



# Geospatial Analysis of Lung Cancer in Denmark: Identifying Opportunities for Decentralized Oncology Care

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## INTRODUCTION

Delivering cancer care closer to patients' homes is a key priority in the Danish healthcare system, aiming to improve patient experience and optimize healthcare system capacity.

Lung cancer is one of the most common cancers in Denmark, yet its geographic distribution and implications for care delivery models remain underexplored.

Assessing whether incidence aligns with proximity to treatment centers is essential to inform decentralized care strategies.

## OBJECTIVES

In this study, we examine the relationship between lung cancer incidence and proximity to treatment centers across 98 Danish municipalities.

We aim to:

- Quantify geographic variation.
- Assess the correlation between lung cancer incidence and travel distance to treatment centers.
- Identify regions where high cancer burden and significant travel barriers create a strong case for decentralized oncology care.

## METHODS

A nationwide geospatial analysis across 98 municipalities using:

- Lung cancer incidence data<sup>1</sup>
- Demographic data<sup>2</sup>
- Treatment center locations from national hospital registries

Distances calculated using a Haversine-based model (tortuosity factor 1.35). Travel time assumed 64 km/h effective speed.

Linear regression was used to assess the relationship between incidence and distance, with bootstrap resampling (n = 2,000) to estimate confidence intervals.

Municipalities were grouped into quintiles. Those with fewer than 10,000 inhabitants were excluded from the primary analysis.

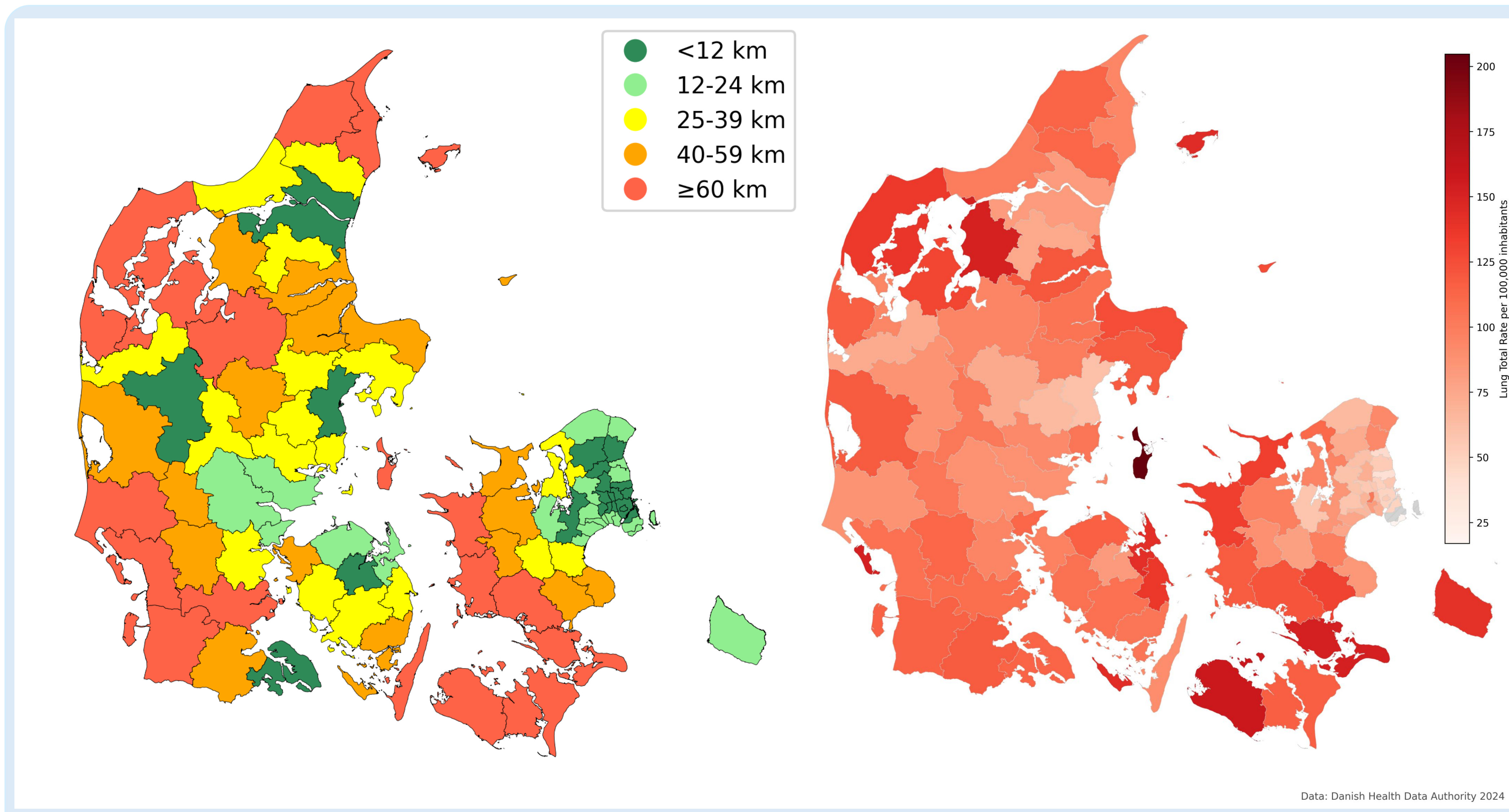


Figure 1. Relationship between municipality distance to treatment centers (left) and cancer incidence (right)<sup>1</sup>

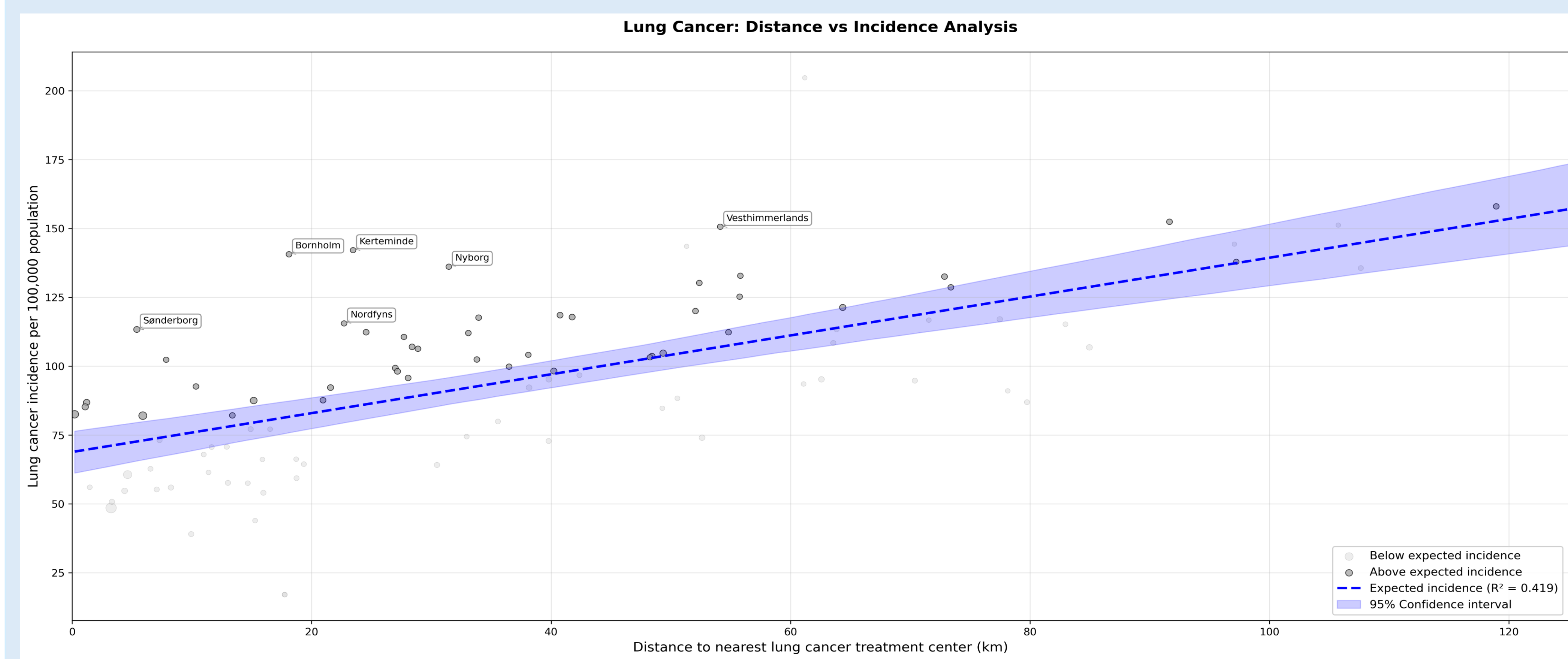


Figure 2. Lung Cancer scatter plot: Distance vs incidence plotted with bootstrap resampling (n = 2000).

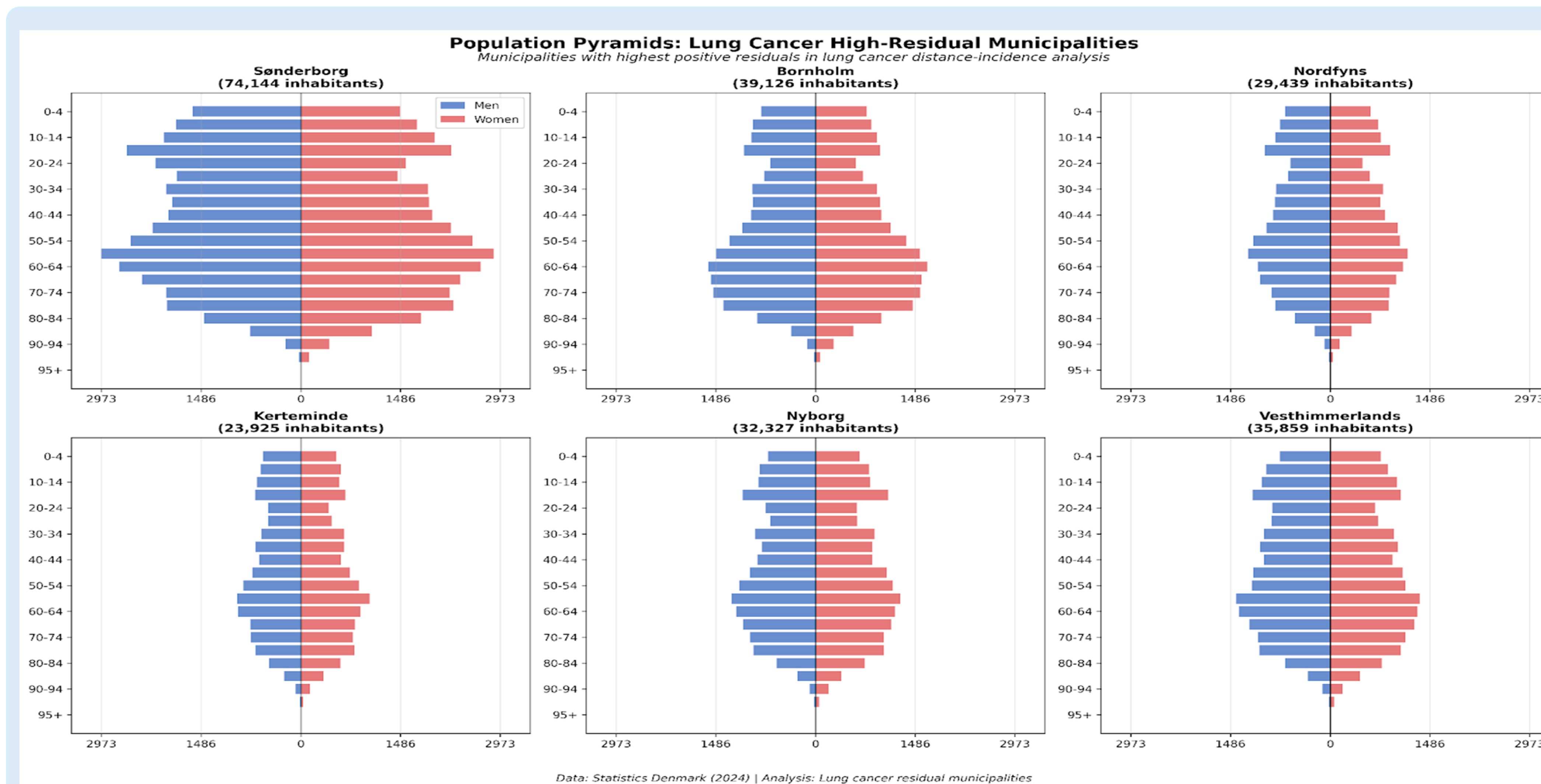


Figure 3. Relationship between lung cancer incidence and distance to treatment centers

## RESULTS

- Significant correlation between distance to treatment centers and incidence ( $R^2=0.42$ ,  $p<0.001$ ).
- Travel distances ranged from 7 km to 217 km across Denmark, average of 65 km to nearest treatment center.
- Six municipalities demonstrated highest positive residuals (above-expected incidence): Sønderborg, Bornholm, Nordfyns, Kerteminde, Nyborg, and Vesthimmerlands.
- Demographic analysis reveals aging populations in identified municipalities, indicating substantial patient impact for community-based lung cancer services.

## DISCUSSION

The observed correlation between distance and incidence likely reflects a complex interplay of geographic isolation, socioeconomics, smoking patterns, and access barriers.

Priority municipalities are well-suited for decentralized solutions, given:

- A solid population base
- Significant travel barriers
- A higher-than-expected cancer burden
- Supportive demographics

While we are not proving causation, the analysis identifies clear zones for equity-driven health planning. Strategically, these areas are obvious candidates for piloting decentralized treatment where the regulatory label allows it.

Key limitations include estimated travel distances (not precise routing) and crude, non-age-standardized incidence rates, with potential confounding from registration practices.

## KEY MESSAGE

Distance to lung cancer care is associated with incidence in Denmark ( $R^2=0.42$ ), highlighting geographic disparities in access to care.

High-burden municipalities face the greatest travel barriers, with travel distances reaching up to 217 km.

Targeted decentralization in these areas is a clear next step to improve access, patient experience, and healthcare system efficiency.

## CONCLUSION

The analysis reveals significant geographic disparities across Denmark when comparing lung cancer cases with access to treatment. The correlation ( $R^2=0.42$ ) suggests that geography is a factor.

Our findings point to six priority municipalities as strong candidates for decentralized treatment pilots. These areas combine a high clinical need with significant access barriers. Moving treatment closer to citizens in these regions could improve patient outcomes and demonstrate the potential for new, more efficient models

## CONTACT AND CONFLICT OF INTEREST

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 Conflict of interest: All authors are employees of Roche A/S.

## REFERENCES

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2. Statistics Denmark, 2024