Use of Health Services by Children of Smokers and Nonsmokers in a Health Maintenance Organization

Colleen M. McBride, PhD, Paula Lozano, MD, MPH, Susan J. Curry, PhD, Daniel Rosner, BA, and Louis C. Grothaus, MA

ABSTRACT

Objectives. Use of health services by children of smokers and nonsmokers was compared to assess whether exposure to environmental tobacco smoke resulted in greater use of health services among children of smokers.

Methods. Primary care and emergency room visits, asthma-related prescriptions, and inpatient stays over the 42-month study period were compared for children of smokers (n = 498) and nonsmokers (n = 1062) who were enrolled in a health maintenance organization. Parents of children aged 1 through 11 years were identified from participants in 2 randomized smoking cessation trials.

Results. After adjustment for parental age, education, and health status and for child's age, there were no differences between children of smokers and children of nonsmokers in use of primary care or emergency room visits, asthma-related prescriptions, or inpatient stays. However, among those with any preventive care visits, children of smokers had significantly fewer visits than children of nonsmokers.

Conclusions. Further study is needed to elucidate whether parents who smoke underutilize health services for their children or use services differently from nonsmoking parents and whether these differences have cost implications. (*Am J Public Health.* 1998;88:897–902).

Introduction

There is consistent evidence that nonsmokers,[1] particularly young children,[2] experience negative health effects from exposure to environmental tobacco smoke. Infants who live in households with smokers are at significantly greater risk than children of nonsmokers for a variety of upper respiratory illnesses, middle ear diseases, chronic respiratory symptoms, and asthma exacerbations.[3–9] Although the association between environmental tobacco smoke and morbidity is strongest and most consistent among very young children, several studies have indicated that primary school–aged children (those aged 5 to 12) who live in households with smokers have an increased risk of middle ear disease,[10,11] respiratory illness,[8,12] and chronic cough[13] compared with those living in nonsmoking households. These conditions represent a significant proportion of all childhood morbidity[14,15] and can greatly increase the demand for pediatric health services.

It is unclear whether chronic exposure to environmental tobacco smoke translates into higher use of health care by exposed children. Two studies have reported an association between parental smoking and hospital admissions among infants.[16,17] In contrast, a study conducted with a broader age range of children (from infancy to 18 years) reported no significant differences in use of outpatient or inpatient health services for respiratory illnesses.[18] Data for these 3 studies were collected between 10 and 20 years ago. Since that time, evidence of the health effects of exposure to environmental tobacco smoke has grown,[1] along with a steady increase in the prevalence of some environmental tobacco smoke–related conditions.[19,20] For these reasons, a reexamination of the patterns of use of health services by children of smokers is warranted. To this end, we compared patterns of use of outpatient and inpatient services by children of smokers and nonsmokers aged 1 through 11 years in a large managed care organization. We hypothesized that children of smokers would use more health services than children of nonsmokers.

Methods

Study Setting

Parents were identified from participants in 2 randomized trials that evaluated self-help smoking cessation interventions and motivational adjuncts.[21,22] Both randomized trials were conducted at Group Health Cooperative of Puget Sound, a staff model health maintenance organization serving more than 400 000 enrollees in western Washington State.

Group Health Cooperative enrollees are demographically representative of the Seattle–Tacoma metropolitan area with respect to age, race, income, and marital status; enrollees are somewhat better educated and have lower rates of smoking than

At the time of the study, all authors were with the Group Health Cooperative of Puget Sound, Seattle, Wash. Colleen M. McBride was, and Susan Curry is, also with the Department of Health Services, University of Washington, Seattle. Paula Lozano is also with the Department of Pediatrics, University of Washington.

Requests for reprints should be sent to Colleen M. McBride, PhD, Duke Comprehensive Cancer Center, Hanes House, Room 236, Trent Dr, Durham, NC 27710-2949.

This paper was accepted December 1, 1997.

the general population.[23] Others have reported that families with children are more likely to be enrolled in managed care than in fee-for-service plans.[24]

Study Sample

Parents of children aged 1 through 11 years were selected from participants in the 2 randomized trials. Parents were selected first from a large population-based trial that was designed to evaluate self-help cessation strategies (study 1). Recruitment for the study, which began in 1989, was conducted via a general health behavior survey of 5903 Group Health Cooperative enrollees; 1137 were smokers who were enrolled in the trial and 4766 were nonsmokers who completed the screening survey. (See Curry et al.[22] for a detailed description of the study design.) Parents who answered yes to 2 questions—Have you smoked at least 100 cigarettes in your lifetime? and Do you currently smoke?—at baseline and at 3- and 12-month follow-ups were considered to be smokers (n = 232). Parents who answered no to these questions at baseline were considered to be nonsmokers (n = 1062). Data were collected from 91% and 97% of the smokers at 3- and 12- month follow-ups, respectively, in study 1.

To augment this sample, parents who had participated in an earlier randomized trial (study 2) were also identified. Study 2 participants were all smokers who responded to advertisements in a Group Health Cooperative monthly magazine sent to all enrollees. Recruitment for the study was conducted over a 4-month period in 1987. Of the 1555 people who initially expressed interest in participating, a total of 1217 smokers returned completed questionnaires and consent forms and were enrolled in the study. A detailed description of the study design is presented elsewhere.[22] Parents in study 2 who reported that they were still smoking at 3- and 12-month follow-ups were included in the sample as smokers (n = 176). Response rates were 98% and 95% among the smokers at the 3- and 12-month follow-ups, respectively, in study 2.

To reduce the potential variability in exposure to environmental tobacco smoke during the study period, parents in both studies who quit smoking at any time between baseline and the 12-month follow-up (n = 32) were excluded. In addition, parents of children younger than one year (n = 20) were excluded because these children did not have a complete year of health services data available for the first year of the study. Thus, the study sample comprised a total of 408 parents who smoked and 1062 parents who were nonsmokers.

The child's pattern of use of health services was identified via automated billing records that enabled parents' consumer numbers to be matched with the consumer numbers of their children. Membership and billing records include date of birth and sex for each enrollee. For parents with more than one child in the target age group, the health care use of the youngest child was selected for analysis.

Measures

Independent measures. The number and ages of children in the family, and the parents' age, sex, marital status, education, perceived health status, and, for smokers, the number of cigarettes smoked in the past 7 days were assessed for participants in both studies 1 and 2.

Health care use indicators. Group Health Cooperative has maintained computerized data on pharmacy prescriptions since 1977 and on inpatient and outpatient visits since 1984. Another Group Health Cooperative study using these systems documented that computer records reliably represented the information contained in the charts (R^2 = 0.93) (D. Cherkin, Phd, unpublished reports, 1995). We defined total primary care visits as visits to family practice and pediatric clinics. Included are visits to physicians, physician's assistants, and nurse practitioners for preventive or acute care. Preventive care visits include camp, sport and well-care physicals. Specialty care includes visits that require referral by a primary care provider. This category includes, but is not limited to, otolaryngology, ophthalmology, dermatology, and urology. Respiratory prescriptions were limited to asthma drugs in the following drug classes: beta agonists, theophylline, oral or inhaled corticosteroids, and cromolyn. These drugs were selected because they are prescribed almost exclusively for treatment and prevention of the symptoms of asthma. Although other drugs, such as antibiotics, are commonly prescribed for environmental tobacco smoke–related conditions, they are also prescribed for a wide variety of childhood morbidities that are unrelated to environmental tobacco smoke exposure. Emergency room visits and hospital stays were distinguished by specific codes in the inpatient database. Hospital stays included short-stay or ambulatory surgery admissions.

Forty-two months of data for use of health services following the baseline survey were available for studies 1 (1989–1993) and 2 (1987–1991). Use of health services by the index child over the study period was measured in 7 categories: total primary care visits, primary care visits excluding preventive care visits, preventive care visits, specialty care visits, emergency room visits, asthma prescriptions, and hospital stays. "Total primary care visits" was defined as the total number of primary care, preventive care, specialty care and emergency room visits. Two outcome variables for each category of health care use were compared for children of smokers and children of nonsmokers: (1) the proportion of children who had any visit, prescription, or hospital stay in the 42-month window and (2) among those with any health care use, the mean number of visits, prescriptions, or hospital stays per child.

Analysis

Bivariate associations between parents' smoking status, parents' demographic characteristics, and use of outpatient and other health care services by their children were tested with chi-square analyses for categorical variables and *t* tests for continuous variables. Repeated-measures analysis of variance (ANOVA) was used to test for differences between children of smokers and children of nonsmokers in patterns of use over time. The association between health care use and parents' smoking after adjustment for potential confounders was tested by logistic regression for the dichotomous outcomes (e.g., primary care visits, none vs any), and linear regression for continuous outcomes (e.g., number of visits among those with any primary care visits).

Results

Demographic Comparison of Smoker Samples

Demographic and smoking characteristics of smoking parents from the population-based sample (study 1) were compared with those of smoking parents from the sample of volunteer participants in a randomized cessation trial (study 2) (data not shown). Compared with smokers in study 2, smokers in study 1 were significantly older (35.6 years vs 33.4 years), had older children (67% had children aged 6–11 years, vs 51% of parents in study 2), were less likely to be female (48% vs 58%), and were lighter smokers (a mean of 18.1 cigarettes per day, vs 25.9 for smokers in study 2).

There were no differences between the 2 samples of smokers in education, self-

reported health status, or average family size. Thus, pooling the 2 samples yielded a relatively heterogeneous sample of smoking parents with respect to parent's sex, smoking characteristics, and children's age. Overall, parents who smoked reported smoking an average of 21.5 (SD = 9.7) cigarettes per day, and 70% reported smoking 20 or more cigarettes in an average day.

Demographic Comparison of Pooled Sample of Smokers with Nonsmokers

Demographic and smoking characteristics of the pooled sample of smoking parents were compared with those of nonsmoking parents. Compared with the smokers, the nonsmoking parents were significantly older, more educated, more likely to be female, and perceived themselves to be in better health (see Table 1). There were no differences between the smokers and nonsmokers in age of index child, average number of children in the household, or patterns of use of health services.

TABLE 1–Demographic Characteristics of Parents in a Study of Health Care Use by Children of Smokers and Nonsmokers: Group Health Cooperative of Puget Sound, 1987 through 1993

	Parent's Smoking Status		
	Nonsmoker (n = 1062)	Smoker (n = 408)	*P*
Education			
Some high school, %	1	9	. . .
High school graduate, %	16	30	. . .
Some college, %	33	43	. . .
College graduate, %	50	18	.001
Average no. of children in family	1.6	1.6	.90
Average age of parent, y (SD)	35.6 (6.2)	34.6 (5.9)	.004
Female parent surveyed, %	58	52	.04
Parent perceives own health status as excellent or good, %	92	78	.001
Age of child			
1–5 y, %	42	40	.90
6–11 y, %	58	60	. . .

Patterns of Use of Health Services

The majority of the children in the study had either a primary care or specialty care visit (97% and 78%, respectively) and just over half of the children had a preventive care visit in the 42-month study period. A smaller proportion of children had an asthma prescription (17%), an emergency room visit (10%), or a hospital admission (4%) in the same time frame. Table 2 shows the proportions of children using health services by parental smoking status. Overall, there was a striking similarity in the children's patterns of use during the study period. Small differences between the groups indicated consistently less use of health services among children of smokers than among children of nonsmokers, although none of the differences were statistically significant. Adjusting for parental demographics, parent's perceived health status, and child's age did not appreciably influence the results.

Table 3 shows the mean numbers of visits, prescriptions, and hospital admissions per child per year for children of smokers and nonsmokers who had used the services during the study period. Again, children of smokers and nonsmokers were very similar in average number of visits across categories of services; children of smokers used slightly, although not significantly, fewer services than children of nonsmokers. However, among those with any preventive care visits, children of smokers had significantly fewer preventive care visits than children of nonsmokers ($P < .05$).

The relationship between parental smoking status and child health has consistently been observed to be strongest for maternal smoking. Analyses were stratified by sex of the parent to explore whether children's use of health services differed according to whether the smoker was the mother or the father. There were no significant differences between children of nonsmokers and children of smokers in the proportion who had any primary care visits, regardless of the sex of the parent. Results were similar for mean numbers of primary care, specialty care, and emergency room visits.

TABLE 2—Proportion of Children Using Health Services During the 42-Month Study Period, by Parental Smoking Status: Group Health Cooperative of Puget Sound, 1987 through 1993

	% with Any Use					
Health Service	Children of Nonsmokers (n = 1062)	Children of Smokers (n = 408)	Difference	95% CI	*P*[a]	Adjusted *P*[b]
Total primary care visits	98.6	98.3	–0.3%	1.7%, 1.1%	.56.	.37
Primary care visits excluding preventive care	97.0	98.0	1.0%	–0.7%, 2.7%	.27	.72
Preventive care visits	57.7	51.5	–6.2%	–11.9%, –0.5%	.03	.32
Specialty care visits	79.0	76.0	–3.0%	–7.8%, 1.8%	.21	.13
Emergency room visits	10.5	11.0	0.5%	–3.1, 4.15	.75	.69
Total outpatient vists[c]	98.8	99.0	0.2%	–1.0%, 1.4%	.80	.65
Asthma prescriptions	17.2	16.7	–0.5%	–4.8%, 3.8%	.80	.88
Hospital admissions	3.7	4.4	0.7%	–1.6%, 3.0%	.51.	.46

Note. CI = confidence interval.
[a]From chi-square statistics.
[b]From chi-square statistics.
[c]Total of primary care, specialty care, and emergency room.

TABLE 3—Mean Number of Visits, Prescriptions, and Hospital Admissions per Child per Year[a] During the 42-Month Study Period: Children of Nonsmokers and Smokers, Group Health Cooperative of Puget Sound, 1987 through 1993

Health Service	Total No.	Unadjusted Means (SE) Children of Nonsmokers	Unadjusted Means (SE) Children of Smokers	P^c	Adjusted Means[b] (SE) Children of Nonsmokers	Adjusted Means[b] (SE) Children of Smokers	P^c
Total primary care visits	1449	3.00 (.07)	2.96 (.11)	.71	3.00 (.07)	2.97 (.11)	.78
Primary care vists excluding preventive care	1430	2.81 (.07)	2.77 (.11)	.73	2.81 (.07)	2.77 (.11)	.78
Preventive care visits	823	0.42 (.01)	0.38 (.01)	.02	0.42 (.01)	0.38 (.01)	.01
Specialty care visits	1149	1.76 (.11)	1.39 (.09)	.07	1.76 (.11)	1.48 (.18)	.23
Emergency room vists	156	0.39 (.02)	0.40 (.03)	.89	0.37 (.02)	0.41 (.03)	.39
Total outpatient vists[d]	1454	4.44 (.12)	4.05 (.16)	.09	4.44 (.12)	4.12 (.20)	.22
Asthma prescriptions	251	1.62 (.22)	1.22 (.17)	.35	1.62 (.26)	1.34 (.38)	.60
Hospital admissions	57	0.52 (.09)	0.31 (.02)	.20	0.48 (.10)	0.35 (.15)	.41

[a]Among children who used the service one or more times.
[b]Adjusted for parent's age, education, and perceived health and for child's age,
[c]From regression analysis.
[d]Total of primary care, specialty, and emergency room visits.

To determine whether there was an association between parental smoking status and use of services among the youngest children, mean numbers of primary care visits, prescriptions, and hospital stays were compared for 4 age categories (1–3, 4–6, 7–9, and 10–11 years). There were no differences in use by age for any of the outcomes. The study period was divided into 6-month intervals, and a repeated measures ANOVA was conducted to test whether there were differences between children of smokers and children of nonsmokers in patterns of health care use over the 42-month study period. As Figure 1 illustrates, the mean number of total primary care visits decreased across age categories, regardless of parental smoking status. A similar pattern was observed for the other health services outcomes.

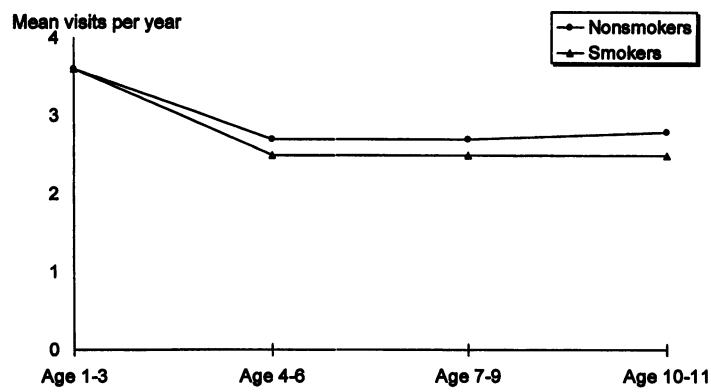


FIGURE 1—Mean number of total primary care visits per year, by child's age and parental smoking status.

Discussion

Contrary to our hypothesis, children of smokers were not heavier users of primary care or inpatient health services than children of nonsmokers. Use of health services was strikingly similar for the 2 groups, with the exception that children of smokers had significantly fewer preventive care visits than children of nonsmokers. These findings are consistent with those of a similar, larger study[18] and suggest that higher rates of morbidity among children of smokers[1] may not necessarily be reflected in higher rates of health care use.

There are several possible explanations for these results. A recent study that suggested an increased potential health care burden of environmental tobacco smoke–related childhood morbidity assumed that use of health care services was similar among smokers and nonsmokers, that is, that parents who smoked would be as likely as nonsmoking parents to use health services for a child's cough.[25] However, it is widely acknowledged that even within managed care settings in which cost is not a barrier to care, other factors impede use of health services.[26–28] Moreover, it has been argued that adult smokers' lower preventive orientation may contribute to their lower use of discretionary health care services.[29] Since parents are gatekeepers for their children's access to health care, parents who smoke may underutilize services, particularly preventive services, for their children as well.

Parents who smoke may differ from nonsmoking parents in how they use health care services for their children. Smokers may bring their children in for different conditions than do nonsmoking parents, or they may be more likely to wait out illnesses and bring in "sicker" children than nonsmokers. In addition, not all respiratory conditions are equally associated with exposure to environmental tobacco smoke.[29] For example, it is possible that a large proportion of primary care visits among children of nonsmokers in our study were for the common cold, which has not been shown to be consistently associated with exposure to environmental tobacco smoke. However, we did not have the data on presenting complaints or diagnoses that would enable us to explore these questions.

While this study has several unique strengths, including prospective data on a comprehensive set of pediatric health services and parent smoking behavior collected separately from data on health care use, these results should be interpreted cautiously. The fact that the study sample did not include infants, the group that has shown the strongest effects of environmental tobacco smoke exposure on negative

health outcomes, may have biased our results. It is noteworthy that analyses stratified by age of the child did not indicate any increased use among children of smokers compared with children of nonsmokers in the youngest age group (ages 1–3). Admittedly, the power for these analyses was limited. However, the Vogt study, which had adequate power to detect differences in use of health services by age, had they been present, also found no association between use of health services and parental smoking status in the youngest children.[18] Moreover, Vogt, too, reported lower use of some health services by children of smokers.

The fact that the sample were all managed care enrollees could also have contributed to the similar patterns of use observed among children of smokers and nonsmokers. However, there were no obvious financial or other system incentives or disincentives for use of health care that would explain our results. Members were not charged for preventive care visits, and all members paid a flat copayment for outpatient and emergency room visits.

Another limitation of the study is that smoking status was available for only 1 parent. Thus, children of parents classified as nonsmokers may have been exposed to environmental tobacco smoke from the other parent or from other smokers living in the household. The generally high concordance between spouses' smoking status[30] suggests that misclassification of exposure in our sample is likely to have been relatively low and not sufficient to substantially change the direction of the observed associations. Moreover, others have found that the presence of other smokers in the household did not increase the association between exposure to environmental tobacco smoke and children's hospital admissions.[16]

Lastly, our population had overall low rates of hospital admissions and emergency room use. Other studies that have reported positive associations between environmental tobacco smoke exposure and hospital admissions among infants have shown high rates of admissions for lower respiratory conditions, which may have enhanced the studies' power to detect differences.[16,17] With our sample size and admission rates, hospital admissions among children of smokers would have had to be double those of nonsmokers' children to be detected. However, it is again noteworthy that Vogt[18] did not find differences in hospital admissions with a larger sample size (n = 1761 children) and adequate statistical power. Potential differences between managed care samples like this one[18] and the Chinese[16] and Israeli[17] samples in patterns of health services use, household composition, indoor ventilation, and other environmental exposures and climatic influences also make the studies difficult to compare.[31]

Further research based on behavioral models of health services use is needed to provide a better understanding of whether smokers underuse services for their children or use services differently from nonsmoking parents and whether these differences have cost implications.[26] The relationship between smokers attitudes and beliefs about use of health care for themselves and their children and specific information about their reasons for visits and resulting diagnoses should be further explored. These issues may be crucial in the design and implementation of interventions to reduce exposure to environmental tobacco smoke for children. □

Acknowledgments

This study was supported in part by grant DA-04447 from the National Institute on Drug Abuse and a grant from Marion Merrill-Dow, Kansas City, Mo.

The authors would like to acknowledge Dr Kathi Kemper for her assistance with the study design and Jason Petteway, Chester Pabiniak, Jim Savarino, and Richard Schaadt for their assistance with preparation of the data file.

References

1. *Respiratory Health Effects of Passive Smoking*. Washington, DC: Environmental Protection Agency, Office of Research and Development; 1992. EPA/600/6-90/006F.
2. *The Health Consequences of Involuntary Smoking*. A Report of the Surgeon General. Washington, DC: US Public Health Service, Office of Smoking; 1986. DHHS publication PHS 87-8398.
3. Wright AL, Holberg CJ, Martinez FD, Halonen M, Morgan M, Taussig LM. Epidemiology of physician-diagnosed allergic rhinitis in childhood. *Pediatrics*. 1994;94:895–901.
4. Martinez FD, Cline M, Burrows B. Increased incidence of asthma in children of smoking mothers. *Pediatrics*. 1992;89:21–26.
5. Burchfiel CM, Higgens MW, Keller JB, Howatt WF, Butler WJ, Higgins ITT. Passive smoking in childhood. *Am Rev Respir Dis*. 1986;133:966–973.
6. Pedreira FA, Guandolo VL, Ferol EJ, Mella GW, Weiss IP. Involuntary smoking and incidence of respiratory illness during the first year of life. *Pediatrics*. 1985;75:594–597.
7. Fergusson DM, Horwood LJ. Parental smoking and respiratory illness during early childhood: a six year longitudinal study. *Pediatr Pulmonol*. 1985;1:99–105.
8. Schenker MB, Samet JM, Speizer FE. Risk factors for childhood respiratory disease: the effect of host factors and home environment exposures. *Am Rev Respir Dis*. 1983;128:1038–1043.
9. Bonham GS, Wilson RW. Children's health in families with cigarette smokers. *Am J Public Health*. 1981;71:290–293.
10. Iversen M, Birch L, Lundqvist GR, Elbrond O. Middle ear effusion in children and the indoor environment: an epidemiologic study. *Arch Environ Health*. 1985;40:74–79.
11. Strachan DP, Jarvis MJ, Feyerabend C. Passive smoking, salivary cotinine concentrations, and middle ear effusion in 7 year old children. *BMJ*. 1989;298:1549–1552.
12. Strachan DP, Jarvis MJ, Feyerabend C. The relationship of salivary cotinine to respiratory symptoms, spirometry, and exercise-induced bronchospasm in seven-year-old children. *Am Rev Resp Dis*. 1990;142:147–151.
13. Charlton A. Children's coughs related to parental smoking. *BMJ*. 1984;288:1647–1649.
14. Wright AL, Taussig LM, Ray CG, Harrison JR, Holberg CJ. The Tucson Children's Respiratory Study, II: lower respiratory tract illnesses in the first year of life. *Am J Epidemiol*. 1989;129:1232–1246.
15. Black N. Surgery for glue ear—a modern epidemic? *Lancet*. 1984;1:835–837.
16. Chen Y, Li W, Yu S. Influence of passive smoking on admissions for respiratory illness in early childhood. *BMJ*. 1986;293:303–306.
17. Harlap S, Davies AM. Infant admissions to hospital and maternal smoking. *Lancet*. 1974;1:529–532.
18. Vogt TM. Effects of parental smoking on medical care utilization by children. *Am J Public Health*. 1984;74:30–34.
19. Gergen PJ, Weiss KB. Changing patterns of asthma hospitalization among children: 1979 to 1987. *JAMA*. 1990;264:1688–1692.
20. Gergen PJ, Mullally DI, Evans R. National survey of prevalence of asthma among children in the United States, 1976 to 1980. *Pediatrics*. 1988;81:1–7.
21. Curry SJ, Wagner EH, Grothaus LC. Evaluation of intrinsic and extrinsic motivation interventions with a self-help smoking cessation program. *J Consult Clin Psychol*. 1991;59:318–324.
22. Curry SJ, McBride CM, Grothaus LC, Louie D, Wagner EH. A randomized trial of self-help materials, personalized feedback and telephone counseling with nonvolunteer smokers. *J Consult Clin Psychol*. 1995;63:1005–1014.
23. Pearson DC, Grothaus LC, Thompson RS, Wagner EH. Smokers and drinkers in a health maintenance organization population: lifestyles and health status. *Prev Med*. 1987;16:783–795.
24. Taylor AK, Beauregard KM, Vistnes JP. Who belongs to HMOs: a comparison of fee-for-service versus HMO enrollees. *Med Care Res Rev*. 1995;52:389–408.
25. DiFranza JR, Lew RA. Morbidity and mortality in children associated with the use of tobacco products by other people. *Pediatrics*. 1996;97:560–568.
26. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav*. 1995;36:1–10.
27. Lieu TA, Black SB, Ray P, Chellino M, Shinefield HR, Adler NE. Risk factors for delayed immunization among children in an HMO. *Am J Public Health*. 1994; 84:1621–1625.
28. McBride CM, Curry SJ, Taplin S, Anderman C, Grothaus L. Exploring environmental barriers to participation in mammography screening in an HMO. *Cancer Epidemiol Biomark-*

ers Prev. 1993;2:599–605.
29. Vogt TM, Schweitzer SO. Medical costs of cigarette smoking in a health maintenance organization. *Am J Epidemiol.* 1985;122:1060–1066.
30. Venters MG, Jacobs DR, Luepker RV, Maiman LA, Gillum RF. Spouse concordance of smoking patterns: the Minnesota Heart Survey. *Am J Epidemiol.* 1984;120:608–616.
31. Marbury MC, Maldonado G, Waller L. The indoor air and children's health study: methods and incidence rates. *Epidemiology.* 1996;7:166–174.

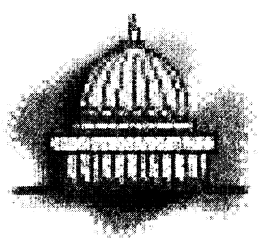
Welcome to the American Public Health Association

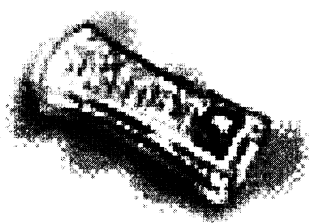
APHA

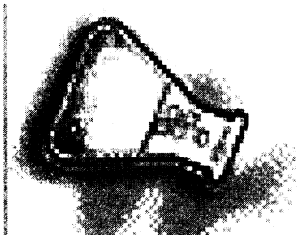
http://www.apha.org

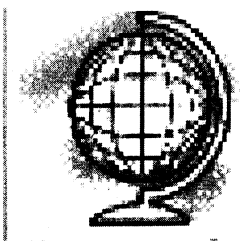
APHA's Home Page has a **NEW LOOK!** Check out the site for:
- American Journal of Public Health abstracts
- Legislative Action Alerts and other hot issues
- Links to public health sites worldwide

Tell us what you think: comments@apha.org


Legislative Affairs & Advocacy


News & Publications


Science, Practice & Policy


Public Health Resources