

# Low level O<sub>3</sub> exposure at rest causes nasal inflammation and neutrophilic bronchitis

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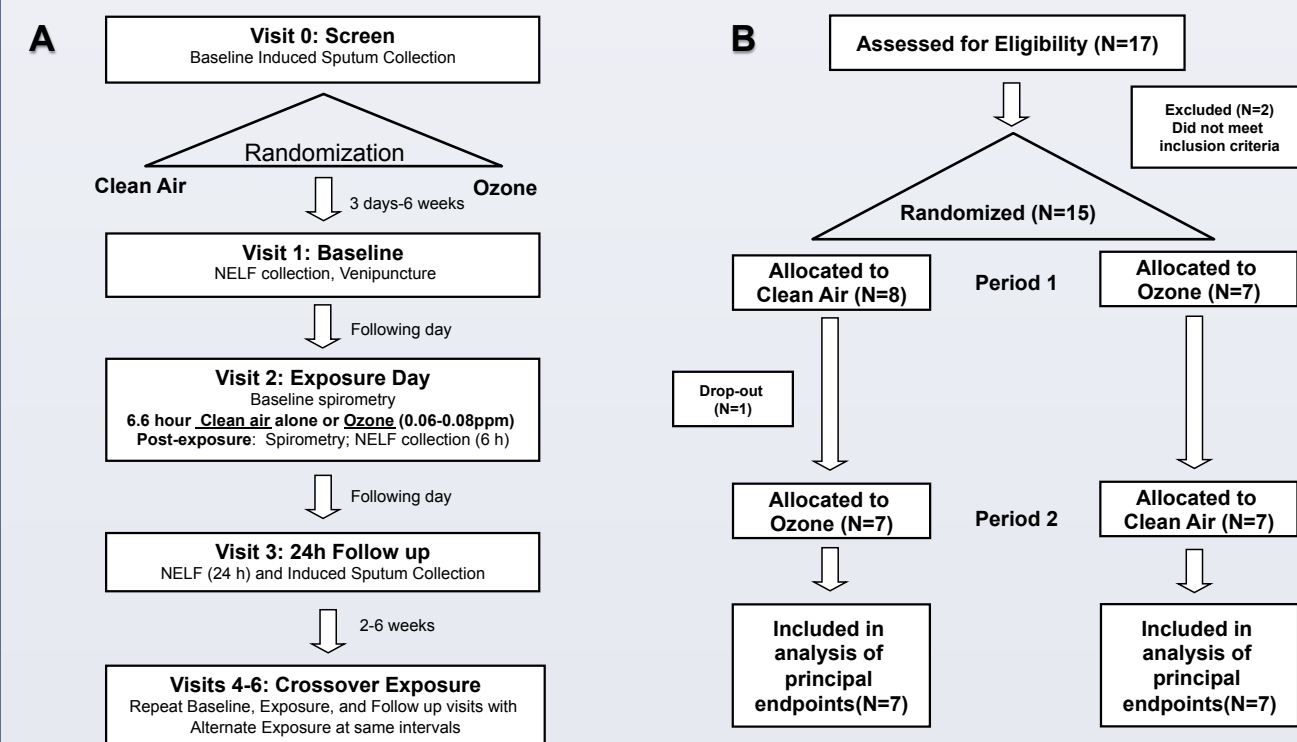
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Abstract ID 11441, Poster 402

## BACKGROUND

- Ambient ozone (O<sub>3</sub>) is a common environmental trigger for asthma exacerbation given its ubiquitous presence
- Epidemiologic evidence suggests exposure to ambient air O<sub>3</sub> at concentrations below the National Ambient Air Quality Standard of 0.07 parts per million (ppm) increases risk of respiratory morbidity and mortality
- The dose of O<sub>3</sub> is dependent on minute ventilation and exposure duration and is known to impact lung function, inflammation, and cause respiratory symptoms
- Study evaluates whether exposure to O<sub>3</sub> below the NAAQS while an individual is at rest contributes to inflammation or a decrease in lung function

## STUDY DESIGN



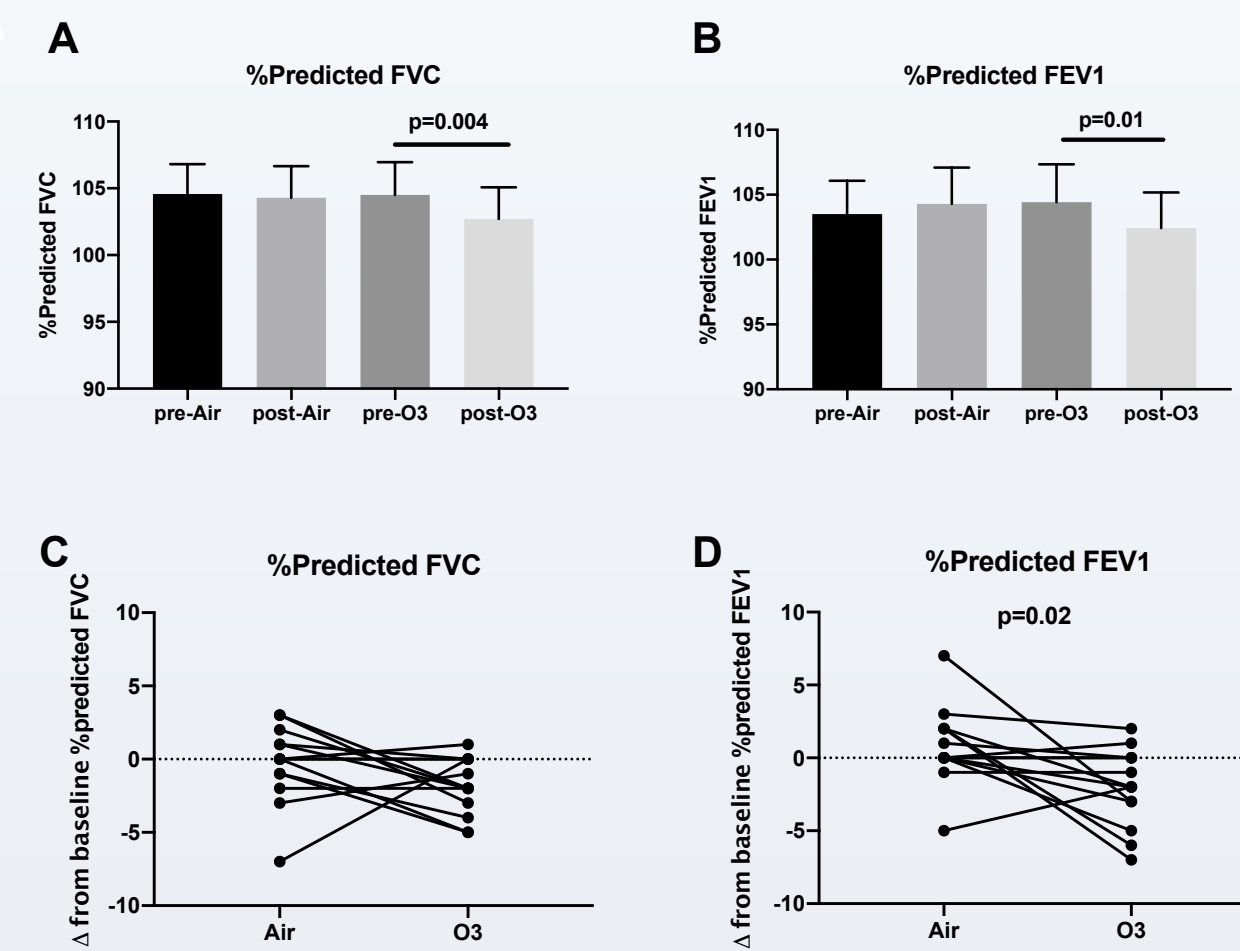
**Figure 1:** Crossover exposure study design of healthy volunteers comparing a sedentary O<sub>3</sub> exposure at an average concentration of 0.07 ppm O<sub>3</sub> versus a CA exposure for 6.6 hours (A). CONSORT diagram outlining subject randomization and participation (B).

## DEMOGRAPHIC INFORMATION

	All Subjects	Male	Female
n	14	7	7
Age (Mean ± SD)	32.2 ± 5.2	30.8 ± 6.4	33.5 ± 3.8
BMI (Mean ± SD)	27.6 ± 5.0	28.4 ± 4.7	26.8 ± 5.6
Race (n)			
Caucasian	11	6	5
African-American	3	1	2
Ethnicity (n)			
Hispanic	2	2	0
Non-Hispanic	12	5	7
Atopic (n)	11	6	5

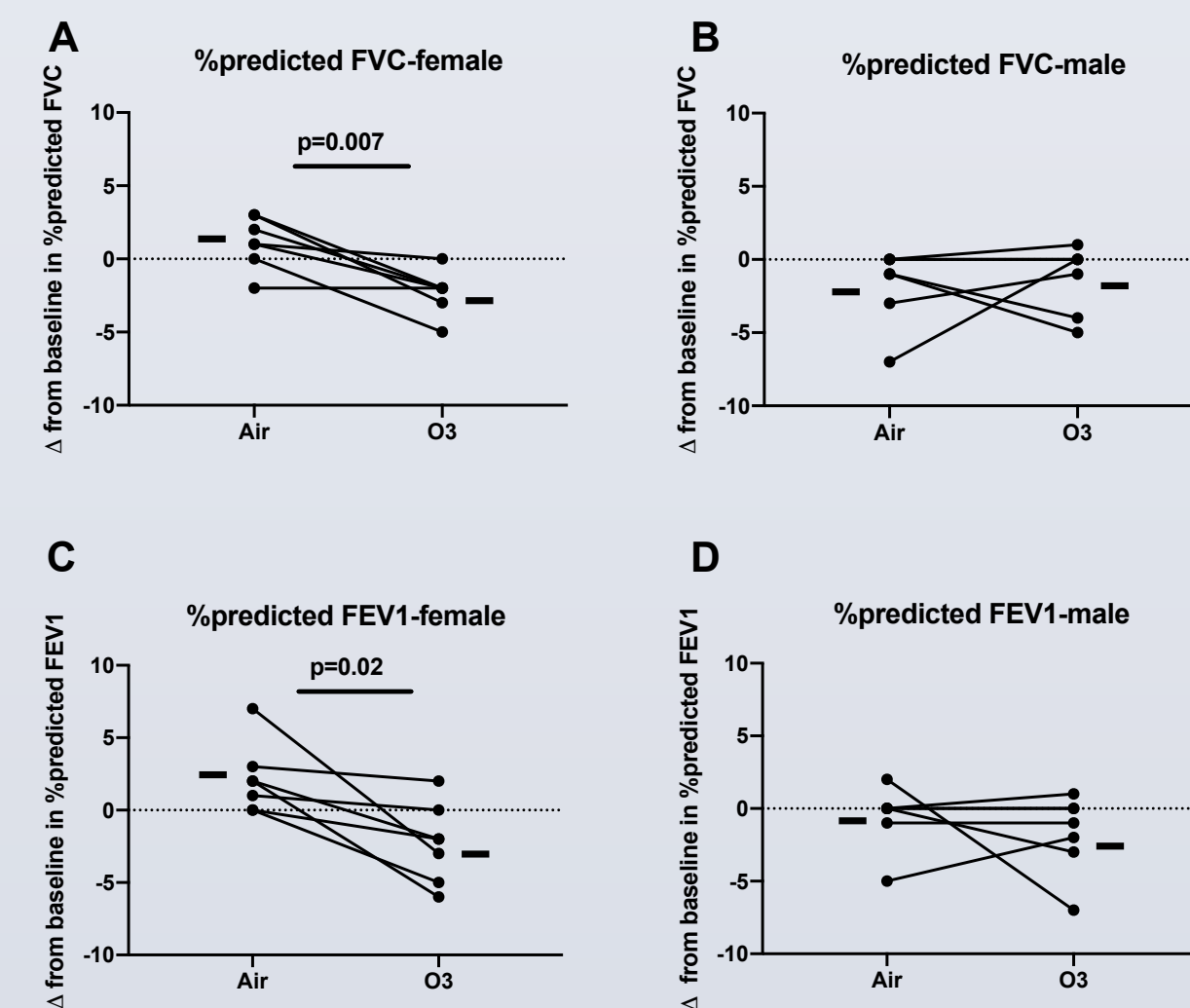
**Table 1.** Demographic characteristics of 14 participants who completed a crossover study comparing a sedentary O<sub>3</sub> exposure at an average concentration of 0.07 ppm O<sub>3</sub> versus a CA exposure for 6.6 hours.

## Low level O<sub>3</sub> at rest reduces lung function



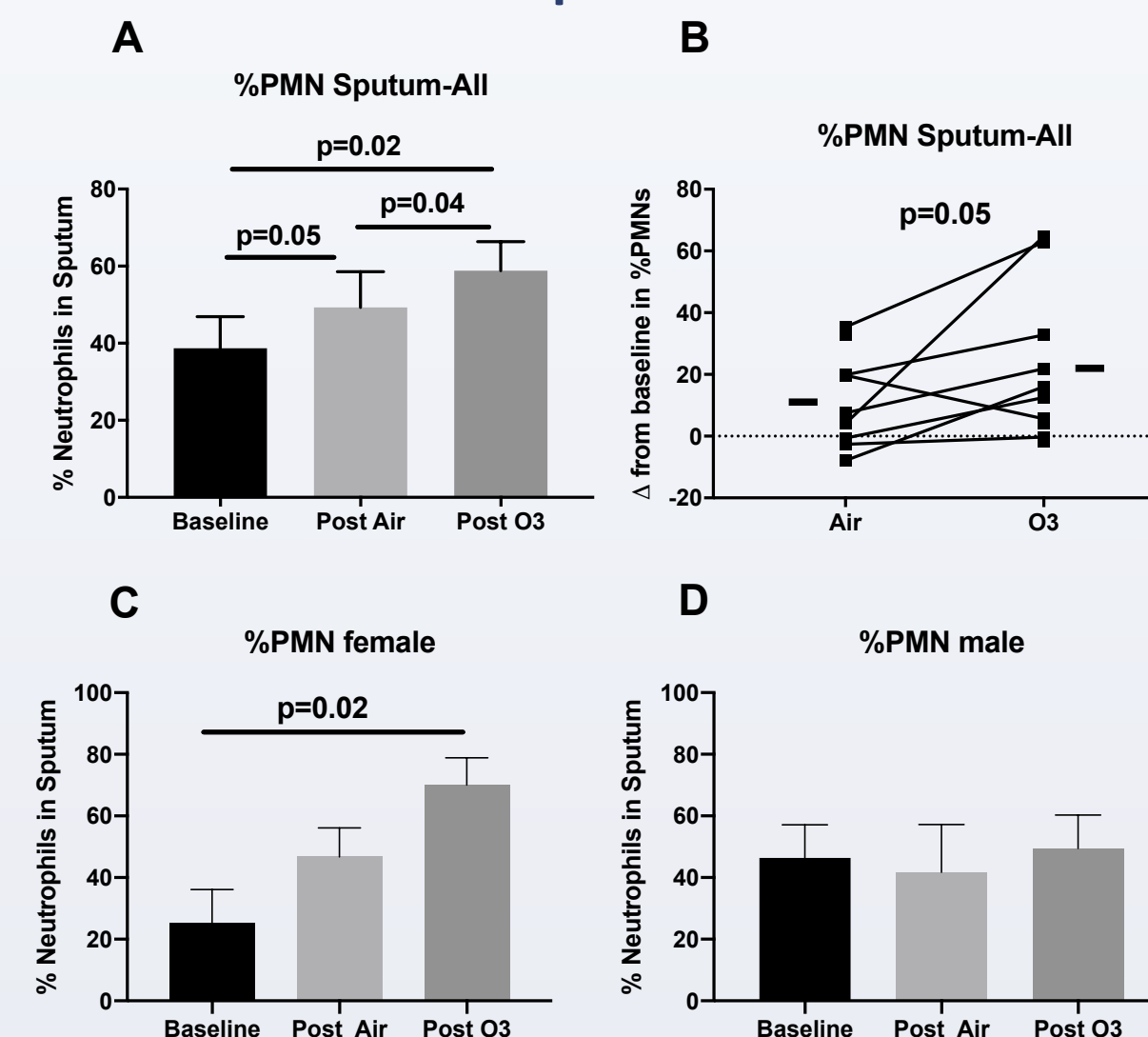
**Figure 2:** %predicted FVC (A) and FEV1 (B) before and after 6.6 hour exposures to CA and to an average O<sub>3</sub> concentration of 0.07 ppm. Change from each exposure's baseline %predicted FVC and FEV1 measures are shown in C and D. Group means (+ SEM) are shown in A-B, while individual changes are shown in C and D. Horizontal bars in C-D denote the mean.

## O<sub>3</sub> induced changes in lung function are sex-specific



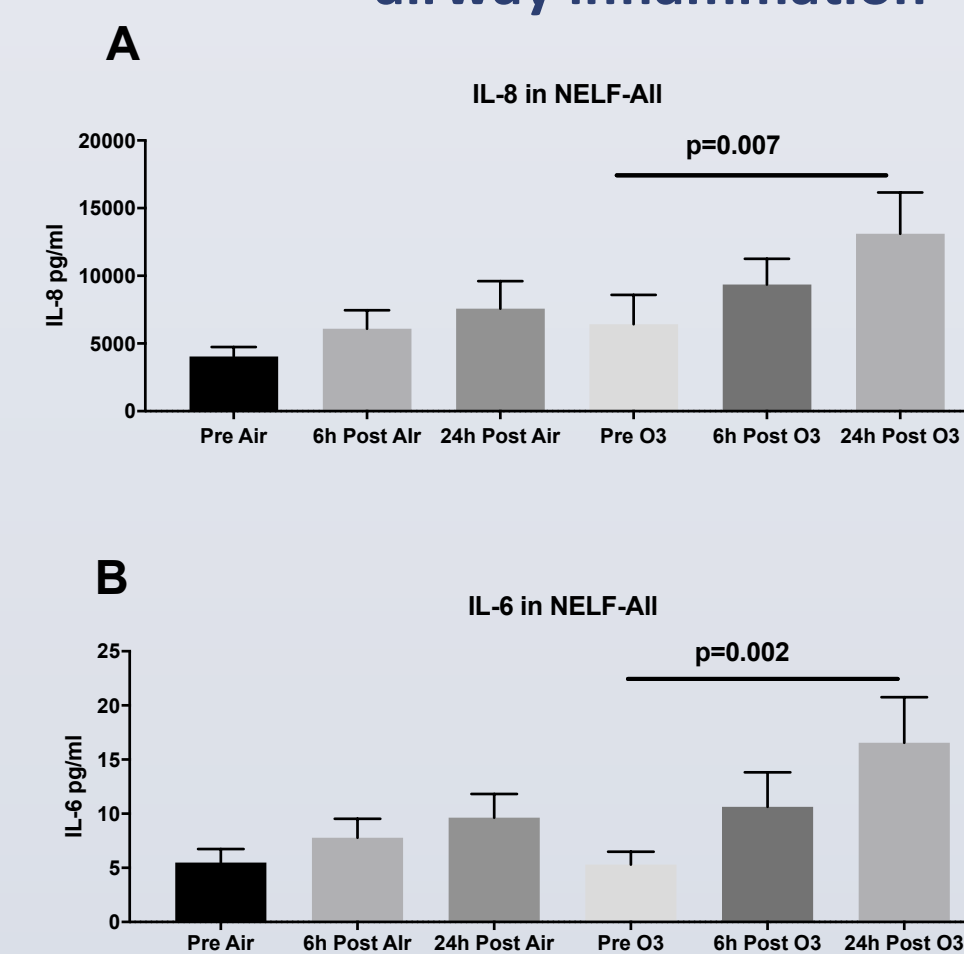
**Figure 3:** Change from each exposure's baseline %predicted FVC (A-B) and FEV1 (C-D) in females (n=7) and males (n=7) comparing a 6.6 hour exposure to CA to 0.07 ppm O<sub>3</sub>. Horizontal bars denote the mean.

## Low level O<sub>3</sub> at rest promotes neutrophilic lung inflammation and is pronounced in females



**Figure 4:** Sputum %Neutrophils (PMNs) at baseline and the morning after each exposure session for the entire cohort (n=8 paired samples) (A), and by sex (n=4 females, n=4 males) (C-D). Change from baseline %PMNs of the O<sub>3</sub> and CA exposures for the entire study cohort (B), with horizontal bars denoting the mean.

## Low level O<sub>3</sub> exposure promotes upper airway inflammation



**Figure 5.** Inflammatory mediators derived from nasal epithelial lining fluid (NELF) the day before the exposures (pre) and six and 24 hours after the beginning of the exposure sessions (post). Mean and SEM are shown. N=14

## CONCLUSIONS

- O<sub>3</sub> exposure at levels below the National Ambient Air Quality Standards (0.07 ppm) while an individual is sedentary leads to reductions in lung function in healthy adults
- Exposure to low-dose O<sub>3</sub> at rest promotes upper and lower airway inflammation
- Changes in lung function and neutrophil recruitment are sex-specific, with a more pronounced pulmonary function decrease and increase in inflammation in females

## FUTURE DIRECTIONS

- Evaluate mechanisms of female specific differences in O<sub>3</sub>-induced inflammation such as hormonal effects, intrinsic responses to O<sub>3</sub>, and production of pro-inflammatory cytokines
- Interrogate the O<sub>3</sub>-induced inflammatory response and effect on pulmonary function in individuals with underlying pulmonary disease such as asthma

## REFERENCES

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## FUNDING

NIH: NHLBI R01 135235, NIEHS R01ES025124, CTSA UL1TR002489  
EPA: Assistance Agreement No. 83578501-0 to UNC