TTURC
TRANSDISCIPLINARY TOBACCO USE RESEARCH CENTER
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UNIVERSITY OF MINNESOTA
Cancer Center

umntturcresearchbrief
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transdisciplinary tobacco use research center

Research summary
To assess how cigarettes per day (CPD) affects adolescents' exposure to tobacco-specific carcinogens, researchers at TTURC compared levels of biomarkers for nicotine and carcinogen exposure in both adults and adolescents.

Results
In both adults and adolescents, levels of total NNAL and total cotinine per ml of urine were significantly associated with number of CPD. However, differences in total NNAL per ml of urine only showed a trend toward significance between the populations. When total NNAL was divided by CPD, the difference between adolescents and adults was significant only for the smokers who smoked 11 to 15 CPD.

About umntturcresearchbrief
The UMN TTURC Research Brief presents timely information on emerging tobacco research from the University of Minnesota. The aims of UMN TTURC are to examine strategies for reducing tobacco toxin exposure, determine the most effective methods for treating smokers who are unable or unwilling to quit smoking, and outline public policy implications for interventions that reduce exposure to tobacco toxins.

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Exposure to tobacco-specific carcinogens: Do cigarettes per day matter in adolescents?

Previous research has demonstrated associations between number of cigarettes smoked per day (CPD) and levels of biomarkers for tobacco-specific carcinogen exposure among adult smokers. (1) However, no studies have been conducted among adolescent smokers. Because almost 90% of adult smokers report initiating smoking during childhood and adolescence (2) and because smoking in adolescence is highly correlated with early onset of lung cancer (3), determining CPD-associated levels of nicotine and carcinogen exposure in adolescents could provide valuable insights into how early smoking habits/patterns affect health outcomes.

To assess the extent of exposure to tobacco-specific carcinogens in adolescents, researchers at the Transdisciplinary Tobacco Use Research Center compared biomarker levels for carcinogen and nicotine exposure in both adult and adolescent smokers by level of cigarette intake.

Methods

To obtain viable comparisons for each group, researchers merged data on smoking history and biomarker levels from six separate studies. The study included two samples—adolescent smokers and adult smokers. No participant was enrolled in more than one of the six studies, and only baseline samples were used when compiling data from these investigations. All subjects participating provided urine samples, completed tobacco use questionnaires and submitted demographic information. Urine analysis in participants yielded biomarkers of exposure to the tobacco specific and potent lung carcinogen, NNK (4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol and its glucuronides or total NNAL) and to nicotine (cotinine plus its glucuronide or total cotinine). Number of CPD was categorized into ranges of 5-10, 11-15, and 16-20.

Findings

Of the 403 participants whose urine samples were analyzed for total NNAL, 273 were adolescents and 130 were adults. The continine analysis included 341 participants—255 adolescents and 86 adults. As expected, researchers observed significantly higher number of cigarettes smoked by adults and longer duration of smoking. Brand type also differed significantly between the two populations (in terms of nicotine/tar yield of cigarettes smoked), with adolescents smoking more regular cigarettes than adults.

In both adults and adolescents, levels of total NNAL and total cotinine per

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ml of urine were significantly associated with number of CPD. However, differences in total NNAL per ml of urine only showed a trend toward significance between the populations. When total NNAL was divided by CPD, adolescent levels were significantly lower than those of adults only for the 11-15 CPD smokers. (See Figures 1a and 1b below.)

Figure 1a. Mean levels of total NNAL for adolescents and adults, by CPD strata

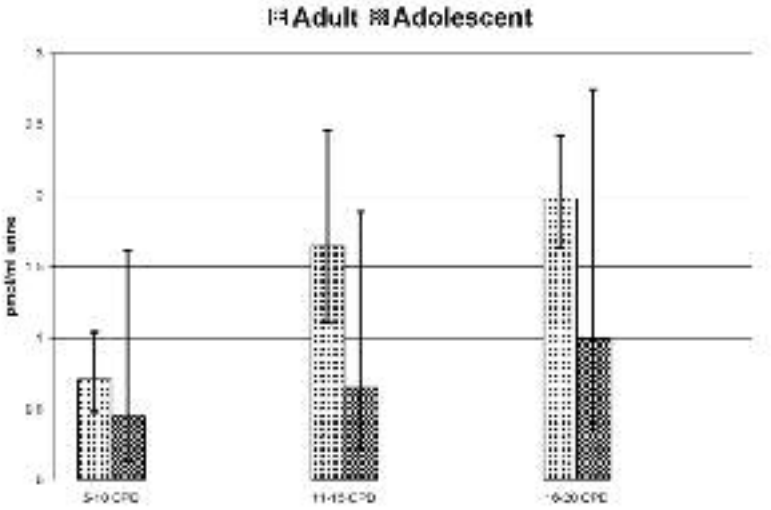
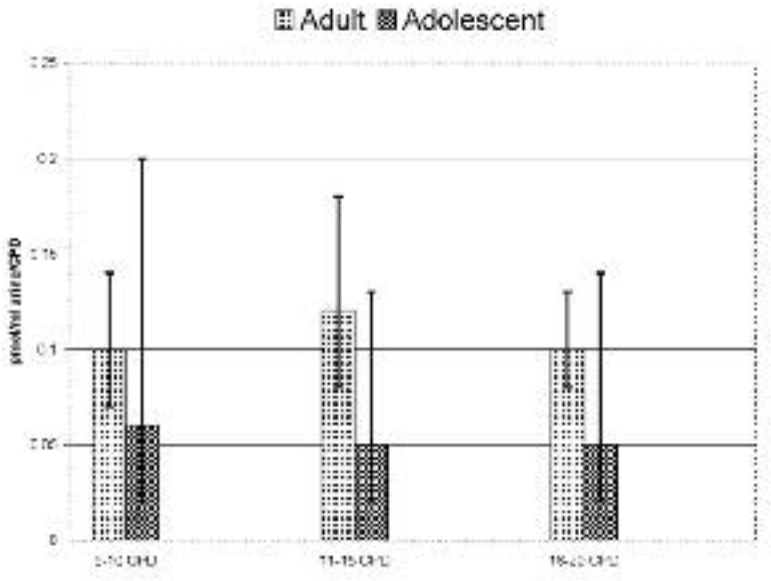


Figure 1b. Mean levels of total NNAL divided by CPD for adolescents and adults across the CPD strata



Reprinted with permission from Hertsgaard LA, Hanson K, Hecht SS, et al. Exposure to a tobacco-specific lung carcinogen in adolescent vs. adult smokers. Cancer Epidemiology, Biomarkers and Prevention. 2008;17(12):3337-43. Figure 1.

Discussion

While this study has obvious limitations (self-reported data on CPD, availability of only baseline cross-sectional data for analysis, limited ranges of CPD [e.g., no populations less than 5 or more than 20 CPD]), the results of this study do shed light on tobacco-specific biomarker levels between two age-specific groups.

There is wide variability in levels of exposure to tobacco-specific carcinogens and nicotine in adolescents, with some adolescent smokers having levels of exposure that are nearly indistinguishable from those of adult smokers. From these findings, one could extrapolate that adolescents who smoke daily from an early age are at high risk for smoking-related cancers, particulary if they continue into adulthood.

Policy implications

Some adolescent smokers are achieving as much exposure to carcinogens and nicotine as adult smokers. It is critical to educate adolescents, clinicians and parents about these high levels of exposure, which might put adolescents at greater risk for severe addiction and at higher risk for disease.

References

1. Joseph AM, Hecht SS, Murphy SE, et al. Relationships between cigarette consumption and biomarkers of tobacco toxin exposure. Cancer Epidemiol Biomarkers Prev 2005;14:2963-8.
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3. Strand TE, Malayeri C, Eskonsipo PKJ, et al. Adolescent smoking and trends in lung cancer incidence among young adults in Norway 1954-1998. Cancer Causes Control 2004;15:27-33.

For more information about this research brief, please see Hertsgaard LA, Hanson K, Hecht SS, et al. Exposure to a tobacco-specific lung carcinogen in adolescent vs. adult smokers. Cancer Epidemiology, Biomarkers and Prevention. 2008;17(12):3337-43.

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