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**Title:** Additive effect of air pollution particulate matter and cigarette smoke on pneumococcal adhesion to lower airway cells

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**Body:** Air pollution particulate matter (PM) and cigarette smoke (CS) are associated with increased vulnerability of children to bacterial pneumonia. In epidemiological studies, PM and CS are considered independent variables. We previously reported that PM<sub>10</sub> (PM diameter <10µm) increases pneumococcal adhesion to lower airway cells. Here we assessed whether PM and CS additively increase the susceptibility of airway epithelial cells to pneumococcal infection. Monolayers of the alveolar epithelial cell line A549 were exposed to sub-optimal doses of PM<sub>10</sub> or cigarette smoke extract (CSE) for 3 hrs. The pollutants were washed off and cells exposed to *Streptococcus pneumoniae* for 2 hrs at a multiplicity of infection (MOI) of 100. After vigorous washing, cells were detached and lysed. Adherent bacteria were assessed by quantitative culture. Data were compared by T tests.

Both PM<sub>10</sub> and CSE stimulated pneumococcal adhesion. An additional increase in pneumococcal adhesion was caused by PM<sub>10</sub> and CSE combined. No decrease in viability was observed by light microscopy. The data suggests that PM<sub>10</sub> and CSE additively increase vulnerability of airway cells to pneumococcal infection. If confirmed in animal models, additive effects of PM<sub>10</sub> and CSE should be considered in epidemiological studies. Individuals at risk are likely to be living in countries with high PM levels and high incidence of indoor smoking.