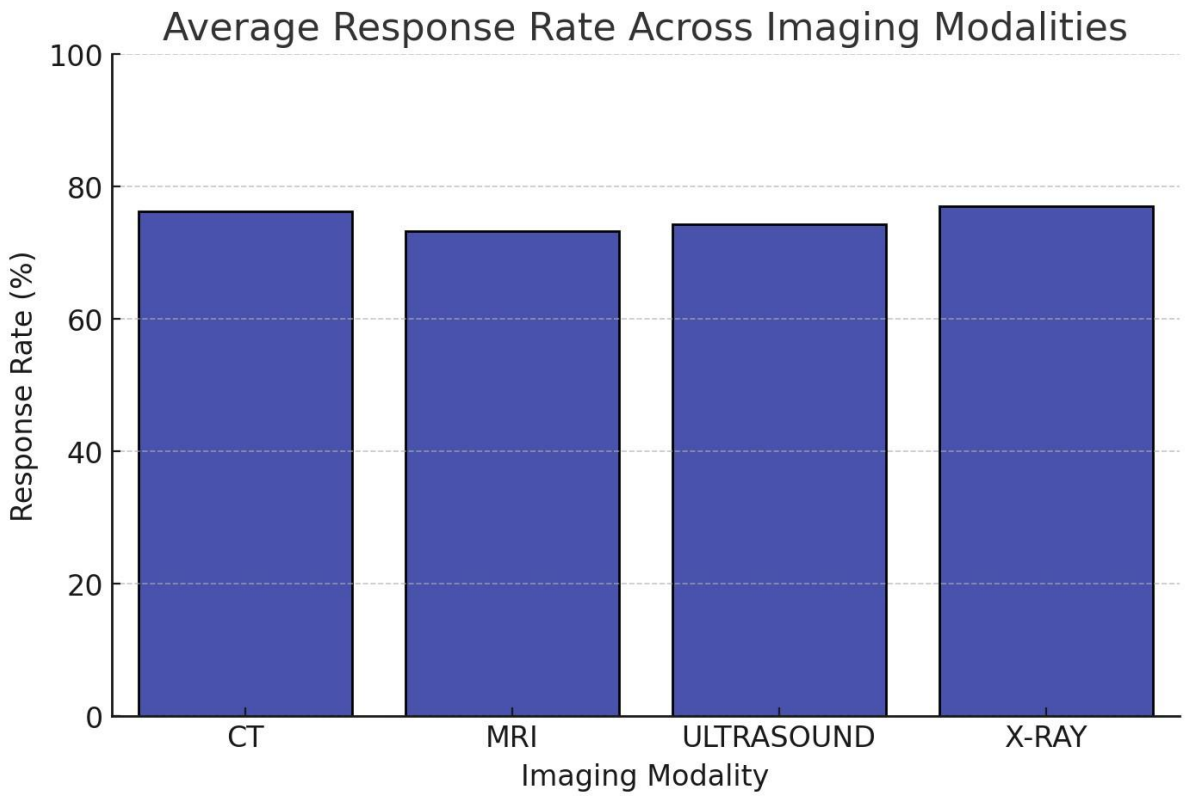

Total for X-Ray
250
200
150
100
50
0
Name
ID
Age
Contact
Patient cooperation
Exam requested
Relevant previous imaging
Imaging done in
Specify exam
Patient's mobility
History and indications for exam
Additional relevent history and comments
Preferred date of Exam
Refering physician name
Refering physician department
Refering physician contact numbers
Refering physician signature
HOD name
Date
Total

8.1. Comparisons amongst modalities

Overall, Plain film had the highest average completion rate of 77%. Followed by CT (76%), Ultrasound (74%) and lowest was MRI (73%). Correlation analysis

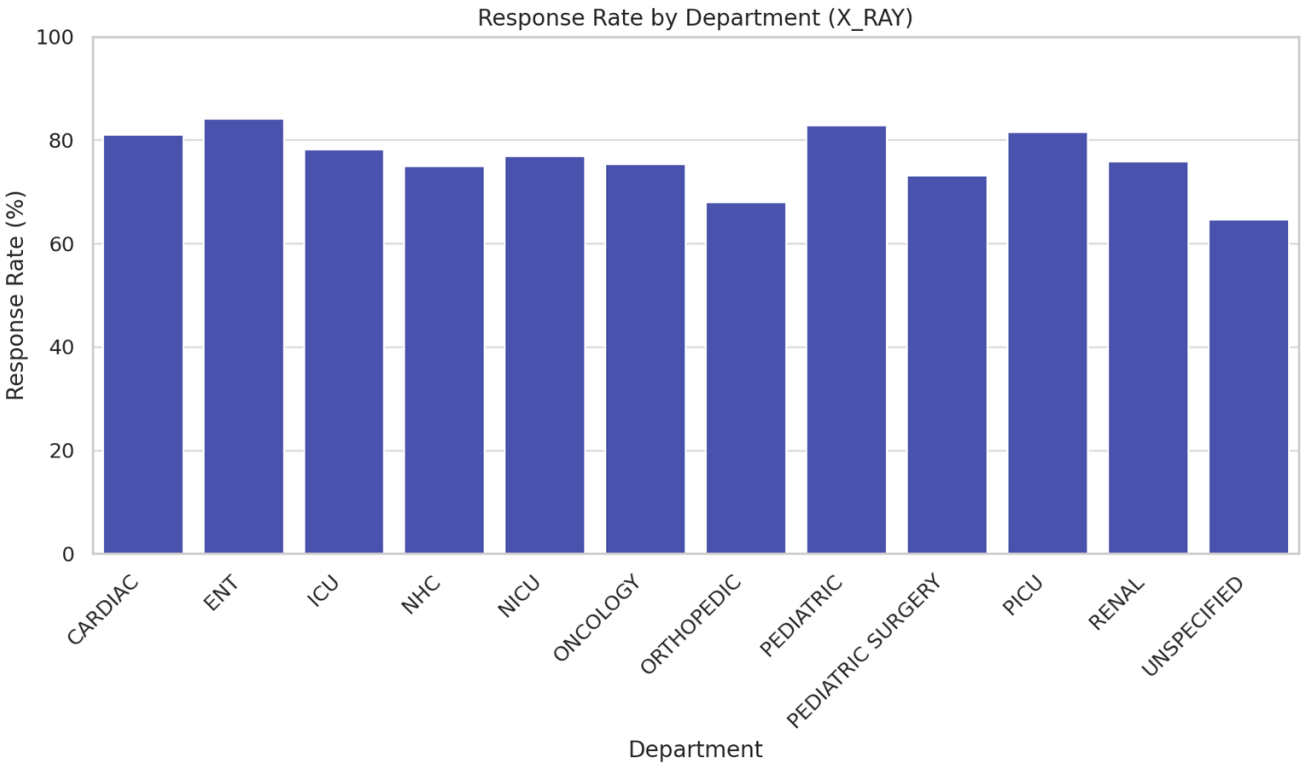
- Plain film vs Ultrasound: Correlation 0.08 (low positive correlation). There's almost no relationship between the response trends of these modalities
- Plain film vs CT: Correlation: 0.15 (low positive correlation). A slight alignment in trends exists, but it's very weak.
- Ultrasound vs MRI: Correlation: 0.20 (moderate positive correlation). Some similarities in how these modalities perform in response rates.
- CT vs MRI: Correlation: 0.03 (minimal correlation). These modalities operate independently with little relationship in response behaviours.

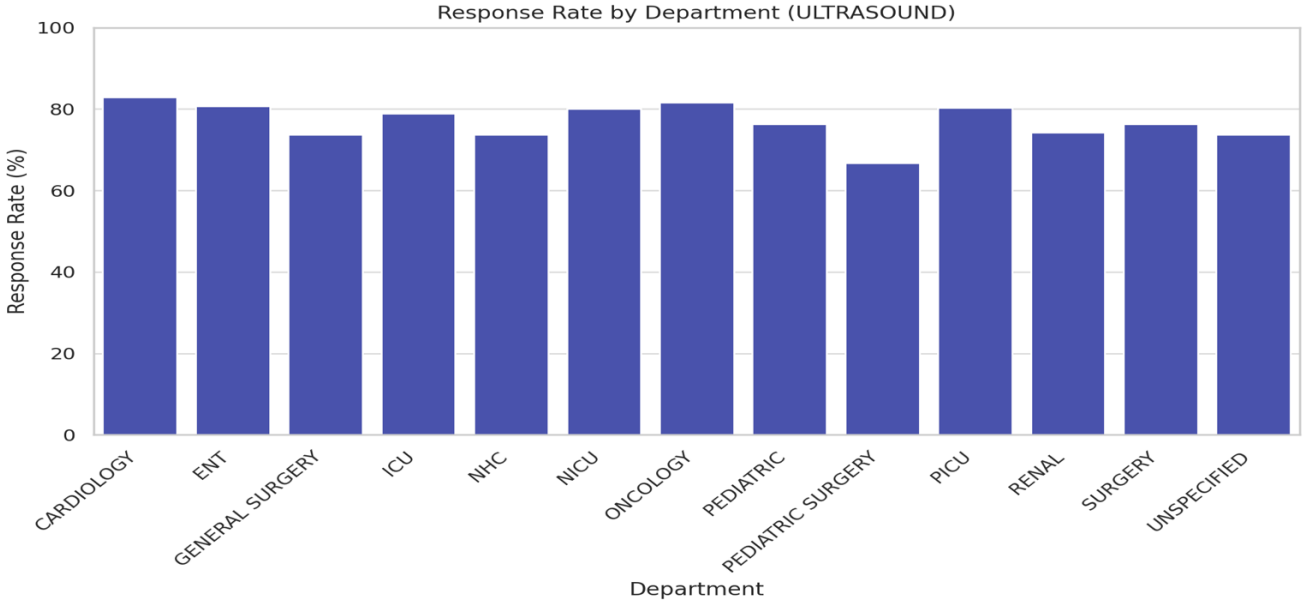
The table below shows the overall response/completeness rate across all modalities.

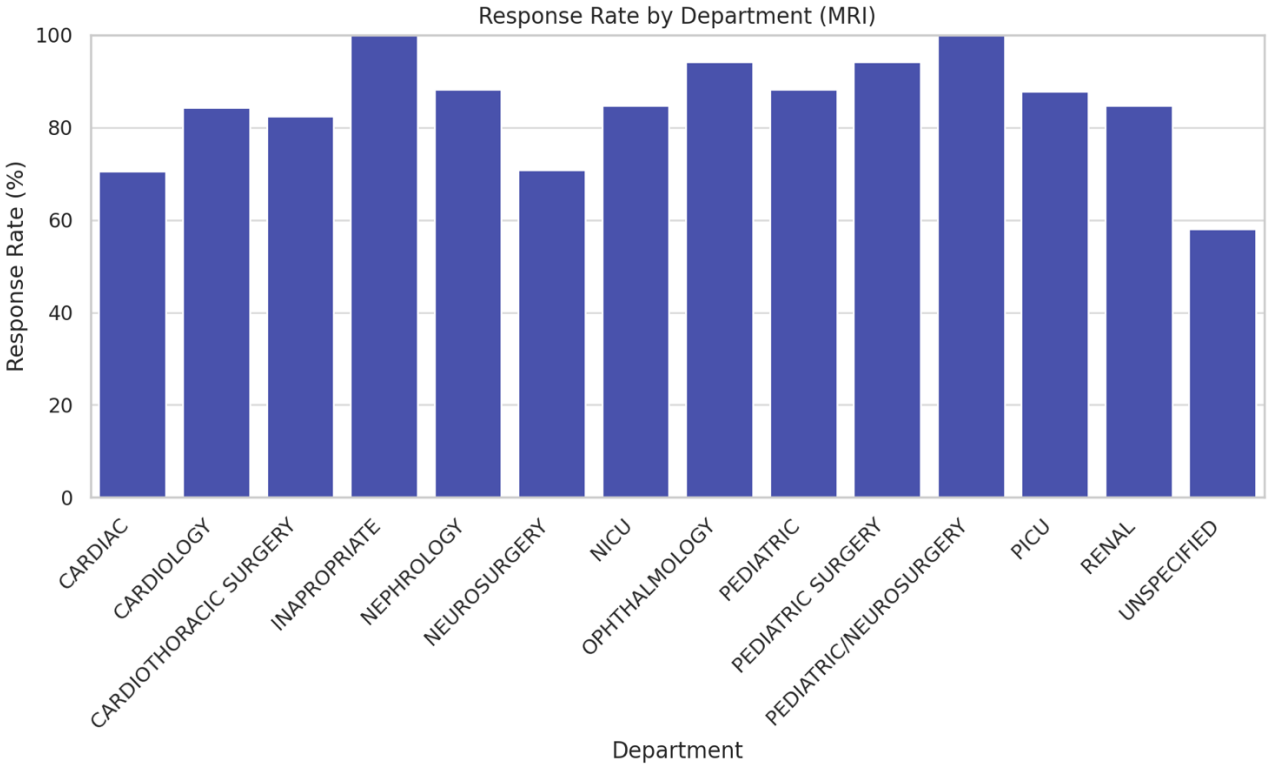


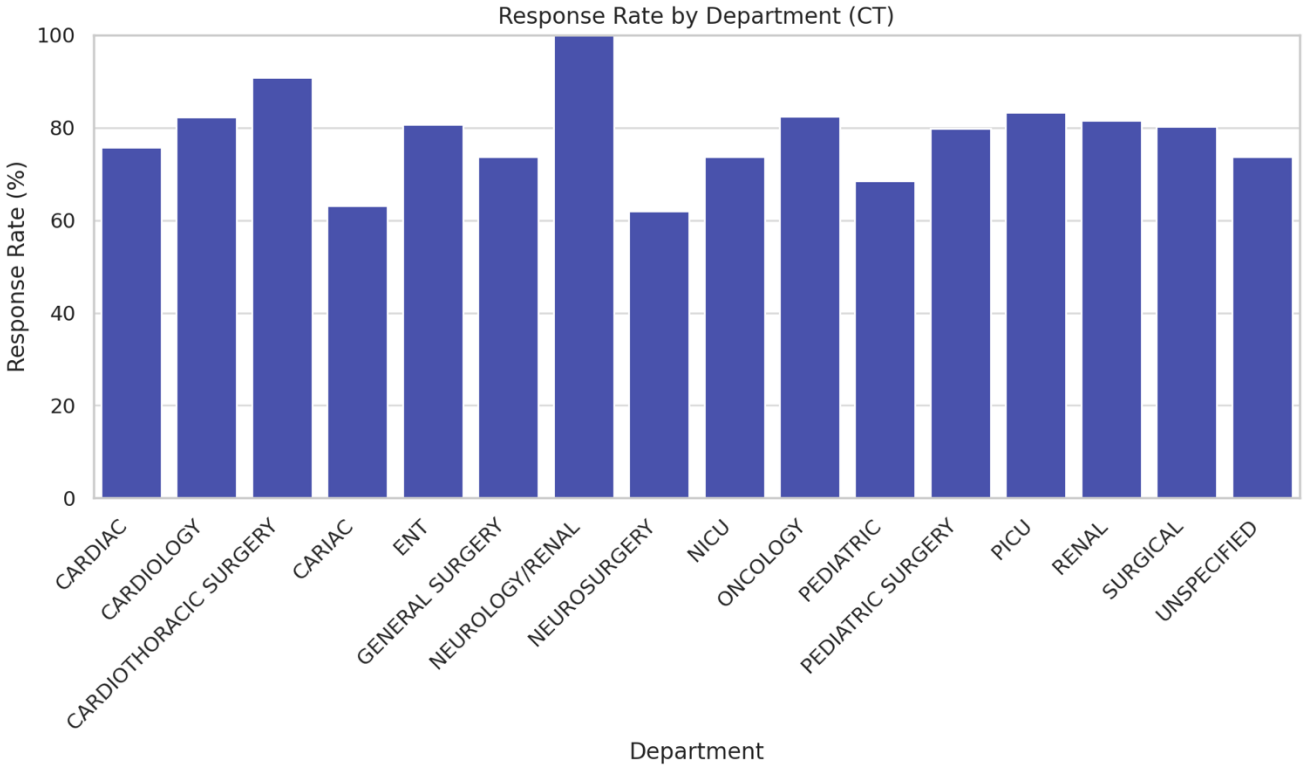
8.2. Comparison amongst departments

On average, departments like Cardiology, NICU (Neonatal Intensive Care Unit), and Paediatric surgery consistently had higher completion rates. While departments like Orthopaedics and Neurosurgery had lower completion rates.


Response Rate by Department (X_RAY)
Response Rate (%)
100
80
60
40
20
0
CARDIAC
ENT
ICU
NHC
NICU
ONCOLOGY
ORTHOPEDIC
PEDIATRIC
PEDIATRIC SURGERY
PICU
RENAL
UNSPECIFIED
Department


Response Rate by Department (ULTRASOUND)
Response Rate (%)
100
80
60
40
20
0
CARDIOLOGY
ENT
GENERAL SURGERY
ICU
NHC
NICU
ONCOLOGY
PEDIATRIC
PEDIATRIC SURGERY
PICU
RENAL
SURGERY
UNSPECIFIED
Department


Response Rate by Department (MRI)
Response Rate (%)
100
80
60
40
20
0
CARDIAC
CARDIOLOGY
CARDIOTHORACIC SURGERY
INAPROPRIATE
NEPHROLOGY
NEUROSURGERY
NICU
OPHTHALMOLOGY
PEDIATRIC
PEDIATRIC SURGERY
PEDIATRIC/NEUROSURGERY
PICU
RENAL
UNSPECIFIED
Department


Response Rate by Department (CT)
Response Rate (%)
100
80
60
40
20
0
CARDIAC
CARDIOLOGY
CARDIOTHORACIC SURGERY
CARIAC
ENT
GENERAL SURGERY
NEUROLOGY/RENAL
NEUROSURGERY
NICU
ONCOLOGY
PEDIATRIC
PEDIATRIC SURGERY
PICU
RENAL
SURGICAL
UNSPECIFIED
Department

9. Discussion

Items on request forms can be divided into 3 broad categories namely patient demographics(biodata), clinical data, as well as referring physician details.
Of all the radiological request forms collected, the patient's demographic categories scored the highest, and the least category filled was relevant previous imaging, which is in the clinical data category.

Patient demographics scored the highest amongst all modalities, and this is because most forms came with computer-generated stickers which had all the patient's demographic information on them. Forms that scored the least in the demographics were those that did not have these stickers on them. I.e. where the referring clinician had to manually complete them.

Previous relevant imaging and additional relevant history scored the lowest amongst all modalities. This finding was also noted by other studies (1,3). This is possibly because some patients simply did not have any previous relevant history or imaging and therefore were not important to mention on the request form. Previous imaging is important for the reporting radiologist as it can help with study comparison, particularly in oncology patients and other similar cases where previous imaging is needed (1). Furthermore, this can help assess if the current request for imaging is indeed necessary to avoid unnecessary radiation in the case of CT and Plain films (1,13).

Clinical history and indication scored the highest in the clinical data category as this is a very important piece of information in deciding which study needs to be done and how the study is planned by the radiologist. Furthermore, noncompletion of these categories often results in rejection of the request form or refusal of the study by the radiologist.

The most completed component in the referring physician category was the referring physician's name and department. This is most likely because referring physician may need to be contacted in case of any urgency regarding the scan result if the patient 's condition changes
during scanning. The referring department is crucial as this helps locate the patient for the study.

The modality that had the most fully completed forms was MRI (which included 1 form from a referral hospital), however, it had the lowest average completion rate among all other modalities. Patient cooperation was the least filled (29%) in MRI forms. This is particularly an important question, as it speaks for the need to potentially sedate the patient.

This could further impact the MRI daily list and workflow as this may require assistance from the anaesthetics department in addition to the paediatric department. Thus, preparation is key to ensure that everything goes according to the day plan, and should any complication arise during scanning, all the relevant specialities are present or aware, to ensure the patient's safety.

The modality that had the highest average completion rate was plain film/ X ray (77%). This could be due to the largest number of audited forms (199 forms) as opposed to CT, Ultrasound, and MRI, which had 100, 100, and 97 forms respectively. Plain films are the most requested in the department, therefore the numbers audited are representative of the average requests.

MRI had the lowest average completion rate (73%), however, the highest number of fully completed forms. That is, each category was completed in full. Amongst the fully completed MRI forms, one was from a referral hospital. This can be attributed to the fact that MRI booking dates for peripheral hospitals are generally far and thus require efforts on the part of these hospitals to ensure that their request is accepted.

Amongst the various departments, NICU, PICU, cardiology, and paediatric surgery had the

most completed forms compared to others. The study by M Kgalaeng done in 2018 also compared completeness among various departments and found that paediatric departments had the lowest average score, and neurosurgery had the highest score (1). It is however important to note that the above-mentioned study compared paediatric departments with other adult specialties as opposed to our study which only looks at various departments in the paediatric population.

There were variations in completeness rates between the departments by specific modalities. For instance, the ENT department had a high completion rate in the X-ray and ultrasound, however, none in the MRI and CT modalities (see X-ray response rate table by department). This finding is most likely because the above-mentioned department did not request any such modalities during the period, or simply didn't request much of these modalities, which ultimately led to poor overall performance. Another department is orthopaedics, which only filled in X-ray request forms and none of the others in the stipulated period, suggesting that they don't request much of the other modalities, which in turn resulted in an apparent lower average completion rate comparatively. Orthopaedics predominantly relies on plain film as a baseline modality, for example in suspected tumours, then subsequent cross-sectional imaging such as MRI, if there is suspicion of pathology. This could be another reason why there were no CT or MRI requests during the studied period.

A fair number of request forms had 2 different departments co-managing the patient, and this was stipulated in the department category, such as renal/neurology and paediatric/neurosurgery. (see MRI and CT response rate table).

Request forms, that had the wrong input in the department category (for instance filling the referring physician name or putting a signature or date in the "department" category, were deemed inappropriate (see MRI response Rate table), and there were many such forms. This is most likely what contributed to the lower average completion rate from MRI compared to the other modalities. Request forms from the other modalities had no inappropriate responses in this regard.

Lastly, the department was not indicated in many instances, and this was across all modalities. Such request forms were labeled with "0" in the department category (see response rate by department tables) to indicate no response.

9.1 Comparison with other studies

	Our study	R Akinola et al. Radiology request forms: are they adequately filled by clinicians?	OA Afolabi et al. Audit of completion of radiology request form in a Nigerian specialist hospital	M Kgalaeng Assessment of the Adequacy of Non-Emergency Computed Tomography Scan Request Forms in a Tertiary Hospital in South Africa
Type of study	Audit	Retrospective	Audit	Audit
Total number of request forms	500 forms of which 4 were excluded	144 forms	218 forms of which 16 were excluded	584 forms of which 5 were excluded
Modalities	Plain film, CT, MRI, and Ultrasound	CT and MRI	Plain film	CT
Total completeness percentage (100% completeness)	2,6%	Not indicated	Not indicated	9.3 %
Most completed data and percentage	Patient name and Age (100%)	Clinical history (99,3%), Surname and examination requested (100%)	Patient name (89,1%), Sex (96%), and ward (88,6%)	Patient name and ward (100%), Sex (99,7%), and Age (99,5%)
Least completed data and percentage	Relevant previous imaging (19,7%), Additional relevant history (15,5%)	Patient address (4,2%), Clinical diagnosis (1,4%), Previous X-ray (11.1%)	Patient Address (11,9%), Previous X-ray examination (35,6%)	Patient mobility (57,5%), and Previous X-ray (17,3%)

Compared with other studies done on the subject, it is clear that radiological request forms are not completely filled, with only 9,3% deemed fully completed (1), although not all studies indicated the actual percentage of fully completed forms. Another study by Depasquale et al found that only 4% of the forms were filled completely (12).

The most completed data were the patient biodata (1,3,10) and clinical history (10). The least completed was previous X-ray/ previous relevant imaging (1,3).

The age and sex of the patients are particularly important in the paediatric population as many diseases can be specific (1, 13). Furthermore, some CT parameters are set according to age (1, 14).

The examination requested category was completed in 100% in R Akinola et al. Similar findings were noted in other studies (1, 13) and including ours which scored an average of 91,2%.

This is imperative information as it determines which part of the body needs to be scanned.

Omission of this information usually results in radiographers or radiologist on duty contacting the referring clinician for more information on the day of the scan.

This information can go unnoticed depending on the booking system the radiology department of a particular hospital has in place. For example, if the booking is done by a nonradiologist (i.e. admin clerk).

This results in delays in workflow and at times delays in reporting times, impacting departmental efficiency.

Most other studies only collected request forms from 1 or 2 different modalities, unlike our study which had 4.

Patient mobility scored the lowest (57,5%) in the one study (1). This was 67.6% in our study. Mobility is important as this helps the porters or radiographers to know which method of transport to use when attending to patients (1, 15).

The patient's address was one of the least completed in the studies stated on the table above. However, in our study, this category was filled the most, because, it was generated on the patient demographic stickers, thus there was no need to fill this manually.

Although our study is merely an audit of completion and as such does not discuss the potential consequences of incomplete request forms, it is worth mentioning. A study by Leslie et al

found that a percentage of CT reports (19%) were modified after the clinical information was added on the forms and stated that with correct clinical information, a staggering 83% of reports were more accurate and 17% less accurate (1, 16).

Another study also found that there was an improved accuracy for detecting pneumonia on plain film when clinical information was given (1, 17).

Poor completion of radiological request forms remains a global burden (1, 3, 7) and there is a general sense that many doctors, particularly junior doctors filling request forms underestimate the potentially negative impact of an incomplete request form (1, 13). One such impact is unnecessary or over-scanning, thus exposing patients to ionizing radiation. One study done in Saudi Arabia by AL-Rammah to evaluate CT radiation dose awareness amongst paediatricians demonstrated that only 15% of respondents were aware of the ALARA principle and radiation risks (20).

ALARA stands for As low as Reasonably Achievable (20, 22).

This principle is a guidance aimed to reduce unwarranted exposure to radiation and is achieved with radiation safety measures such as time, distance, and shielding (22). Such as limiting the amount of time near a radioactive source (in our case, this will be X-rays and CT), decreasing the distance between the patient and radiation source and providing shielding (I.e. Use of lead apron).

The risk of malignancy from radiation in children is greater than that of adults (20), thus the ALARA principle should always be applied, specifically when working with the paediatric population.

Part of the problem could be the lack of orientation for referring doctors on how to properly fill radiological request forms and the importance of each category stipulated on the particular forms.

An important point to note is that the request forms for a paediatric institution may have more parameters to include for better understanding of the individual patient history, which impacts on the diagnosis. For example, the department is reviewing addition of birth history as a parameter, which includes whether the patient was born via normal vaginal delivery or caesarean section, the APGAR score, whether was admitted to ICU or not post-delivery. This information is crucial as pathology may be related to the perinatal period and have life-long

consequences. Some clinicians, particularly in NICU and PICU, are more likely to include the information in the clinical history of the request for as it is relevant to their patients, whereas other consulting clinicians may not be aware of the value of this information.

Having these additional parameters as an addition to the request form may be beneficial as clinicians will note that as a different section that requires completion.

This may also cause the request form to appear too extensive and clinicians may still omit the section.

Another important factor is that request forms may also be completed by junior doctors with minimal experience and are not aware of the consequences of incomplete forms. Junior doctors also sometimes put their heads of units as referring clinician instead of their own contact details, which makes it difficult to get information easily by the radiology department. The head of unit may have ordered the examination during a ward round and the request form completed by junior doctors, who may not have insight on the indication of the scan.

9.2. Limitations of the current study

The study didn't include Fluoroscopy as a modality.

9.3. Future applications

As discussed above, we can conclude that most forms are inadequately filled,

- One way to circumvent that is to introduce an online booking system. This would ensure that all forms are adequately filled, and that all information needed on the Form is included.
- Having either formal or informal training tutorials for clinicians (particularly junior doctors) on how to fully complete request forms and the importance thereof.
- Continuous audit of the forms to ensure compliance.

10. Conclusion

This research showed that the radiology request forms remain incompletely filled across the various modalities and departments. This is not limited to South Africa but is a global problem (1, 3) Although the forms were filled adequately and with an average percentage completion rate of 75% (all modalities combined), only a dismal 2,6% of the forms well fully completed which is in line with the 9,3% found in M Kgalaeng study done in a tertiary hospital in South Africa.

This needs to be addressed as it is clearly concerning as this is the main written and official tool for communication between the radiology department and the referring departments, including referral hospitals. It also serves as a medico-legal document.

An online application form platform can be implemented to improve the completion rate. Artificial intelligence (AI) is being experimentally used in adding diagnostic yield in the field of radiology, although still in its infancy, this has a potential role in preparing radiology reports (21). Hence AI can also be used in this regard to assist clinicians when filling up the forms, prompting when required fields are not completed. This will be a very effective way forward to ensure completion and compliance from the clinician. In addition, an online booking system is paperless, thus will contribute to a green ecosystem.

In addition, there is a need to train clinicians on the importance of fully completing request forms and the potential impact of inadequacy, which can result in radiologists having to call referring clinicians for additional information, which is time-consuming and results in delays in scanning and reporting. Another impact may include unnecessary scanning, therefore leading to more and unwarranted radiation to the patients specifically in the paediatric population, thus reducing associated cancer risks (14, 19). Furthermore, omitting categories such as clinical history can also have an impact on the reporting of scans as mentioned earlier(1, 16). But this is beyond the scope of this research.

11. References

1. Kgalaeng MM. Assessment of the Adequacy of Non-Emergency Computed Tomography Scan Request Forms in a Tertiary Hospital in South Africa.2018

2. Abbas M, Omer A, Hamad M. Adequacy of clinical information on radiology request cards from medical assessment unit-James Cook University Hospital, clinical Audit. Nucl Med Biomed Imaging. 2016;1:5-6.
3. Afolabi OA, Fadare JO, Essien EM. Audit of completion of radiology request form in a nigerian specialist hospital. Ann Ib Postgrad Med. 2012;10(2):48-52.
4. Sibanda L. Diagnostic radiography requests in Zimbabwe's public hospital complex: completeness, accuracy and justification: Cape Peninsula University of Technology; 2012.
5. Yousef MO, Ayad CE, Elzaki AA, Sulieman A. Evaluation of radiology request forms in diagnostic centers in Khartoum state. Sudan Medical Monitor (SMM). 2011;6(3):201-10.
6. Hagi S, Khafaji M, Ahmed N, Al Nowami M. Current Trends in Computed Tomography Referral Practice Experience at a Large Academic Hospital. Life Science Journal. 2014;11(11).
7. Cohen MD, Curtin S, Lee R. Evaluation of the quality of radiology requisitions for intensive care unit patients. Acad Radiol. 2006;13(2):236-40.
8. Triantopoulou C, Tsalafoutas I, Maniatis P, Papavdis D, Raios G, Siafas I, et al. Analysis of radiological examination request forms in conjunction with justification of X-ray exposures. Eur J Radiol. 2005;53(2):306-11.
9. Bosanquet D, Cho J, Williams N, Gower D, Thomas KG, Lewis M. Requesting radiological investigations–do junior doctors know their patients? A cross-sectional survey. JRSM short reports. 2013;4(1):1-6.
10. R Akinola, M Akinkunmi, K Wright, O Orogbemi. Radiology request forms: are they adequately filled by clinicians?. The Internet Journal of Radiology. 2009 Volume 12 Number 1 11. 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.

12. Depasquale R, Crockford MP. 2005. Are Radiology Request Forms Adequately Filled In? An Audit Assessing Local Practice. Malta Medical Journal, 17(4):36-38.

13. 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

14. Ogbole GI. 2010. Radiation Dose in Paediatric Computed Tomography: Risks and Benefits. Annals of Ibadan postgraduate medicine, 8(2):118-26.

15. 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.

16. 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.

17. Doubilet P, Herman PG. 1981. Interpretation of Radiographs: Effect of Clinical history. American Journal of Roentgenology, 137:1055-8.

18. 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.

19. DeVries A, Young PC, Wall E, et al. 2013. CT Scan Utilization Patterns in Pediatric Patients With Recurrent Headache. Pediatrics, 132(1):1-8.

20. AL-Rammah, T.Y. CT radiation dose awareness among paediatricians. *Ital J Pediatr* **42**, 77 (2016).

21. Nciki AI, Hlabangana LT. Perceptions and attitudes towards AI among trainee and qualified radiologists at selected South African training hospitals. S Afr J Rad. 2025;29(1), a3026.

22. Basics of Radiation Protection for Everyday Use How to achieve ALARA: Working Tips and Guidelines**.** Available**:**
https://iris.who.int/bitstream/handle/10665/42973/9241591781_eng.pdf (Accessed on 10/03/2025).

Appendix A Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Dr M Muyingi

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M2111120

NAME: (Principal Investigator) Dr M Muyingi

DEPARTMENT: School of Clinical Medicine
Department of Radiation Sciences
Division of Diagnostic Radiology
Medical School
University

PROJECT TITLE: *Completeness of radiology request forms in a Johannesburg paediatric hospital*

DATE CONSIDERED: 2021/11/26

DECISION: Approved unconditionally

CONDITIONS:

NOTE: If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>

SUPERVISOR: Drs N Koranteng and S Lucas

APPROVED BY: CB Penny
Dr CB Penny, Chairperson, HREC (Medical)

DATE OF APPROVAL: 2022/02/22

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

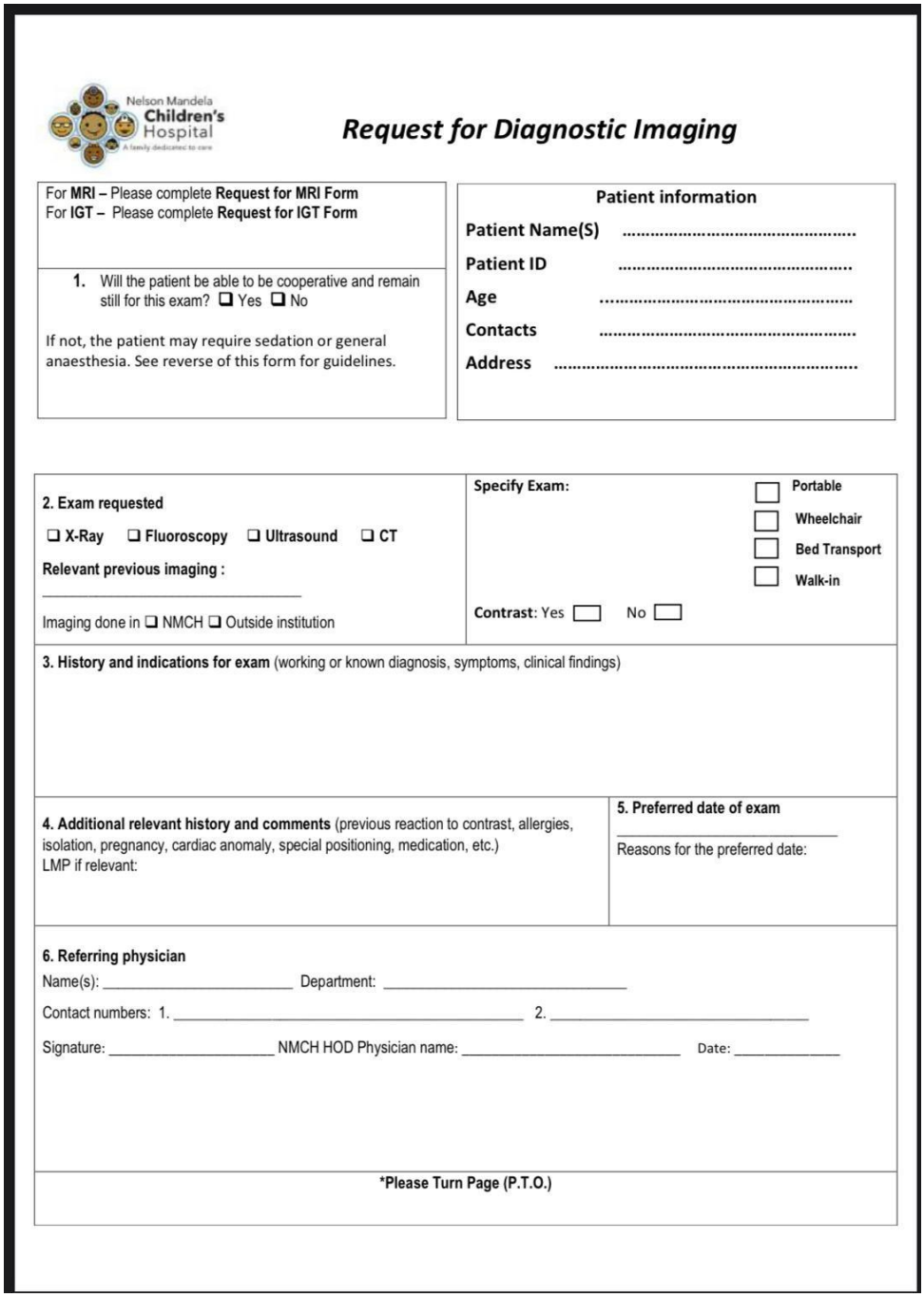
To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

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 submit details to the Committee. **I agree to submit a yearly progress report.** When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **November** and therefore reports and re-certification will be due in the month of **November** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator

Date 24/02/2022

Appendix B Request forms



Nelson Mandela Children's Hospital
A family dedicated to care

Request for Diagnostic Imaging

For **MRI –** Please complete **Request for MRI Form**
For **IGT –** Please complete **Request for IGT Form**

1. Will the patient be able to be cooperative and remain still for this exam? ❑ Yes ❑ No

If not, the patient may require sedation or general anaesthesia. See reverse of this form for guidelines.

Patient information

Patient Name(S) .....
Patient ID .....
Age .....
Contacts .....
Address .....

2. Exam requested

❑ **X-Ray** ❑ **Fluoroscopy** ❑ **Ultrasound** ❑ **CT**

Relevant previous imaging :

_____

Imaging done in ❑ NMCH ❑ Outside institution

Specify Exam:

☐ **Portable**
☐ **Wheelchair**
☐ **Bed Transport**
☐ **Walk-in**

Contrast: Yes ☐ No ☐

3. History and indications for exam (working or known diagnosis, symptoms, clinical findings)

4. Additional relevant history and comments (previous reaction to contrast, allergies, isolation, pregnancy, cardiac anomaly, special positioning, medication, etc.)
LMP if relevant:

5. Preferred date of exam

_____

Reasons for the preferred date:

6. Referring physician

Name(s): _____ Department: _____

Contact numbers: 1. _____ 2. _____

Signature: _____ NMCH HOD Physician name: _____ Date: _____

***Please Turn Page (P.T.O.)**

Nelson Mandela Children's Hospital
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PATIENTS DETAILS
NAME
DATE OF BIRTH **AGE**
GENDER
HOSPITAL NUMBER
ADDRESS

PARENT/GUARDIAN DETAILS

ADDRESSOGRAPH

Request for Magnetic Resonance Imaging (MRI)

1. Will the patient be able to be cooperative and remain still for about 60 min? ❑ Yes ❑ No
If not, the patient may require sedation or general anesthesia.

2. Exam requested (all parts to be examined)

Relevant previous imaging: _____
Imaging done in ❑ NMCH ❑ Outside institution

3. History and indications for exam (working or known diagnosis, symptoms, clinical findings)

❑ Wheelchair ❑ Bed Transport ❑ Walk-in

4. Additional relevant history and comments

Cardiac anomaly	Y❑ N❑	Family Hx of malignant hyperthermia	Y❑ N❑
Respiratory/airway problems	Y❑ N❑	Neck instability	Y❑ N❑
Allergies	Y❑ N❑	Pregnancy LMP:	Y❑ N❑
Previous reaction to contrast	Y❑ N❑	Provide details if you answered "Yes" to any of the questions:	
Diabetic	Y❑ N❑		
Metabolic	Y❑ N❑		
Renal disease	Y❑ N❑		
Sickle cell disease	Y❑ N❑		

5. Preferred date of exam:
Elective Y❑ N❑
_____
Date of O.R. if pre-procedure exam:
_____
If follow-up please state time interval desired:

6. Responsible physician
Physician Name: _____ Telephone #: _____
Department at NMCH: _____ Mobile _____ Pager #: _____

7. Ordering clinician Signature: _____ Print name: _____ Date: _____

DI USE ONLY
Comments:

Urgency
❑ Emergent (<24 hours)
❑ Inpatient or Urgent (<2 days)
❑ Semi-Urgent (<10 days)
❑ Elective
❑ Specified time procedure
Radiologist's initial:

Protocol:

Radiographer initials:

Radiologist initials:

Booking Clerk
Date received: _____
Appointment date: _____

Arrival time:_____
Departure time:_____

Incomplete forms will be returned to you for completion, resulting in a delay in obtaining an appointment.

Appendix C Turnitin Report

DR Muyingi_Research Report.docx

by Matondo Muyingi

Submission date: 20-Mar-2025 07:30PM (UTC+0200)

Submission ID: 2620220541

File name: DR_Muyingi_Research_Report.docx (2.18M)

Word count: 6067

Character count: 34415

DR Muyingi_Research Report.docx

Please note that the WITS radiology MMed registrar use the same template for both protocol and final research reports and this is shared on the internet and as a result, this information , as well as my own previously submitted protocol shared on the internet give the 1st source a higher percentage than usual.

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