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Cigarette Smoking and Age at Natural Menopause

DAVID W. KAUFMAN, MS, DENNIS SLONE, MD, LYNN ROSENBERG, ScD, OLLI S. MIETTINEN, MD, AND SAMUEL SHAPIRO, MB, FRCP

Abstract: In a cohort of 656 naturally postmenopausal women who were interviewed at age 60 to 69 years, and who had reached their menopause between the ages of 35 and 59 years, the mean age at menopause declined with increasing number of cigarettes smoked, from 49.4 years of age among women who had never smoked to 47.6 years of age among women who smoked at least 15 cigarettes per day ($p < 0.02$). The relationship was not attributable to the onset of menopause inducing women to take up smoking. (*Am J Public Health* 70:420-422, 1980.)

Introduction

Several studies [1-6] have suggested that cigarette smokers have an earlier natural menopause than non-smokers. However, these studies lacked sufficient data to give precise quantitative estimates of the effect of smoking on age at menopause. To provide such estimates, we studied the relationship in a cohort of 656 naturally postmenopausal women.

Methods

The data collection procedures used in this study have been described in detail elsewhere.[7,8] Briefly, specially trained nurse-monitors stationed in hospitals in seven metropolitan areas in the United States, one hospital in Canada, and two in Israel interview patients admitted to medical, surgical, gynecological, and other specialty wards. The information, recorded on standard forms, includes descriptive data (such as age); a detailed medical history, including age at menopause; and comprehensive information on drug use before admission. Details of use of a variety of other agents, such as coffee, alcohol, and cigarettes, are also recorded. Subsequently, a copy of the discharge summary is obtained and abstracted.

This report is based on women interviewed between July 1976 and December 1978. Women were included if they were 60 to 69 years of age at the time of interview and reached a natural menopause between the ages of 35 and 59. It was further specified that all subjects must belong to one of three cigarette smoking categories: those who had never smoked, those who had stopped smoking permanently before the age of 35 (that is, before the earliest menopausal age in the cohort), and those who were current smokers at the time of interview and had started smoking before the age of 35. A total of 656 women met these criteria, and formed the final study population.

Results

The mean age at menopause was 49.4 years among women who had never smoked, 49.2 among ex-smokers, 48.0 among women who smoked 1 to 14 cigarettes per day, and 47.6 among those who smoked at least 15 cigarettes per day (Table 1). The differences between never-smokers and each of the three categories of current smokers were statistically significant ($p < 0.02$). Among the current smokers, the differences by level of smoking were not significant. In addition, when the data were subjected to multiple regression analysis, there was no significant trend in age at

From the Drug Epidemiology Unit, Boston University School of Medicine, and the Department of Epidemiology, Harvard School of Public Health. This paper, submitted to the Journal August 30, 1979, was revised and accepted for publication November 13, 1979.

TABLE 1—Mean Age at Menopause among 656 Naturally Postmenopausal Women Ages 60-69 According to Number of Cigarettes Smoked

No. of Cigarettes*	No. of Women	Mean Age at Menopause (yr)	Mean Difference from Never Smokers (yr)	Std. Error of Difference
Never-smoker	434	49.4	—	—
Ex-smoker	10	49.2	0.2	1.5
1-14/day	66	48.0	1.4	0.6
15-24/day	99	47.6	1.8	0.5
≥25/day	47	47.6	1.8	0.7

*Refers to smoking status at time of interview. All smokers began smoking before age 35; all ex-smokers stopped before age 35.

menopause according to number of cigarettes smoked. When the means were separately adjusted for parity, ponderal index (weight [lb]/height [in]^2 × 1000) at interview, and geographic region, the findings were not materially changed. The data for the United States and Canada (there were insufficient numbers from Israel) were analyzed separately; in each country, women smokers had an earlier menopause than women who had never smoked.

The 212 smokers were divided according to the age at which they started smoking. Within smoking categories there was no appreciable correlation between age at menopause and age started smoking.

Discussion

The results of this study confirm and extend previous reports[1-6] that cigarette smoking is associated with an early onset of natural menopause. In 1962, Bernhard[1] found an "early menopause" (undefined) in 20 per cent of 659 smokers compared with 1.7 per cent of 5,000 non-smokers. In 1976, Daniell[2] noted that the average age at natural menopause was 44.3 years in 26 smokers, compared with 49.6 years among 21 non-smokers. Since then, Jick, et al,[3] reported on two independent groups of women between the ages of 44 and 53 years, together totaling over 3,500. The study included premenopausal and naturally menopausal women; the prevalence of the latter was lowest among never-smokers and it increased with the number of cigarettes smoked. Bailey, et al,[4] reported a similar association from Great Britain. A second report by Daniell[5] described an earlier natural menopause among smokers when obesity was taken into account. Overall, the mean age at menopause was 47.4 years among 78 smokers, as against 49.4 years among 158 non-smokers. Most recently, Lindquist and Bengtsson[6] found a higher proportion of smokers among 346 naturally postmenopausal women, compared with 527 premenopausal women of the same ages.

In our study, smokers had a significantly earlier menopause than women who had never smoked. Further, the mean age at menopause declined with increasing number of cigarettes smoked, although the trend was not significant. Women who smoked at least 15 cigarettes per day had their menopause, on average, 1.8 years sooner than women who had never smoked.

The women in this study were all aged 60 to 69 years at the time of interview; thus, secular changes in smoking patterns could not have influenced our results. Since we stipulated that all of the smokers must have begun smoking before tha age of 35, the possibility that menopausal symptoms induce women to start smoking can be ruled out as an explanation for the association.

A potential bias arises because our information on the number of cigarettes smoked refers to ages 60 to 69, rather than the years before the women became menopausal, which is the period of interest. Cigarette consumption of women in their 60s may well not be an accurate reflection of how much they smoked, say, in their 20s. For example, it is possible that the onset of menopause might cause a woman to change her cigarette consumption. However, it is improbable that such inaccuracies would be systematically related to age at menopause, and any random misclassification would tend to blur differences among smokers and weaken a possible dose-response relationship. In any event, this problem does not affect the overall conclusion that smokers have an earlier menopause than non-smokers.

This study was based on hospitalized patients who may differ from the general population in some relevant aspect, which could explain the results. This possibility seems far-fetched, however, because for most subjects the period of interest was at least 10 years before hospitalization, if not considerably longer.

Finally, while it may be that women did not accurately remember their age at menopause, particularly those with an early menopause, there are no plausible grounds to suspect that smokers would systematically remember their menopause to be earlier than it actually was. Thus, biased recall of age at menopause is unlikely to explain our results.

A possible mechanism for an earlier natural menopause among smokers has been proposed by Mattison and Thorgeirsson,[9] who found that benzo(a)pyrene, a polycyclic aromatic hydrocarbon which is a component of cigarette smoke, destroys primordial oocytes in the ovaries of mice. Natural menopause occurs when the ovaries are depleted of oocytes. If this is the mechanism in women, one might expect an earlier menopause among women who have stopped smoking, as well as decreasing age at menopause as the number of cigarettes smoked increases. While our data suggested a slightly reduced menopausal age among ex-smokers, there were only 10 women in this category, and informative analysis of this issue was not possible.

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Effectiveness of a Mailed Reminder on the Immunization Levels of Infants at High Risk of Failure to Complete Immunizations

SETH A. YOUNG, MBA, MS, THOMAS J. HALPIN, MD, MPH, DEANE A. JOHNSON, BS, JOHN J. IRVIN, AND JAMES S. MARKS, MD

Abstract: The Ohio Department of Health initiated a program of mailing an immunization reminder to the mothers of six-month-old children predicted to be at high risk of failure to receive vaccinations based on birth certificate information. The evaluation results indicated a 50 per cent gain in immunizations amongst children whose parents received the letter when compared with those not receiving the letter. (*Am J Public Health* 70:422-424, 1980.)

Introduction

Based on analysis of a 1977 survey of 1,003 Ohio two-year-olds immunization levels,[1] the Ohio Department of Health (ODH) found two major categories of birth certificate data, parental education and family size, to be statistically meaningful in predicting children at high risk of failing to complete an immunization series by the age of two.[2]

Using these risk factors to select high risk children, ODH initiated a mail motivation program whereby parents would receive a letter when their child was six months old. This letter, sent to the 25 per cent of all of Ohio's live, legitimate resident births classified as high risk, was intended to return potential immunization drop-outs to the health care system. The impact of the letter is assessed in this report.

Methodology

All records of live, legitimate births for March 1978, were examined and classified by computer as to high or low risk. Children were judged to be high risk if they had: 1) at least one parent with less than a high school education regardless of family size, or 2) only one parent with some college education and the family (including index child) consisted of four or more children.

A 10 per cent random sample (N = 254) was taken from the total high risk group. This sample (control group) had the sixth month motivational letter withheld. All other parents of high risk children received the letter. The letter was timed to

Address reprint requests to Seth A. Young, Research Analyst, Ohio Department of Health, Bureau of Preventive Medicine, P.O. Box 118, Columbus, OH 43216. This paper, submitted to the Journal June 21, 1979, was revised and accepted for publication November 14, 1979. Dr. Halpin and Mr. Young are both with the Ohio Department of Health; D. A. Johnson is from the Bureau of State Services, CDC; J. J. Irvin is from the Immunization Division, Bureau of State Services, CDC, currently with the ODH; Dr. J. S. Marks was formerly with the Field Services Division, Bureau of Epidemiology, CDC, and presently is with the Robert Wood Johnson Clinical Scholar Program at Yale University School of Medicine.