**Title:** Indoor air quality and filter weight change

**Introduction:** Indoor air quality is influenced by several factors. Portable air filters with high-efficiency particulate air (HEPA) technology may be one way to reduce exposure to pollutants from either indoor or outdoor origin as they are rated to filter out nearly all particles < 2.5 microns in diameter (PM 2.5). This study was a sub-group analysis of a larger study, which is still enrolling, examining the effect of indoor portable HEPA filters and respiratory symptoms. This sub-study specifically explored the variation of weight changes in two different types of air filters across subjects and how these weight changes were associated with determinants of indoor air pollution.

**Methods:** This was a randomized, blinded, cross-over study. Participants of the study were enrolled via clinic, internet and television broadcasting and included former smokers who have symptoms during periods of poor outdoor air quality along Utah’s Wasatch front. Surveys that included questions on indoor air quality were administered at the beginning of the study. Portable electric air filters were installed in the bedrooms of participants to be run throughout the duration of the 12-week study. A low-efficiency filter remained in the filter device throughout the entirety of the study, which allowed blinding of the participants with respect to the presence or absence of the HEPA filter. Participants were randomized to either placement of a HEPA filter or no HEPA filter first with cross-over 6 weeks into the study, including a week of washout. HEPA and low-efficiency filters were carefully weighed at the beginning and end of the study in a sealed plastic bag to prevent loss of captured particulates, and the difference in weight was recorded. Changes in weight of filters from the beginning to the end of the study were assumed to be representative of the amount of particulate captured.

**Results:** This analysis is based off of 25 patients in year 1 of study recruitment. The study was not powered to find statistically significant associations between participants' answers to the questionnaires and amount of weight change in either filter. Results of answers to these questions are listed in Table 1. The average weight change in the HEPA and low-efficiency filters for all participants was 8.38 mg (6.13 SD) (1.7% weight change) and 5.53 mg (2.81 SD) (7.6% weight change) respectively. There was significant variation in filter weight changes across participants. The weight change in HEPA filters did not appear to correlate with the weight change in low-efficiency filters (Figure 1). Four categories of participants were described as listed in Table 2, the largest group (32%) were those that had a small increase in the low-efficiency filter and large increase in the HEPA filter.

**Conclusion:** Change in weight of filters in a portable air filtering device might be one way to measure the amount of indoor air particulate matter. In our study, larger percentage changes in weight were found among the low-efficiency filters likely because of the longer duration of use and larger size of particles trapped.

|  |  |
| --- | --- |
|  | **% "Yes" (n)** |
| **Questionnaire item** |
| *Do you have a wood burning fireplace?* | 16% (4) |
| *Do you have a wood burning stove?* | 8% (2) |
| *Do you have an electric stove?* | 50% (12) |
| *Do you have a gas stove?* | 44% (11) |
| *Do you frequently use candles or incense?* | 35% (8) |
| *Is there mold or water damage in the home?* | 17% (4) |
| *Do you cook frequently at home?* | 79% (19) |
| *Do you own pets?* | 83% (19) |
| *Do you have carpet in your home?* | 91% (21) |

**Table 1.** Answers to indoor air questionnaire

**Figure 1.** Change in weight of the HEPA and low-efficiency filter across participants in milligrams, organized by increasing weight change in HEPA filter

|  |  |  |
| --- | --- | --- |
|  | **Large increase in low-efficiency filter weight** | **Small increase in low-efficiency filter weight** |
| **Large increase in HEPA filter weight** | 7 (28) | 8 (32) |
| **Small increase in HEPA filter weight** | 5 (20) | 5 (20) |

**Table 2.** Participants grouped by weight change in HEPA or low-efficiency filter, n (%)