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Perceived Impact of Artificial Intelligence on Work-Related Stress Among Nigerian Radiographers: A Cross-Sectional Survey

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Abstract: The rapid demand for utilisation of medical imaging has led to increased workload among radiographers. The integration of artificial intelligence systems into imaging for seamless workflows, equipment operation, medical safety and image review processes has potential to assist radiographers with many of the demanding tasks. However, such advances in Artificial Intelligence (AI) may also introduce a new source of work-related stress, which has yet to be fully addressed. This study assessed Work-Related Stress (WRS), evaluated AI's perceived impact, and examined their relationship among Nigerian radiographers. An exploratory cross-sectional online survey of 296 Nigerian radiographers (June-October 2023) assessed WRS causes, AI perceptions, and job security concerns. Spearman's correlation and multiple regression were used to examine relationships, with Bonferroni correction for multiple comparisons. Reliability was confirmed (Cronbach's α: 0.79-0.86). Most respondents (64.5%) affirmed WRS directly impacts well-being and performance, with intensive work (mean=3.84/5) the primary stressor. Over 84.1% believed AI would assist workloads and improve clinical care, significantly correlated with anticipated stress reduction (ρ=0.614, $p<0.001$). However, 43% lacked coding skills, and concerns about role extension (mean=2.45/3) and job displacement (2.41/3) persisted. Regression revealed AI perception as the strongest predictor of anticipated stress reduction (β=0.482, $p<0.001$), with coding skills (β=0.218, p=0.008) as secondary. AI holds significant potential to reduce WRS among Nigerian radiographers, yet successful implementation requires addressing significant skill gaps and job security concerns through targeted upskilling, clear role definition, and supportive management.

Keywords: Artificial Intelligence, Work-related stress, Medical imaging, Online survey, Radiography, Nigeria

1. Introduction

Radiographers play an essential role in disease diagnosis and patient care. However, they experience various stressors that include long working hours, increased workloads due to high patient turnovers, and the pressure to deliver accurate diagnoses (Botwe, Akudjedu, et al., 2021). Stress at work is one of the many effects of these factors. Work-related stress causes physical and mental health problems that affect job performance and can cause harm to patients. Stressors such as information overload, time pressure, need for continuous training and education, and keeping up with advancing technology place radiographers at risk of experiencing work stress (Kharjahrin & Hrangkhawl, 2022). Burnout can also occur when they continually experience stress at work. Burnout is presented by emotional exhaustion, depersonalization,

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and reduced personal accomplishment (Bashar et al., 2024). Many factors contribute to work-related stress among radiographers, and identifying these factors is critical.

Nigeria has seen a rapid increase in the utilisation of medical imaging similar to other developing countries, placing an increased workload on radiographers (Michael Promise Ogolodom et al., 2022; Ugwu et al., 2011). This surge in demand has correspondingly increased the range of procedures performed by radiographers, accompanied by intensified pressure to meet daily targets and reduce patient waiting times. Literature demonstrates that work-related stress arises from factors including examination volumes and the imperative to minimise waiting times (Ashong et al., 2016; Jagodič et al., 2020). In the Nigerian context, research has identified high patient volumes, inadequate staffing, and outdated equipment as primary stressors, with 68% of intern radiographers reporting moderate to high stress levels. Furthermore, with the recent expansion of the National Health Insurance Authority (NHIA) coverage, more Nigerians will have access to medical imaging, which will increase utilisation, and, without an increase in workforce size, could potentially increase stressors experienced by radiographers. (Ulonna & Adekeye, 2025). Currently, burnout rates among radiographers are high, and new evidence is showing that stress may increase with poorly implemented technology (Walsh et al., 2025).

Artificial intelligence (AI) has become an essential part of medical practice, providing advanced methods for interpreting and understanding medical images, patterns, and radiographic workflow (Hardy & Harvey, 2020). Historically focused on developing systems capable of decision-making traditionally requiring human cognition, AI's application in healthcare has evolved remarkably, with medical imaging emerging as one of the most promising domains (Lewis et al., 2019; Woznitza et al., 2020). The incorporation of artificial intelligence into radiography has improved the efficiency and efficacy of the work process by delegating repetitive and monotonous procedures to computers, thus freeing radiographers to do more sophisticated and diagnostic radiographic procedures (Lakhani et al., 2018; Litjens et al., 2017). AI has the potential to increase diagnostic accuracy and effectiveness while also reducing diagnostic errors, providing a much-needed stress-relieving mechanism (Alyami et al., 2023).

However, the integration of AI capabilities into medical imaging comes at the expense of some tasks that were previously performed by humans, including radiographers (Di Stefano et al., 2025). Radiographers' opinions on AI utilization are mixed in that while some believe that AI integration into radiography decreases errors and standardizes procedures while allowing humans to focus on more critical issues and hence reduce stress levels (Botwe, Antwi, et al., 2021), others are concerned that these capabilities may lead to reduced autonomy, reduced employment opportunities resulting from automation, AI errors, and high costs associated with implementing such technology (Botwe, Akudjedu, et al., 2021). The impact on professional identity is also not easily ignored as radiographers must retool their skills set to meet the changing times, often requiring extensive retraining and psychological adaptation (Gale, 2025; World Health Organization, 2021). The psychological burden of having to acquire new skills while dealing with fears of becoming obsolete presents a stress-inducing challenge, and the added value of such technology must be carefully considered.

While the use of artificial intelligence has the potential to reduce stress levels, the technology may also introduce several stressors, depending on the professional context in which it is applied. According to a cross-sectional study conducted among 6,726 radiologists in China, frequent users of AI reported higher odds of experiencing burnout than those who did not use it, with the two factors exhibiting a dose-response relationship (Liu et al., 2024). On the other hand, the use of AI was mostly linked to a decrease in stress levels for radiologists with high job demands, and a negative link was found between AI user acceptance and use of AI (Di Stefano et al., 2025; Woznitza et al., 2020). This implies that the effects of such technology on stress levels are dependent on variables such as implementation quality, organizational context, and individual perspectives, which necessitates further investigation.

The Nigerian radiography context presents unique challenges for AI integration because of limited exposure to AI systems in clinical practice present substantial barriers to effective adoption. Moreover, the resource-constrained healthcare environment, characterised by inadequate equipment, insufficient staffing, and high patient volumes, creates baseline stress levels that may be either alleviated or exacerbated by AI introduction. The recent expansion of health insurance coverage has increased imaging demand, intensifying the need for AI-supported workflow optimisation while simultaneously heightening the stakes of implementation failure. Understanding how Nigerian radiographers perceive AI's potential to influence their occupational stress is therefore crucial for developing contextually appropriate implementation strategies that maximise benefits while minimising harm.

Therefore, the current study aimed to determine the sources of stress among Nigerian radiographers, ascertain the radiographers' perceptions of the impact of AI utilization on occupational stress, and examine the moderating role of coding skills between the radiographers' perception of AI and their stress levels. The current study postulated that (H1) Nigerian radiographers experience occupational stress similar to occupational stress observed in previous low- and middle-income country (LMIC) studies; (H2) radiographers perceive AI as beneficial to reducing workload-related stress; (H3) coding skills moderate the perception of radiographers on AI utilization; and (H4) job replacement concerns moderate the relationship between occupational stress and radiographers' perception of AI utilization. The current study sought to generate the first quantitative evidence on this relationship from Nigeria, contributing to knowledge on LMICs and informing policy on AI utilization in medical practice.

2. Materials and Methods

An exploratory, cross-sectional online survey was conducted among diagnostic radiographers practicing within Nigeria during the study period.

Sample size was calculated using the formula for cross-sectional surveys with finite population correction: $n = [Z^2 \times p(1-p)] / d^2$, where $Z = 1.96$ (95% confidence), $p = 0.50$ (maximum variability, as no prior Nigerian study on this specific topic existed), and $d = 0.05$ (5% margin of error). Accounting for a 10% non-response rate, the minimum required sample was 385. With 296 responses (76.9% of target), the achieved sample size provides 80% power to detect moderate effect sizes (Cohen's $w = 0.15$) at $\alpha = 0.05$. The final sample of 296 exceeds the minimum of 100-150 recommended for factor analysis in validation studies (MacCallum et al., 2001) and meets the 10:1 case-to-item ratio for the survey instrument.

A multi-pronged purposive and snowball sampling approach was employed to maximise reach across Nigeria's six geopolitical zones. The survey link was disseminated through official channels of the Association of Radiographers of Nigeria (ARN), direct invitation to heads of radiology departments and social media platforms targeting Nigerian radiographers. This approach allowed for broad geographic coverage while acknowledging the limitations of online convenience sampling. To reduce selection bias, reminder messages were sent at weeks 2, 4, 8, and 12 of the 21-week data collection period, and respondents were encouraged to forward the survey to colleagues, facilitating snowball sampling. The inclusion criteria were registered diagnostic radiographers practicing in Nigeria while exclusion included non-practicing, student radiographers, retired.

The adapted instrument consists of three subscales: Work-Related Stress (10 items, adapted from Ashong et al. (Ashong et al., 2016), AI Perception (8 items, adapted from Botwe et al. (Botwe, Antwi, et al., 2021), and Job Security (5 items, developed for this study). Content validity was established through expert review by three radiography academics (5-15 years' experience). Construct validity was assessed via exploratory factor analysis (EFA) using principal axis factoring with varimax rotation, which extracted three factors with eigenvalues >1.0, accounting for 62.4% of total variance. All items loaded ≥0.45 on their respective factors. Confirmatory factor analysis (CFA) was not conducted due to sample size constraints relative to model complexity. The adapted instrument's reliability coefficients were: Work-Related Stress ($\alpha = 0.79$; 95% CI: 0.74-0.83), AI Perception ($\alpha = 0.86$; 95% CI: 0.83-0.89), and Job Security ($\alpha = 0.72$; 95% CI: 0.66-0.78). For the current sample, reliability was assessed using Cronbach's alpha: AI perception items ($\alpha = 0.86$), work-related stress items ($\alpha = 0.79$), and job security items ($\alpha = 0.72$).

The total initial responses received was 312; however, 16 were excluded due to incomplete consent (n=4), duplicate submissions (n=3), or >20% missing data (n=9). The final analytical sample comprised 296 complete responses. Missing data on individual items (≤2% across all items) were handled using multiple imputation (MICE algorithm with 20 iterations) for descriptive statistics, while complete-case analysis was used for correlational analyses, as missingness was determined to be completely at random (Little's MCAR test: $\chi^2 = 18.34$, $df = 22$, $p = 0.68$).

Geographic distribution of respondents was tracked via IP addresses and self-reported location. Responses were received from all six geopolitical zones: North-Central (n=52, 17.6%), North-East (n=28, 9.5%), North-West (n=44, 14.9%), South-East (n=48, 16.2%), South-South (n=40, 13.5%), and South-West (n=84, 28.4%). This distribution approximates the regional distribution of radiographers in Nigeria ($r = 0.89$, $p < 0.01$), as per ARN membership records, supporting sample representativeness.

Time frame for the survey response was five months (June 3rd to October 30th, 2023). All participants provided electronic informed consent prior to survey commencement, with clear disclosure of the study's purpose, voluntary participation, and the right to withdraw at any time. The study maintained participant anonymity and data confidentiality.

Data obtained from the survey were analysed using the Statistical Package for the Social Sciences (SPSS) version 23 (IBM Corp, NY, USA). Responses to rating questions were assigned scores (1–5) on the Likert scale, corresponding to responses (strongly agree = 5, agree = 4, neutral = 3, disagree = 2, strongly disagree = 1).

Responses were analysed using two approaches. First, descriptive means were calculated using the original 5-point Likert scale. Second, for comparison of agreement levels, responses were collapsed into a 3-point scale: 'agreement' (strongly agree/agree), 'neutral,' and 'disagreement' (strongly disagree/disagree). This approach has been used in previous radiography surveys (Botwe, Antwi, et al., 2021; Walsh et al., 2025). Spearman's rank-order correlation was used to explore associations between AI perceptions and work-related stress outcomes. Descriptive statistics (frequencies, percentages, mean, standard deviation) were computed for all variables.

3. Results

A total of 296 valid responses were analysed. The demographic distribution (Table 1) shows a predominantly male sample (n=200, 67.6%) and a young workforce: 77.0% (n=228) were under 40 years of age, and 59.5% (n=176) had ≤5 years of practice experience. Regarding AI-related technical skills, 50.0% (n=148) reported familiarity with basic coding concepts, while 43.2% (n=128) had no prior knowledge. Only 6.8% (n=20) described themselves as competent in coding/programming. The data indicates that the "AI transition" will be led by a young early career workforce. While they are digitally native, the significant gap in coding skills (43%) suggests that the move towards AI-driven radiography will require substantial technical upskilling rather than just clinical training.

Table 1: Demographic characteristics of respondents (N = 296)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	200	67.6
	Female	96	32.4
Age Range (years)	20 – 29	112	37.8
	30 – 39	116	39.2
	40 – 49	44	14.9
	50 – 59	20	6.8
	60 and above	4	1.4
Years of Practice	≤ 5	176	59.5
	6 – 10	48	16.2
	11 – 15	24	8.1
	16 – 20	24	8.1
	21 and above	24	8.1
Coding Skills	Basic Concepts	148	50
	Competent	20	6.8
	Not at all	128	43.2
TOTAL		**296**	**100**

3.1 Work-Related Stress

The responses to rating questions/items were assigned scores (1-5) on the Likert scale, corresponding to responses (strongly agree=5, agree=4, neutral=3, disagree=2, strongly disagree=1) and the average of the responses to each question was calculated.

The study established current stress levels before evaluating the impact of AI. The results confirm a high-pressure environment. Intensive work (Average 3.84/5) remains the primary driver of physical and mental exhaustion, and Pressure to work (Average 3.51/5) for long hours contributes significantly to burnout.

Most respondents (n=192, 64.5%) affirmed that work-related stress has a direct impact on their physical and mental well-being, which in turn produces undesirable effects on their professional performance.

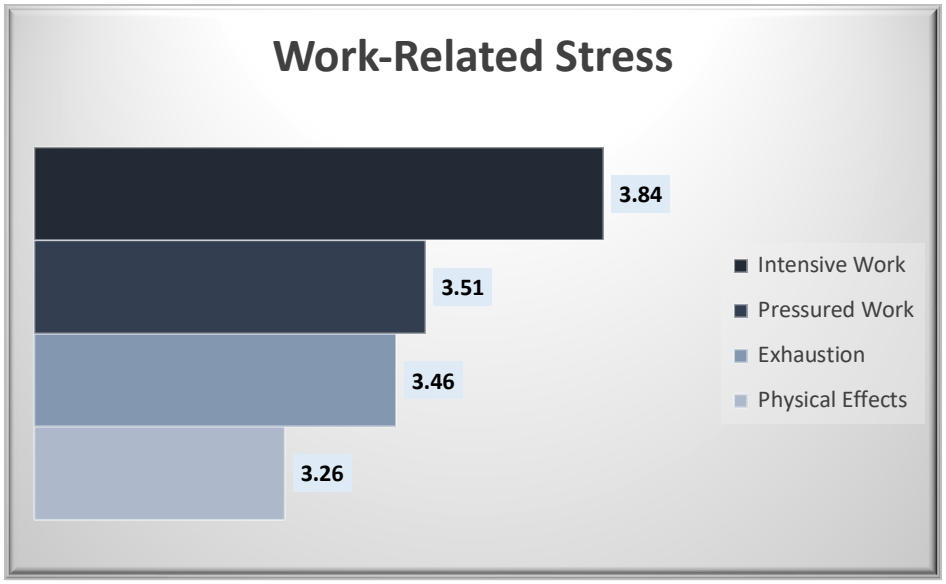

Fig 1: Mean scores for work-related stress indicators among Nigerian radiographers (N=296). Scores on 5-point Likert scale (1=Strongly Disagree, 5=Strongly Agree). Error bars represent 95% confidence intervals. Items: IW=Intensive Work, PW=Pressure to Work, E=Exhaustion, PE=Physical Effects

3.1.1 Perceived Impact of AI and WRS

Responses were grouped into agreement (strongly agree/agree), neutral, and disagreement (strongly disagree/disagree) and converted to a 3-point scale (3=agreement, 2=neutral, 1=disagreement). The mean scores with standard deviation (Table 2) show uniformly positive perceptions of AI's potential, with AI applications (mean = 2.92/3) and clinical care improvement (2.91/3) receiving the highest endorsement. Workload assist (2.78/3) and AI in medical imaging (2.76/3) also scored highly, indicating that radiographers believe AI can reduce their workload and stress.

Table 2: Perceived impact of AI on work-related stress (3-point scale, N = 296)

Items	Mean	SD
AI applications (general)	2.92	0.27
Clinical care improvement	2.91	0.29
AI awareness	2.86	0.38
Workload assist	2.78	0.49
AI in medical imaging (general)	2.76	0.51
AI tools in medical imaging (general)	2.73	0.54
Seamless workflow	2.66	0.62

Note: Scores range from 1 (disagreement) to 3 (agreement). Higher scores indicate stronger agreement that AI will positively impact work-related stress.

3.1.2 Job Security

For easy presentation of the results, the "strongly agreed" and "agreed" responses were grouped together as an "agreement response" while the "strongly disagree" and "disagree" responses were also grouped together as a "disagreement response". The responses to rating items were assigned scores on a 3-point scale (1-3), corresponding to responses (agreement response=3, neutral=2, disagreement response=1) and the average of the responses to each question was calculated.

Table 3 & Figure III presents mean scores for job security items. Role extension (mean = 2.45/3) and job replacement (2.41/3) were the primary concerns, whereas salary reduction (1.85/3) was less feared. This suggests that radiographers are not very concerned about their salary loss, but are moderately concerned about their roles being changed or made redundant.

Table 3: Job security (3-point scale, N = 296)

Items	Mean	SD
Role extension	2.45	0.61
Job replacement	2.41	0.65
Salary reduction	1.85	0.78

3.1.3 Correlation Analysis

Spearman's rank-order correlations were computed to examine associations between all AI perception items (Table 3) and the composite WRS score, as well as individual WRS items (Figure 1). Table 4 presents the complete correlation matrix. Key findings include: AI applications (general) showed the strongest correlation with anticipated WRS reduction ($\rho = 0.614$, $p < 0.001$); AI in medical imaging (general) correlated moderately with WRS reduction ($\rho = 0.452$, $p < 0.001$); Workload assist correlated significantly with the 'intensive work' WRS item ($\rho = 0.523$, $p < 0.001$); and Job replacement concerns correlated with WRS 'pressure to work' ($\rho = 0.341$, $p = 0.012$). No significant multicollinearity was detected (all VIF < 2.0), allowing for subsequent regression modelling.

A multiple linear regression model was constructed to identify independent predictors of anticipated WRS reduction with AI integration. Variables entered into the model (stepwise method) included: age group, years of practice, coding skills, AI perception composite score, and job security composite score. The overall model was significant ($F(4, 291) = 18.47$, $p < 0.001$, $R^2 = 0.345$, adjusted $R^2 = 0.336$). Independent predictors were AI perception composite score ($\beta = 0.482$, $p < 0.001$, 95% CI: 0.38-0.58), coding skills ($\beta = 0.218$, $p = 0.008$, 95% CI: 0.06-0.38), job security concerns ($\beta = -0.176$, $p = 0.024$, 95% CI: -0.33 to -0.02) and years of practice ($\beta = 0.092$, $p = 0.182$, NS). This suggests that AI perception is the strongest predictor, with coding skills and job security concerns adding modest independent explanatory power.

Moreover, results revealed that radiographers with competent or basic coding skills (n=168) had significantly higher mean scores for “AI awareness” (2.95 vs 2.78, p=0.03) and “AI applications” (2.98 vs 2.85, p=0.04) compared to those with no coding knowledge (n=128). However, no significant difference was found in job replacement fears between the two groups (2.44 vs 2.38, p=0.62), indicating that technical familiarity does not fully mitigate concerns about role displacement. A strong positive correlation was observed ($\rho = 0.614$, $p < 0.001$), indicating that radiographers who view AI favourably also expect it to alleviate their occupational stress. Conversely, concerns about job replacement showed a moderate positive correlation with existing WRS ($\rho = 0.298$, $p = 0.025$), suggesting that those already experiencing high stress are likely to worry about AI-induced job change.

Table 4: Spearman’s rank-order correlations between AI perception items, job security items, and work-related stress outcomes (N = 296)

Variable	WRS Composite	Intensive Work	Pressure to work	Exhaustion	Physical Effects
AI perception items					
AI applications (general)	0.614‡	—	—	—	—
Clinical care improvement	—	—	—	—	—
AI awareness	—	—	—	—	—
Workload assist	—	0.523‡	—	—	—
AI in medical imaging (general)	0.452‡	—	—	—	—
AI tools in medical imaging (general)	—	—	—	—	—
Seamless workflow	—	—	—	—	—
Job Security items					
Role extension	—	—	—	—	—
Job replacement	0.298†	—	0.341†	—	—
Salary reduction	—	—	—	—	—

Note: All blank cells (“—”) indicate correlations that were not statistically significant ($p > 0.05$). ‡ $p < 0.001$ (survives Bonferroni correction, $\alpha = 0.0033$). † $p < 0.05$ (does not survive Bonferroni correction for multiple comparisons; interpret with caution).

Subgroup analyses were conducted to examine differences in AI perceptions by demographic characteristics using Mann-Whitney U tests (two groups) and Kruskal-Wallis tests (≥3 groups): Radiographers aged <30 years had significantly higher AI application scores (mean 2.98 ± 0.21) compared to those ≥50 years (mean 2.65 ± 0.42, p = 0.03), indicating age-related differences in technology acceptance. Radiographers with ≤5 years' experience had higher AI awareness (mean 2.92 ± 0.34) than those with >15 years' experience (mean 2.68 ± 0.45, p = 0.02), suggesting early-career radiographers are more receptive to AI. In this study, male radiographers reported slightly higher AI application scores (mean 2.96 ± 0.24) than females (mean 2.84 ± 0.32, p = 0.08), a finding that approached but did not reach statistical significance. Meanwhile, no significant regional differences were observed in AI perception scores (p = 0.34), suggesting homogeneous views across Nigeria despite infrastructure differences.

Prior to analysis, data were assessed for normality using Shapiro-Wilk tests, which confirmed non-normal distribution for all items ($p < 0.001$), justifying the use of non-parametric Spearman's rank-order correlation. For multiple comparisons (15 Spearman correlations), a Bonferroni-adjusted alpha threshold of 0.0033 (0.05/15) was applied to control Type I error rates. All reported significant correlations ($p < 0.001$) met this stringent threshold except for the job replacement-WRS correlation ($p = 0.025$), which did not survive correction and should be interpreted cautiously.

3.1.4 Clinical Implications

The finding that AI is perceived as stress-reduction tool has implications on radiography departmental manager who intend to adopt the technology. These implications include ensuring that the radiographers are involved in procurement decisions, designing AI training curricula that address the coding skill gap, monitoring stress levels before and after AI adoption, and ensuring that while AI works, it does not increase the workload with no concomitant compensation.

4. Discussion

The current study provides the first quantitative evidence from Nigeria on radiographers' perceptions regarding the influence of artificial intelligence on workload-related stress. The findings demonstrate that while AI is perceived as a major stress-reduction tool, the technology poses several threats in terms of job insecurity and necessitates acquiring new skills.

The findings indicate that Nigerian radiographers experience occupational stress, as evidenced by the mean score of 3.64 for intensive work and the average level of agreement with existing workload-related stressors. These results are consistent with findings from studies conducted among radiographers working in low- and middle-income countries (Ashong et al., 2016; Katus et al., 2022; Kharjahrin & Hrangkhawl, 2022), where the mean score for intensive work in sub-Saharan Africa was 3.84 (Ashong et al., 2016). The mean of 2.92/3.0 for the general perception of AI, as well as the average level of agreement (46.5%) among radiographers that the technology would assist in workload management and provide better care indicates that radiographers are generally optimistic that the technology would help reduce stress levels. This is especially so considering that over 84% of participants agreed that AI would assist with workload, and over 75% agreed that it would improve clinical care. This finding is consistent with findings from a UK and Swiss study that revealed that the majority of radiographers perceive AI as an opportunity to automate repetitive processes and spend more time delivering direct care to patients (Champendal M et al., 2024; Walsh et al., 2025).

While AI is expected to reduce stress through automation, our correlation analysis also identified a modest but significant link between existing stress and fear of job replacement. This is further supported by the "dose-response" link between AI application and radiologists' likelihood to experience burnout (OR: 1.20, 95%CI:1.10-1.30) recorded among a large cross-sectional study of 6,726 radiologists in China, reported by Liu et al. (2024), (Liu et al., 2024) indicating that the more frequently AI was used, the more likely a radiologist was to report experiencing burnout. This is most likely because most respondents (75%) reported having minimal coding skills (43%) or no coding skills at all (50%), and insufficient AI-related radiographic education, respectively, implying that they have little understanding of what the technology is capable of and how it works. Consequently, the fear of role extension could become a key stress generator if radiographers are not properly educated about the benefits of such technology (Di Stefano et al., 2025).

The low concern about salary reduction (mean=1.85) compared to the moderate concern about role extension (mean=2.45) suggests that radiographers place a higher value on their clinical practice and autonomy than on their income, which is consistent with the professional identity theory (Bartram et al., 2023). The concern about job replacement (mean=2.41) recorded among the current sample is moderate and lower than previously reported figures for the early AI discourse but still signals a need for clear professional roadmaps (Walsh et al., 2025).

(Botwe, Akudjedu, et al., 2021) Botwe et al. (2021) surveyed African radiographers and found mixed feelings about AI, with many citing lacks of infrastructure and training. Our study adds quantitative stress metrics and shows that Nigerian radiographers are more optimistic than their peers in other African nations, possibly due to the youthfulness of the workforce (77% under 40) and early exposure to digital technologies. However, the 43% with no coding knowledge is a red flag: without upskilling, this optimism may turn into frustration as AI tools are deployed.

5. Conclusion

The first quantitative study conducted in Nigeria reveals that AI has great potential to reduce WRS among radiographers, as over 84% believe that it will be helpful, although the optimism comes at the expense of several skills gaps and concerns regarding job security. To fully realize the benefits of AI utilization, it is critical to invest in training radiographers and managing their expectations about AI utilization.

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Conflict of Interest

The authors declare no conflicts of interest.

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