Long-term air pollution exposure is associated with sick-leave 20 years later

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Background
Little is known on outdoor air pollution in a long-term perspective and societal costs such as sick leave. In the Nordic countries, recent pollution health impact assessments have had to rely on outdated studies.

Aim
To investigate if air pollution exposure is associated with sick leave in a longitudinal perspective.

Methods
We analysed self-reported sick leave (all-cause and respiratory) in 7,466 subjects from Bergen, Gothenburg, Umeå, Uppsala in the RHINE3 study in 2010–12. Home addresses were geocoded and linked to annual average concentrations of PM1.5, PM10 and NO2 at RHINE3, 10 years earlier and 20 years earlier, using existing land-use regression (LUR) models. We performed multilevel logistic regression clustered by workplace change.

Results
Mean age in RHINE 3 was 52 yrs, with age range 40-66 yrs. Men constituted 48% of the population. Of all participants, 34% and 4% reported all-cause and respiratory sick leave during the last year. Annual average mean exposures were well below the recommended EU limits, suggesting that this population is not exposed to harmful levels of air pollution.

In the adjusted analyses all-cause sick leave was associated with PM2.5 20 years earlier (OR per quartile increase in exposure 1.14 (95%CI 1.03, 1.25)), ten years earlier (OR 1.15 95%CI 1.02, 1.30) and borderline with NO2 (OR 1.09 (95%CI 1.00, 1.19)). Respiratory sick leave was associated with PM2.5 20 years earlier (OR per quartile increase 1.34 (95%CI 1.00, 1.80), with PM10 20 year searlier (OR 1.57 (95%CI 1.09, 2.27)), and borderline with NO2 (OR 1.27 (95% CI 0.96, 1.69)). Pollution exposures at present as well as 10 years earlier were not significantly associated with sick leave in the multivariate models.

Conclusions
✓ Air pollution exposure in a general population was associated with sick leave 20 years later.
✓ In this population with low mean annual air pollution exposure, our results suggest that exposure 20 years ago were more important than current exposure and exposure 10 years ago.
✓ Our results indicate that even low air pollution levels have adverse health effects over time.

Table 1. Exposure characteristics

<table>
<thead>
<tr>
<th>Exposure (range) µg/m³</th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
<th>EU limit values (annual) µg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM1.5</td>
<td>9.3 (0.2, 16.6)</td>
<td>9.2 (0.2, 17.5)</td>
<td>9.1 (0.1, 18.9)</td>
<td>25</td>
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<tr>
<td>PM10</td>
<td>14.1 (7.9, 22.8)</td>
<td>14.0 (7.9, 24.6)</td>
<td>13.9 (8.3, 23.3)</td>
<td>40</td>
</tr>
<tr>
<td>NO2</td>
<td>18.7 (6.3, 40.4)</td>
<td>18.1 (6.3, 70.0)</td>
<td>16.4 (0.1, 49.9)</td>
<td>40</td>
</tr>
</tbody>
</table>

Figure 1. Lowess plots: air pollution exposures in 1990 and sick leave reports in 2010

Figure 2. Multivariate logistic regression, respiratory sick leave (left) and all-cause sick leave (right) by air pollution exposures 20 years earlier, 10 years earlier and now.

References
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