

24 - 27 September
#ISQua2024

**ISQUA2024-
ABS-3390**

Association between PM_{2.5} exposure and incident Metabolic Dysfunction-Associated Steatotic Liver Disease(MASLD): a Cohort Study

Wei-Chun Cheng^{1,2,3}, Pin-Nan Cheng², Chung-Yi Li^{1,4,5}

¹Department of Public Health, College of Medicine, National Cheng Kung University, Tainan, Taiwan; ²Department of Internal Medicine, College of Medicine, National Cheng Kung University, Tainan, Taiwan; ³Department of Gastroenterology and Hepatology, Tainan Hospital, Ministry of Health and Welfare, Tainan, Taiwan; ⁴Department of Public Health, College of Public Health, China Medical University, Taichung, Taiwan; ⁵Department of Healthcare Administration, College of Medical and Health Science, Asia University, Taichung, Taiwan.

INTRODUCTION

Metabolic dysfunction-associated steatotic liver disease (MASLD) represents a significant global health challenge. Recent redefinitions of the disease [1] highlight its growing prevalence and the associated increase in morbidity and mortality [2]. Emerging evidence suggests a link between MASLD and environmental factors, such as air pollution [3].

AIM

To explore the association between particulate matter with an aerodynamic diameter $\leq 2.5 \mu\text{m}$ ($\text{PM}_{2.5}$) exposure incident MASLD

METHOD

- This retrospective cohort study included participants who underwent health checkups at the MJ Clinic in Taiwan between 2012 and 2015, with at least one follow-up health checkup completed by 2017.
- The three-year average exposure to PM_{2.5} prior to the health checkups were estimated using the geocoded home addresses of each participant, using a Hybrid Kriging-Land Use Regression model combined with an XGBoost algorithm [4].
- MASLD diagnosis was based on sonographic evidence of hepatic steatosis, coupled with at least one of five cardiometabolic criteria:
 - 1) BMI ≥ 23 kg/m² (in Asians) or waist circumference (WC) >94 cm in men or WC >80 cm for women; 2) fasting serum glucose ≥ 100 mg/dL or HbA1c $\geq 5.7\%$ or type 2 diabetes or under treatment for type 2 diabetes; 3) BP $\geq 130/85$ mmHg or under specific antihypertensive drug treatment; 4) plasma triglyceride ≥ 150 mg/dL or under lipid lowering treatment ; 5) plasma high-density lipoprotein ≤ 40 mg/dL in or ≤ 50 mg/dL in women or under lipid lowering treatment [1].
- Each participant was followed until MASLD diagnosis, death, or the study's end on November 30, 2022.
- A time-dependent Cox regression model, incorporating Fine-Gray sub-distribution hazards to account for mortality as a competing risk, was employed to analyze the hazard ratio (HR) for MASLD development during the follow-up period.

REFERENCES

1. **Rinella ME**, et al. A multi-society Delphi consensus statement on new fatty liver disease nomenclature. *Hepatology*. 2023;78:1966–86.
2. **Golabi P**, et al. Burden of non-alcoholic fatty liver disease in Asia, the Middle East and North Africa: Data from Global Burden of Disease 2009–2019. *J Hepatol*. 2021;75:795–809.
3. **Cheng WC**, et al. Non-linear association between long-term air pollution exposure and risk of metabolic dysfunction-associated steatotic liver disease. *Environ Health Prev Med*. 2024;29:7
4. **Wong PY**, et al. Using a land use regression model with machine learning to estimate ground level $PM_{2.5}$. *Environ Pollut*. 2021 May 15;277:116846.

RESULTS AND CONCLUSIONS

- The study encompassed 19,464 participants without baseline MASLD. Over a median follow-up of 28.3 months, 3,220 individuals (16.5%) developed MASLD, and 580 (3.0%) died. The baseline demographic of these participants were presented in **Table 1**.
- The Hazard ratio (HR) for MASLD was 1.09 (95% CI: 1.02-1.16) for every 10 $\mu\text{g}/\text{m}^3$ increase in the 3-year average $\text{PM}_{2.5}$ as determined by Fine-Gray sub-distribution hazard (SDH) analysis. A sensitivity analysis with cause-specific hazard (CSH) yielded similar results of HR as 1.09 (95% CI: 1.02-1.16) (**Figure 2**)
- **Figure 3** illustrates the dose-response relationship between the 3-year average $\text{PM}_{2.5}$ exposure and the hazard ratio (HR) for MASLD.

Table 1. Baseline Demographic and Clinical Characteristics of Participants Without MASLD at Baseline in This study

Baseline Cases without MASLD (n=19,464)			
	Mean ± SD / n (%)		
Age, years	41.0 ± 12.5	Diabetes Mellitus	325 (1.7)
Male (n, %)	7,575 (38.9)	Hypertension	1,617 (8.3)
Marriage (Single)	6,555 (33.7)	Dyslipidemia	2,655 (13.6)
Education (college or higher)	10.621 (54.6)	Chronic Viral Hepatitis	56 (0.3)
Annual household income > 28,000 USD	7,242 (37.2)	Alanine aminotransferase (ALT), U/L	20.4 ± 13.8
Smoking (former or current)	3,332 (17.1)	Abnormal liver function test (ALT ≥ 33 U/L)	1,583 (8.1)
Alcohol drinking (former or current)	2,592 (13.3)	Glutamyl Transferase (GGT), U/L	20.4 ± 21.2
Vegetable Intake (frequent)	4,814 (24.7)	Triglyceride (TG), mg/dL	84.2 ± 47.4
Fried food intake (frequent)	2,503 (12.9)	Cholesterol (Chol), mg/dL	190.4 ± 33.0
Habit of regular exercise	7,113 (36.5)	High-density lipoprotein (HDL), mg/dL	63.4 ± 14.6
Body mass index (BMI), kg/m²	21.6 ± 2.6	Low-density lipoprotein (LDL), mg/dL	110.3 ± 30.0
Overweight	3,551 (18.2)	3-yearaverage of PM _{2.5} exposure, µg/m³	28.9 ± 5.6
Obesity	1,838 (9.4)		
Waist circumference, cm			
Male	78.7 ± 6.8		
Female	69.0 ± 6.0		

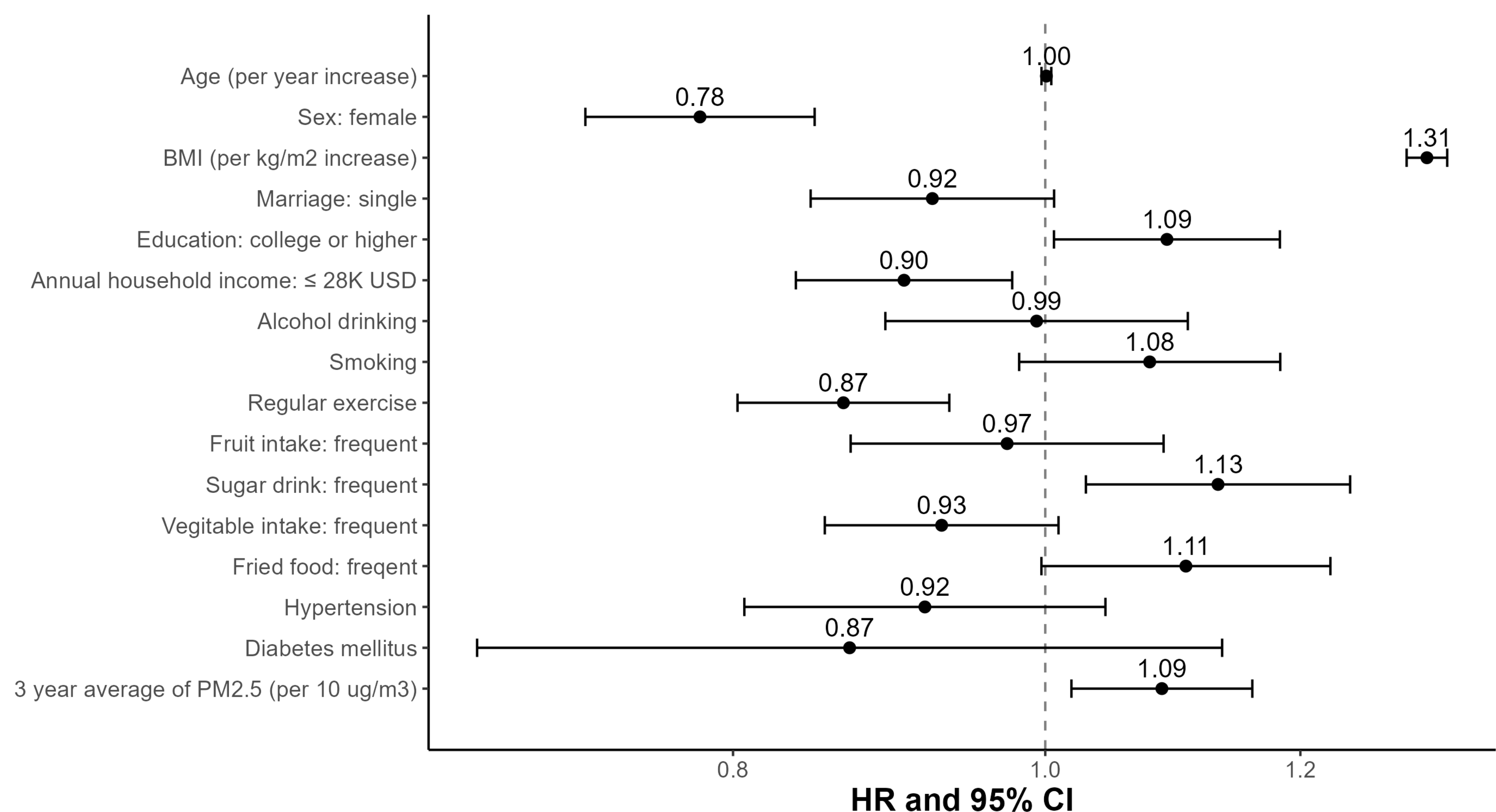


Figure 2. Hazard Ratios (HRs) and 95% Confidence Intervals (CIs) of Risk Factors for incident MASLD

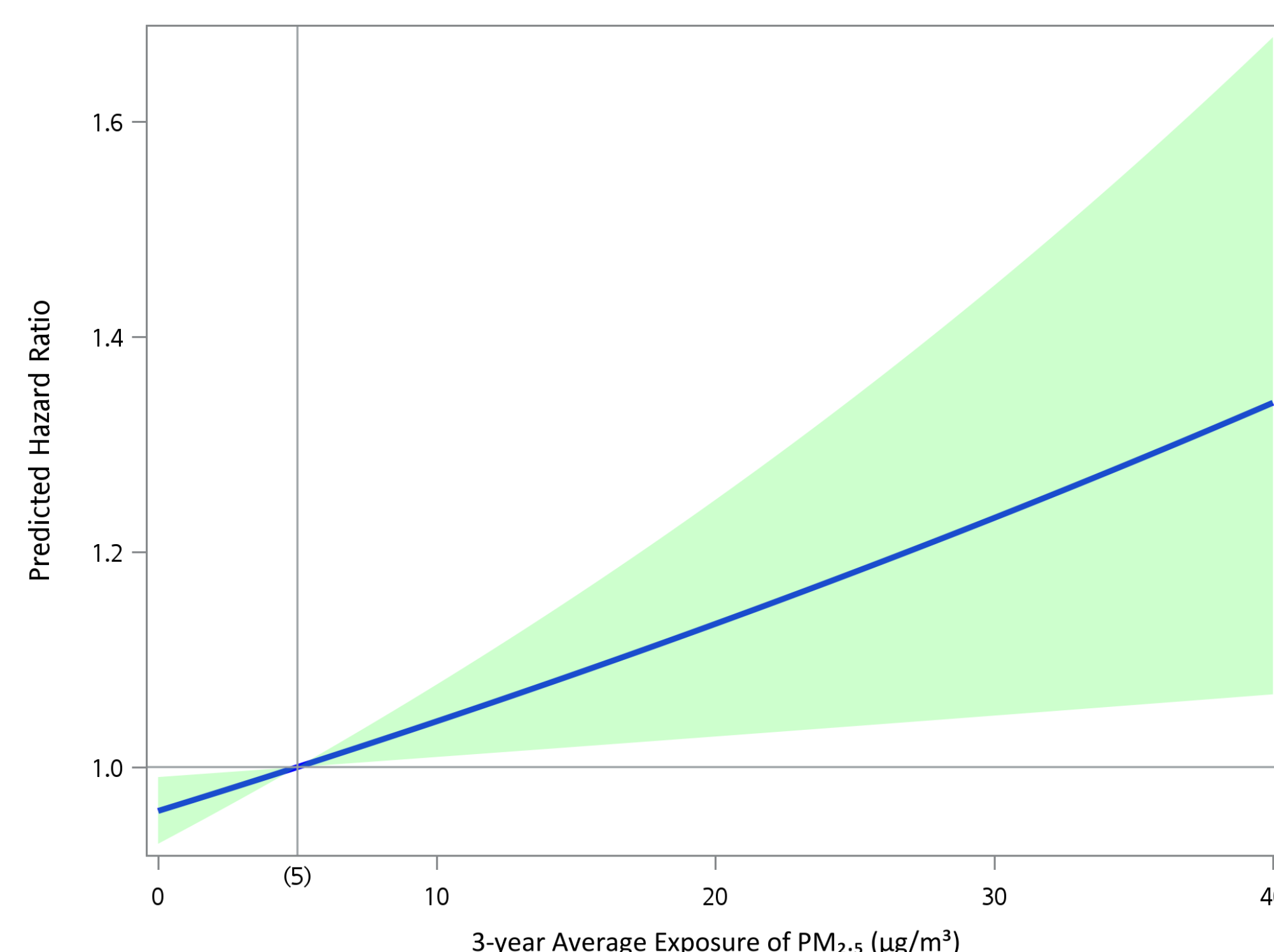


Figure 3. Dose-Response Curve of 3-Year Average PM_{2.5} Exposure and the Predicted Hazard Ratio for Incident MASLD

- **Abbreviations:**
 BMI: body mass index; CI: confidence interval; HR: hazard ratio;
 Metabolic dysfunction-associated steatotic liver disease (MASLD);
 PM_{2.5}: particulate matter with an aerodynamic diameter ≤ 2.5 μm;
 USD: United State dollars

- **Conclusions:**

The three-year average PM_{2.5} exposure, alongside dietary and lifestyle risk factors, was associated with the incidence of MASLD in health checkup participants.

CONTACT INFORMATION

Wei-Chun Cheng, M.D., M.S.
weichun.cheng@gmail.com