



Article

# Effects of Environmental Air Pollution on Pulmonary Function Level of Residents in Korean Industrial Complexes

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**Abstract:** This study aims to identify environmental air pollution adversely affecting pulmonary function among a community-based general population living in Korean industrial complexes. A total of 1963 residents participated in a pulmonary function test (PFT). The sample population consisted of an exposed group ( $n = 1487$ ) living within a radius of 5 km of industrial complexes and a control group ( $n = 476$ ) living over a radius of 10 km from the industrial complexes in Gwangyang and Yeosu cities. PFT results were calculated for each resident of the study population. On-site questionnaire surveys with face-to-face interviews were also conducted to collect more detailed information on personal lifestyles, medical history, exposure to air pollution, and respiratory disease and related symptoms. A total of 486 measured samples were collected by eight automated air-monitoring stations installed in four counties of Gwangyang and four counties of Yeosu in South Korea from January 2006 to February 2007. Mean levels of  $\text{SO}_2$  (0.012 ppm), CO (0.648 ppm),  $\text{NO}_2$  (0.02 ppm),  $\text{O}_3$  (0.034 ppm), and  $\text{PM}_{10}$  ( $43.07 \mu\text{g}/\text{m}^3$ ), collected within a radius of 5 km, were significantly higher than those collected over a radius of 10 km from Gwangyang and Yeosu industrial complexes. Prevalence odds ratio (OR) of abnormal pulmonary function in the exposed group of residents ( $<5$  km) was elevated at 1.24 (95% CI 0.71–1.96), but not statistically significant ( $p > 0.05$ ). In multiple linear regression analysis, forced expiratory volume in one second ( $\text{FEV}_1$ ) and forced vital capacity (FVC) levels significantly declined as  $\text{SO}_2$ , CO, and  $\text{O}_3$  levels increased when adjusting for age, sex, body mass index (BMI), alcohol, smoking, secondhand smoke, and respiratory disease and related symptoms ( $n = 1963$ ) ( $p < 0.05$ ). These results suggest that exposure to air pollution affects pulmonary function levels of residents living in Korean industrial complexes.

**Keywords:** air pollution; health effect; industrial complex; ozone; pulmonary function test; sulfur dioxide

## 1. Introduction

Since the 1970s, a number of large-sized industrial complexes of petrochemical and steel industries were constructed and contributed to the fast economic growth in South Korea [1]. The industrial



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**Abstract:** This study aims to identify environmental air pollution adversely affecting pulmonary function among a community-based general population living in Korean industrial complexes. A total of 1963 residents participated in a pulmonary function test (PFT). The sample population consisted of an exposed group ( $n = 1487$ ) living within a radius of 5 km of industrial complexes and a control group ( $n = 476$ ) living over a radius of 10 km from the industrial complexes in Gwangyang and Yeosu cities. PFT results were calculated for each resident of the study population. On-site questionnaire surveys with face-to-face interviews were also conducted to collect more detailed information on personal lifestyles, medical history, exposure to air pollution, and respiratory disease and related symptoms. A total of 486 measured samples were collected by eight automated air-monitoring stations installed in four counties of Gwangyang and four counties of Yeosu in South Korea from January 2006 to February 2007. Mean levels of  $\text{SO}_2$  (0.012 ppm), CO (0.648 ppm),  $\text{NO}_2$  (0.02 ppm),  $\text{O}_3$  (0.034 ppm), and  $\text{PM}_{10}$  ( $43.07 \mu\text{g}/\text{m}^3$ ), collected within a radius of 5 km, were significantly higher than those collected over a radius of 10 km from Gwangyang and Yeosu industrial complexes. Prevalence odds ratio (OR) of abnormal pulmonary function in the exposed group of residents ( $<5$  km) was elevated at 1.24 (95% CI 0.71–1.96), but not statistically significant ( $p > 0.05$ ). In multiple linear regression analysis, forced expiratory volume in one second ( $\text{FEV}_1$ ) and forced vital capacity (FVC) levels significantly declined as  $\text{SO}_2$ , CO, and  $\text{O}_3$  levels increased when adjusting for age, sex, body mass index (BMI), alcohol, smoking, secondhand smoke, and respiratory disease and related symptoms ( $n = 1963$ ) ( $p < 0.05$ ). These results suggest that exposure to air pollution affects pulmonary function levels of residents living in Korean industrial complexes.

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