

Air pollution and community health: acute cardio-respiratory events attributable to SO₂ and NO₂ exposure

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Measuring health effects attributable to air pollution is challenging in low-pollution areas. We quantified the community-based burden of acute cardiac and respiratory disease caused by exposure to SO₂ and NO₂ in a non-industrial coastal Mediterranean environment.

Continuous NO₂, SO₂ and particulate matter concentrations, temperature, precipitation, and wind direction were drawn from 18 regional monitoring stations and pooled by consecutive 12-hour periods for the interval between January 2000 and December 2006. Outcomes included physician-patient encounters due to acute cardiac and respiratory syndromes at 9 primary-care community clinics, and a regional hospital emergency department (ED). For each 12-hour period, pollutants were introduced as independent exposure variables, adjusted for meteorological variables, seasonality, weekday/weekends/holidays, day/night, precipitation and wind speed. The association between exposures and outcomes was analyzed using multivariate Poisson regression models and negative binomial models fitted for over-distributed community data.

The final data-base included 5,113 half-days, ~700,000 ED records, and ~1,100,000 community clinic visits. Both NO₂ and SO₂ were associated with increased overall cardio-respiratory ED patient volumes (RR=1.005 [1.003-1.008] for SO₂, 1.002 [1.001-1.003] for NO₂). For community clinics, NO₂ was significantly associated with increased patient load (RR=1.005 [1.002-1.008]), but SO₂ was not (RR=1.006 [0.996-1.016]). Population attributable fractions for both pollutants were substantial. Each 10 µg/m³ increase in SO₂ and NO₂ concentrations increased ED patient volume by 4.76% and 1.96%, respectively; this same increase in NO₂ also increased community visit volume by 4.76%. Weaker associations were observed when a 12hr lag period was introduced. A strong confounding effect was noted for the effect of daytime/nighttime on the association between exposure and outcome, rendering crucial the analysis by 12-hour period.

The observed association between SO₂ and NO₂ concentrations and increased cardio-respiratory patient load demonstrates these pollutants' substantial impact on population health, even in low-pollution areas.