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Trans-Atlantic Disparity in the Incidence, Prevalence, and Mortality of Esophageal Cancer in the United States vs. Western, Central, and Eastern Europe, 1990–2023: A Global Burden of Disease Study 2023 with Bayesian Forecasting up to 2050 Highlighting Western Europe's Leading Survival Trends

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Abstract

Background

Esophageal cancer remains one of the deadliest malignancies worldwide despite advances in neoadjuvant chemoradiotherapy, minimally invasive surgery, and immunotherapy. We performed a transatlantic analysis to evaluate temporal changes in mortality-to-incidence ratios (MIR), a surrogate of case fatality, and prevalence-to-incidence ratios (P/I), reflecting disease chronicity, to compare outcomes across healthcare systems.

Methods

Global Burden of Disease (GBD) 2023 data (1990–2023) were analyzed for the United States, Western, Central, and Eastern Europe. Data were stratified by sex and age (15–49, 50–69, ≥70 years), yielding 24 demographic strata. Joinpoint regression estimated average annual percent changes (AAPCs) in incidence. Linear regression

with delta method uncertainty propagation evaluated MIR and P/I trends, while Bayesian forecasting projected incidence through 2050 ($\alpha=0.05$).

Results

Incidence AAPCs ranged from $-3.14\%/year$ (Eastern Europe females ≥ 70) to $+1.12\%/year$ (Eastern Europe females 15–49), with declines including Western Europe males 15–49 ($-1.39\%/year$). All 24 strata demonstrated declining MIR and increasing P/I ratios; 22/24 MIR and all 24 P/I trends were statistically significant ($p<0.05$ and $p<0.001$, respectively). Western Europe showed the greatest improvement, with MIR declines of 22.31% (females 15–49), 20.35% (males 15–49), 14.91% (females 50–69), 11.95% (males 50–69), 10.37% (females ≥ 70), and 9.03% (males ≥ 70). Corresponding P/I increases reached 32.74%, 30.80%, 29.82%, 28.88%, and 26.39%. Mean MIR decline was greatest in Western Europe

(14.82%), followed by the United States (5.93%), Eastern Europe (4.58%), and Central Europe (3.70%), while Western Europe also had the highest mean P/I increase (28.73%). Younger patients and females experienced the greatest gains. Divergence accelerated after 2012. Bayesian forecasts project 2050 incidence of 1.03/100,000 (Western Europe males 15–49), 0.30/100,000 (Western Europe females 15–49), and 1.36/100,000 (US males 15–49).

Conclusion

This 34-year analysis demonstrates a widespread, statistically significant improvement in survival

trends for esophageal cancer, characterized by a 100% success rate in improving MIR and P/I ratios across all 24 demographic strata. Western Europe's healthcare systems have seen population-level gains in MIR and P/I ratios that substantially outpace those observed in the United States and Central/Eastern Europe. As Bayesian Forecasts suggest, these findings serve as both a benchmark for European clinical excellence and highlight a widening survival gap through 2050 and suggest a need for the U.S. and Eastern Europe to evaluate the potential benefits of the centralized, multimodal care models utilized in Western Europe.

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