

Environmental Double Burden in Multiple Myeloma: PM_{2.5} Exposure and Racial Outcome Disparities Among Non-Hispanic Black and White Patients in the United States

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INTRODUCTION

Multiple myeloma (MM) disproportionately affects Non-Hispanic (NH) Black patients in the United States, while environmental exposure to fine particulate matter (PM_{2.5}) is also unequally distributed across racial groups. SEER estimates 36,000 new MM cases and 10,850 MM deaths in the United States in 2026. NH Black patients have approximately two-fold higher MM incidence and mortality compared with NH White patients, and emerging evidence suggests that higher PM_{2.5} exposure may be associated with worse MM survival.

AIM

To evaluate whether high residential PM_{2.5} exposure may compound racial disparities in MM outcomes among NH Black and NH White patients.

SETTING: United States population-based cancer registry and residential environmental exposure data.

PARTICIPANTS: NH Black and NH White adults with MM represented in SEER and published MM environmental exposure cohorts.

METHOD

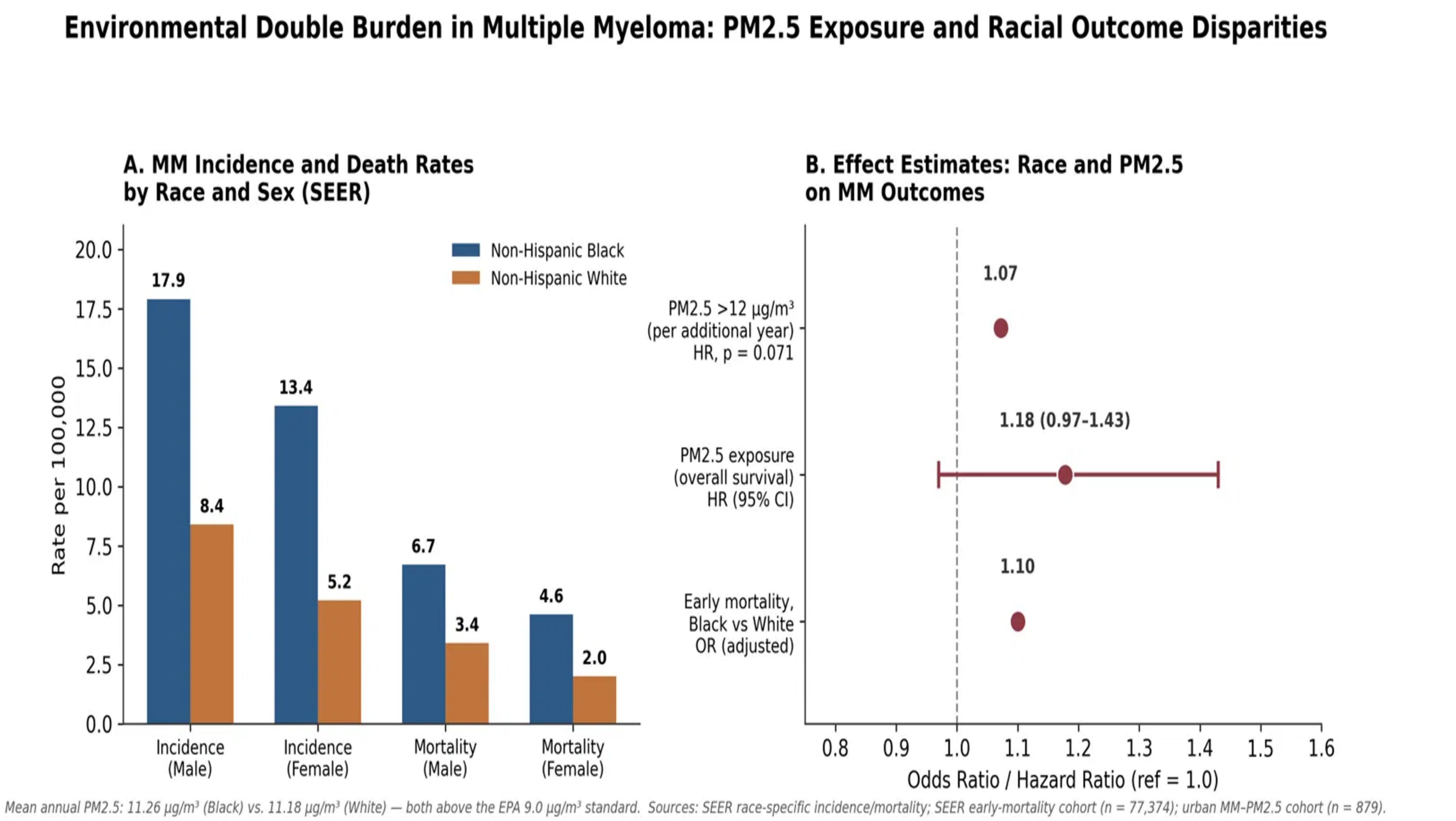
Population-based environmental justice framework using SEER MM race-specific incidence and mortality data, published SEER early mortality estimates, and published MM-PM_{2.5} survival data. High PM_{2.5} exposure was defined using the 2024 EPA annual standard threshold of >9.0 µg/m³, with >12.0 µg/m³ considered in sensitivity framing. The planned original analysis will link SEER county-level MM survival data with annual PM_{2.5} exposure estimates and test race × PM_{2.5} interaction terms in Cox models.

CONCLUSIONS

NH Black patients experience a dual burden of higher MM incidence/mortality and disproportionate exposure to environmental risk conditions. Existing SEER and PM_{2.5}-MM survival data support the hypothesis that air pollution may contribute to MM outcome inequities. A SEER-linked PM_{2.5} survival analysis with race × exposure interaction testing could identify whether high PM_{2.5} exposure amplifies racial survival disparities and inform environmentally targeted MM disparity interventions.

RESULTS

MM continues to exhibit marked racial disparities in the United States. NH Black patients experienced approximately two-fold higher incidence and mortality than NH White patients. Among 77,374 MM patients diagnosed between 2000 and 2019, 36% died within two years, and NH Black patients had higher odds of early mortality (OR 1.10). In an independent MM cohort, Black patients experienced slightly higher annual PM_{2.5} exposure than White patients (11.26 vs. 11.18 µg/m³). Higher PM_{2.5} exposure showed a trend toward worse overall survival (HR 1.178), while longer exposure to PM_{2.5} levels >12 µg/m³ was associated with progressively poorer survival outcomes.



REFERENCES

- Wysota, M., Pradhan, K., Jacobs, S. *et al.* Fine particulate matter exposure is linked to worse myeloma outcomes in a diverse urban cohort. *Blood Cancer J.* **15**, 115 (2025). <https://doi.org/10.1038/s41408-025-01301-0>
- Wei JX, Shastri A, Sica RA, Mantzaris I, Kornblum N, Shah U, Janakiram M, Gritsman K, Verma A, Goldfinger M, Cooper D, Shah N. Impact of race and ethnicity on early mortality in multiple myeloma: a SEER analysis. *Haematologica* 2024; 109(5):1480-1486; <https://doi.org/10.3324/haematol.2023.283304>.

[3. Particle Pollution Designations Memorandum and Data for the 2024 Revised Annual PM_{2.5} NAAQS | US EPA](#)

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