

ABSTRACT NO:22
RESEARCH ARTICLE**Quantifying the surgical mediation of income-based survival disparities in glioblastoma: a SEER causal four-way decomposition (2007–2022)**Abdul Rafay Khan¹, Sara Khan², Komal Khan³, Mohammad Shahmir Waqas⁴, Arslan Ali⁵**Abstract**

Objective: Socioeconomic survival disparities in glioblastoma (GBM) are documented, but whether they operate through differential receipt of surgical resection is unquantified. We estimated the proportion of the county income-based survival disparity in GBM transmitted through receipt of surgical resection, using causal four-way decomposition.

Methods: We analysed a population-based SEER 17-registry cohort of adults aged 18–64 with histologically confirmed GBM (ICD-O-3 9440/3) diagnosed from 2007 to 2022. The exposure was county-level median household income, lowest (Q1) versus highest (Q4) quartile. The mediator was receipt of surgical resection versus none or biopsy. The outcome was overall survival. We applied the VanderWeele four-way decomposition with a Cox survival estimator and an exposure–mediator interaction, adjusting for age, sex, diagnosis year, race/ethnicity, marital status, and rurality, with 1000 bootstrap replications. Robustness to unmeasured confounding was assessed using E-values.

Results: Among 19,051 patients, median overall survival rose from 12 months (Q1) to 15 months (Q4), whereas resection rates were near-identical (Q1 66.0%, Q4 68.9%). The lowest-income quartile carried a higher hazard of death than the highest (total-effect HR 1.23, 95% CI 1.17–1.30). Surgery mediated almost none of this gap (proportion mediated 2.6%, 95% CI –2.7 to 7.6%; pure indirect HR 1.00). The controlled direct effect persisted (HR 1.19, 95% CI 1.13–1.25), with a significant income–surgery interaction (proportion eliminated 28.0%, 95% CI 10.9–44.6%). E-values were 1.58 (total effect) and 1.50 (direct effect).

Conclusion: The income-based survival disparity in GBM is substantial but operates predominantly through non-surgical pathways; equalizing receipt of surgery alone would not close it. Unmeasured clinical confounders of moderate strength could account for the residual direct effect.

Keywords: Glioblastoma; Healthcare disparities; Mediation analysis

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