

IBCL – 936 - Chronification of Follicular Lymphoma Mortality: A 22-Year National Multiple-Cause-of-Death Analysis, 2003-2024

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INTRODUCTION

- Follicular lymphoma (FL)** is an indolent B-cell malignancy where modern immunochemotherapy and maintenance strategies have substantially extended overall survival.
- As patients live longer with FL, death-certificate patterns may evolve from lymphoma being the direct fatal insult to a chronic background condition alongside competing age- and treatment-related comorbidities.
- Population-level evaluation of national underlying versus multiple-cause mortality captures real-world shifts toward disease chronification.

AIM

- Primary Aim:** Evaluate national 22-year shifts (2003–2024) in the classification of FL as the underlying cause of death (UCOD) versus a contributing multiple-cause-only (MCOD-only) condition.
- Secondary Aim:** Quantify non-FL causes replacing lymphoma mortality and assess temporal inflection points following therapeutic advances (knot at 2013).

METHOD

Data Source: CDC WONDER / NCHS Multiple Cause of Death records (2003–2024) identifying decedents with FL (ICD-10 code C82.x) in UCOD or contributing entity fields.

Outcomes: Proportion of deaths classified as FL-as-UCOD vs. MCODE-only; distribution of competing UCODs (cardiovascular, second primary malignancies, infections, dementia, respiratory).

Statistical Analysis: Binomial logistic regression across 2003–2024 and piecewise regression evaluating trajectory changes before versus after 2013.

CONCLUSIONS

- Population-level mortality patterns confirm the transformation of follicular lymphoma into a **chronic disease entity**, with more than one-third of decedents now dying of competing conditions rather than lymphoma itself.
- The accelerated post-2013 shift shows an urgent clinical need to pivot long-term survivorship care toward cardiovascular risk reduction, infection mitigation, and second-malignancy screening.

RESULTS

- Cohort Growth (N = 16,295):** Annual FL-associated deaths increased >5-fold from 236 (2003) to 1,299 (2024).
- Decline in FL as Direct Cause:** FL listed as UCOD dropped from **80.3%** (2003–2013) to **68.7%** (2014–2024), reaching 65.0% in 2024 (OR **0.938**/yr, 95% CI 0.932–0.944, $p < 0.001$).
- Post-2013 Inflection:** Piecewise modeling demonstrated a flat trajectory pre-2013 (OR 0.997, $p = 0.765$) followed by a significant post-2013 decline in FL-as-UCOD classification (slope-change OR **0.914**, 95% CI 0.890–0.938, $p < 0.001$).
- Competing Causes:** Non-malignant UCODs nearly doubled (**10.1% to 19.4%**), driven by cardiovascular disease, and other primary malignancies rose (**9.2% to 11.6%**).

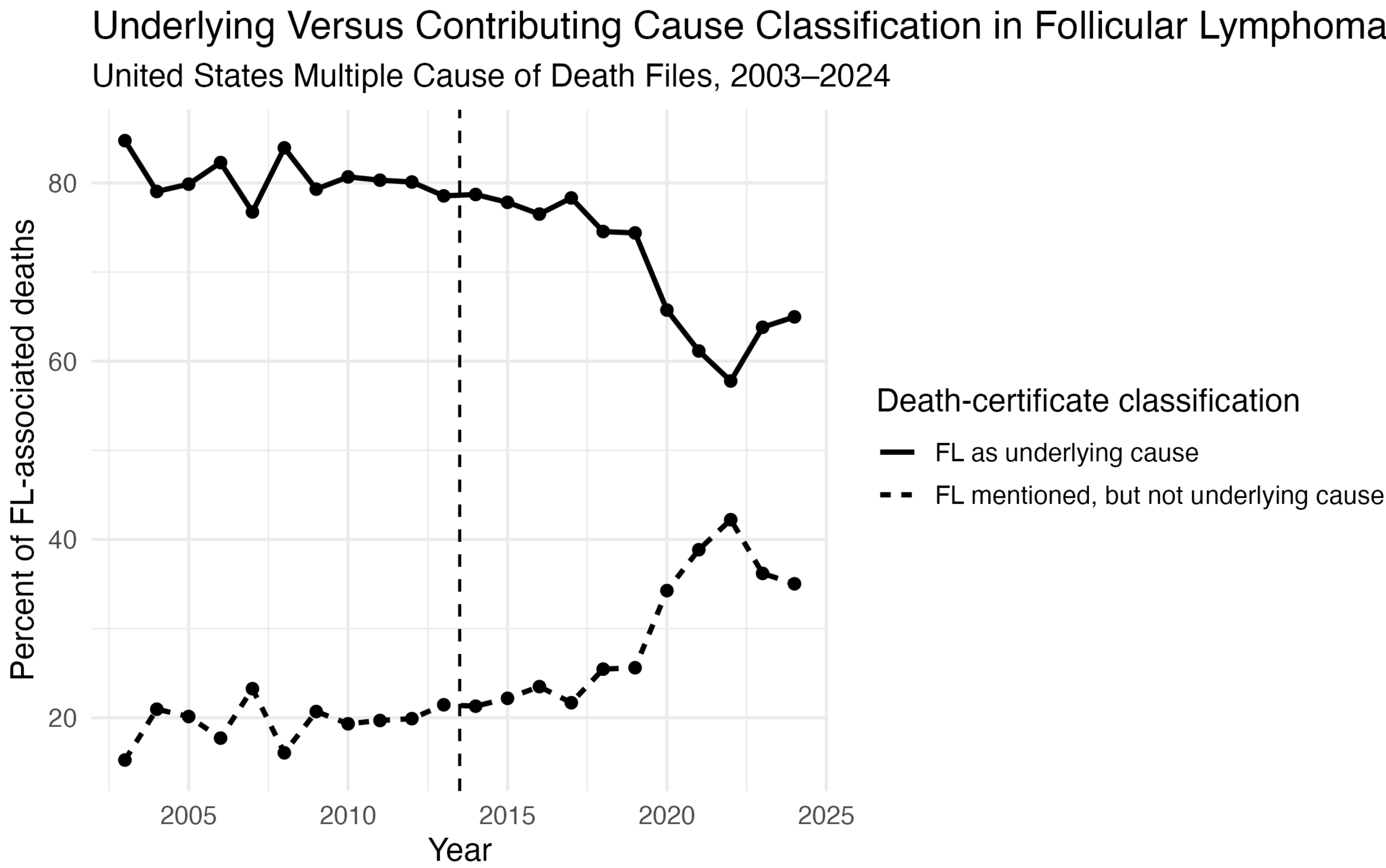
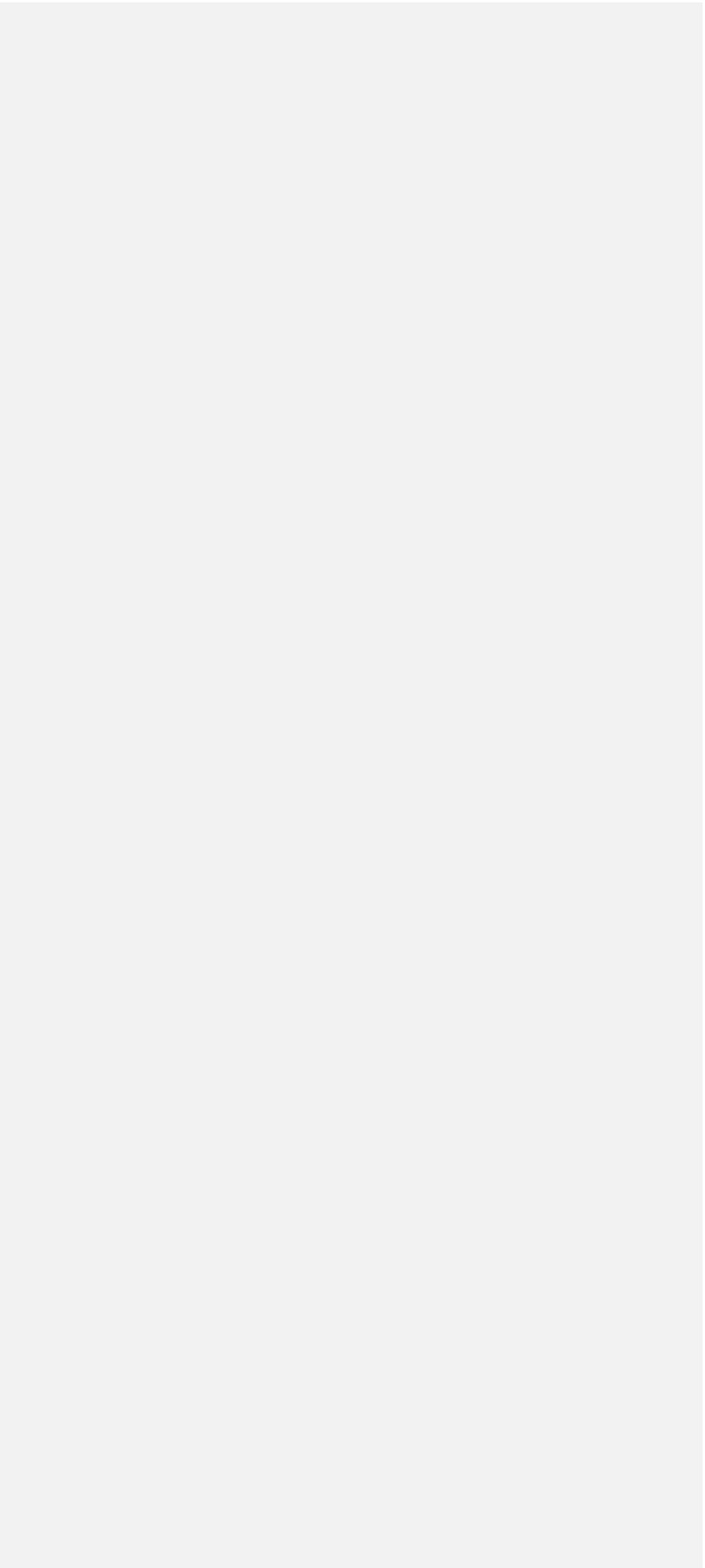


Figure 1. 22-Year Divergence in Underlying Versus Contributing Mortality Classification in Follicular Lymphoma (2003–2024). Proportions of nationwide FL-associated decedents listing FL as the primary underlying cause of death (solid line) versus a contributing condition (dashed line). Dashed vertical line at 2013 indicates the piecewise inflection knot, highlighting the accelerated transition toward a chronic disease phenotype in the modern era.

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REFERENCES

Rajamäki A, Hujo M, Sund R, et al. Mortality among patients with low-grade follicular lymphoma: a binational retrospective analysis. *Cancer*. 2022;128(13):2474–2482. doi:10.1002/cncr.34221. PMID: 35467746.

Dixon JG, Çağlayan Ç, Chihara D, et al. Factors affecting the clinical course of follicular lymphoma: a multistate survival analysis using individual patient data from eight multicenter randomized clinical trials. *Clin Lymphoma Myeloma Leuk*. 2022;22(12):e1009–e1018. doi:10.1016/j.cml.2022.07.015. PMID: 36008272.

Centers for Disease Control and Prevention, National Center for Health Statistics. Multiple Cause of Death Files, 1999–2024 on CDC WONDER Online Database. Available from: <https://wonder.cdc.gov/mcd.html>.