Communication

Smoking, Air Pollution and Emphysema/COPD in six US cities 2000-2018: Contextualizing statistical association in health communication

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Abstract: A recent study found that a 3ppb increase in O_3 ambient concentration was associated with an increased progression of 0.18 percentage points in percent emphysema and that such increase was equal to smoking 20 cigarettes per day for 29 years. A simple estimation of population attributable fraction shows that COPD diagnoses due to smoking are actually 30 times more than those attributed to a 3 ppb increment in O_3 concentration. Labelling ozone pollution as the new smoking may distort perception of the risks and hinder proper response to real life threatening risk such as smoking.

Keywords: smoking; air pollution; health communication; population attributable fraction; COPD; emphysema; relative risks

1. Introduction

In the last years, air pollution has become a hot topic in the media and, as already happened to other public health issues that gained special (but momentary) attention, has been quickly labelled as the new smoking [1].

A recent study by Meng Wan and colleagues on the association between long-term exposure to O_3 and percent emphysema [2] (i.e. the percentage of emphysema-like lung on computed tomographic scan) got an enormous media attention with 195 news outlets from more than a dozen countries in August alone [3]. The Authors analyzed a population of 7,000 individuals aged around 60 years old and found that, "a 3 ppb–higher long-term mean O_3 exposure […] was significantly associated with an increased progression of 0.18 percentage points in percent emphysema over 10 years" and that, "This increase is equal to the association of 29 pack-years of smoking". Such scary equivalence was immediately reported by media with shocking titles like, "Exposure to polluted air is like smoking a pack a day, study says", "Air Pollution May Be As Harmful To Your Lungs As Smoking Cigarettes, Study Finds", "Breathing polluted air at levels present in Louisiana is like smoking a pack per day: study", and so on [3].

As these news titles clearly show, there is plenty of reasons to be concerned that these results could be misinterpreted, eventually leading to unintended negative consequences. For instance, among the six US cities taken into account the highest annual mean O_3 concentration was around 25 ppb (Winston-Salem), which is way below the ozone standard of 70 ppb proposed by EPA's current national ambient air quality standards; nonetheless, some smokers may fallaciously believe that if breathing ambient air with such O_3 levels is the same as smoking 20 cigarettes per day for 29 years, than there is no reason to quit since smoking is just as bad as being exposed to urban air.

In actuality, smoking is still the leading cause of chronic obstructive pulmonary disease (COPD), including emphysema, followed by fine particulate matter ($PM_{2.5}$) [4]. To put things in perspective, we calculated the population attributable fraction (PAF) of COPD for smoking, $PM_{2.5}$, and O_3 exposure in Chicago, where the authors found the highest increase in O_3 concentration (3 ppb from 18.3 to 21.4) and where $PM_{2.5}$ decreased from 16.2 μg/m^3 to 13.6 μg/m^3.

2. Materials and Methods

We calculated PAF using the standard formula [5]

$$\mathrm{PAF} = \frac{\mathrm{Exposure} \cdot (\mathrm{RR} - 1)}{\mathrm{Exposure} \cdot (\mathrm{RR} - 1) + 1} \quad (1)$$

We retrieved from literature relative risks (RR) of COPD from 30 pack-years of smoking (4.69) [6], $PM_{2.5}$ at 15 μg/m3 (1.224) [6], 10 ppb (1.04) [7] and 3 ppb increment in O_3 (1.012, assuming a linear risk-outcome curve). Exposure to air pollution was considered ubiquitous (100%) and smoking rate for Chicago in 2017 was extracted from Chicago Health Atlas [8].

3. Results

Forty percent of COPD diagnoses are due to smoking, which is 2.2 times more than those attributed to a PM2.5 concentration of 15 μg/m3, 10 times more than those attributed to a 10 ppb increment in O3 (4%), and 30 times more than those attributed to a 3 ppb increment (1.2%) in Chicago (Figure 1). Furthermore, since the mean percent emphysema at baseline was 5.37 in Chicago, thus a progression of 0.18 percentage points over 10 years equals to an increase of 0.3% per year, which is far lower than the 1.12% yearly progression estimated for current smokers by Mohamed Hoesein et al. [9].

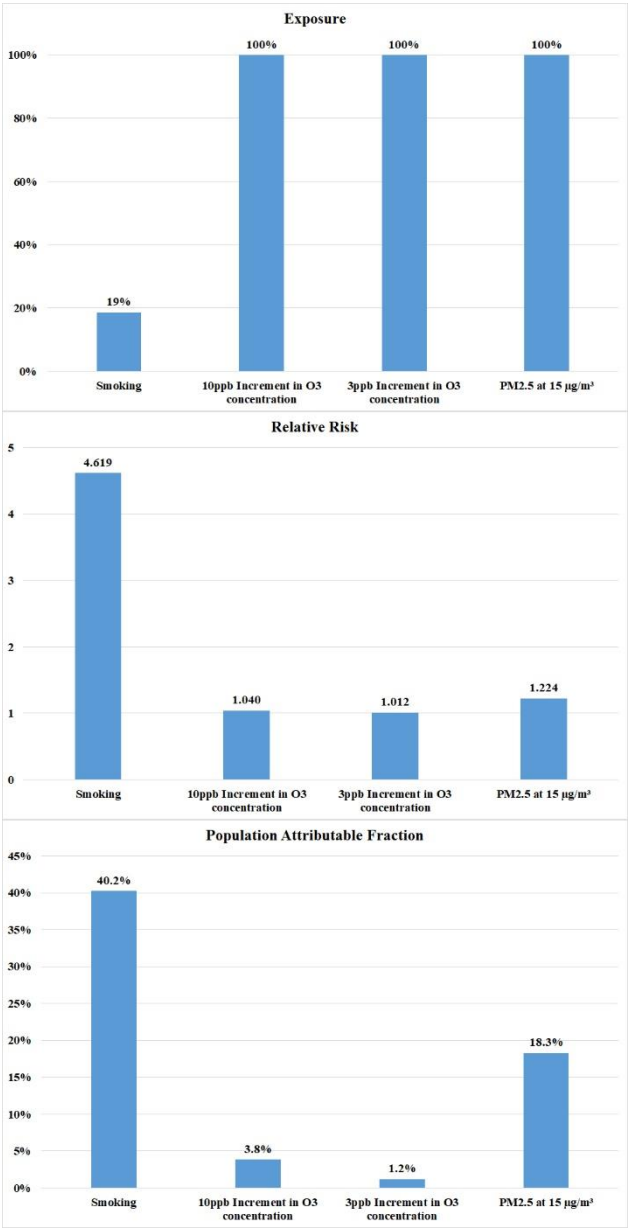

Figure 1. Exposures, Relative Risks and Population Attributable Fractions for smoking, O3, and PM2.5 as causes of COPD in Chicago.

4. Conclusions

We believe researchers should be concerned about the possible over-interpretation of the finding of a statistical association between a small variation in air quality and natural disease progression over time as a causal relationship. Analogizing this finding as comparable to the harms of life-long heavy smoking may distort perception of the risks and hinder proper response to real life threatening risk such as smoking.

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