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Invited Commentary: Attendance and Absence as Markers of Health Status—The Example of Active and Passive Cigarette Smoking

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Abbreviation: ETS, environmental tobacco smoke.

Absence from work and school is an important social issue. Four percent of workers in the United States were absent during an average workweek in 2001 (1). Absences from work can lead to lost productivity and can influence the likelihood that a person keeps a job (2). Among the more than 50 million children aged 5–17 years in the United States in 1998, 18 percent missed 6 or more days of school because of illness or injury (3). Absence from school can adversely affect school achievement (4, 5) and hence educational aspirations and eventual educational attainment (6, 7).

Attendance patterns result from a complex array of factors, including health status as a major contributor, and are thus potential markers of health status (8). In families with children, a close interrelation exists between parent and child attendance. Child health can affect parental work attendance, and the health of other family members can affect a child's school attendance. The younger the child, the more likely a school absence will directly impact parental work attendance because younger children require full supervision, even if home because of minor illnesses.

ACTIVE CIGARETTE SMOKING AND ATTENDANCE

Active cigarette smoking has been investigated as a potential determinant of absence. The considerable literature regarding adults consistently shows that smokers are more likely than nonsmokers to be absent from work (9–17). Furthermore, the likelihood of workplace absence increases according to the number of cigarettes smoked per day (18–20). Compared with persistent smokers, smokers who quit tend to have a reduced rate of absenteeism (21–23). A comparison of the attendance patterns of smokers who quit and those who persisted smoking over time showed improved attendance among those who stopped smoking but an increase in absences among the persistent smokers (24).

When school attendance and active cigarette smoking have been studied among youths, cross-sectional associations have indicated lower attendance among youths who smoke compared with nonsmokers (25–28). These studies leave unaddressed the critical question of whether school absence (or its determinants) is a risk factor for becoming a smoker and/or a consequence of smoking. Both may be true. In a case-control study of high school smokers and nonsmokers, the smokers were observed to have been more likely to be absent from school as far back as second grade (29). In this context, absence is often used as one of several measures of academic performance, along with characteristics such as academic achievement and educational aspirations. Prospective studies also have shown that smokers are at higher risk of subsequent absence (30, 31). The link between active smoking and school absence is complex, because school absence is a risk factor for smoking initiation, with the near-term adverse health effects of smoking cigarettes in turn further contributing to an increased likelihood of absences among youths who smoke cigarettes (30, 32).

A NEW GENERATION

The paper by Gilliland et al. (33) in this issue of the *Journal* is notable for several reasons. It extends the previously explored link between tobacco exposure and school absence from active to passive smoking. Passive smoking has already been associated with a greater likelihood of absence from work among adults (34, 35). In the present study, rates of absence among children exposed to passive smoking at home were elevated compared with children not

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exposed to passive smoking. Compared with the children not exposed to environmental tobacco smoke (ETS), the ETS-exposed children had absence rates 32 percent higher for nonillnesses, 34 percent higher for respiratory illnesses, and 39 percent higher for gastrointestinal illnesses. This association is biologically plausible, because exposure to passive smoking has been observed to be associated with markedly greater concentrations of tobacco-specific nitrosamines and cotinine in children exposed to passive smoking (36), documenting that exposed children inhale substantial quantities of tobacco smoke.

By stratifying the data jointly according to both asthma status and passive smoke exposure, this study (33) unites our understanding of attendance in relation to both morbidity and tobacco smoke exposure. The value of this approach is clear from the finding that the association between household exposure to passive smoking and absence was stronger in asthmatics than nonasthmatics, highlighting an important interaction between ETS exposure and disease status. Exposure to ETS has also been observed to be associated with increased absence from work among adult asthmatics (37) and, in recently reported cross-sectional studies, with increased school absences among children with asthma (38, 39).

In the United States, 12 percent of children aged 17 years or younger have ever been diagnosed with asthma, and 5 percent have had an asthma attack in the past year (3). The observation of a strong association in a risk group comprised of so many youths has potentially far-reaching implications. ETS exposure is an established risk factor for asthmatic episodes (40), and school absences represent the tip of the iceberg with respect to the upheaval asthma causes in families. Lurking behind a school absence may lie sleepless nights, physician visits, emergency department visits, hypersomnolence, poor concentration, parents missing work, and poor asthma-specific quality of life (41). For example, in a cohort of asthmatics, absence from school and work was associated with hospitalizations (42). This increased risk of asthma episodes is likely due in part to the effect of ETS on nonspecific bronchial hyperresponsiveness, a hallmark of uncontrolled asthma (43). ETS can increase bronchial hyperresponsiveness even in nonasthmatics (43). An increase in bronchial hyperresponsiveness could plausibly lead to an increase in the incidence of symptomatic respiratory illness and school absences, even in a nonasthmatic population.

Undiagnosed and inadequately treated asthma in children is a community health problem (44). The strong association between asthma and absence raises the possibility that if a surveillance program were in place, frequent absences due to respiratory illness could serve as a "sentinel event" (6). This sentinel event could trigger an investigation for undiagnosed asthma or other health problems or for already-diagnosed asthmatics who require intensification of treatment. Such information would be particularly useful to schools with proactive policies toward asthma control (45).

Compared with previous studies of absence, the study by Gilliland et al. (33) has strengths that have generally been uncommon. The intensive follow-up of a cohort over time is laudable. Given the numerous factors unrelated to health that contribute to overall attendance patterns, focusing on absences due to illness considerably enhances the usefulness of absence as a marker of health status. By further collecting data on the specific types of illnesses responsible for absences, these investigators were able to isolate respiratory illnesses, the outcome of greatest interest for a study of ETS.

Clues to how patterns of household exposure to passive smoking, such as those associated with family structure, relate to school absence merit future exploration. Nationwide, 31 percent of children reside in a single-parent household (46), and, compared with children from two-parent households, these children are more likely to have asthma (47) and to be absent from school (3). The prevalence of parental smoking is also higher in single-parent than two-parent households (48). In families with one parent who smokes, the degree of exposure may be greater in the single-parent household than the two-parent household if, for example, the time spent with the one parent who smoked was greater.

Few members of the cohort studied by Gilliland et al. (33) were active smokers because they were fourth-graders, younger than the ages at which most children start to smoke. Thus, the results of Gilliland et al. could not have been substantially altered by including the active smokers. Future studies that explore the connection between passive smoking and school absence, particularly those among older youths, would be wise to exclude youths who are active smokers for the following reasons. Children whose parents smoke are not only exposed to ETS but also more likely to become smokers themselves (30, 49, 50). As noted above, children who are active smokers are more likely to be absent from school. Active smoking by children is thus strongly linked to both ETS exposure and school absence and is an intermediate in the causal pathway, making it difficult to disentangle the influence of active smoking from passive smoking on school absences. Under these circumstances, studies that include active smokers run the risk of overestimating the association between passive smoking and school absence.

TARGETING PARENTAL SMOKING

The study by Gilliland et al. (33) adds to the importance of promoting smoking cessation among parents who smoke cigarettes. Parents who smoke not only increase their personal risk of diseases caused by smoking but, by modeling smoking, also increase the likelihood that their children will become smokers (51). Children of parents who smoke are also exposed to the adverse health effects of ETS exposure. The findings of Gilliland et al. document that children who have a parent who smokes are also more likely to lose time from school. In this regard, attendance is an outcome that not only serves as a useful marker of health status but also sheds light on the downstream costs of a factor that reduces attendance. For example, time lost from school can result in poorer academic achievement (4, 5), with the long-term potential to negatively affect educational attainment (6, 7). Additionally, the time parents lose from work when staying home with sick children has economic consequences.

Parental smoking is thus a critical family health issue. Successful smoking cessation strategies for parents could

reap substantial public health benefits. Of the interventions targeted toward established risk factors for asthma exacerbations, reducing ETS exposure may offer the most promising opportunity for reducing asthma morbidity because this risk factor is potentially modifiable. Even in the absence of smoking cessation, ETS exposure can be reduced by implementing a policy of "smoke-free" homes.

It is hoped that publication of the study by Gilliland et al. (33) on ETS exposure in relation to school absence among youths will stimulate further interest in this important public health issue. As mentioned by these authors, advancing our understanding of the wide range of potential determinants of absence is worthy of greater attention. Further understanding of the complex array of factors that result in absence promises not only to reveal new insights into the underpinnings of health and disease but also to more fully characterize the costs associated with risk factors for absence.

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