Original Article

Clinical Reporting of Pneumonia Chest Radiographs by Filipino Radiographers: A Diagnostic Accuracy Study

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Abstract

Pneumonia is a leading cause of morbidity and mortality, and chest radiography remains central to diagnosis. Global radiologist shortages have renewed interest in radiographer reporting, yet evidence from low and middle income countries is scarce. This diagnostic accuracy study assessed the performance of Filipino radiographers in reporting pneumonia chest radiographs against a radiologist reference standard. Ten registered radiographers from hospitals and diagnostic centers in Iligan City interpreted a set of 30 anonymised chest radiographs that included 10 normal and 20 abnormal images, with pneumonia and other pathologies. Sensitivity, specificity, and overall agreement were calculated for all cases and for pneumonia cases alone, and compared with radiologist readings. For all cases, mean sensitivity was 94.49%, specificity 39.77%, and agreement 59.67%. For pneumonia cases, mean sensitivity was 91.18%, specificity 55.55%, and agreement 67.00%. Sensitivity did not differ significantly from radiologists, while specificity and agreement did. Filipino radiographers showed strong ability to detect abnormality but difficulty in classifying normal studies, indicating the need for structured reporting education and formal role development.

Keywords: chest radiography, diagnostic accuracy, pneumonia, radiographer reporting

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1. Introduction

Pneumonia remains a major cause of preventable death worldwide and continues to strain health systems in low and middle income countries. Chest radiography is still the most widely used imaging test for suspected pneumonia because it is inexpensive, rapid, and available at lower levels of care compared with computed tomography or magnetic resonance imaging (Li et al., 2020; Hofmeister et al., 2024). In practice, however, chest radiographs often wait for specialist interpretation, especially in settings with few radiologists.

The global shortage of radiologists has been described as a structural threat to timely diagnosis. Recent reviews show that diagnostic demand continues to rise faster than radiologist workforce growth and that underserved populations have limited access to imaging and expert reporting (Afshari Mirak et al., 2025; Alipio et al., 2025; Clemen et al., 2023; DeStigter et al., 2021; Frija et al., 2021; Pelias et al., 2023). In response, many health systems have expanded the scope of radiographers to include image interpretation and formal reporting. Meta analysis shows that trained radiographers can reach high levels of accuracy in plain film reporting, with pooled performance above 90 percent when compared with radiologist standards (Brealey et al., 2005; Piper et al., 2014).

The United Kingdom has the most mature model of reporting radiographers. Studies there show that radiographer chest radiograph reporting can match consultant radiologist accuracy and can shorten time to diagnosis for serious disease such as lung cancer (Woznitza et al., 2018; Woznitza et al., 2023). Similar results appear in more recent comparisons where radiographer and radiologist performance for chest radiographs did not differ significantly (Trivett et al., 2024). These findings support advanced practice roles for radiographers as part of multidisciplinary reporting teams.

In the Philippines, radiographer reporting is not yet an established role. A recent study in rural health units showed that Filipino radiographers with targeted education achieved sensitivity and specificity above 90 percent for tuberculosis on chest radiographs and that even untrained radiographers performed at an acceptable level (Alipio et al., 2022). That work suggested that Filipino radiographers can contribute to first line interpretation in resource constrained settings, although evidence remains limited.

At the same time, technology is reshaping image interpretation. Deep learning models now reach high accuracy for automated detection of pneumonia and other thoracic findings on chest radiographs, yet they still require careful integration with human readers and local workflows (Li et al., 2020; Becker et al., 2022; Usman, 2025; Avola et al., 2022). In low and middle income countries, the most realistic short term strategy remains upskilling existing radiography staff and embedding them in supervised reporting pathways.

The present study evaluated the diagnostic performance of Filipino radiographers in clinical reporting of pneumonia chest radiographs. The primary objective was to estimate sensitivity, specificity, and agreement when radiographers

distinguished normal from abnormal studies and identified pneumonia, and to compare these metrics with a radiologist gold standard. The findings aim to inform decisions about role expansion, education, and service redesign in the Philippine context.

2. Methodology

2.1 Design

The study used a prospective diagnostic accuracy design. Radiographers interpreted a fixed set of anonymised chest radiographs, and their reports were compared with a reference standard established by radiologists.

2.2 Setting and Participants

The study took place in Iligan City in Northern Mindanao, Philippines. Radiographers were recruited from four institutions: a private tertiary hospital, two diagnostic centers, and a multipurpose cooperative that provides imaging services. All institutions routinely perform chest radiography and serve mixed urban and peri urban populations.

Ten registered radiologic technologists participated. Inclusion criteria were current clinical practice in general radiography and at least one year of post registration experience. Radiographers with formal postgraduate training in chest radiograph reporting were excluded to focus on real world performance under current training conditions.

2.3 Chest Radiograph Set and Reference Standard

The research team assembled a set of 30 anonymised digital chest radiographs. Demographic identifiers were removed. Age, sex, and alphanumeric codes were retained. The set contained 10 normal radiographs and 20 abnormal radiographs, including cases of pneumonia and other thoracic pathologies. The mix allowed assessment of both general abnormality detection and pneumonia specific performance.

Two board certified radiologists, each with more than five years of thoracic imaging experience, independently reported all radiographs. Disagreements were resolved by consensus, which served as the reference standard for presence of pneumonia and for normal versus abnormal status.

2.4 Reading Procedure

Radiographers received the 30 radiographs in digital format with basic clinical details mimicking routine practice. They viewed the images on calibrated diagnostic monitors at their own institutions. Each radiographer judged whether each radiograph

was normal or abnormal. For abnormal films they indicated whether pneumonia was present. They also wrote a short free text summary, though this study focused on binary classifications.

Radiographers worked independently and had no access to clinical records, laboratory results, or each other's reports. They were unaware of the proportion of normal and abnormal cases. No feedback was given during data collection.

2.5 Outcome Measures and Statistical Analysis

For each radiographer, classifications were cross tabulated against the radiologist consensus. Four counts were derived: true positives, true negatives, false positives, and false negatives. Sensitivity described the proportion of abnormal or pneumonia cases correctly identified. Specificity described the proportion of normal or pneumonia absent cases correctly identified. Overall agreement represented the proportion of all radiographs with concordant radiographer and radiologist classifications.

Performance metrics were calculated in two ways: for all 30 radiographs and for the pneumonia subset. For group level results, counts were pooled across radiographers. Mean sensitivity, specificity, and agreement were then obtained. Differences between radiographers and radiologists were tested with McNemar type comparisons, with significance set at $p < .05$.

2.6 Ethical Considerations

The IMCC institutional ethics review committee approved the protocol. The radiograph set used de identified images from routine clinical care. All radiographers signed informed consent. No patient was contacted, and no clinical decisions depended on study readings.

3. Results

3.1 Overall Diagnostic Performance for All Chest Radiographs

Ten radiographers interpreted 30 radiographs each, yielding 300 individual readings. Table 1 summarises pooled diagnostic performance for all cases. Radiographers identified most abnormal radiographs. Sensitivity for all abnormal findings was 94.49 percent. Specificity was 39.77 percent, which showed frequent misclassification of normal images as abnormal. Overall agreement with radiologists across all cases was 59.67 percent.

Table 1. Sensitivity, specificity, and agreement rates for all chest radiographs.

Metric	Value
True positives	107
True negatives	72
False positives	115
False negatives	6
Sensitivity (%)	94.49
Specificity (%)	39.77
Overall agreement (%)	59.67

3.2 Diagnostic Performance for Pneumonia Cases

For pneumonia specific analysis, counts were restricted to radiographs with or without pneumonia according to the reference standard. Table 2 shows pooled performance. Compared with the all case analysis, pneumonia sensitivity remained high at 91.18 percent. Specificity increased to 55.55 percent, and agreement rose to 67.00 percent. Radiographers still misclassified a substantial share of non-pneumonia cases as pneumonia.

Table 2. Sensitivity, specificity, and agreement rates for pneumonia cases.

Metric	Value
True positives	62
True negatives	72
False positives	57
False negatives	6
Sensitivity (%)	91.18
Specificity (%)	55.55
Overall agreement (%)	67.00

3.3 Comparison with Radiologist Reference Standard

Radiologists, by definition of the reference standard, achieved 100 percent sensitivity, specificity, and agreement in both the all case and pneumonia analyses. Table 3 and Table 4 summarise the statistical comparison. There was no significant difference between radiographers and radiologists in sensitivity for all cases and for pneumonia specific cases. Differences in specificity and overall agreement were statistically significant in both analyses.

Table 3. Comparison of radiographers and radiologists for all chest radiographs.

Outcome	Radiologist (%)	Radiographer (%)	p-value	Interpretation
Sensitivity	100.00	94.49	0.082	Not significant
Specificity	100.00	39.77	< 0.001	Significant
Agreement	100.00	59.67	< 0.001	Significant

Table 4. Comparison of radiographers and radiologists for pneumonia cases.

Outcome	Radiologist (%)	Radiographer (%)	p-value	Interpretation
Sensitivity	100.00	91.18	0.061	Not significant
Specificity	100.00	55.55	< 0.001	Significant
Agreement	100.00	67.00	< 0.001	Significant

4. Discussion

This study is one of the first to quantify the diagnostic performance of Filipino radiographers in clinical reporting of pneumonia chest radiographs. The main finding is a pattern of very high sensitivity but modest specificity. Radiographers reliably identified abnormal and pneumonia positive films, yet struggled to recognise normal or non-pneumonia studies.

The high sensitivity aligns with global evidence that radiographers can become safe front line readers. A meta-analysis of radiographer plain film reporting found accuracy rates that approximated those of radiologists when appropriate training and governance were in place (Brealey et al., 2005). Studies focused on chest radiographs show similar trends. Piper and colleagues reported that trained radiographers could correctly identify normal chest radiographs and could describe abnormal findings clearly (Piper et al., 2014). In a multicentre study, reporting radiographers achieved chest radiograph performance that was not inferior to consultant radiologists when they had completed formal postgraduate education (Woznitza et al., 2018).

The current study differs in one important respect. The Filipino radiographers evaluated here had no structured postgraduate reporting education. Their performance therefore reflects the baseline that can be expected from image acquisition specialists working in busy general radiography departments. That sensitivity still rose above 90 percent for pneumonia cases suggests that everyday exposure to chest radiographs and informal feedback have already shaped robust abnormality detection skills.

The low specificity and moderate agreement require closer attention. Frequent misclassification of normal films as abnormal is consistent with a cautious interpretive strategy. Radiographers in this study appeared more willing to over call doubtful findings than to risk missing disease. Similar patterns have been observed in early stages of radiographer reporting schemes in the United Kingdom, where radiographers initially showed a bias toward sensitivity that later balanced out after feedback and mentoring (Wood, 2022; Piper et al., 2014). From a patient safety perspective, false

positives are less harmful than false negatives but they still create cost, anxiety, and downstream investigations.

Context helps explain these findings. The Philippines faces the same structural drivers that have prompted radiographer reporting elsewhere. Global analyses estimate that up to two thirds of the world population lack adequate access to imaging and timely reports, with the problem most severe in low and middle income countries (Frija et al., 2021; DeStigter et al., 2021). Recent work on the future of imaging and radiology workforce in high income settings also describes mounting pressure from rising volumes and an inadequate labour force (Afshari Mirak et al., 2025; Siewert et al., 2025). In that environment, health systems increasingly look to radiographers, decision support tools, and artificial intelligence to protect diagnostic quality and turnaround time.

Philippine data already show that Filipino radiographers can reach high performance when they receive structured training. In rural health units, radiographers who completed a chest radiograph reporting education programme achieved sensitivity and specificity of about 95 percent for tuberculosis, while untrained radiographers still performed at acceptable levels (Alipio et al., 2022). The present findings are consistent with that work and extend it to pneumonia. Together these studies suggest that targeted education, supervised practice, and clear governance can convert the underlying potential into safe reporting roles.

Technology will influence the next steps. Deep learning systems now match or surpass human performance for pneumonia and other thoracic findings on curated chest radiograph datasets, with area under the curve values above 0.90 and sensitivity around 95 percent in external validation cohorts (Li et al., 2020; Becker et al., 2022; Avola et al., 2022; Usman, 2025). These tools should not replace radiologists or radiographers in the near term, but they can serve as second readers or triage engines, particularly in settings with few specialists. An integrated model in which algorithms flag probable pneumonia cases, radiographers provide structured reports under protocol, and radiologists focus on complex or discordant studies may offer a realistic compromise in the Philippine context.

This study has limitations. The radiograph set was relatively small and may not capture the full spectrum of pneumonia severity or mimic the disease prevalence in routine practice. The sample included only ten radiographers from one city, which limits generalisability. The study also focused on binary normal versus abnormal and pneumonia versus non pneumonia judgments rather than full narrative reporting quality. Despite these constraints, the work provides clear quantitative signals: Filipino radiographers can detect pneumonia with high sensitivity but require support, education, and governance to improve specificity and consistency.

Future research should use larger, more diverse image sets, include radiographers from multiple regions, and evaluate structured reporting templates and training programmes. Studies that combine human readers and artificial intelligence systems would also help clarify how each component contributes to diagnostic accuracy and efficiency in real world Philippine radiology services.

5. Conclusion

Filipino radiographers in this study detected pneumonia and other chest radiograph abnormalities with high sensitivity but showed limited specificity and only moderate agreement with radiologists. These findings indicate that radiographers in Iligan City already have strong abnormality detection skills, likely shaped by repeated exposure to thoracic imaging, yet they need structured education and supervised experience in formal reporting to refine their thresholds and reduce false positives.

In a health system that faces radiologist shortages and persistent pneumonia burden, a phased expansion of radiographer reporting, backed by clear standards, postgraduate training, and supportive technology, could improve access to timely chest radiograph interpretation. Policy makers and professional bodies in the Philippines may use this evidence to design pilot programmes, define competency frameworks, and build collaborative reporting teams that place radiographers at the centre of safe, efficient pneumonia diagnosis.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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