EAS Journal of Radiology and Imaging Technology
Abbreviated Key Title: EAS J Radiol Imaging Technol
ISSN: 2663-1008 (Print) & ISSN: 2663-7340 (Online)
Published By East African Scholars Publisher, Kenya

Volume-5 | Issue-1 | Jan-Feb-2023 | DOI: 10.36349/easjrit.2023.v05i01.002

OPEN ACCESS

Original Research Article

Anatomical Side Marker Use in Digital Radiography at the University Teaching Hospital (UTH) of Lusaka, Zambia

Dr. Osward Bwanga (PhD)[1*], Henry Kashweka[2], Ernest Chanda[3], Soka Nyerenda[4], Mr Mubanga Bwalya[5]

[1]Midlands University Hospital Tullamore, Radiology Department, Ireland
[2]Munyumbwe Level One Hospital, Gwembe District, Zambia
[3]Lusaka Apex Medical University and Cancer Diseases Hospital, Lusaka, Zambia
[4]University Teaching Hospital, Radiology Department, Lusaka, Zambia
[5]St Francis Central Hospital, Katete and University of Lusaka, Zambia

Article History
Received: 28.11.2022
Accepted: 07.01.2023
Published: 11.01.2023

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Background:*** All general radiographic images must always display a correct permanent anatomical side marker (ASM). However, literature reports a decline in the use of permanent ASMs in digital radiography (DR). The ASM has been reported as one of the most common sources of error in radiography of which some have resulted in performing wrong-site surgery and treatment. Since the installation of a DR X-ray machine in 2015 at the University Teaching Hospital (UTH) no research or audit has been conducted on this subject. ***Aim:*** This study aimed at auditing the use of ASMs in digital radiography (DR) and identifying the barriers to the use of permanent ASMs at the University Teaching Hospital (UTH) of Lusaka, Zambia. ***Methodology:*** This study was conducted in two phases. The first phase involved a retrospective auditing of the use of ASMs in DR with a sample of 290 radiographic images. Data were collected using a checklist. The second phase was aimed at identifying the barriers to the use of permanent ASMs and suggestions to overcome them. Data were collected using an online questionnaire. Quantitative data were analysed using descriptive statistics, whilst qualitative data from open-ended questions were analysed using content analysis. ***Results:*** In the first phase, all the audited images N=290 (100.0%) had electronic (digital) ASMs and were placed on the correct anatomical side (right or left). However, no image had a permanent ASM. A total of N=45 (18.8%) images had ASMs that obscured the anatomy. In the second phase, a total of N=20 (46.0%) respondents agreed that they do not always use permanent ASMs because of a lack of ASMs, increased workload, and time-consuming. ***Conclusion:*** This study revealed the non-use of permanent ASMs by radiographers and radiography students. The purchasing of permanent ASMs and delivery of educational awareness programme is recommended as well as frequent auditing.

Keywords: Anatomical side marker, Clinical audit, Digital Radiography, Zambia.

INTRODUCTION

General (plain-film) radiography is the oldest and most frequently used form of medical imaging in the diagnosis of diseases and injuries in medicine. It is standard practice that all general radiographic images must always display a correct permanent ASM (Adejoh *et al.*, 2014; Barry, 2016; College of Radiographers, 2021). Adejoh *et al.*, (2014) define an anatomical side marker as a portable radiopaque accessory used for the annotation of 'right' or 'left' on radiographic images. The permanent ASM must be placed in the primary X-ray beam before imaging (Ballinger *et al.*, 2013; College of Radiographers, 2021). The ASM has been reported as one of the most common sources of error in radiography (Aaker & Johnson, 2006; Titley & Cosson, 2014) and some have resulted in performing wrong-site surgery and treatment (Titley & Cosson, 2014). The non-use of ASMs can be considered medical negligence and does not meet the best practice standards of radiography (Platt & Strudwick, 2009). Medical negligence is any action that falls below an acceptable standard of care, and which directly causes injury, or diseases, or allows the health of the patient to deteriorate as a result (Platt & Strudwick, 2009; Ehrlich & Coakes, 2020). A radiographer is not guilty of negligence if adhered to the professional scope of practice and acted in accordance with best imaging practice. Thus, it is the responsibility of radiographers and radiography students to correctly use ASMs for the safety of patients and maintain the standards of radiography.

There are two imaging systems currently in use: traditional film-screen combination and digital radiography (DR). DR consists of computed

***Corresponding Author:** Dr. Osward Bwanga (PhD)
Midlands University Hospital Tullamore, Radiology Department, Ireland

radiography (CR) and direct digital radiography (DDR). In both systems, radiographers must place the ASM before X-ray exposure, but DR allows the placement of electronic ASM during the post-processing of the image. With the coming of DR, literature reports a reduction in the use of permanent ASMs because radiographers can easily apply ASMs as part of post-processing procedures (Platt & Strudwick, 2009; Titley & Cosson, 2014). However, this can lead to human error. For example, adding post-processing ASM in patients with anatomical anomalies such as dextrocardia and situs inversus can result in the wrong ASMs placed on an image (Barry *et al.*, 2016). The same applies to conditions such as pneumothorax (Titley & Cosson, 2014; Barry *et al.*, 2016). This can potentially have harmful consequences for patients. It is recommended to use an electronic ASM only if the permanent ASM is incorrect, but if the radiographer is unsure or there is any anatomical doubt, an image must be retaken (Khosa *et al.*, 2015; College of Radiographers, 2021). Electronic ASMs are not admissible in a court of law because they can be manipulated post-image acquisition.

The other important feature of the use of ASM reported in the literature is that it must not be placed where the anatomical structures, such as soft tissues and bones, are obscured (Khosa *et al.*, 2015). The use of the wrong ASM and obscuring of anatomical structures can also lead to the repetition of an imaging examination resulting in additional exposure of patients to ionising radiation, increased costs, and extra workload for radiographers.

In Zambia, both the Health Profession Council of Zambia (HPCZ) and Radiological Society of Zambia (RSZ) codes of professional conduct emphasise the importance of maintaining standards of professional practice for the safety of patients (HPCZ, 2014; RSZ, 2018). Radiographers have a professional duty of care to their patients. For this reason, the Zambian radiography education system incorporates the teaching of professional standards and patient safety, including the use of permanent ASMs. In the theoretical component, radiography students are taught in radiographic technique the importance of using permanent ASMs. Radiography students apply the use of ASMs during clinical practice under the supervision of experienced supervising radiographers and clinical tutors (Bwanga & Sichone, 2020; Bwanga, & Mwansa, 2022). Therefore, supervising radiographers and clinical tutors should always use permanent ASMs as students copy their behaviour and medical imaging practices.

Literature reports many advantages of DR imaging compared with traditional film-screen imaging, which includes increased latitude and dynamic range, and the ability to post-process images (Whitley *et al.*, 2015; Bwanga, 2021). One of the disadvantages of DR is the decrease in the use of permanent ASMs, as radiographers and radiography students are frequently using digital ASMs instead. For example, a clinical audit conducted in the United Kingdom (UK) by Platt and Strudwick (2009) found a decline in the use of permanent ASMs post-DR installation, from 32% to 25%. The radiology department at the UTH has both analogue (film-screen combination) and DR X-ray machines. The first DR X-ray machine at UTH was installed in 2015. During the literature search, no published study was found to have been conducted at UTH or other hospitals on this subject in Zambia. Therefore, the aim of this study was to audit the use of ASMs in digital radiography (DR) and identify the barriers to the use of permanent ASMs at the University Teaching Hospital (UTH) of Lusaka, Zambia.

METHODOLOGY

This study used a quantitative research design and was conducted in two phases. The first phase involved a retrospective clinical auditing of the use of ASMs in DR, whilst the second phase was a survey to identify the barriers to the use of permanent ASMs and suggestions to overcome them.

Phase 1: Auditing the Use of ASMs in Digital Radiography

The first phase involved a retrospective clinical auditing of the use of ASMs in DR at UTH, the main radiology department. UTH is the biggest public tertiary hospital in Zambia, and the principal radiography clinical training centre. The radiology department offers a range of imaging services: general radiography, theatre radiography, ultrasound (US), computed tomography (CT), radionuclide imaging (RNI), interventional radiology (IR), catheterisation laboratory (Cath Lab), and dual-energy X-ray absorptiometry (DEXA). At the time of conducting this study, there were seven general radiography rooms: six analogue (film-screen) and one DR. The department was staffed with 36 radiography technologists, 15 radiographers, and three radiologists. In Zambia, a radiography technologist is a healthcare professional with a diploma in radiography, whilst a radiographer holds a bachelor's degree in radiography. But in this study, both will be referred to as radiographers.

The population for the first phase comprised 1200 radiographic images performed in March 2021 on the DR X- ray machine. An online calculator (www.surveysystem.com) was used to calculate the sample size of 290 radiographic images with a confidence level of 95%. The sample size was selected using systematic sampling. The population size was divided by the sample size and a sampling interval of 4.14 was obtained, rounded off to 4. On the computer workstation of the DR X-ray machine, the researchers then selected the first radiographic image (examination) performed in March 2021 and the rest of the images using a count interval of 4 until the sample size was achieved.

A checklist was used to collect data and was developed by the researchers based on the literature (Ballinger *et al.*, 2013; College of Radiographers, 2021). The checklist provided a simple method to record the data from radiographic images and provided a standard format. It was also easy to use and record data, had no time constraints and was easy to analyse the data. It contained one open question on the type of examination and three closed-ended statements with two options of "Yes" or "No". The statements focused on the type of ASM, the correct side, and the obscurity of the anatomical structures. Figure 1 and 2 shows chest radiographs with permanent and electronic ASMs, respectively, and correctly placed.

Figure 1: Chest radiograph with a correctly placed permanent ASM

Figure 2: Chest radiograph with a correctly placed electronic (digital) ASM

Figures 3 and 4 show chest radiographs with permanent and electronic ASMs obscuring the left shoulder respectively.

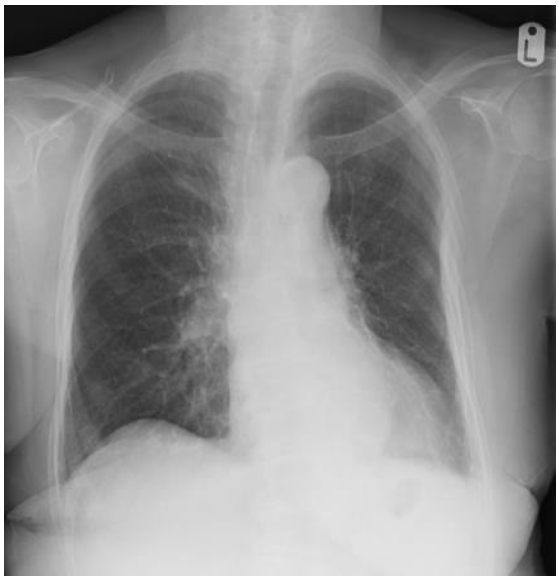

Figure 3: Chest radiograph with a permanent ASM obscuring the left shoulder

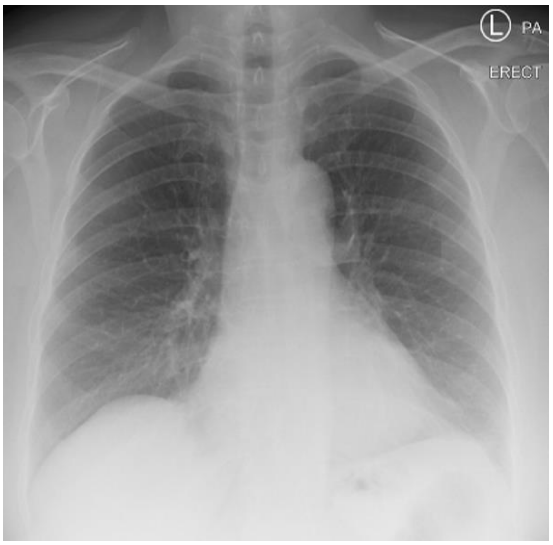

Figure 4: Chest radiograph with an electronic (digital) ASM and annotations obscuring the left shoulder

A pilot study was conducted in April 2021 on a sample of five digital radiographic images performed in February 2021 to test the checklist. After successfully conducting a pilot study, data were retrospectively collected from 290 digital images performed in March 2021. Data were collected from the computer workstation of the DR X-ray machine in April 2021 and entered directly on the checklists (hand copy). Collecting data retrospectively was quicker, cheaper, and easier because the data was readily on the radiographic images and data storage system of the DR X-ray machine (Bwanga & Bwalya, 2022).

In this first phase, data was analysed upon completion of the data collection process using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics was used to present the data with appropriate tables and graphs. The overall results were compared with the standard guide in the radiography guidelines of having permanent ASMs on all (100%) radiographic images (Ballinger *et al.*, 2013; College of Radiographers, 2021).

Phase 2: Survey on the Use of ASMs in Digital Radiography

The second phase of this study aimed to identify the barriers to the use of permanent ASMs and suggestions to overcome these challenges. The study population was 75: radiographers working at UTH (N=50) and 2021 final-year radiography students (N=25) at Lusaka Apex Medical University (LAMU). The second phase was conducted in May 2021 after the completion of the audit. The inclusion criteria were radiographers and radiography students who worked in the DR X-ray machine during the audited period. Radiography students had undertaken clinical training at UTH, being the principal radiography training site.

In this phase, data were collected using an online questionnaire. The online questionnaire used the internet to provide access to radiographers and students from two sites: UTH and LAMU respectively. This saved time for the researchers to survey the potential respondents who were separated by geographical distances (Bryman, 2016). It was also less costly when compared with the traditional paper survey using mailed questionnaires. The online questionnaire eliminated the need for paper and other costs, such as printing, postage, and data entry (Wright, 2005). The questionnaire was developed and hosted using SurveyMonkey (www.surveymonkey.com). It contained five main questions on whether the respondents had worked in the DR X-ray room in March 2021, ranks of respondents (radiographer or radiography student), use of permanent ASM by the respondents, barriers to the use of permanent ASM, and solutions to overcome them.

The questionnaire was piloted on five radiographers and radiography students to determine whether the individuals in the sample can complete it, understand the questions and whether the data supplied is required to achieve the aim of the study (Bryman, 2016; Dawson, 2019). The feedback from the pilot study was considered, and minor alterations were made to the questionnaire before the final administration. Pilot respondents were excluded from taking part in the main survey to avoid contamination of the study. A statement excluding pilot respondents was stated under instructions for the completion of the questionnaire.

The online questionnaire was self-administered in May 2021 to the entire population (N=70) using SurveyMonkey. Five (5) pilot respondents were excluded. The link containing the online questionnaire and study information was distributed using the UTH radiology staff and LAMU final-year radiography student WhatsApp groups. The first page of the questionnaire contained study information: aim, benefits, a statement on confidentiality and anonymity, and informed consent. Respondents were asked to complete the questionnaire within a week. After two weeks the survey was closed for data analysis.

Data analysis for quantitative data was performed upon completion of data collection using Statistical Package for the Social Sciences (SPSS) software. Quantitative data was analysed using descriptive statistics with an appropriate table. To quantify the answers to open-ended questions on the barriers to the use of permanent ASMs and suggestions to overcome them, the researchers coded the qualitative data and analysed it using content analysis.

Ethical Considerations

Ethical approval for this study was obtained from the Lusaka Apex Medical University Bio-Medical Research Ethics Committee (Ref: 00093-21). Permission to conduct the research was also sought and obtained from UTH Senior Medical Superintendent. Anonymity and confidentiality were maintained by the researchers in conducting this study.

RESULTS

Phase 1: Audit on the Use of ASMs in Digital Radiography

A total number of 290 digital radiographic images were audited. These included chest N= 123 (43.0%), abdomen N=47 (16.0%), pelvis N= 15(5.0%), skull N=5 (2.0%), spine N=32, (11.0%), upper limb N= 41 (14.0 %) and lower limb N=27 (9.0%). The results are presented in Figure 5.

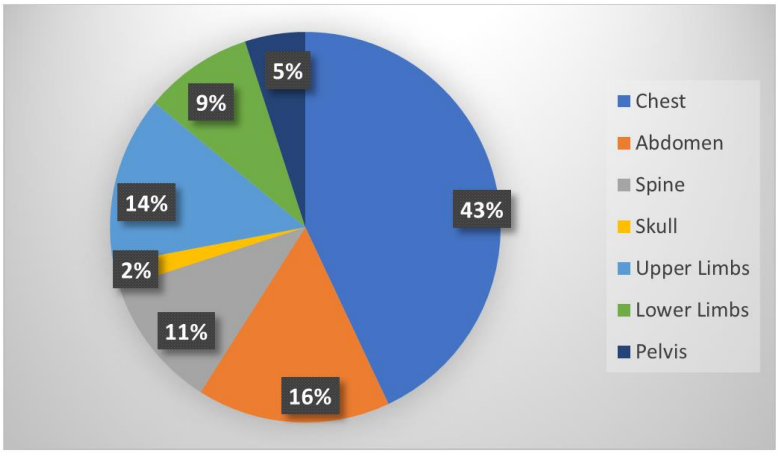

Figure 5: Examination distribution of radiographic images audited (N=290)

The audited radiographic images had the presence of ASMs, all had electronic ASMs, none had a permanent ASM, and all were placed on the correct anatomical side (right or left). Table 1 summarises the information.

Table 1: Presence of ASMs (N=290)

	Image characteristic		Number of images	Percentage
1	Electronic ASM	Yes	290	100%
		No	0	0%
2	Permanent ASM	Yes	0	0%
		No	290	100%
3	ASM placed on the correct anatomical side (right or left)	Yes	290	100%
		No	0	0%

From a total of 290 digital radiographic images that were audited, N=45 (18.8%) images had ASMs that obscured the radiographic anatomy (Figure 6).

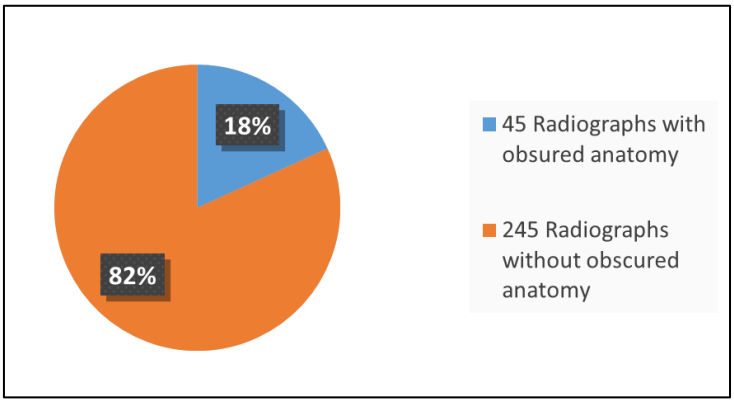

Figure 6: Radiographic images with and without obscured anatomy (N=290)

Of the N=45 (18.8%), sampled images that had part of the radiographic images obscured by the ASM, N=36 (80.0%) radiographic images were from chest examinations, N=8 (17.8%) from abdominal examinations, and N=1 (2.2%) from pelvic examinations. No image had radiographic anatomy obscured for the other anatomical regions.

Phase 2: Survey on the Use of ASMs in Digital Radiography

A total number of 43 respondents (26 radiography students and 17 radiographers) responded to the survey, giving a response rate of 61.4%. All respondents agreed that they had used the DR X-ray machine in March 2021. Respondents were asked whether they always use permanent ASM during imaging. As demonstrated in Figure 7 below, N=23 (54.0%) of respondents reported always using permanent ASMs, whilst the remaining N=20 (46.0%) indicated not using permanent ASMs.

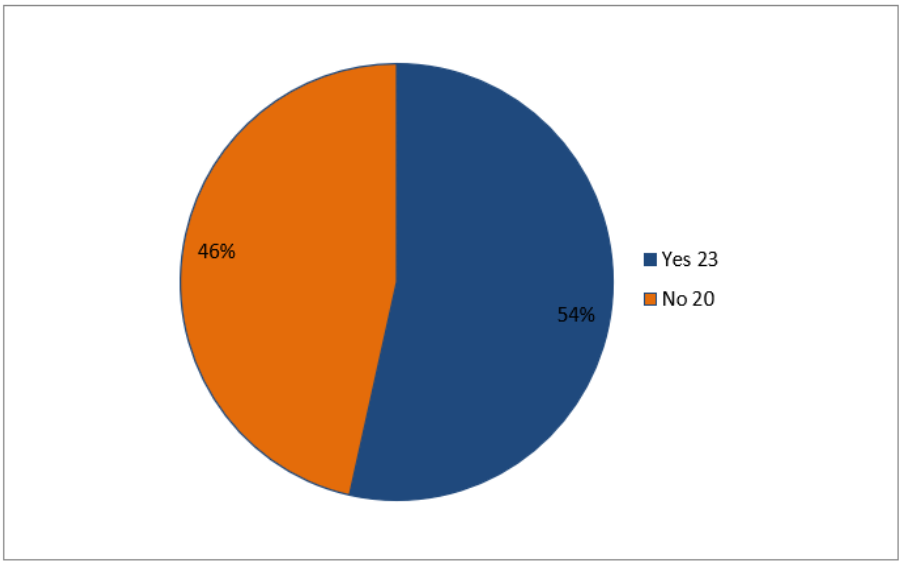

Figure 7: Use of permanent ASMs (N=43)

From the N=17 (43.0%) respondents that indicated not using permanent ASMs during imaging, N=12 (70.0%) reported 19 barriers to the use of permanent markers. These were analysed and grouped into three main barriers: a lack of ASMs N=13 (68.0%), increased workload N=3 (16.0%), and time constraints N=3 (16.0%). Respondents were also asked to suggest how the use of permanent ASMs could be improved during the imaging of patients at the study site. N=27 (62.7%) responded, and their suggestions are summarised in Table 2.

Table 2: Suggestions on how to improve the use of permanent ASMs in DR (N=27)

	Suggestions	Frequency
1	Employers and universities should procure permanent ASMs for radiographers and students, respectively	10(37.0%)
2	Introduction of ASMs that have an adhesive strip with them to avoid going missing	1(3.7%)
3	Establishment of an education awareness programme on the use of ASMs during imaging	1(3.7%)
4	Conducting periodical departmental clinical audits on the use of ASMs	15(55.6%)

DISCUSSION

The decrease in the use of permanent ASMs is currently a huge problem affecting the practice of radiography globally. Medicolegal requirements mandate that all radiographic images (100%) must have a permanent ASM (Ballinger *et al.,* 2013; Whitley *et al.,* 2015; College of Radiographers, 2021). Electronic ASM found in DR should only be used if a permanent ASM is missing or has been placed incorrectly (College of Radiographers, 2021). However, our audit found no radiographic image with a permanent ASM. When compared to similar previous audits conducted around the world, there has been a significant decrease in the use of permanent ASMs in digital imaging. An audit conducted in Australia by Barry *et al., (*2016), found that 22% of the radiographic images had permanent ASMs, and 72.3% had electronic (digital) ASMs. In another similar study carried out in Malta by Attard *et al.,* (2016) it was found that 15.4 % of radiographers preferred using permanent ASMs, whilst 84.6% preferred using electronic ASMs. A recent audit carried out in Australia by Chung *et al.,* (2020) found 22.2% of radiographic images with permanent ASMs and 78.8% with digital ASMs. In all these audits, the standard of having all (100%) images with permanent ASM present was not met.

In the second phase of this study, N=23 (54.0%) respondents indicated that they always use permanent ASMs during the imaging of patients. This finding does not match with the results of the first phase which revealed the non-use of permanent ASMs by radiographers and radiography students. This discrepancy in the finding may be due to social acceptability bias. Latkin *et al.,* (2017) define social acceptability bias as a type of response bias that is the tendency of respondents to answer questions in a manner that will be viewed favourably by others. For this reason, the audit results in our study can be more reliable than the survey.

The ASMs and annotations should never obscure anatomy (Ballinger *et al.,* 2013; Whitley *et al.,* 2015). However, a review of digital images performed in the Republic of Ireland by Khosa *et al.,* (2015) found one case of an annotation placed on a chest radiograph, obscuring a left clavicle fracture. The fracture was

missed during the first visit and only detected days later following a second X-ray of the left shoulder. In our study, N=45 (18.8%) of the audited radiographic images had ASMs obscuring anatomy. This number is higher than an audit conducted in Nigeria by Adejoh *et al.,* (2014), where N=12 (2.0 %) of the radiographic images contained ASMs that obscured anatomy. It should be mentioned that placing an ASM or annotations over anatomy can obscure important features that would be of diagnostic value in the management of a patient. It is reported in the literature that an ASM should never be placed over the patient's identification information (Ballinger *et al.,* 2013). This will ensure accurate identification of the patient, correct diagnosis, and treatment. Therefore, it is important that radiographers and radiography students follow the given guidelines on the use of ASMs, as they can be held accountable for any adverse effect resulting from their negligence.

In our audit, all radiographic images contained digital ASMs which were correctly annotated. This contrasts with previous audits conducted abroad which reported wrong or missing ASMs on the radiographic images. For example, in an audit conducted by Barry *et al.,* (2016), it was found that 5.8% of the radiographic images were incorrectly marked. In other similar audits conducted by Attard *et al.,* (2016) and Chung *et al.,* (2020), 2.4 % and 14% had no evidence of any ASMs respectively, which can result in experiencing adverse events. For example, one medicolegal case report and a survey have been reported in the literature. The case report in Sweden by Finnbogason *et al.,* (2002) involved a chest radiograph with a left-and-right side confusion due to a lack of permanent ASMs. Two premature babies with pneumothorax got thoracostomy on the wrong side, in one patient with a fatal outcome. The second case was a survey carried out in the United States of America (USA) by Meinberg *et al.,* (2002) where N=217 (21.0 %) of the surgeons reported performing a wrong-site surgery at least once. Permanent disability occurred in 9% of the cases and 38% led to legal actions. This case report and a survey show the importance of radiographers and radiography students placing permanent ASMs on all radiographic images and marking them correctly.

This study identified a few barriers to the use of permanent ASMs during the imaging of patients. Three main barriers were reported: a lack of ASMs, increased workload, and time constraints. Previous audits have also identified the same barriers (Attard *et al.,* 2016; Chung *et al.,* 2020). Other reasons reported in the literature for omitting ASMs before X-ray exposure include dealing with critically ill patients or uncooperative patients, fatigue, and a lack of experience (Titley & Cosson, 2014; Attard *et al.,* 2016). These situations make radiographers and radiography students forget to use permanent ASMs. The time of image acquisition has also been reported to contribute to the poor use of ASMs, with radiographers using permanent ASMs less at night due to fatigue (Titley & Cosson, 2014). Other barriers to the poor use of permanent ASMs relate to the facilitation of practice-based learning for radiography students during their clinical practice. The participation of students in imaging patients is demanding and time-consuming which may lead to supervising radiographers feeling pressured and omitting permanent ASMs (Platt & Strudwick, 2009; Attard *et al.,* 2016). Interestingly, the clinical supervision of students was not reported as a barrier in our study despite the study site being the main radiography clinical training centre.

LIMITATIONS OF THE STUDY AND RECOMMENDATIONS

The radiographic images audited in this study were from a single month, which limited the information that was attained in that month. Future audits and research should increase the audit period to six (6) months or more. Another study can be conducted to compare the use of ASMs between DR and film-screen imaging rooms at UTH. To have a comprehensive understanding of the problem, future research in other settings can use an explanatory mixed-method research design. The study can begin with the quantitative approach where an audit on the use of ASMs in DR can be undertaken, followed up with qualitative methods (using individual interviews or focus group discussions) to investigate the practices of radiographers regarding the use of ASMs in DR in order to explain the quantitative findings in depth. This qualitative approach can also investigate the enablers and barriers to the use of f permanent ASMs.

CONCLUSION

This study found that radiographers and radiography students at the study site do not use permanent ASMs in digital imaging; instead, they use electronic ASMs. In our audit, the standard of having all (100%) radiographic images with permanent ASMs was not reached. To improve the use of permanent ASM and the safety of patients, it is recommended ASMs are procured locally, radiography students asked to have permanent AMSs as part of the school requirements. Further, radiographers can be re-educated on the importance of using permanent ASMs through continuous professional development (CPD).

ACKNOWLEDGEMENTS

Special thanks go to the management of the University Teaching Hospital (UTH) for granting us permission to conduct the research, the radiology staff for their unwavering support and participation in this study, and the Lusaka Apex Medical University (LAMU) radiography final year students of 2021 for their full participation. The authors would also like to thank Joseph Bwambya for reviewing the manuscript before submitting it for publication.

REFERENCES

1. Aakre, K. T., & Johnson, C. D. (2006). Plain-radiographic image labeling: a process to improve clinical outcomes. *Journal of the American College of Radiology: JACR*, *3*(12), 949–953. https://doi.org/10.1016/j.jacr.2006.07.005
2. Adejoh, T., Onwuzu, S. W. I., Nkubli, F. B., & Ikegwuonu, N. (2014). Radiation field preference for radiographic anatomical markers by radiographers in a University Teaching Hospital in Nigeria. *Open Journal of Radiology*, 4, 275-278.
3. Attard, S., Couto, J. G., MacKay, S., & Zarb, F. (2017). Anatomic Site Markers: Evaluation of Their Use among Maltese Radiographers. *Journal of medical imaging and radiation sciences*, *48*(1), 30–38. https://doi.org/10.1016/j.jmir.2016.08.006
4. Ballinger, P., Frank, E., & Merrill, V. (2013). Merrill's atlas of radiographic positions and radiographic procedures (13th ed). St Louis: Mosby.
5. Barry, K., Kumar, S., Linke, R., & Dawes, E. (2016). A clinical audit of anatomical side marker use in a paediatric medical imaging department. *Journal of medical radiation sciences*, *63*(3), 148–154. https://doi.org/10.1002/jmrs.176
6. Bryman, A. (2016). Social research methods. 5th ed. Oxford: University Press.
7. Bwanga, O. (2021). Causes of reject and repeat of digital radiographic images: a literature review to guide the practice of radiography in Zambia. *Medical Journal of Zambia*, 48(1), 38-45.
8. Bwanga, O., & Bwalya, M. (2021). Clinical audit in diagnostic radiography. *British Journal of Medical & Health Sciences*, 3(10), 1168-1172.
9. Bwanga, O., & Mwansa, E. (2022). Roles of clinical supervisors in the clinical training of radiography students in Zambia: a qualitative study. *Afri Health Sci.*, 22(2), 638-646.
10. Bwanga, O., & Sichone, M.J. (2020). Experiences of clinical supervisors regarding the clinical training of radiography students in Zambia. *The South African Radiographer*, 58(2), 22-28.
11. Chung, L., Kumar, S., Oldfield, J., Phillips, M., & Stratfold, M. (2020). A clinical audit of anatomical side marker use in a pediatric medical imaging department: A quantitative and qualitative investigation. *PloS one*, *15*(11), e0242594. https://doi.org/10.1371/journal.pone.0242594
12. College of Radiographers (2020). Use of anatomical side markers. From https:// www.sor. org/ learning/document-library/use-anatomical-side-markers/use-anatomical-side-markers (accessed 27/05/21).
13. Dawson, C. (2019). Introduction to research methods: a practical guide for anyone undertaking a research project. 5th edition. Oxford: How to books Ltd.
14. Ehrlich, R. A., & Coakes, D. M. (2020). Patient care in radiography: with an introduction to medical imaging. 10th ed. London: Elsevier.
15. Finnbogason, T., Bremmer, S., & Ringertz, H. (2002). Side markings of the neonatal chest X-ray: two legal cases of pneumothorax side mix up. *European radiology*, *12*(4), 938–941. https://doi.org/10.1007/s003300101067
16. Health Professions Council of Zambia (2014). Professional code of ethics and discipline: fitness to practice. Lusaka: HPCZ.
17. Khosa, H., Thomas C., & Ramesh, N. (2015). Revalidating the importance of anatomical side markers and annotations on radiographic Images. European Congress of Radiology. From http://dx.doi.org/10.1594/ ecr2015/C-2464 (accessed 20/04/21).
18. Latkin, C. A., Edwards, C., Davey-Rothwell, M. A., & Tobin, K. E. (2017). The relationship between social desirability bias and self-reports of health, substance use, and social network factors among urban substance users in Baltimore, Maryland. *Addictive behaviors*, *73*, 133–136.
19. Meinberg, E, G., & Stern, P. J. (2003). Incidence of wrong-site surgery among hand surgeons. *J Bone Joint Surg Am*, 85(2), 193-197.
20. Platt, J. M., & Strudwick, R. M. (2009). The application of anatomical side markers during abdominal and IVU examinations: an investigation of practice prior to and post-installation of computed radiography (CR). *Radiography*, 15, 292-299.
21. Radiological Society of Zambia (2018). Code of conduct for radiographers. Lusaka: RSZ.
22. Titley, A. G., & Philip, C. (2014). Radiographer use of anatomical side markers and the latent conditions affecting their use in practice. *Radiography*, 20(1), 42-47.
23. Whitley, A. S., Jefferson, G., Sloane, K. H. C., Anderson, G., & Hoadley, G. (2015). Clark's positioning in radiography. 13th ed. London: CRC Press Ltd.
24. Wright, K. B. (2005). Researching internet-based populations: advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services, *Journal of Computer-Mediated Communication* (*JCMC)*, 1034. https://doi.org/10.1111/j.1083-6101.2005.tb00259.x

Cite This Article: Osward Bwanga, Henry Kashweka, Ernest Chanda, Soka Nyerenda, Mr Mubanga Bwalya (2023). Anatomical Side Marker Use in Digital Radiography at the University Teaching Hospital (UTH) of Lusaka, Zambia. *EAS J Radiol Imaging Technol*, *5*(1), 11-18.