Cigarette Smoking and Adolescent Menstrual Disorders

by Phyllis Marie Jensen and Robert B. Coombs

The negative effects of smoking manifest in disturbances of the menstrual cycle.

Adolescent girls have been adopting smoking at a faster rate than boys, and starting younger than previous generations (Waldron, et al.). In 1991, 20 per cent of girls in Canada aged 15 to 19 years were smoking regularly compared to 12 per cent of the boys (Millar 1992). Twenty per cent of girls aged 13 years are estimated to smoke once a week (Health and Welfare Canada). The percentage of adolescent girls in the Northwest Territories smoking in 1991 is among the highest in the world: non-Native girls, 44 per cent, and First Nation girls: Dene, 62 per cent, Metis, 62 per cent, Inuit 73 per cent (Millar 1989). Unless these figures can be reversed, illness in this population will reach epidemic proportions in the future.

Most are aware of the health consequences of long-term smoking: lung cancer, heart disease, and respiratory disorders, but few know about the negative effects of short-term smoking that manifest in disturbances of the menstrual cycle and reproductive functioning. The major cause is nicotine, the addictive substance in tobacco smoke. Toxic to the ovaries, nicotine also interferes with the hypothalamic-pituitary-ovarian axis that controls the menstrual cycle, and interferes with the metabolism of the female hormone, estrogen. The result is that the body of a woman smoker behaves in an estrogen-deficient way (Baron), and shows an increased incidence of ovarian cysts (Wyshak, et al.), ectopic pregnancies (Campbell and Gray), infertility (see Baird and Wilcox, Darling et al.), spontaneous abortion (Harlap), early menopause (see Adena and Gallagher, Mattison), menstrual disorders (Sloss and Frerichs), irregular periods (Hammoud), and menstrual pain (Wood et al., Kauranemi). The good news is that these can be reversed with stopping smoking.

Given the apparent direct effect of nicotine, it was hypothesized that the relationship between smoking and menstruation would appear even in adolescent girls who had been smoking for a short time. We used high school student health data to investigate this question.

Method

This study is part of a student health and happiness survey collected in the fall of 1993. The sample of girls is from an urban high school in Toronto, the largest metropolitan centre in Canada with a population of nearly three million. This central city high school reflects the wide diversity of ethnicity, social, and economic status in the city. In order to get the best representative sample of students, teachers of English, (a compulsory subject), were asked to contribute one period of student time for completion of the anonymous survey. Ten of the 13 English teachers agreed to use it as a reading comprehension project. Students were asked to cooperate, but not required to do so. None refused, but some declined to answer specific questions or series of questions, such as the ones on menstruation, saying they were too personal. Of the total number of girls in the school 258 (41 per cent) filled out the questionnaire in the fall. Others were scheduled to complete it in the new year. Not all the surveys distributed were fully completed, as class time for the task varied, as did the ability of the students, aged 13 to 25, to read, comprehend, and answer the questions. Six surveys were spoiled by students giving multiple replies to questions asking for a single response. Four girls (one per cent) had not begun their menstrual period. From a total of 268 surveys completed by the girls, 258 were used. In some of the analyses the sample dropped to 211 due to statistical program deletions for missing data.

Smoking status was defined as (1) never smoked, (2) triers (those who had taken an experimental puff at some time but never pursued it beyond this), (3) occasional smokers (those who have smoked on an irregular basis, at parties and special events), (4) former smokers (those who had smoked for a period of time, but claimed to have quit recently), and (5) regular smokers (those who smoke regularly, often daily).

Menstrual function was measured with a series of self-scored questions where “0” meant not a problem, “1” mild problem, “2” moderate problem, and “3” severe problem. The premenstrual time period was defined as the two weeks before menses, with questions on weight gain, depression, mood changes, irritabili-
ity, bloating, nausea or vomiting, suicidal thoughts, anxiety, leg
cramps, anger, breast tenderness, headaches, low back pain, and vagi-
nal discharge. Responses were com-
bined into a single score called pre-
menstrual syndrome. The menstrual
period was defined as the days of
menstrual flow. Questions included
in a simple additive scale labelled
period discomfort were frequency of
urination, diarrhoea, headaches,
bloating, menstrual cramps, the need
to lie down for one or
two days, craving
of sweets, sleep dif-
culty, breast
changes, and heav-
iness of menstrual
flow.

The more cigarettes
smoked, the more
likely women were
to report discomfort.

Results

Over half of the girls in the sample
had never smoked (34.6 per cent).
Fifteen per cent had taken a puff at
some time, but never pursued smok-
ing beyond initial experimentation.
Nine per cent reported smoking oc-
casionally. The same number of girls
claimed to have smoked regularly,
but to have quit recently (nine per
cent), and twelve per cent admitted
to smoking cigarettes regularly, often
daily. Former smokers averaged one
cigarette a day when they were smok-
ing, while occasional smokers aver-
aged one cigarette every other day.
The number consumed by regular
smokers ranged from one to 30 ciga-
rettes a day (average = eleven).

The ages of the girls in the study
ranged from 13.0 to 25.0 years, with
an average of 16.0 years. Girls who
smoked had started between the ages
of 6.0 and 20.0 years with an average
age of commencement of 12.7 years.
Because it usually takes months of
occasional smoking before a regular
habit is established, it is not surpris-
ing that the average age of the non-
smokers was half a year younger (15.5
years) than the average age of the
smokers (16.0 years).

The start date of menarche ranged
from 8.0 to 19.0 years with an aver-
age age of 12.3 years. There was no
significant relationship between the
age the girls started smoking and age
of menarche. Scores for premenstrual
syndrome ranged from 0 to 45.0, the
highest possible, with an average of
10.7 (where the most frequently oc-
curring score was 0). Scores for pe-
riod discomfort ranged from 0 to 33.0, the highest possible, with an
average of 7.6 (where the most fre-
quently occurring score was 3.0).
These two scores were added together
to create a variable labelled menstrual
discomfort, which ranged from 0 to
78, with an average of 18.3 (where
the most frequently occurring score
was 9).

To examine the relationship be-
tween menstrual discomfort and the
extent of involvement in smoking,
statistical means of the three vari-
bles, premenstrual syndrome, pe-
riod discomfort, and total menstrual
discomfort were calculated for "never
smoked," "triers," "occasional smok-
ers," "former smokers," and "regular
smokers." The never smoked group
had the lowest mean scores for all
three measures: premenstrual syn-
drome (9.0), period discomfort (6.5),
and total menstrual discomfort (15.5).
The regular smokers scored highest
for all three measures: premenstrual
syndrome (14.2), period discomfort
(10.0), and total menstrual discom-
fort (24.2; see graph).

Smoking status, plus two other
unrelated variables, irregularity of
period, and age of menarche were
combined in a multiple regression
model and explained eleven per cent
of the total variance of menstrual
discomfort \(p=.0001\).\(^1\)

Discussion

This study shows that the previ-
ously found relationship between
smoking and menstrual discomfort
in adults appears to extend to adoles-
cent smokers. Menstrual disorders
were linked to cigarette smoking in
Britain as early as 1961, as women
over the age of 30 who smoked were
found to experience more menstrual
irregularity than non-smokers
(Hammond). A later Australian study
of adult women at a community
health clinic found current smokers
reported more irregularity of men-
strual periods than non-smokers or
ex-smokers (Wood). However, in the
study reported here, adolescent smok-
ers did not fit the adult pattern. There
was no significant relationship be-
tween level of involvement in smok-
ing and irregularity of menstrual pe-
riods. There are three possible ex-
planations. First, non-smokers were
younger, on average, than the smok-
ers, and during menarche irregularity
in the menstrual cycle is normal, so
a higher degree of irregularity of peri-
ods in the older girls who were smokers
was not evident. Second, girls who
were smoking were much more
likely to be using oral contraceptives\(^2\)
which have a regulatory effect on the
menstrual cycle. Thus, irregularity
caused by the toxic effects of nicotine
would be corrected by oral contra-
ceptives. Third, for irregularity to be
evident in smokers, it may require a
higher dose of nicotine than the rela-
tively light smoking of these adoles-
cents, or fourth, irregularity may take
more years of smoking to manifest.

It is disturbing that a higher per-
centage of young smokers were using
oral contraceptives because the com-
bination creates a greater health risk.
Both nicotine and oral contraceptives
affect lipid metabolism by rais-
ing the level of total blood cholesterol
and LDL ("bad") cholesterol, and low-
ering the level of HDL ("good") chole-
sterol. This increases the risk of pulmo-
nary embolism and strokes, even at young ages (Perlman et al.).

An early Finnish study reported
that the frequency of period pain
increased with the number of ciga-
rettes smoked (Kauraneni). A 1979
Australian study showed that women
who were current smokers had higher
rates of menstrual pain than non-
smokers or ex-smokers (Wood et al.).
A more recent British study found a
higher prevalence of menstrual disor-
ders in women smokers (25.1 per
cent) compared to non-smokers (18.6
per cent) including menstrual pain,
premenstrual staining, missed peri-
ods, and cysts/polyps/fibroid tumours of the reproductive organs. In addition, the more cigarettes the women smoked each day, the more likely they were to report menstrual disorders (Sloss and Freirichs). In the study reported here, a multiple regression model with menstrual discomfort as the dependent variable showed eleven per cent of the variance explained by three predictors: smoking status, irregularity of menstrual period, and age of menarche. In a step-wise regression, smoking status was the first variable brought into the equation. All three variables are related to menstrual function in different ways. Nicotine has toxic effects on the reproductive organs, while irregularity of menstrual periods and age of menarche are markers of endocrine function. This clearly demonstrates that nicotine is so toxic to the reproductive system that measures of menstrual discomfort are high even in adolescents, who are relatively light smokers.

In conclusion, this study shows that the relationship between menstrual difficulty and smoking occurs even in very young smokers. Since there is no obvious reason to suggest that menstrual difficulties cause smoking, or that a mediating factor causes both, it would appear that smoking may cause menstrual difficulties even in young women. Further research is needed on this question. The fact that one Canadian woman dies every 35 minutes from disease due to smoking (National Clearing House on Tobacco and Health) is a remote concept for adolescent girls. However, the reality of the immediate relationship between smoking and menstrual difficulties promises to be useful in influencing adolescent girls not to smoke, and to stop smoking. Given the relationship between smoking and menstrual discomfort, reproductive difficulties, and high rates of mortality, educating our daughters about tobacco use, and helping our sisters to quit need to be made priorities of the women's health movement. In addition to anti-smoking programs in schools, cessation programs are needed which address the interests and special needs of adolescent girls (see Ershler et al., Gordon).

For a copy of the Multiple Regression Model with the Analysis of Variance, Beta Coefficient and Confidence intervals and partial F, please contact the authors.

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1This p = .0001 indicates that there is only one chance in 10,000 that the relationship in this model occurred by chance alone.
2The correlation r = .44 says there is a moderately strong relationship between smoking and the use of oral contraceptives.

References


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