

P3.010: Comparative Analysis of Low-Dose CT Lung Cancer Screening in Kazakhstan According to Regional Indoor Radon Burden

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INTRODUCTION

Lung cancer remains a leading cause of cancer-related mortality in Kazakhstan. Regional data suggest that higher indoor radon burden is associated with less favorable lung cancer incidence and mortality patterns. This study compared low-dose computed tomography (LDCT) screening findings between radon-burdened regions of Kazakhstan and the less radon-contaminated city of Almaty.

METHODS

Design

Comparative analysis of two population-based LDCT lung cancer screening cohorts in Kazakhstan, combined with an ecological, region-level analysis of indoor radon burden and lung cancer incidence and mortality.

Setting

Three regions with high lung cancer burden and established LDCT capacity (East Kazakhstan, Pavlodar, Kostanay), compared with Almaty city.

Participants

Regional cohort: 3,671 asymptomatic participants aged 40–75 years. Comparison cohort: 3,000 participants aged 49–71 years screened in Almaty, 2021–2023.

Index test

Single-round low-dose CT, categorised using Lung-RADS v2022. In the regional cohort a positive screen was defined as Lung-RADS 3 or higher.

Region-level exposure

Indoor radon burden, defined as the proportion of dwellings exceeding 20 Bq/m³.

Outcomes

Nodule positivity, Lung-RADS distribution, cancer detection rate, stage at diagnosis, diagnostic performance and smoking history.

Analysis

Correlation of region-level radon burden with lung cancer incidence and mortality; between-cohort comparison of screening outcomes.

Ethics

Institutional ethics committee approval, protocol No. 025-34, 23 July 2025.

DISCUSSION AND CONCLUSION

Discussion

LDCT screening in radon-burdened regions of Kazakhstan showed higher nodule positivity and higher lung cancer detection than in the less radon-contaminated Almaty cohort, consistent with the less favourable incidence and mortality patterns observed in those regions. The correspondence between regional radon burden and disease burden held across the country, and in both cohorts a large share of the cancers found occurred in people with former or never smoking history — a group that conventional smoking-based eligibility criteria would not have reached.

Conclusion

These findings support a risk-adapted LDCT screening strategy that prioritises regions with higher indoor radon burden, and indicate that screening eligibility should not rely on smoking history alone.

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AI tools used: Grammarly — language editing of the abstract and poster text; Claude (Anthropic) — assistance with poster structure and figure layout. No scientific content, data or conclusions were generated by AI; all content was authored and verified by the listed authors.

RESULTS

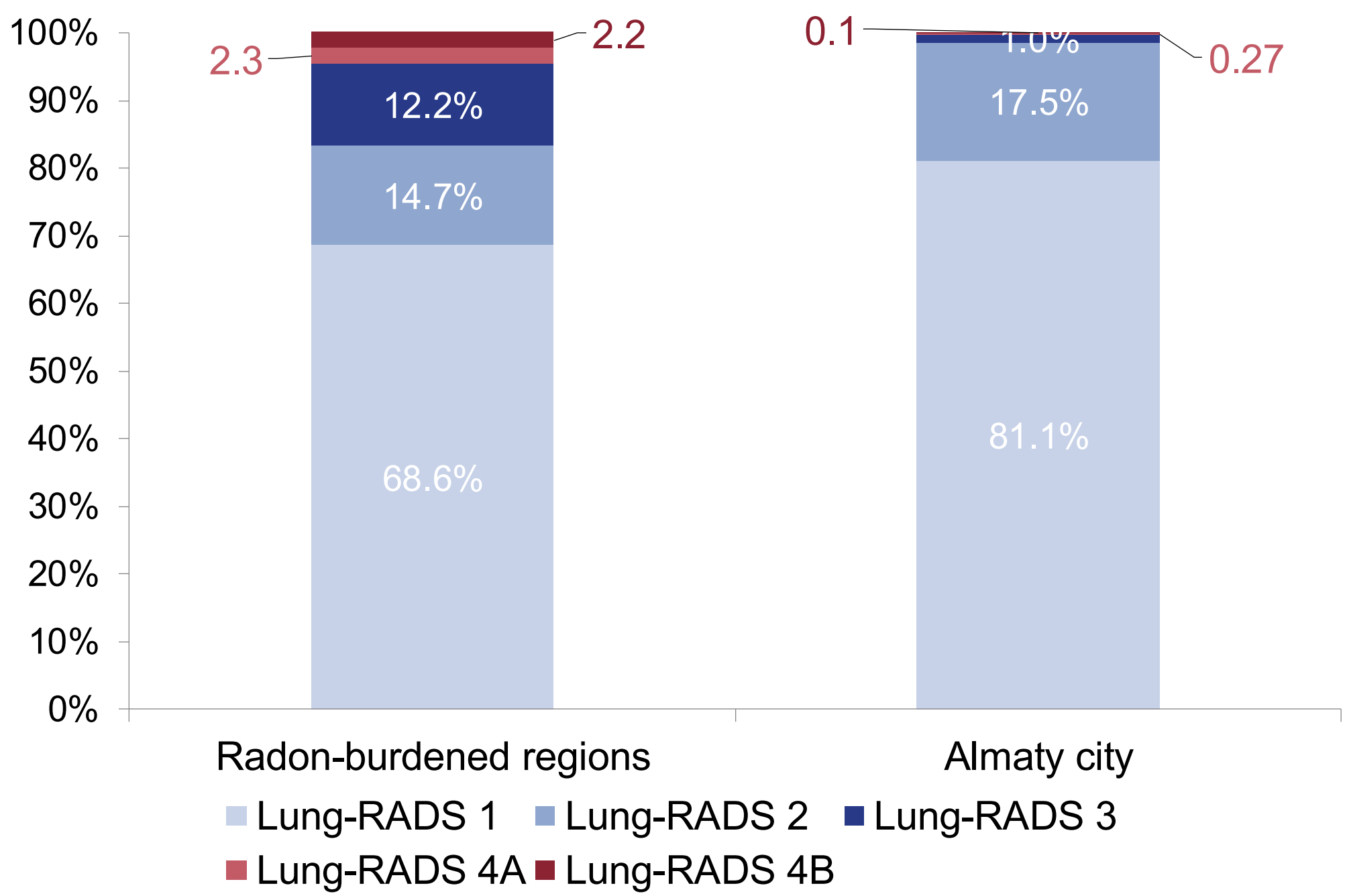
Across Kazakhstan regions, indoor radon burden was directly correlated with lung cancer incidence ($r=0.8$) and mortality ($r=0.7$). The four regions studied are shown below.

Table 1. Region-level indoor radon burden and lung cancer rates

Region	Dwellings >20 Bq/m³, %	LC incidence /100,000	LC mortality /100,000
Kostanay	47.6	34.9	15.4
Pavlodar	33.8	36.6	22.0
East Kazakhstan	29.1	30.2	25.0
Almaty city	12.8	18.2	12.6

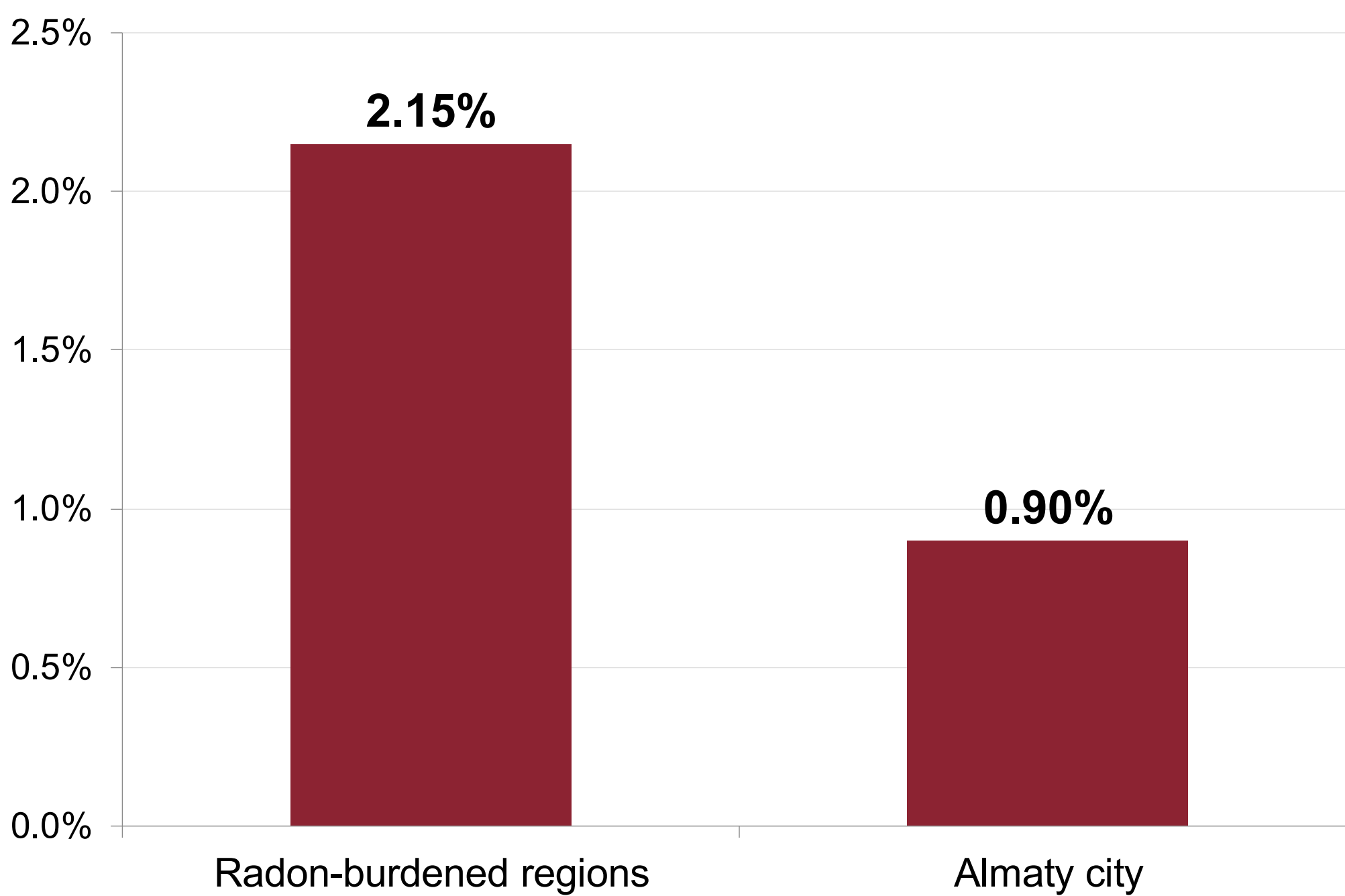
Correlation coefficients were calculated across all Kazakhstan regions, not the four shown here.

Figure 1. Lung-RADS distribution



Lung-RADS 3 or higher accounted for 16.7% of screens in the radon-burdened regions versus 1.4% in Almaty city.

Figure 2. Cancer detection rate



79 lung cancers among 3,671 participants versus 27 among 3,000 — a 2.4-fold higher detection rate.

Table 2. Screening cohorts, findings and diagnostic performance

	Radon-burdened regions	Almaty city
Participants, n	3,671	3,000
Age range, years	40–75	49–71
Pulmonary nodules, %	31.4	18.9
Lung-RADS 3 or higher, %	16.7	1.4
Screen-detected lung cancers, n	79	27
Cancer detection rate, %	2.15	0.90
Stage I–II among detected cancers, %	39.2	41.7
Former or never smoking history among detected cancers, %	54.1	55.3
Sensitivity, %	94.1	92.6
Specificity, %	85.2	99.46

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