## **Avalere Health**<sub>m</sub>

# **Evaluation of US/European Deprivation Indices** Applications in Oncological, Health Economics and Outcomes Research (HEOR) Studies

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#### Introduction

- Numerous deprivation indices are in circulation at various geographic levels in HEOR research; these indices are aimed at characterizing an individual's socioeconomic and neighborhood-level risk-factor exposure and facilitate examination of health inequality questions in the real-world evidence space.
- In Europe, examples of area-level deprivation indices in the UK, France, and Ireland include the Townsend Deprivation index, Carstairs index, municipality-level deprivation indices, and Pobal HP Deprivation Index; in the US, examples include Area Deprivation Index (ADI), Social Deprivation Index, and Social Vulnerability Index.

Figure 1: Venn Diagram for Capturing Patient Experience and Barriers in Oncology Care



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While area-level deprivation or social determinants of health (SDOH) may be helpful for monitoring inequalities, area-level deprivation measures may vary in their usefulness depending on the exposure, size of the area, and heterogeneity within the area. Additionally, use of area-level measures may still not capture the individualized patient experience, such as SDOH risk exposure and barriers to care.

## Objectives

- To review and analyze the use of area-level deprivation indices for detecting social inequalities in oncology-focused HEOR studies
- To provide a narrative synthesis of patterns and relationships between studies and evaluate strengths and weaknesses of the area-level deprivation indices considered

#### Methods

- We conducted a thematic literature review of current existing peer reviewed data published between 1985-2020 that focused on using deprivation indices in oncological HEOR research, addressing health disparities, and SDOH.
- Study inclusion criteria for peer reviewed articles included a key word search using the following key words and Boolean operators (e.g., "deprivation index" AND "oncology" AND "health disparities"), sample size >500, and lung cancer.
- Studies were evaluated using index measures, application of deprivation index, and geography accuracy.

### Results

Deprivation measures are empirical summaries of area-level variance in deprivation areas; many of these measures are attempting to explain variance in multiple component areas.

#### Conclusions

- The use of ADI (Area Deprivation Index) in HEOR cancer research poses several strengths and limitations regarding identifying areas for disease intervention, population-level impact, and management from a geographical perspective.
- ADI as a macro-level measure may not capture individual socio-economic factors that influence health outcomes reported in oncology studies; however, it may enable researchers to assess the population impact of socioeconomic factors on cancer outcomes.
- Some confounding variables may not be accounted for in the neighbourhood-level measures, such as the ADI, that may negatively influence outcomes in oncology studies, such as treatment adherence, quality of care, and genetic factors.
- Although the use of ADI in oncological studies are common, it is important that researchers • continue to utilize patient-level data when available to supplement claim-based research that uses ADI.
- Application of area-level versus individual-level deprivation measures is important; area-level measures of deprivation may be helpful in identifying social characteristics of communities. Individual-level deprivation measures not always available in larger cancer databases.
- An area of ongoing research is whether associations exist between neighborhood-level deprivation measures independent of individual-deprivation measures (shown in some observational and clinical trial work alike) with lung cancer or with lung cancer specific mortality. A growing area of research is the synthesis of health disparity research concepts and oncological end points. For example, impactful findings related to late lung cancer diagnosis (e.g., stage 3) among individuals from most disadvantaged neighborhoods (ref 3 in table).
- ADI is the most frequently used area-level deprivation index used in our review of lung cancer studies. Studies do a sufficient job of describing linkage of area-level metrics to individual-metrics, but reproducibility of findings requires description of linkage by individual and by area.

#### Table 1: Thematic Review of Lung Cancer in Oncology Studies

ADI, SVI, or other SDOH summary measures are not meant to replace individual measures at the patient level, therefore, researchers must couple the use of ADI and alternative research methodologies to understand the lived experiences and social determinants of health factors not captured in the ADI in order to understand patient socioeconomic risk factors and how to advance lung cancer care.

#### References

- 1. Fairfield et al. JNCI Cancer Spectr. 2020 Mar 7;4(4):pkaa011.
- 2. Sanderson et al. BMJ Open 2018;8:e021059.
- 3. Cheng et al. JAMA Netw Open. 2021;4(12):e2139593.
- 4. Unger et al. J Clin Oncol. 2021 Apr 20;39(12):1339-1348.
- 5. Han et al. *Lancet Oncol*. 2023 Aug;24(8):855-867.

| Article                                    | Deprivation<br>Index  | Index Measures  | Application of<br>Deprivation Index  | Individual<br>Geolocation               | Geographic<br>Accuracy                    | Main Data Source   | Contributions  | Strengths/Limitations   |
|--|---|---|--|---|---|--|--|---|
| Fairfield et<br>al. (2020) <sup>1</sup>    | Area<br>Deprivation<br>Index  | Poverty, education,<br>housing, employment  | Lung cancer prevalence<br>(e.g., prevalence rate<br>ratio) by ADI quintiles                          | Zip Code                                | Census block<br>level                     | Statewide all-<br>payers claims<br>dataset (2012-<br>2016)   | <ul> <li>Deprivation (not rurality) associated<br/>with lung cancer prevalence</li> <li>Disentangle associations with<br/>deprivation compared to rurality</li> </ul>          | <ul> <li>+ Adjusted for demographic and behavioral factors (including smoking)</li> <li>- Single State</li> <li>- Area-level measure, not individual-level</li> </ul>   |
| Sanderson<br>et al.<br>(2024) <sup>2</sup> | Neighborhood-<br>level index;<br>first principal<br>component<br>from PCA                         | Education,<br>employment,<br>occupation, housing,<br>and poverty                              | Lung cancer prevalence<br>(by deprivation quartile)  | Addresses<br>geocoded to<br>coordinates | Block group<br>level                      | Prospective<br>Southern<br>Community Cohort<br>Study (2002-2009);<br>Linkage with state<br>cancer registries | - Area-level measures of SES associated<br>with lung cancer risk in black men only<br>after adjustment for smoking and<br>individual-level SES                                 | +Strong design (diversity, cancer registries,<br>density matching)<br>+Adjustment for smoking (including cigarettes<br>smoked per day, former smoking years)<br>+Effect modification by race and sex                          |
| Cheng et al.<br>(2021) <sup>3</sup>        | Neighborhood:<br>ADI (quintiles)<br>Individual:<br>Medicare-<br>Medicaid dual<br>eligibility (DE) | Education,<br>employment, housing<br>quality, poverty   | Lung-cancer specific<br>mortality  | Zip codes                               | Not described<br>(assume<br>Census block) | SEER Medicare<br>Database (2008-<br>2011); breast,<br>prostate, lung or<br>colorectal cancer                 | <ul> <li>Evaluating associations in<br/>neighborhood level vs. individual-level<br/>SES with survival</li> <li>No changes in associations with<br/>adjustment by DE</li> </ul> | +Large study population (16,684 with lung<br>cancer)<br>+Examined interactions between individual-<br>level SES and area-level SES<br>-No adjustment by behavioral factors, such<br>as smoking<br>-Older Medicare FFS only    |
| Unger et al.<br>(2021)⁴                    | ADI (quintiles)   | Education,<br>employment, housing<br>quality, poverty   | 5-year overall survival,<br>progression-free<br>survival, Lung-cancer<br>specific survival           | Zip codes                               | Not described<br>(assume<br>Census block) | SWOG Cancer<br>Research Network<br>(1985-2012; phase<br>II-III clinical trials)                              | -Multiple oncological outcomes showing<br>greater hazard in most deprived ADI<br>quintile compared to lowest ADI quintile  | +Adjustment for demographic, insurance,<br>prognostic risk, and urban/rural<br>+Cox frailty model with random effect for<br>enrollment, cancer-specific staging, and<br>prognosis<br>+Large study (n=41,109 all cancer types) |
| Han et al.<br>(2023)⁵                      | SDI   | Poverty, educational<br>attainment, housing<br>status, home/car<br>ownership,<br>unemployment | Change in number and<br>change in stage<br>distribution of new<br>cancer diagnoses from<br>2019-2020 | Zip codes                               | Zip code (ZCTA)                           | US National Cancer<br>Database (2018-<br>2020)   | -15% decrease in cancer diagnosis in<br>US; mirrors decrease seen in England in<br>2020 compared to 2019   | +Large study of 2.4 million adults with newly diagnosed cancer in the US around the pandemic  |