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INTRODUCTION

- In 2013, the International Agency for Research on Cancer (IARC) classified air pollution as a **carcinogen for lung cancer**.
- Recently, new evidence has emerged regarding the general population and other cancer sites, **including the bladder, kidneys, and urinary tract**.

MATERIALS & METHODS

Data source and study population

- Data from the National Health Information Database (2011-2021) and combined with air quality data (2006-2019)
- In the case-control study, cases were defined as individuals hospitalized for at least one day with **bladder cancer (BC) between 2011 and 2020**. Controls were selected at a ratio of 1:4 using propensity score matching based on variables such as age, sex, BMI, smoking, drinking, and income.

Exposure

- Analyzes **five air pollutants (PM₁₀, PM_{2.5}, NO₂, SO₂, CO)** to evaluate individual exposure levels.
- Air pollution exposure levels were calculated using **5-year and 10-year moving averages** before diagnosis for cases and at the study end for controls.

Outcome

- ICD-10 “C64” and codes “V193” or “V194”

Statistical analysis

- We assessed the mixture effects of air pollutants on the risk of BC incidence using the **quantile g-computation (qgcomp) model**.
- We applied **lag options of 1-year and 2-years** between exposure and outcome.

RESULTS

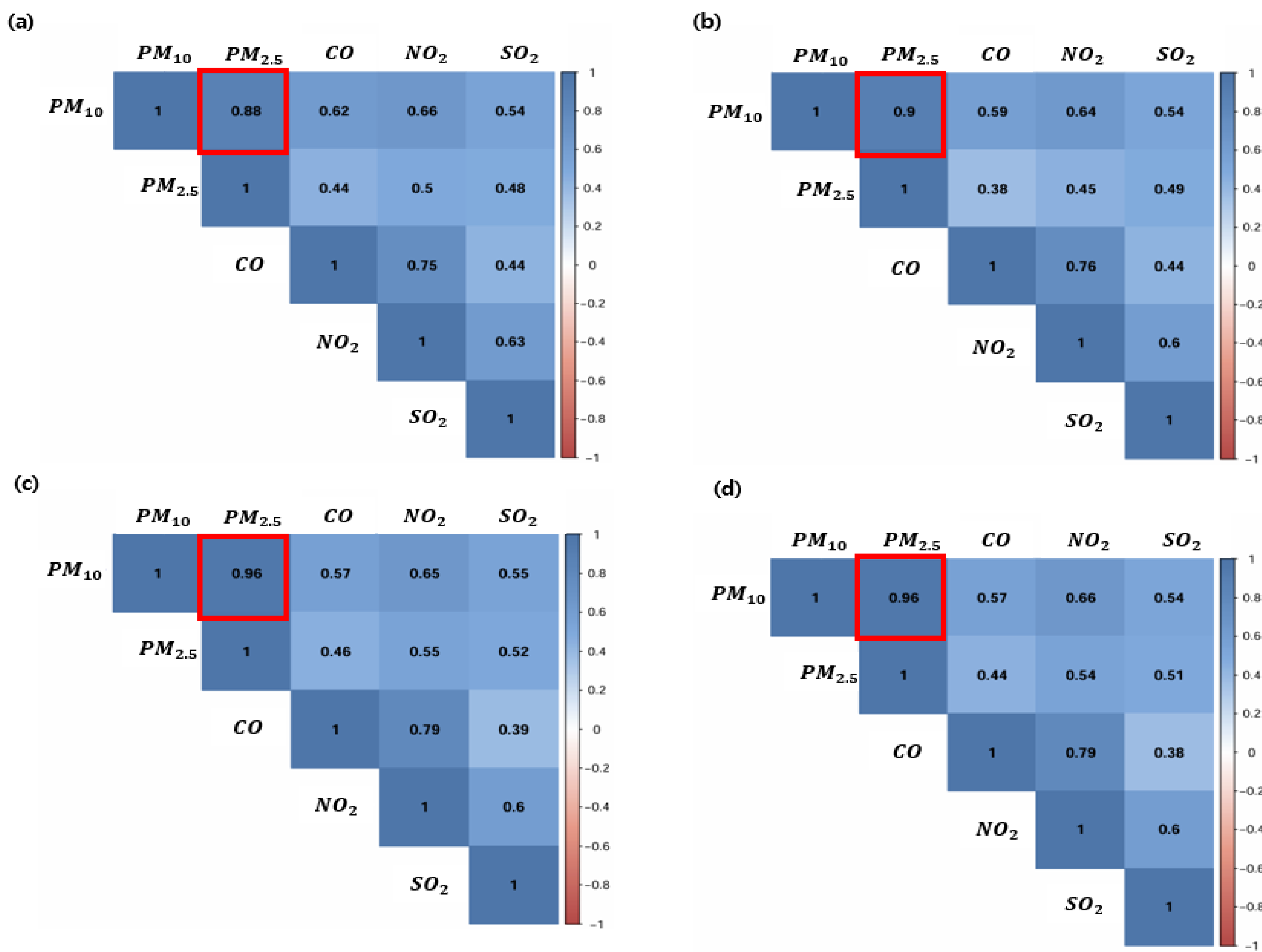
Table 1. Basic characteristic of study participants

Characteristics	Total (n=23,694)	Case (n=4,764)	Control (n=18,930)	P-value
Age ^a	54.2 ± 7.9	54.2 ± 7.9	57.8 ± 7.6	0.969
Sex ^b				1
Male	16,504 (69.7)	3,318 (69.6)	13,186 (69.7)	
Female	7,190 (30.3)	1,446 (30.4)	5,744 (30.3)	
Household income ^b				1
Lowest quartile	4,673 (19.7)	939 (19.7)	3,734 (19.7)	
Lower middle quartile	3,897 (16.4)	785 (16.5)	3,112 (16.4)	
Upper middle quartile	5,638 (23.9)	1,133 (23.8)	4,505 (23.8)	
Highest quartile	9,486 (40.0)	1,907 (40.0)	7,579 (40.0)	
Alcohol drinking ^b				0.802
Low-risk drinking	21,277 (89.8)	4,275 (89.7)	17,002 (89.8)	
High-risk drinking	2,417 (10.2)	489 (10.3)	1,928 (10.2)	
Smoking ^b				1
Never smoker	11,684 (49.3)	2,348 (49.3)	9,336 (49.3)	
Former smoker	5,718 (24.1)	1,150 (24.1)	4,568 (24.1)	
Current light smoker	961 (4.1)	192 (4.0)	769 (4.1)	
Current moderate smoker	1,657 (7.0)	335 (4.0)	1,322 (7.0)	
Current heavy smoker	3,674 (15.5)	739 (15.6)	2,935 (15.5)	
BMI (kg/m ²) ^b				0.988
< 25.0	12,343 (52.1)	2,484 (52.1)	9,859 (52.1)	
≥ 25.0	11,351 (47.9)	2,280 (47.9)	9,071 (47.9)	

^a Student's t-test was used to compare normally distributed continuous variables between BC and control groups.

^b A Chi-square test was used to test the distributions of categorical variables between BC and control groups.

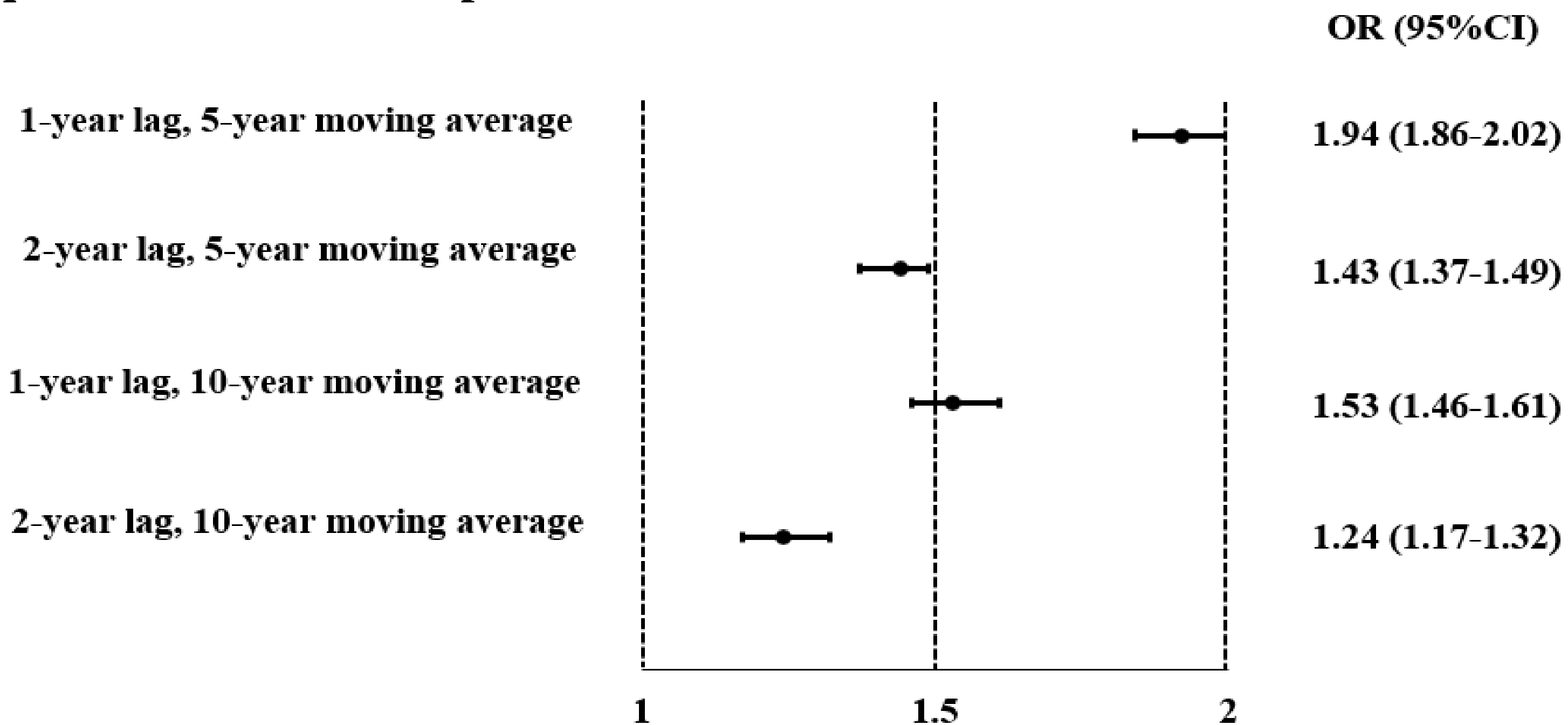
Figure 1. Spearman correlation of the air pollutants among study participants



(a) 1-year lag, 5-year moving average, (b) 2-year lag, 5-year moving average, (c) 1-year lag, 10-year moving average, (d) 2-year lag, 10-year moving average

In all conditions, **PM₁₀ and PM_{2.5}** showed the highest positive correlations (0.88, 0.90, 0.96, 0.96, respectively).

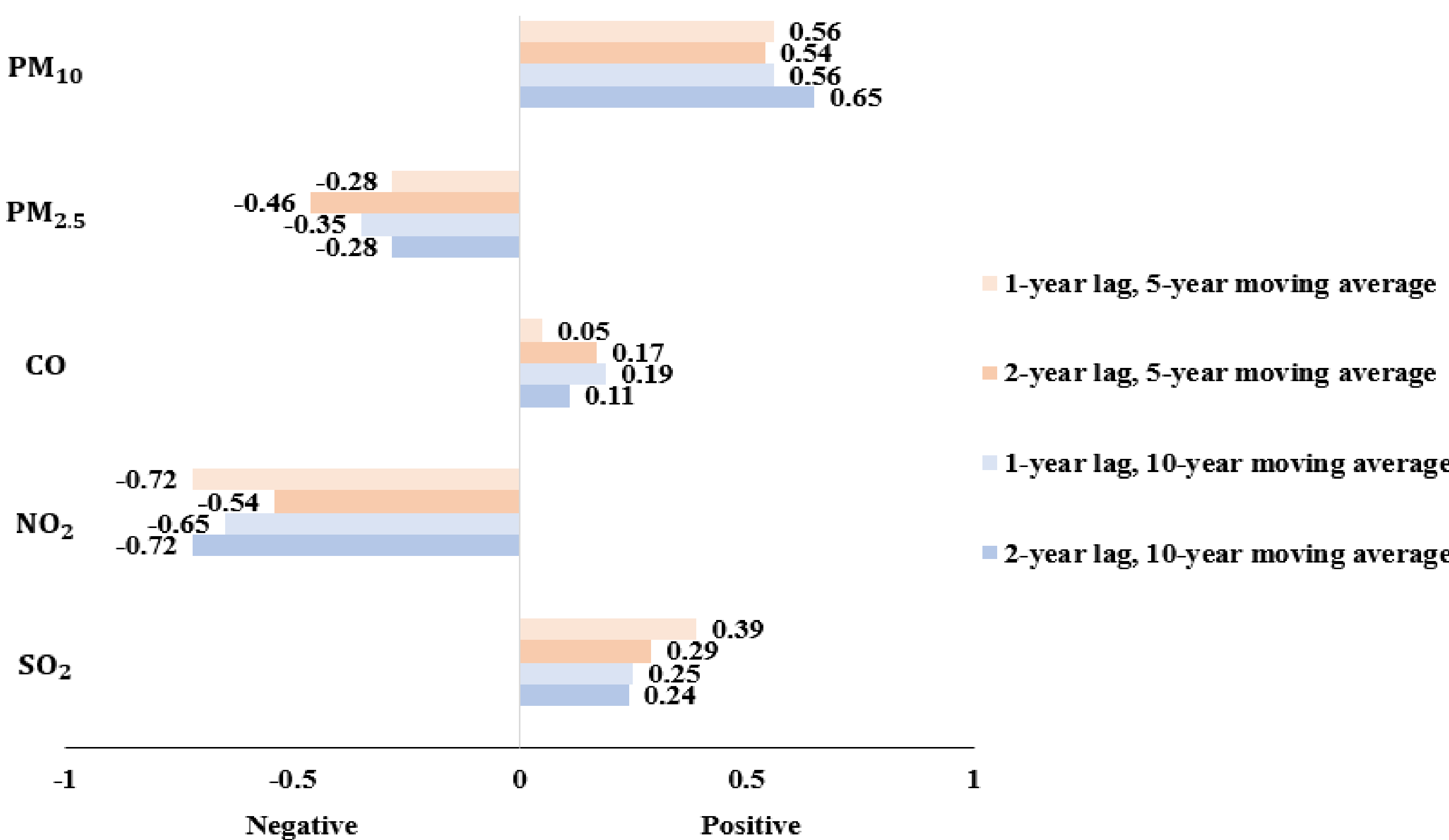
Figure 2. The risk of BC incidence within 5 and 10 years associated with a 4th quartile increase in air pollutants concentrations



OR : odds ratio; Adjusted for age, sex, income, alcohol, smoking, BMI

Regardless of the exposure period and lag, all models showed a **significant positive association between air pollution levels and BC incidence**.

Figure 3. Qgcomp model regression index weights of each air pollutants for BC incidence.



PM₁₀, CO, and SO₂ had a positive impact, while **PM_{2.5} and NO₂** had a negative impact.

CONCLUSIONS

- It was confirmed that as air pollution levels increase, **the risk of BC significantly increases**.
- The most significant impact was found for exposure levels characterized by a **1-year lag and a 5-year moving average**.