

Allergen removal from hard floors: Assessment of a range of sweeping devices

To the Editor:

Floor cleaning has been used in several allergen-avoidance studies,^{1,2} and the use of hard floors has been promoted as a means of reducing exposure to allergens.^{3,4} Methods of allergen removal from hard floors have not been examined. We tested 7 cleaning devices by using them to remove an allergenic house dust mixture that had been applied to hard floor surfaces.

Seven cleaning devices were tested on a vinyl floor: (1) a disposable electrostatic cloth sweeper (Swiffer, Procter & Gamble, Cincinnati, Ohio), (2) a rubber-bristled broom (Vileda Super Scopa, Vileda, Weinheim, Germany), (3) a sweeper with a disposable oil-impregnated cloth (Velo Magico, Casallegra, Italy), (4) a traditional nylon-bristled broom (Rubbermaid Broom, Rubbermaid, Wooster, Ohio), (5) a sponge-rubber sweeper (Scopa Gomma, Vileda), (6) a dry nylon dustmop (Rubbermaid Mop, Rubbermaid), and (7) a sweeper with a fleecy synthetic fiber pad (Vileda Fibra Attiva, Vileda).

The disposable electrostatic cloth sweeper, the sweeper with a disposable oil-impregnated cloth, and the sweeper with a fleecy synthetic fiber pad were also tested on a wooden floor.

A 5 × 8-ft area of flooring was marked into 1-ft² sections. Five sections were used before cleaning, and 15 sections adjacent to these were used after cleaning to sample allergen in each area.

A thin, even coating of 23 mg/ft² of prepared dust was applied to the floor. This represented approximately 11 µg/m² of Der p 1, 5 µg/m² of Der f 1, 14 µg/m² of Fel d 1, and 18 µg/m² of Can f 1.

Samples were collected from individual squares by means of cotton swabs (Nu Gauze, Johnson & Johnson, Montreal, Canada) wetted with 1 mL of 1% BSA in PBS with 0.05% Tween 20 (1% BSA-PBST).

Sweeping was performed with each of the test devices in such a way as to achieve single-pass cleaning; in each case, an overlap of 20% of the width of the device was allowed. Accumulated dust was swept outside the test areas.

Swabs were extracted with a further 1 mL of 1% BSA-PBST. Samples from the vinyl floor were assayed through use of ELISA (Indoor Biotechnologies, Charlottesville, Va) for Der p 1, Fel d 1, and Can f 1. Samples from the wooden floor were assayed for Der p 1, Fel d 1, and Der f 1, inasmuch as Can f 1 had given results similar to those for Fel d 1.

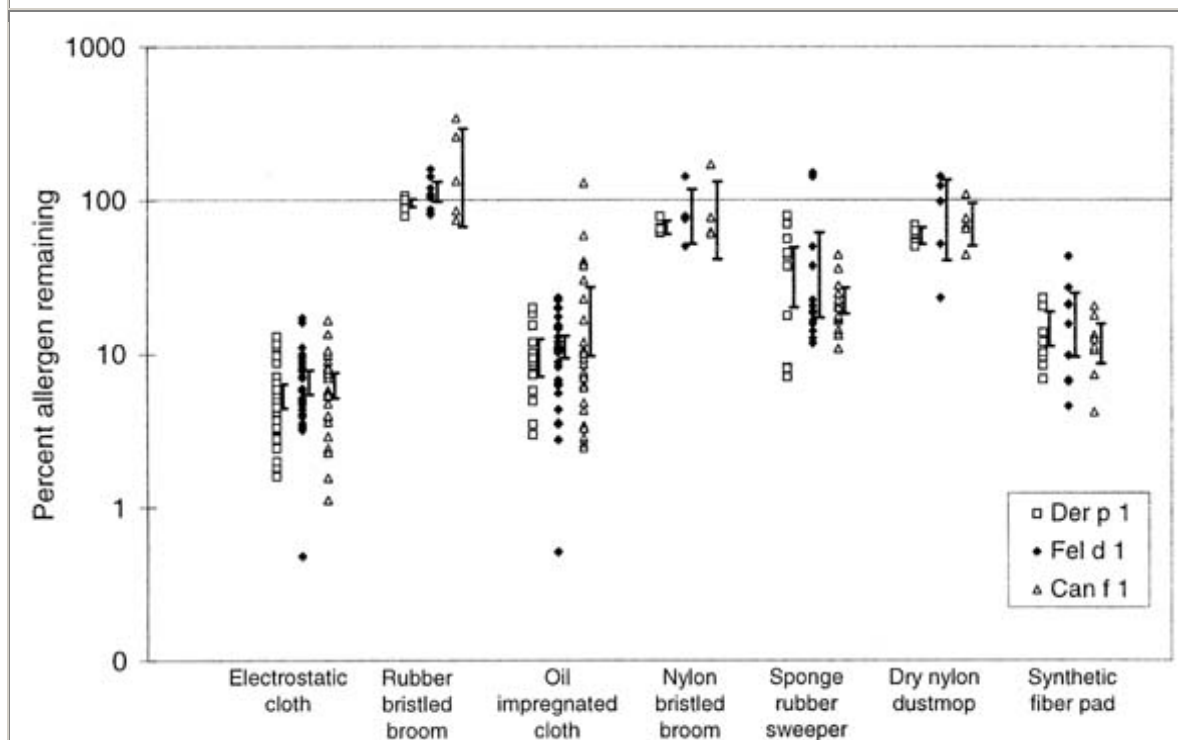
Results from the precleaning sections and postcleaning sections were used to calculate the percentage of each allergen remaining after cleaning for each device. Results for the 3 posttreatment sections were averaged to give a mean result per test. Log-transformed data were used in the analyses.

Comparison of the most effective device against the alternatives was performed with the 2-

sample *t* test; *P* values ($\alpha = 0.1$) less than .05 were considered significant.

The electrostatic cloth sweeper removed significantly more Der p 1, Fel d 1, and Can f 1 from the vinyl floor than the other devices (Fig 1); it removed >94% of Der p 1, >93% of Fel d 1, and >93% of Can f 1.

Fig. 1. Allergen remaining on the vinyl floor after cleaning with each of the tested devices. Bars indicate $\pm 90\%$ CIs.



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The ranking of the devices with respect to cleaning efficiency was similar for all 3 allergens tested on the vinyl floor. In this protocol, 3 devices showed a large variation in cleaning efficiency, which was the result of dust being redistributed rather than removed.

The devices tested on the wooden floor displayed results similar to those seen with the vinyl floor, the electrostatic cloth sweeper again being the most effective device tested; it removed >90% of Der p 1, >95% of Der f 1, and >89% of Fel d 1. Other devices maintained similar rankings.

In this standardized cleaning procedure, sweepers featuring cloth pads were the devices most efficient at reducing allergen levels. Electrostatic materials are known to increase allergen capture in air filters.⁵ In our tests, the electrostatic cloth sweeper removed significantly more allergen than the other devices.

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Jason Kingsley Sercombe, BSc (Biomed Sci), GDip Biomed Eng^a

David John Malachy Taylor, BSc (Hons)^a

Simona Battucci, MD^b

Laura K. Brown, BS (Chem Eng)^c

Jennifer L. Counts, PhD ^c

Euan Roger Tovey, PhD ^a

^a*Institute of Respiratory Medicine University of Sydney
Sydney, Australia*

^b*Procter & Gamble Italian Research Center
Rome, Italy*

^c*The Procter & Gamble Company
Cincinnati, Ohio*

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