

Effects of Parental Smoking on Medical Care Utilization by Children

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Abstract: A household interview survey of 2,582 adult members of the Kaiser-Permanente Medical Care Program of Oregon conducted in 1970-71 contained detailed questions about cigarette smoking patterns. Detailed, computerized medical records were maintained for all inpatient and outpatient care rendered between 1967 and 1974 to the 1,761 children of the interviewed sample. Adjusted for age, family size, socioeconomic status, and duration of Health Plan membership, children in non-smoking households used

significantly more outpatient services than did children in smoking households, a relationship largely accounted for by their use of more preventive medical services than by children in smoking households. There were no significant differences in inpatient medical care use and outpatient care use for respiratory illness by children of smoking and non-smoking households. (*Am J Public Health* 1984; 74:30-34.)

Introduction

A growing body of evidence suggests that tobacco smoking is a significant source of air pollution in enclosed areas.^{1,2} This has given rise to investigations of the effects of exposure to tobacco smoke on the health of children.³⁻⁵ Tager, *et al.*, showed that children exposed to tobacco smoke have poorer pulmonary function than do those who are not.³ Bonham and Wilson showed that smoking in the household is associated with more respiratory conditions and bed days in children.⁴ The degree to which smoking is associated with changes in medical care utilization among exposed children has not, however, received direct attention. This study examines the use of both total and morbidity-specific medical care services among children during a seven-year period in relation to the level of cigarette smoking in the household.

Methods

The Health Services Research Center of the Kaiser-Permanente Medical Care Program (KPMCP) of Oregon has maintained a detailed computerized record of the medical care utilization of a 5 per cent random sample of Health Plan members since 1966. This record includes all contacts for both inpatient and outpatient care, including morbidities, surgical procedures, outpatient laboratory studies and procedures, letters, and telephone calls.

In 1970-71 a household survey was conducted of the subgroup of the 5 per cent random sample who had been in the Health Plan for two or more years. Of the 1,659 households which qualified, 1,529 were interviewed, a completion rate of 92 per cent. The interview obtained information on 2,582 adults and included detailed data on their smoking behavior. Since the 5 per cent random sample was enrolled on a household basis, the medical care of the 1,761 children of the interviewed persons was also recorded. Inpatient care was analyzed from 1967 through 1974 and outpatient data from 1967 through 1973. The smoking data were, therefore, gathered at the midpoint of the period of observation. Smoking questions were asked of each adult household member, interviewed separately. Demographic data were provided by the individual identified as the head of the household. The smoking data included 19 questions dealing with time of onset of smoking, years smoked, types

of tobacco smoked, smoking patterns of former smokers, and previous efforts to quit smoking. These questions were asked by a trained interviewer in the same manner, within the context of a 250-question, one-and-a-half to two-hour interview. The KPMCP data systems are discussed in more detail in previous publications.⁵⁻⁸

A revision of the California Relative Value Studies⁹ was constructed which permitted the categorizing of all outpatient care in terms of relative value system (RVS) units. The RVS units permit the addition of outpatient care services within medical, surgical, laboratory, and radiology categories. A single RVS unit is worth approximately four 1970 dollars (range \$3-5 for the various categories).*

To remove the effects of potentially important confounding variables, rates were adjusted for age, number of children in the household, socioeconomic status (SES), and duration of health plan eligibility using standard indirect adjustment techniques.¹⁰ The pooled sample served as the standard population from which stratified utilization rates for each of the control variables were calculated. These rates were then applied to the subsample under study (e.g., non-smoking households) to calculate the expected outcome in the subsample based on the distribution of adjustment variables in that group. The ratio of the observed to the expected outcomes times the crude rate observed in the sample produces a hypothetical adjusted rate which would prevail in the subsample if its distribution of control variables matched that of the standard (pooled) population exactly. This adjustment did not change the conclusions that were reached through analysis of the crude data, but it confirms that these conclusions are not due to a maldistribution of the control variables.

Results

Table 1 presents the demographic characteristics and smoking patterns of the households studied. Socioeconomic status was assessed using the Duncan Decile¹¹ measure applied to total family income.** In Table 1, the deciles have been reduced to tertiles for simplicity. However, in the analyses to follow, the variable consisted of the 10 deciles, plus a category of unemployed. The population studied was 95.4 per cent White, 3.3 per cent Black, and 1.3 per cent other racial backgrounds. Although this racial distribution is not particularly unrepresentative of the Portland SMSA, it precludes observations of racial differences in patterns of

*Detailed information on this system can be obtained from the author.

**This is a household score which is made up of a composite ranking of education and occupation and has proved useful in disaggregating the relationship between socioeconomic status and psychological distress.¹²

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TABLE 1—Demographic and Smoking Characteristics of the Households Studied [These are the responses for each child (N = 1607)].

| Characteristic | Number |
|--|--------|
| Sex of Child | |
| Male | 808 |
| Female | 799 |
| Number of Cigarettes Smoked in Household | |
| None | 765 |
| 1-10 | 78 |
| 11-20 | 326 |
| 21-40 | 277 |
| 41+ | 158 |
| Number of Smokers in Household | |
| 0 | 765 |
| 1 | 530 |
| 2+ | 310 |
| Age of Child (years) | |
| 0-5 | 434 |
| 6-11 | 599 |
| 12-18 | 574 |
| Occupation of Head of Household (US Census Classification) | |
| Professional | 357 |
| Managerial | 167 |
| Clerical | 196 |
| Crafts | 295 |
| Operative | 283 |
| Service | 173 |
| Labor | 71 |
| Unemployed | 65 |
| SES (Duncan Decile) | |
| Lowest tertile | 278 |
| Middle tertile | 469 |
| Upper tertile | 801 |
| Both parents unemployed | 53 |

care associated with cigarette smoking. Other demographic measures are similar to the general population in the area. For example, a recent study of participants in the Health Plan, Blue Cross-Blue Shield, and commercial health care plans in Portland, Oregon found little difference in age, sex, income, occupation, or size of households.¹³

Table 2 presents outpatient utilization by specific respiratory morbidities*** by age of child and cigarettes smoked in household. Sample size precludes analysis of inpatient data by individual morbid diagnoses. There is a linear relationship between age and use of outpatient services for all respiratory disease that is accounted for almost entirely by acute upper respiratory infections; there is no evident relationship between household smoking and use of outpatient medical care for respiratory illness. In fact, in all three age groups overall outpatient utilization for respiratory disease is highest in the non-smoking households. Although the differences are not significant, this fact makes it highly unlikely that children in smoking households use more outpatient medical care for respiratory illness than do those in non-smoking homes.

Table 3 presents the results of stepwise multiple regression analyses in which age, sex, number of children in the household, number of cigarettes smokers in the household, number of smokers in the home, occupation, and SES were used to predict medical care utilization. Only those variables significant for each analysis are shown. For all children combined, age, SES, and number of children in the household were significant predictors of inpatient care, but sex, occupation, and smoking variables were not. For outpatient care, age and number of children in the household remained significant predictors, and number of smokers in the household was also significant. The cumulative variation (R²) explained by these three variables is still small, only 4.6 per cent.

Because the sample is not truly independent due to the fact that multiple children from the same household were included, separate regressions were also performed using only the oldest child in each house and only the youngest child in each house. This reduces the number for analysis to 672, but, for the youngest children, the number of cigarettes smoked in the household remained a significant predictor of outpatient care. As before, the relationship was inverse—

***All diagnoses used in this analysis are updated (confirmed) physician diagnoses.

TABLE 2—Mean Doctor Office Visits (OV) and Mean Total Outpatient Medical Care Use (RVS) Per Person Year for Seven Respiratory Disease Categories for Children* by Number of Cigarettes Smoked per Day in the Household and Age

| AGE | CIGS/DAY IN HOUSE | URI | | FLU | | PNEUMONIA | | BRONCHITIS | | ALLERGY | | OTHER | | ALL | |
|-------|-------------------|------|------|------|------|-----------|------|------------|------|---------|------|-------|------|------|-------|
| | | OV | RVS | OV | RVS | OV | RVS | OV | RVS | OV | RVS | OV | RVS | OV | RVS |
| 0-5 | 0 | 3.69 | 6.52 | 0.29 | 0.44 | 0.39 | 0.79 | 0.84 | 1.60 | 0.19 | 0.29 | 0.49 | 0.62 | 5.84 | 10.27 |
| | 1-20 (N = 217) | 2.86 | 5.32 | 0.45 | 0.62 | 0.63 | 1.45 | 0.57 | 1.22 | 0.13 | 0.24 | 0.34 | 0.39 | 4.97 | 9.25 |
| | 21+ (N = 115) | 3.50 | 6.45 | 0.36 | 0.53 | 0.58 | 1.38 | 0.40 | 0.74 | 0.15 | 0.31 | 0.36 | 0.45 | 5.35 | 9.88 |
| 6-11 | 0 | 1.76 | 3.64 | 0.28 | 0.47 | 0.27 | 0.65 | 0.32 | 0.64 | 0.24 | 0.49 | 1.84 | 1.34 | 4.70 | 7.23 |
| | 1-20 (N = 286) | 1.23 | 2.48 | 0.21 | 0.35 | 0.23 | 0.57 | 0.25 | 0.46 | 0.27 | 0.50 | 0.62 | 0.79 | 2.81 | 5.16 |
| | 21+ (N = 142) | 1.21 | 2.39 | 0.21 | 0.34 | 0.18 | 0.47 | 0.30 | 0.59 | 0.15 | 0.25 | 0.56 | 0.54 | 2.61 | 4.58 |
| 12-18 | 0 | 1.27 | 2.69 | 0.16 | 0.33 | 0.17 | 0.46 | 0.19 | 0.36 | 0.14 | 0.24 | 1.32 | 0.92 | 3.24 | 5.01 |
| | 1-20 (N = 264) | 1.21 | 2.49 | 0.20 | 0.47 | 0.08 | 0.23 | 0.27 | 0.60 | 0.17 | 0.33 | 0.46 | 0.58 | 2.39 | 4.71 |
| | 21+ (N = 147) | 0.87 | 1.92 | 0.14 | 0.26 | 0.15 | 0.40 | 0.20 | 0.38 | 0.07 | 0.14 | 0.27 | 0.28 | 1.71 | 3.37 |
| TOTAL | N = 1606 | 1.88 | 3.66 | 0.35 | 0.41 | 0.27 | 0.65 | 0.37 | 0.72 | 0.17 | 0.32 | 0.83 | 0.74 | 3.77 | 6.50 |

*Dependents Over Age 18 Excluded from Analysis.

TABLE 3—Stepwise Multiple Regression in Which Demographic and Smoking Variables Are Used to Predict* Use of Medical Services for All Children

| Predictors | Cum R ² | Beta | T | sig. T |
|--|--------------------|--------|--------|--------|
| Outpatient Use, RVS/1000 PY, (all children) | | | | |
| Age | .046 | -0.214 | -8.769 | .000 |
| No. Children in Household | .072 | -0.165 | -6.856 | .000 |
| No. Smokers in Household | .075 | -0.061 | -2.552 | .011 |
| Hospital Days/1000 PY, (all children) | | | | |
| Age | 0.013 | -0.118 | -4.762 | .000 |
| SES (Duncan decile) | 0.020 | -0.088 | -3.539 | .000 |
| No. children in Household | 0.025 | -0.071 | -2.868 | .004 |
| Outpatient Utilization, RVS/1000 PY, (youngest child in each family) | | | | |
| Age | .080 | -.341 | -9.089 | .000 |
| No. Children in Household | .123 | -.215 | -5.736 | .000 |
| No. Cigarettes Smoked in Household | .129 | -.072 | -1.989 | .047 |
| Hospital Days/1000 PY, (youngest child in each family) | | | | |
| Age | .056 | -.274 | -7.104 | .000 |
| No. Children in Household | .070 | -.123 | -3.180 | .002 |
| SES (Duncan decile) | .079 | -.094 | -2.529 | .012 |
| Outpatient Utilization, RVS/1000 PY, (oldest child in each family) | | | | |
| Age | .056 | -.212 | -5.459 | .000 |
| No. Children in Household | .068 | -.101 | -2.705 | .007 |
| Hospital Days/1000 PY, (oldest child in each family) | | | | |
| SES (Duncan decile) | .006 | -.076 | -1.97 | .049 |

*Only significant predictors shown.

children in smoking households used less outpatient care than those in non-smoking households. The patterns observed are very similar to those observed in the full sample. All analyses indicate that higher SES was related to lower hospitalization rates, but was not related to outpatient use.

Because occupational categories do not form a linear sequence, the effect of occupation of head of the household was tested using the method of Polissar and Diehr.¹⁴ This involves the creation of separate regression variables for each occupational category compared against a reference category. In this instance, the largest category (professional)

was used as the reference category against which the other groups were compared. Subsequently, separate analyses were repeated without the inclusion of the occupational variables in order to ascertain the impact of all occupational variables on the total R². In this instance occupation did not contribute significantly to the total model. One occupational subgroup—clerical workers as head of household—was associated with a significantly lower rate of RVS use than that in the reference category. Although it is tempting to assume that this group contains a lot of working mothers who lack the time to take their children to the doctor, it must be

TABLE 4—Medical Care Utilization, per 1000 Person Years, by Number of Cigarettes Smoked in the Household Adjusted for Age, SES, Family Size, and Months of Health Plan Eligibility

| Type of Utilization | Number Cigarettes per Day Smoked in Household | | |
|--|---|-------|------|
| | 0 | 10-20 | 21+ |
| No. Office Visits | 2876 | 2680 | 2661 |
| Laboratory RVS Units | 1076 | 1053 | 1022 |
| X-ray RVS Units | 973 | 865 | 933 |
| Well-child Physical Examination RVS Units ^a | 1338 | 1233 | 1129 |
| RVS Units, Surgical ^b | 639 | 553 | 497 |
| Hospital Days | 209 | 217 | 244 |
| Type of Utilization | Number Smokers in Household | | |
| | 0 | 1 | 2+ |
| No. Office Visits ^c | 2875 | 2737 | 2549 |
| Laboratory RVS Units | 1076 | 1081 | 960 |
| X-ray RVS Units | 973 | 941 | 825 |
| Well-child Physical Examination RVS Units ^d | 1339 | 1221 | 1113 |
| RVS Units, Surgical ^e | 639 | 547 | 481 |
| Hospital Days | 209 | 231 | 229 |

- a) Z value for 0:21+ cigarettes = 3.13 (p ≤ .001)
- b) Z value for 0:21+ cigarettes = 2.30 (p ≤ .05)
- c) Z value for 0:2+ smokers = 2.39 (p ≤ .05)
- d) Z value for 0:2+ smokers = 3.06 (p ≤ .001), for 0:1 smoker = 2.01 (p ≤ .05)
- e) Z value for 0:2+ smokers = 2.22 (p ≤ .05)

TABLE 5—Well-Child Physical Examinations by Household Smoking

| No. Smokers in Household | Mean No. Well-child Exams per Child over 7 Years Time | % with No Well-child Exams in 7 Years | % with 7 or More Well-child Exams in 7 Years |
|---------------------------------|---|---------------------------------------|--|
| 0 | 3.35 | 20.3 | 17.7 |
| 1 | 2.76 | 27.7 | 14.5 |
| 2 | 2.38 | 34.8 | 9.4 |
| No. Cigarettes/Day in Household | | | |
| 0 | 3.35 | 20.3 | 17.7 |
| 1-20 | 2.94 | 28.5 | 14.9 |
| 21+ | 2.34 | 32.0 | 6.6 |

emphasized that this analysis was conducted without an a priori hypothesis, and multiple comparisons have been made.

Similar analyses were conducted independently for the oldest and youngest children in each household. Again, the addition of occupation to the regression model did not add significant information. However, among the youngest children, the presence of a head of household engaged in an operative trade was associated with a significantly higher rate of hospital days. The same caution against over interpreting this result can be made. In summary, there was little evidence that occupation added significant information to regression models aimed at explaining the variation in inpatient or outpatient care, although certain occupational subgroups might be associated with small increases or decreases in utilization.

Regression analyses, like most other forms of multivariate analysis, are limited by their assumptions of linearity, while the relationships among age and number of children in the household and use of medical care services were clearly J-shaped in bivariate plotting. To overcome this problem, standard rates were derived using the pooled all-year sample, and this pooled sample was used as the standard in an indirect adjustment as previously described.

Table 4 presents rates adjusted for age, number of children in the household, SES, and duration of health plan eligibility, for inpatient and outpatient care by number of cigarettes smoked in the household and by number of smokers in the household. Non-smoking households have significantly more outpatient care than do households in which 21 or more cigarettes are smoked per day, and the relationship appears to be linear. The relationship of outpatient care to number of smokers in the household is similar.

The significantly higher use of outpatient medical care services by non-smoking homes was due to more office visits, surgical procedures, and well-child examinations among these households. By far the greatest differences were in the number of well-child physicals performed. In fact, 20 per cent of non-smoking households had no well-child examinations during the seven-year follow-up, while 28 per cent of households with one smoker and 35 per cent of households with two or more smokers lacked any such examinations (Table 5).

Discussion

It must be emphasized that the outcome measures of this study are measures of health care utilization and not of morbidity. Use of health services is a health behavior which is influenced by health status, but also by a wide variety of other factors. The relationships between cigarette smoking

and morbidity are well established and are in no way questioned by these data. The data do indicate, however, that the often made assumption that morbidity differences produce equivalent differences in health care utilization may be unfounded. There is a clear excess of outpatient care among children in non-smoking households. This excess is derived from a higher use of medical care directed toward early detection of disease (well-child examinations). No difference in use of outpatient services was detectable for any respiratory morbidity, and no differences were apparent in inpatient care, although sample size limitations limit the degree to which the inpatient results can be regarded as definitive. There were not enough hospitalizations to examine differences by specific morbidities, for example.

Since morbidity studies have suggested that children in smoking households have higher rates of respiratory diseases,^{3,4,15} it is likely that smoking parents are not only less likely to take their children in for preventive care, but also are less likely to seek care for mild outpatient illnesses. In fact, the parents of the children in this study themselves were less likely to seek preventive care and less likely to use outpatient services for mild illnesses for themselves if they were smokers than if they were non-smokers.****

The psychological differences between smokers and non-smokers have been extensively discussed.¹⁶⁻²² Current smokers do not view themselves as susceptible to the adverse effects of smoking²³ and it is possible that this attitude extends into all other aspects of their lives. The degree to which smokers' attitudes toward health and illness contribute to public health problems needs to be separated from the contribution of their smoking to those problems. It seems rather likely that the risk-taking behavior of smokers is not limited to the use of cigarettes.

The data suggest that smoking parents need to be educated not only about the risks of cigarette smoking, but also about the need for providing proper preventive and outpatient medical care for their children.

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ACKNOWLEDGMENTS

The author would like to thank Clyde Pope, PhD, for allowing the use of data from his Household Interview Survey; Dawn Hayami, Judy Kimmey, and Jan Blank for research assistance; Judy Henderson for editorial assistance; and Ernie Tong for manuscript preparation.

Thus study was supported by National Center for Health Services Research Grant No. 5 R01 HS 03601.

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