

## Assessment of Compliance to European Commission on Quality Criteria for Diagnostic Paediatric Radiography in Southern Nigeria

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### ABSTRACT

**BACKGROUND:** Quality and safety have become bedrocks for efficient and successful medical intervention throughout the whole world.

**OBJECTIVE:** To assess for quality screening practice in paediatric radiography; compliance with European Commission guide lines for diagnostic paediatric radiography in Southern Nigeria.

**MATERIALS AND METHODS:** University Teaching Hospitals and private health centres in Southern Nigeria were screened through questionnaires and on-site observation of paediatric radiography practices. The questionnaires contained the recommended parameters of EC in respect of skull, chest and abdominal radiography imaging.

**RESULTS:** They revealed that radiography device (RD) usage had good scores in all medical institutions. Nominal focal spot value (NFSV), tube filtration (TF), Film-focus distance (FFD) had good scores only in public hospitals. Automatic exposure control (AEC)

had good scores only in private health centres. Quality assurance was good for public hospitals. Most of X-ray machines were manufactured 31 years ago and installed about 37 years ago.

**CONCLUSION:** University Teaching Hospitals had fair compliance to EC recommendations than private health centres. The poor compliance was probably due to lack of proficient radiography technologists, lack of adequate information necessary in carrying out paediatric radiography, use of obsolete equipment or lack of incentives.

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**Key words:** Paediatric; Radiography; European Commission; Hospital

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### INTRODUCTION

Paediatric radiography is a sub-specialty of radiology involving imaging of fetuses, infants and children, adolescents and young adults. Paediatric radiology is the use of any imaging modality to prevent, detect, diagnose and treat diseases in children<sup>[1]</sup>. Paediatric radiography procedure is different from that of the adult although some diseases seen in paediatric are same as that of adult<sup>[2]</sup>. Children undergoing these examinations are expected to be given special attention, both because of the diseases specific to childhood and the additional risks to them. In addition, children need special care and comfort as well as care that has to be provided by specially trained health professionals<sup>[1]</sup>.

Some tissues in children are more susceptible to damaging effects

of ionizing radiation than those in adults. Organs and tissues are closer together in small children making them harder to exclude from the primary beam and to protect them from scattering. Children also have thinner layers of abdominal visceral fat; thus, the natural contrast usually available in adults is much reduced<sup>[3-5]</sup>. Children have a two to four times higher risk of late manifestation of radiation induced neoplasms<sup>[6]</sup>.

Radiographers working with children need skill and experience in order to gain their patient's confidence and cooperation. Commitment to paediatric examination is very essential as well as understanding of child's needs, development, psychology and ranges of pathologies that is required of the examination.

Commission for European communities (CEC) has given minimum parameters so that at all times radiation dose to the patient is reduced without reduction in image quality. For this to be achieved, a high quality service must be provided through the safe and accurate performance of a deliberate plan of action. This must be based on an ethical approach and an understanding of the increased sensitivity of a child to ionizing radiation<sup>[7]</sup>. Achieving diagnostic quality radiographs whilst minimizing patient dose is the goal of any imaging department and this is more important in paediatric because of the development that takes place in children.

Saddled with these challenges, the present research work was carried out to investigate the state of affairs in some public and private medical institutions in South-Eastern region of Nigeria.

## MATERIALS AND METHODS

### Subjects

The target population for this research included chief radiographers and their assistants, practicing radiographers and workers of the department of paediatric radiography working in University Teaching Hospitals and private health centers in Southern Nigeria.

### Methodology

Multi centre sampling method was adopted as described by Linda<sup>[8]</sup>. Questionnaires were shared between University Teaching Hospitals and private health centres containing minimum parameters as recommended by European Commission<sup>[9]</sup>. The department of paediatric radiography was given a form to fill concerning departmental practice in paediatric examinations for chest, abdomen and skull radiography. All the questions asked were on the following: Radiography device (RD), Total filtration/ Tube filtrate/ added filtration (TF), Nominal focal spot value (NFSV), Anti-scatter grid (ASG), Screen-film system (SFS), Film-focus distance (FFD), Radiographic voltage (RV), Automatic Exposure Control (AEC), Exposure time in Milli ampere per second (MAs), Protective shielding (PS), quality assurance (QA), International European commission (IEC), European Commission (EC). A scoring system of '1' for compliance and '0' for non-compliance to EC criteria was used. This research work was carried out under strict UCL Research Ethics Committee guidelines<sup>[10]</sup>.

### Statistical analysis

Data were analyzed using Pickering and Weatherall method<sup>[11]</sup>.

## RESULTS

Compliance of University Teaching Hospitals and private health centres to EC recommendations for good practice in paediatric chest radiography is shown in table 1. All the medical institutions possess

RD and scored good while TF and FFD measured in accordance with EC. All institutions scored low in RV, PS, MAs except CXD that scored good in PS while UPTH scored good in MAs and UUTH in RV. Total score for University Teaching Hospitals was 15 while that of private health centers was 14.

Compliance of University Teaching Hospitals and private health centres to EC recommendations for good practice in paediatric abdomen radiography is shown in table 2. Again all institutions showed good scores for RD while only UUTH showed low scores in TF and SFS. Only UPTH scored good in PS while UUTH scored good in RV. Total score for University Teaching Hospitals was 20 while for private health centers was 12.

Compliance of University Teaching Hospitals and private health centres to EC recommendations for good practice in paediatric skull radiography is shown in table 3. All institutions scored good in using PS. Only CXD scored low in TF and ASG. Total score for University Teaching Hospitals was 24 while for private health centers was 20.

Comparative percent compliance of University Teaching Hospitals and private health centers to EC recommendations is shown in figure 1. In paediatric abdomen imaging, there is no great change between University Teaching Hospital and private health centres. In paediatric chest and skull radiography, there is significant change between University Teaching Hospitals and private health centres with the former being high in chest radiography while latter being high in skull radiography as compared to EC standards.

**Table 1** Compliance of University Teaching Hospital and private health centers to EC criteria for good practice in paediatric chest radiography.

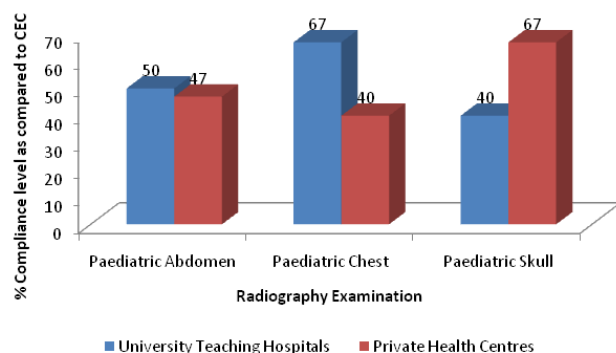
Criteria	University Teaching Hospitals			Private Health Centers		
	UUTH	UPTH	UBTH	IVR	TMCD	CXD
RD	1	1	1	1	1	1
NFSV	1	1	1	0	0	0
TF	1	1	1	1	1	0
ASG	0	0	0	0	1	1
SFS	0	1	1	1	1	0
FFD	1	1	1	1	1	0
RV	1	0	0	0	0	0
AEC	0	0	0	1	1	1
MAs	0	1	0	0	0	0
PS	0	0	0	0	0	1
QA	1	1	0	0	0	0
TOTAL	5	5	5	5	5	4

UPTH: University of Port Harcourt Teaching Hospital, UBTH: University of Benin Teaching Hospital, UUTH: University of Uyo Teaching Hospital, TMCD: Testimony Medical Consultant and Diagnostics, IVR: Ivaee Radio-diagnostic centre, CXD: Central X-ray and diagnostic centre.

**Table 2** Compliance of University Teaching Hospital and private health centers to EC criteria for good practice in paediatric abdomen radiography.

Criteria	University Teaching Hospitals			Private Health Centers		
	UUTH	UPTH	UBTH	IVR	TMCD	CXD
RD	1	1	1	1	1	1
NFSV	1	1	1	0	0	0
TF	0	1	1	1	1	0
ASG	0	1	0	1	1	0
SFS	0	1	1	1	1	1
FFD	1	1	1	0	0	0
RV	1	0	0	0	0	0
AEC	1	1	0	0	0	1
MAs	1	0	1	0	1	0
PS	0	1	0	0	0	0
QA	0	1	0	0	0	0
TOTAL	6	8	6	4	2	3

UPTH: University of Port Harcourt Teaching Hospital, UBTH: University of Benin Teaching Hospital, UUTH: University of Uyo Teaching Hospital, TMCD: Testimony Medical Consultant and Diagnostics, IVR: Ivaee Radio-diagnostic centre, CXD: Central X-ray and diagnostic centre.



**Figure 1** Percent of compliance of University Teaching Hospitals and private health centers to EC standards.

**Table 3** Compliance of University Teaching Hospital and private health centers to EC criteria for good practice in paediatric skull radiography.

Criteria	University Teaching Hospitals			Private Health Centers		
	UUTH	UPTH	UBTH	IVR	TMCD	CXD
RD	1	1	1	1	1	1
NSFV	1	1	1	0	0	0
TF	1	1	1	1	1	0
ASG	1	1	1	1	1	0
SFS	0	1	1	1	1	0
FFD	1	1	0	1	1	0
RV	1	1	0	0	0	1
AEC	1	0	1	1	1	1
MAs	0	1	0	1	1	0
PS	1	1	1	1	1	1
QA	1	1	0	1	1	0
TOTAL	8	9	7	8	8	4

UPTH: University of Port Harcourt Teaching Hospital, UBTH: University of Benin Teaching Hospital, UUTH: University of Uyo Teaching Hospital, TMCD: Testimony Medical Consultant and Diagnostics, IVR: Ivaee Radio-diagnostic centre, CXD: Central X-ray and diagnostic centre.

## DISCUSSION

The findings that compliance of University Teaching Hospitals and private health centres in paediatric radiography were largely on the margin of EC recommendation may have implications for children's health and development.

### Methodological aspect

In the course of administering the questionnaires, some hospitals were on industrial strike action. However, they were still reached after the strike and it is believed that respondent had no bias mind in filling the questionnaires though it was time consuming for the researchers.

There was also lack of adequate funds to explore all the Teaching Hospitals in the country and to have an in-depth view of paediatric radiology imaging to ascertain the image quality and dosing. Nevertheless, it is believed that the sample size used is reflective of the real state of affairs in the country.

### Compliance level

It was observed that X-ray machines were mostly manufactured 31 years ago and installed about 27 years ago even though but was hard to ascertain the functionality of the device since some of the institutions had no patients at the time of visit. However, a lot of time was spent on waiting for patients to avail for radiology imaging exercise. Most of University Teaching Hospitals had children waiting for imaging tests which could be linked to relatively cheap charges as compared to private health centres. Quality assurance was good for public hospitals as compared to private health centres probably due to

funding from indigenous politicians who seek for votes.

It was generally revealed that anti-scatter grid use was not based on patient thickness and field of view (FOV) but rather on age. Meanwhile, removing anti-scatter grid for children/small patients reduces dose without a substantial increase in scatter-to-primary ratio when FOV is restricted appropriately<sup>[12]</sup>.

The quality and radiation dose of different tube voltage sets for chest digital radiography was not complied with by both University Teaching Hospital and private health centres. It has been proven that higher kVp may help optimize the trade-off between radiation dose and image quality and it may be acceptable for use in a pediatric age group<sup>[13]</sup>.

In private health centres, this research work revealed that normal spot focus usage was till problematic as depicted from scanned images. The shape and size of a focal spot influence the resolution of a radiographic image. An increase in focal spot size, which may accompany deterioration of the X-ray tube, reduces the ability to define small structures<sup>[14]</sup>.

The quality control programmes in private health centres was low probably because of the quality administrative procedure. There were less observed management actions intended to ensure that monitoring techniques are properly performed and necessary corrective measures to be taken in response of monitoring results. There were also lack of quality control techniques which are techniques used in the monitoring or testing and maintenance of the components of an X-ray system.

## CONCLUSION

Despite the time consuming nature of this research, the objective of it was satisfactorily achieved even though finance proved to be unfriendly. University Teaching Hospitals, which are government funded, showed greater adherence to EC recommendations in paediatric radiography than private health centres. However, the compliance is still to be improved as it is seen with their on-and-off strike battles with the Federal Government. Radiologic technologist should be provided with opportunities to sharpen their proficiency through workshops, seminars and conferences. There should be installed monitoring teams in every X-ray Department to enforce quality control programmes.

### Appendix

1. European commission guidelines for standard radiographical practice<sup>[15]</sup>.
2. Criteria for radiation dose to patient Entrance surface dose for a standard-sized patient: 0.3 mGy.
3. Example of good radiographic technique.
  - 3.1. Radiographic device: vertical stand with stationary or moving grid.
  - 3.2. Nominal focal spot value: <1.3.
  - 3.3. Total filtration: >3.0 mm Al equivalent.
  - 3.4. Anti-scatter grid:  $r = 10$ ; 40/cm.
  - 3.5. Screen film system: nominal speed class 400.
  - 3.6. FFD: 180 (140-200) cm.
  - 3.7. Radiographic voltage: 125 kV.
  - 3.8. Automatic exposure control: chamber selected - right lateral.
  - 3.9. Exposure time: < 20 ms.
  - 3.10. Protective shielding: standard protection.

## AUTHORS CONTRIBUTIONS

Author EAE designed the work and acquired data; author ADE drafted

the article; author NE and LPT analyzed the study and managed literature searches. All authors read and approved the final manuscript.

## CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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