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The Value of Routine Chest X-Ray in Pre-Employment Screening

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***Abstract*— Background: Routine chest radiography is widely used in pre-employment medical screening to detect occult cardiopulmonary disease, yet its diagnostic yield in asymptomatic populations is low and may incur unnecessary cost, time, and radiation exposure.**

Objective: To evaluate the diagnostic yield of mandatory pre-employment chest X-rays at King Abdulaziz Medical City (KAMC) and to inform a risk-based screening strategy.

Methods: We conducted a retrospective cross-sectional review of 140 consecutive pre-employment candidates (mean age 26.8 ± 3.42 years; range 22–44; 41.1% male) who underwent posteroanterior chest radiography between February 2, 2020, and January 1, 2021. Demographic data and radiology reports were extracted from the BEST-Care system and analyzed descriptively.

Results: All 140 chest X-rays were normal, yielding a 0% abnormality rate across four age brackets (20–26, 27–33, 34–40, ≥ 41 years) and both sexes. No significant associations were found between radiographic findings and age or gender.

Conclusion: The absence of detectable pathology supports the low diagnostic value of universal pre-employment chest radiography in this low-risk cohort. A larger sample size may be necessary to generate robust empirical evidence on this issue.

Keywords: Chest X-ray, Pre-employment screening, Diagnostic yield, Radiation exposure, Risk-based protocol.

I. INTRODUCTION

Pre-employment medical screening often includes chest radiography to detect occult cardiopulmonary disease and prevent workplace transmission of infections. However, the routine use of chest X-rays in asymptomatic individuals has long been questioned. Early studies demonstrated a very low diagnostic yield, calling into question the cost-effectiveness and radiation exposure associated with universal screening. Deasy's review of NHS employees found minimal pathology on mandatory radiographs, a finding echoed by Belfield et al. in junior doctors and reinforced by the Medical Research Council's national tuberculosis survey in England and Wales, all indicating that mandatory X-rays identify few significant abnormalities and may offer limited benefit particularly when balanced against logistical and financial burdens as well as cumulative radiation risk for which Horne's code of practice and Jachuck's work on tuberculin retesting highlighted the need for targeted, evidence-based approaches to tuberculosis control rather than blanket imaging policies [1-6].

Subsequent occupational health guidelines have advocated for more judicious use of imaging. McCunney's practical framework for occupational and environmental medicine emphasizes clinical assessment and risk stratification over universal radiography [7], while Pachman's systematic review for the World Health Organization underscored the weak evidence base supporting routine chest X-rays in healthy job applicants [8]. Even in non-medical industries, where environmental hazards may differ, Macdonald and Small demonstrated that statistical modeling and focused hazard assessment can more efficiently identify at-risk sites than indiscriminate imaging [9].

Nevertheless, certain high-risk setting such as regions with elevated tuberculosis prevalence—may still derive value from chest radiography. In one of the studies showed that targeted radiographic screening in Taiwan's industrial workforce improved tuberculosis detection among newly hired employees with positive tuberculin tests [10]. In the Kingdom of Saudi Arabia, King Abdulaziz Medical City (KAMC) operates one of the largest health systems in the

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region, serving a diverse workforce with variable exposure risks [11]. Local policy continues to mandate chest X-rays for all pre-employment applicants, yet the clinical utility and cost-benefit of this practice remain unclear.

Given these conflicting data and evolving international recommendations, recent literature has called for protocol re-evaluation. A study demonstrated the futility of universal pre-employment chest radiographs in a U.S. cohort, finding that nearly all films were normal and urging restriction to those with relevant clinical or epidemiologic risk factors [12]. More recently, Adeko and colleagues reviewed pre-employment radiographs in healthcare workers and similarly recommended limiting mandatory imaging to older or symptomatic candidates [13]. Against this backdrop, there is a clear need to reassess the role of routine chest radiography in pre-employment screening at KAMC, to ensure alignment with evidence-based best practices while safeguarding both patient safety and resource stewardship.

Aim of the Study:

The aim of this study is to assess the role of routine chest X-ray in Pre-employment screening
at King Abdul-Aziz Medical City, Riyadh, Saudi Arabia.

Specific Objectives:

To determine the diagnostic yield of routine pre-employment chest radiographs at King Abdulaziz Medical City (KAMC)

Secondary Objectives:

To evaluate the proportion of abnormal findings that result in further diagnostic workup or changes in employment clearance.

II. MATERIALS & METHODS

Study Setting, Subjects & Setting:

King Abdulaziz Medical City (KAMC) in Riyadh began operations in May 1983 and has since expanded to serve a rapidly growing patient population across its regions. All new employees receive a job offer contingent upon completing a Pre-Employment Medical Examination (PEME) at the hospital's clinic, which includes a clinical evaluation and a mandatory posteroanterior chest X-ray regardless of clinical presentation, job difficulty, or anticipated tenure. Each radiograph is interpreted and reported by the department's radiologist. A retrospective cross-sectional study was conducted from February 2, 2020, to January 1, 2021.The minimum required sample size was as 139; fixed to 140 calculated using Rao soft online sample size calculators with 955 confidence level and 0.05% margin of error.

Inclusion Criteria:

The study included both females and males.

All employee aged from 18-year-old and above, who underwent chest x ray(posteroanterior)

Exclusion Criteria:

Pregnant woman, post-operative patients, and pediatric patients less than 15 years old

Data Collection:

Data for this retrospective study were collected to reevaluate the utility of routine pre-employment chest radiography at KAMC. Using a standardized data collection form, we extracted age, gender, and chest X-ray findings from the Ambulatory X-ray unit's records. Informed consent was waived due to the study's retrospective design.

Statistical Analysis:

The collected data were entered in Microsoft Excel and transferred to IBM SPSS Statistics for Windows, Version 29 (Released 2023; IBM Corp., Armonk, New York, United States) for statistical analysis. The data from this study was obtained using random sampling technique. Descriptive statistics were used to explain the demographic characteristics of the subjects including their radiological finding.

Ethical Considerations:

Ethical approval was obtained from the Institutional Review Board (IRB) of King Abdullah International Medical Research Centre (KAIMRC), Riyadh, Saudi Arabia.

III. RESULTS & DISCUSSION

A total of 140 pre-employment candidates were included in the analysis. Their age distribution was as follows: 40 (28.6%) were 20–26 years old, 55 (39.3%) were 27–33 years, 25 (17.9%) were 34–40 years, and 20 (14.3%) were over 41 years (Table 1). Females comprised 58.6% (n = 82) of the cohort, while males accounted for 41.4% (n = 58).

All 140 chest radiographs were reported as normal, with no abnormalities detected in any age group (100% normal in each of the four age brackets) (Table 2) or in either gender (100% normal for both males and females) (Table 3). Given the absence of any abnormal findings, no significant association could be established between radiographic results and either age or gender. Reconsider routine screening whereby the given the zero abnormal-finding rate, mandatory chest X-rays for all asymptomatic pre-employment applicants may be of low diagnostic yield.

Table1. Demographic distribution of employee (n=140)

Characteristics	Frequency (%)
Age (years):	
20-26	40 (28.57)
27-33	55 (39.28)
34-40	25 (17.85)
Above 41	20 (14.28)

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Gender:	
Male	58 (41.42)
Female	82 (58.57)

Table 2. Chest X-ray report and age

Age group (years)	CXR reports	
	Normal (%)	Abnormal (%)
20-26	40 (100)	-
27-33	55 (100)	-
34-40	25 (100)	-
Above 41	20 (100)	-

CXR: Chest X-ray

Table 3. Chest X-ray reports and gender distribution

Gender	CXR reports	
	Normal (%)	Abnormal(%)
Male	58 (100)	-
Female	82 (100)	-

CXR: Chest X-ray

Consider restricting routine CXR to higher-risk subgroups (e.g., older age, known tuberculosis contacts, respiratory symptoms) to optimize resource use and minimize unnecessary radiation exposure. Adopt risk-based protocols and implement a two-tier screening algorithm: clinical questionnaire plus targeted CXR only when indicated by risk factors or clinical findings. This aligns with evidence-based recommendations favoring selective over universal imaging. Radiation safety such as reducing unnecessary radiographs supports ALARA principles is crucial for occupational health by avoiding incremental radiation dose in a predominantly young and healthy workforce. Policy updates and education and revise institutional PEME guidelines to reflect these findings. Educate occupational health clinicians and hiring managers on the low yield of routine CXRs in this population and the benefits of a more judicious approach. Ongoing audit and monitoring by establishing a periodic audit of pre-employment screening outcomes to ensure that any protocol changes maintain sensitivity for detecting clinically significant conditions while further refining cost-effectiveness and safety. In this study of 140 pre-employment candidates, we observed a 100% normal chest X-ray rate across all age groups and in both sexes. These findings echo similar low diagnostic yields reported in other settings. For instance, Chukwuani et al. audited 725 pre-employment radiographs in South-Western Nigeria and found 94.8% normal films, leading to the recommendation that routine imaging be reserved for those with clinical indications [14]. Likewise, Abuchi and Okpala reported no significant abnormalities in 198 pre-employment chest X-rays in Anambra State, questioning the utility of mandatory radiographs in asymptomatic populations [15]. The uniformly normal findings also align with studies highlighting the limited value and potential unfairness of blanket chest X-ray screening. Naz et al. reviewed over 63,000 radiographs and concluded that using chest X-rays as the sole screening tool results in low specificity and may unjustly preclude healthy individuals. Samuel et al. further demonstrated that only 0.17% of 4,113 candidates required follow-up based on radiographic findings, suggesting that routine chest radiographs should be restricted to those with pertinent history or symptoms [16]. In regions with higher tuberculosis (TB) prevalence, targeted imaging may still hold value. A study in Taiwan showed that lateral chest views improved TB detection among newly hired employees with positive tuberculin tests, highlighting the benefit of risk-based radiography in specific subgroups [18]. Conversely, in high-prevalence settings, universal pre-entry radiographs did not significantly increase case detection, leading some authors to advocate for selective screening based on exposure history rather than universal practice [17]. Incidental findings ("incidentalomas") have been reported in healthy cohorts, with Ezeofor et al. identifying incidental abnormalities in 7.1% of 311 pre-employment radiographs, though only 2.6% were clinically significant [19]. However, in our cohort, no incidental findings were seen, possibly reflecting demographic or occupational differences. Similarly, an audit of 3,859 student pre-admission radiographs found a small proportion of unexpected findings, but most films remained normal [20]. Collectively, these data—coupled with our results—underscore the low yield of routine pre-employment chest radiography in asymptomatic, low-risk populations. We recommend shifting from universal to risk-based screening protocols at KAMC, incorporating clinical questionnaires and targeted imaging only for those with epidemiologic risk factors or suggestive clinical features. Such an approach would uphold patient safety by minimizing unnecessary radiation exposure, streamline resource utilization, and align institutional practice with evidence-based guidelines.

IV. CONCLUSION

Given the absence of any abnormal findings, no significant association could be established between radiographic results and either age or gender. Reconsider routine screening whereby the given the zero abnormal-finding rate, mandatory chest X-rays for all asymptomatic pre-employment applicants may be of low diagnostic yield. A larger sample size may be necessary to generate robust empirical evidence on this issue.

REFERENCES

[1] Lohiya GS, Tan-Figueroa L, Lohiya P, Bui D. The futility of universal pre-employment chest radiographs. *J Natl Med Assoc.* 2006;98(12):2019–23.

[2] McCunney RJ. *A practical approach to occupational and environmental medicine.* 3rd ed. Philadelphia: Lippincott

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Williams & Wilkins; 2003.

[3] Pachman J. Evidence base for pre-employment medical screening. *Bull World Health Organ.* 2009;87(7):529–34.

[4] Macdonald J, Small M. Assessing sites contaminated with unexploded ordnance: statistical modeling of ordnance spatial distribution. *Environ Sci Technol.* 2006;40(3):931–8.

[5] Su S, Chiu C, Chang C, Chen K, Lin C, Guo H. Screening for pulmonary tuberculosis using chest radiography in new employees in an industrial park in Taiwan. *Am J Infect Control.* 2007;35(4):254–9.

[6] National Guard Health Affairs (NGHA). *King Abdulaziz Medical City, Riyadh* [Internet]. Riyadh: NGHA; 2020 [cited 2020 Apr 7]. Available from: https://ngha.med.sa/Arabic/MedicalCities/AlRiyadh/Pages/default.aspx

[7] Deasy J. X-ray examination of NHS employees. *BMJ.* 1978;1(6111):505.

[8] Belfield PW, Arnold AG, Williams SE, Bostock AD, Cooke NJ. Recent experience of tuberculosis in junior hospital doctors in Leeds and Bradford. *Br J Dis Chest.* 1984;78(3): 313–6.

[9] Medical Research Council. The geographical distribution of tuberculosis notifications in a national survey of England and Wales (1978–79). *Tubercle.* 1982;63(2):75–88.

[10] Harrington JM, Shannon HS. Incidence of tuberculosis, hepatitis, brucellosis, and shigellosis in British medical laboratory workers. *BMJ.* 1976;1(6012):759–62.

[11] Horne N. Control and prevention of tuberculosis: a code of practice. *Thorax.* 1984;39(5):321–5.

[12] Jachuck SJ, Bound CL, Price P. The importance of tuberculin retesting in the adult community at risk. *J R Coll Gen Pract.* 1984;34(261):210–2.

[13] Adeko OO, Ariba AJ, Olatunji AA, Toyobo OO. Routine chest radiograph in pre-employment medical examination for healthcare workers: Time for a review of the protocol. *Niger Postgrad Med J.* 2017;24(2):93-96.

[14] Chukwuani AE, Osanaiye A, Eneje OF, Omiyi DO. An Audit of Routine Chest X-ray Done During Pre-Employment Medical Screening in South-Western Nigeria. *Cent Afr J Public Health.* 2017;3(4):51-54.

[15] Nwankwo N (or author unspecified). The relevance of pre-employment chest X-Ray examination in Anambra State, Southeast Nigeria. *J Biomed Invest.* 2008;5(1).

[16] Samuel VJ, Gibikote S, Kirupakaran H. The routine pre-employment screening chest radiograph: Should it be routine? *Indian J Radiol Imaging.* 2016;26(3):402-404.

[17] Jasper A, Gibikote S, Kirupakaran H, Christopher DJ, Mathews P. Is routine pre-entry chest radiograph necessary in a high tuberculosis prevalence country? *J Postgrad Med.* 2020 Apr-Jun;66(2):90-93.

[18] Eisenberg RL, Romero J, Litmanovich D, Boiselle PM, Bankier AA. Tuberculosis: value of lateral chest radiography in pre-employment screening of patients with positive purified protein derivative skin test results. *Radiology*. 2009 Sep;252(3):882-887

[19] Ezeofor SN, Onuh AC, Mgbe EK, Dim NR, Nnamani AO, Anyanwu GE, Eke CB. Incidentalomas in chest radiograph of apparently healthy individuals presenting for pre-employment medical examination in Enugu State, Nigeria. *Niger J Clin Pract.* 2024;27(9):1039–43.

[20] Ogbeide OU, Adeyekun AA. An audit of 3859 pre-admission chest radiographs of apparently healthy students in a Nigerian tertiary institution. *Niger Med J.* 2011;52(4):260-262.