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Department of Health Services  
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Dear Margaret:

I think a comprehensive study of effects of environmental tobacco smoke in flight attendants is an excellent idea. My suggestions are as follows:

1. Flight Selection and Characterization

- a. Consider duration of flight. Longer flights should result in greater exposure.
- b. Consider altitude, location and time of year of flight. These factors will influence ozone exposure, which may result in symptoms similar to those of ETS exposure.
- c. Consider anticipated ventilation on particular flights. Differences in ventilation will influence ETS exposure.

2. Personal Exposure Monitoring: Air Sampling

Personal air sampling devices to measure breathing space exposures over specific periods of time are available. I would recommend:

- a. Measurement of total number and size of particles, tar, nicotine, benzo(a)pyrene, pyrene, phenols, ammonia, formaldehyde, acrolein, nitrogen oxide, carbon monoxide and, importantly, ozone concentrations.
- b. Relative humidity, which can cause respiratory symptoms and which tends to decrease with increasing duration of flight, should be measured.
- c. Air measurements should be done before and hourly during the flight. Results are expected to change over time.
- d. Air should be sampled in several locations, including both smoking and nonsmoking sections.
- e. The size of the plane, i.e., total air space, and ventilation rate should be noted.
- f. The number of cigarettes burned during the flight should be recorded.

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3. Personal Exposure Monitoring: Biological Samples

- a. The best overall measure of intake of tobacco smoke is cotinine level. There are no good biological measures of tar or irritant gas exposure. Carbon monoxide can be measured, but levels have not been observed to change with usual levels of ETS exposure, including other studies of flight attendants. Nicotine levels should also be measured, although some studies have shown this not to be as useful as cotinine.
- b. The most convenient sample to assay is saliva. Urine is also useful and relatively not invasive. Urine collection may provide a better measure of cumulative exposure during the flight. Urine could also be used for assays of mutagenicity, an indirect measure of tar exposure.
- c. Saliva should be sampled before and, if possible, hourly during the flight. Urine can be collected prior to the flight, a collection spanning the time period of the flight and, if possible, for several hours after the end of the flight.

4. Subjective Data

- a. A history of usual ETS exposure should be obtained. This should include number of smokers at home and number of hours exposed to ETS per day or per week.
- b. Subjects should complete questionnaires on symptoms such as eye irritation, nasal stuffiness, headache, sore throat, etc., before and at intervals during the flight.
- c. An attempt should be made to correlate intensity of symptoms with air sampling and biological measures.

I am sorry I am unable to participate in the planning session. I hope these comments are helpful. I would be glad to contribute in any way I can when I return from Australia in September.

Best regards,

*Neal*

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