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Diminished autonomy over tobacco can appear with the first cigarettes[☆]

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Abstract

Individuals have lost full autonomy over their smoking when quitting becomes unpleasant or difficult. We examined autonomy in relation to smoking frequency and lifetime cigarette use. A self-administered questionnaire was completed by three convenience samples of Year 10 students (ages 14–15) in New Zealand between 2002 and 2004 ($n=96,156$). The Hooked On Nicotine Checklist was used to measure diminished autonomy. Diminished autonomy was reported by 46% of subjects who smoked less often than monthly and by 25%–30% of current smokers who had smoked only one cigarette in total. The prevalence of diminished autonomy increased with increasing frequency of current use and with increasing lifetime use. Symptoms developed earlier among girls than boys. The data confirm previous reports that diminished autonomy appears soon after the onset of intermittent tobacco use and extends this literature by providing the first description of how diminished autonomy develops in relation to the total number of cigarettes smoked. These data suggest that smoking one cigarette in total can prompt a loss of autonomy.

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Keywords: Tobacco; Nicotine; Addiction; Youth

Abbreviations: DANDY, Development and Assessment of Nicotine Dependence in Youth Study; HONC, Hooked On Nicotine Checklist; NDIT, Nicotine Dependence in Teens Study; TAP, Teenage Attitudes and Practices.

[☆] The work was performed at the University of Auckland.

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1. Introduction

Autonomy over tobacco is a useful index of addiction (DiFranza et al., 2002a). Smokers have lost full autonomy when quitting becomes unpleasant or difficult. The Development and Assessment of Nicotine Dependence in Youth (DANDY-1) study was the first to demonstrate that novice smokers lose autonomy quickly with intermittent use. DiFranza et al. (2000) found that each of the 10 symptoms of diminished autonomy included in the Hooked On Nicotine Checklist (HONC) had been reported within a few weeks of the first cigarette. The median usage when autonomy was lost was two cigarettes per week (DiFranza et al., 2002b). The rapid loss of autonomy was confirmed by three additional prospective studies. In the McGill University Nicotine Dependence in Teens study (NDIT), symptoms of lost autonomy were reported before the onset of monthly smoking, and long before 100 cigarettes had been smoked (O'Loughlin, Bancej, Gervais, Meshefedjian & Tremblay, 2006). In another study, 35% of adolescents who experienced a symptom of dependence did so within one month of their beginning to use tobacco (Kandel, Hu, Griesler & Schaffran, 2006). In the second DANDY study, subjects also reported a mean cigarette consumption of 2 per week at the onset of symptoms (DiFranza et al., 2007).

Gender differences in the number of symptoms and the rapidity of their onset have been reported. In the DANDY-1 study, females developed more symptoms than males, experiencing an initial symptom within a mean of 21 days of the onset of monthly smoking, while males took an average of 183 days (DiFranza et al., 2002b). A similar pattern was found in the NDIT study (O'Loughlin et al., 2003), but no gender differences in the timing of the first symptom were found in two other prospective studies (Kandel et al., 2006; DiFranza et al., 2007). No prior study has examined the loss of autonomy after the first cigarette, or in relation to different levels of lifetime use. Here we present the results from three large surveys of a multi-ethnic sample of Year 10 students in New Zealand to examine the loss of autonomy in relation to lifetime cigarette consumption and the current frequency of smoking.

2. Methods

2.1. Sample selection

National surveys of tobacco smoking by Year 10 students have been carried out yearly in New Zealand since 1999 (Scragg, 2005). This paper reports data from the 2002–2004 surveys which included the HONC. Each year, all New Zealand schools were invited to administer a two-page questionnaire to Year 10 students in November. The proportion of schools that participated were 67.3% in 2002 ($n=309$), 66.1% in 2003 ($n=312$), and 64.7% in 2004 ($n=319$). This was a convenience sample, it could not be weighted to make it representative of the national population. A total of 99,063 (70.4%) out of 140,721 students enrolled in participating schools completed questionnaires (30,972 in 2002; 34,812 in 2003; 33,279 in 2004).

2.2. Survey administration

The Ethics Committee of the Ministry of Health in Auckland granted a waiver of the formal review and consenting processes. We obtained permission from school principals to allow teachers to proctor the anonymous self-administered questionnaires in class. To maintain confidentiality, teachers did not examine the surveys for completeness.

2.3. Survey content

The survey collected data on demographics, tobacco use and the HONC. The response categories for lifetime cigarette consumption (“How many cigarettes *in total* have you smoked in your whole life?”) in 2002 and 2003 were “only one, two, 3 or 4, 5–9, 10–19, 20–99, 100 or more.” In 2004, these were changed to “1–2 puffs only, one, 2–5, 6–15, 16–25, 26–99, 100 or more.” All subjects who had ever puffed on a cigarette were queried about lifetime use, but those who indicated that they currently “never” smoke did not complete the HONC.

2.4. The Hooked On Nicotine Checklist

The HONC is composed of 10 items that have face validity as indicators of diminished autonomy over tobacco (DiFranza et al., 2002a). Agreement with any item indicates that full autonomy has been lost. The total score (the number of items endorsed) indicates the degree to which autonomy is diminished. The HONC has excellent internal consistency: in four studies with more than 700 adolescent smokers, Cronbach’s alpha ranged from 0.90 to 0.94 (DiFranza et al., 2002a; O’Loughlin, Tarasuk, DiFranza & Paradis, 2002; Wellman et al., 2006; Wheeler, Fletcher, Wellman & DiFranza, 2004). The validity of the HONC has been demonstrated by its correlation with cigarette intake (O’Loughlin et al., 2003; Wheeler et al., 2004) and its ability to predict the likelihood of both continued smoking and successful cessation (DiFranza et al., 2002a; Wellman et al., 2006).

2.5. Statistical methods

Analyses were restricted to the 96,156 respondents aged 14 and 15 years (2002: $n=30,096$, 2003: $n=33,661$, 2004: $n=32,399$). We next excluded subjects with missing data for gender ($n=268$) or smoking status ($n=806$). There were 66,844 individuals who denied any current tobacco use and 28,238 current smokers. Each HONC item was completed by about 99% of subjects. Rather than imputing missing data, we opted to exclude the 2516 subjects who had missing data for one or more of the 10 HONC items. An additional 727 subjects were excluded because of inconsistent responses between lifetime cigarette consumption and current smoking frequency. This left 24,995 (88.5%) of the current smokers in the analysis. The CROSSTAB procedure in SAS callable SUDAAN (SAS Institute, 2005) was used to compare distributions between boys and girls while correcting the standard errors for design effects arising from clustering by school.

Current lifetime cigarette consumption was obtained for all subjects who had ever smoked. Subjects who smoked 100 or more cigarettes had at one time had a lifetime consumption of 1 cigarette, 2 cigarettes, etc. The number of subjects who had at any time reached each milestone in lifetime cigarette consumption was calculated. We then determined the proportion of subjects who, having achieved each milestone in lifetime use, stated at the time of the survey that they currently “never” smoke. This produced a ‘quit-ratio’ for each level of lifetime cigarette consumption.

Since HONC symptoms impair cessation efforts (Wellman et al., 2006), symptomatic subjects are more likely to continue smoking and be included in a cross-sectional sample of current smokers. To the degree that subjects with HONC symptoms are preferentially retained as smokers, our data will overstate the prevalence of symptoms in relation to lifetime cigarette consumption. A sensitivity analysis was performed to assess the potential impact of preferential retention. Current smokers was defined as having

puffed on a cigarette and answering other than “never” to the question, “How often do you smoke now?” The group of current smokers with a lifetime consumption of one cigarette was not influenced by differential retention since it included both individuals who would never smoke another cigarette and those who would continue to smoke. By the definition of preferential retention, we assumed that the prevalence of symptoms at each level of lifetime consumption was no less than that observed among those who had smoked only one cigarette. For each category of lifetime consumption we knew the number of current smokers, ex-smokers, and current smokers with HONC symptoms. For a worst-case scenario we assumed that none of the ex-smokers had HONC symptoms, i.e., that every symptomatic subject was retained as a current smoker. This analysis was performed on the data from 2002–2003.

3. Results

The smokers who met all inclusion criteria had the following demographic characteristics: 11,960 (47.8%) were 14 years of age and 13,035 were 15; 10,070 (40.3%) were male and 14,925 female; 15,059 (60.3%) were European, 6697 (26.8%) Maori, 1779 (7.1%) Pacific Islanders, 919 (3.7%) Asian, 289 (1.2%) reported other ethnicities, and 252 (1.0%) did not indicate their ethnicity.

As shown in the far right column of Table 1, 46% of subjects who smoked less often than monthly reported one or more HONC symptoms. The proportion of subjects reporting symptoms, and median HONC scores, increased in a stepwise fashion with increasing frequency of current use (Table 1). At each level of current consumption, more girls than boys reported symptoms, and girls’ HONC scores were higher (Table 1). Girls also reported more symptoms than boys when stratified according to reported lifetime cigarette consumption (Table 2).

Table 1

Gender differences in HONC scores as a function of current frequency of tobacco use: 2002–2004

Both genders		HONC score (%)				Median HONC score	HONC score ≥ 1
<i>How often do you smoke now?</i>	Current smokers-N (%)	0	1–3	4–6	7–10		(%)
Less than monthly	8284 (33)	54	34	8	3	0	46
Monthly	3666 (15)	34	46	15	5	1	66
Weekly	3665 (15)	18	42	26	14	3	82
Daily	9380 (38)	5	17	27	52	7	95
Boys							
Less than monthly	3690 (37)	64	27	6	3	0	36
Monthly	1392 (14)	46	40	11	4	1	54
Weekly	1295 (13)	26	41	21	12	2	74
Daily	3693 (37)	7	19	26	47	6	93
Girls							
Less than monthly	4594 (31)	46	40	10	4	1	54
Monthly	2274 (15)	27	50	18	5	2	73
Weekly	2370 (16)	13	43	28	16	3	87
Daily	5687 (38)	3	16	27	55	7	97

* $p < 0.0001$ for chi-square test comparing distribution of HONC scores between boys and girls, using SUDAAN to correct for design effects.

Table 2

Gender differences in HONC scores as a function of lifetime use in current smokers: 2002 and 2003 surveys

	How many cigarettes in total have you smoked in your life?						
	1	2	3–4	5–9	10–19	20–99	≥ 100
Boys: current smokers- <i>n</i>	176	200	471	569	879	1912	3112
Girls: current smokers- <i>n</i>	111	184	548	849	1251	3135	4370
Boys: HONC ≥ 1 (%)	24	24	27	30	39	60	88
Girls: HONC ≥ 1 (%)	28	31	41	47	61	81	96
Boys: median HONC	0	0	0	0	0	1	5
Girls: median HONC	0	0	0	0	1	2	7
Boys: HONC score 0 (%)	76	76	73	70	61	40	12
Girls: HONC score 0 (%)	72	69	59	53	39	19	4
Boys: HONC scores 1–3 (%)	17	18	23	25	31	39	22
Girls: HONC scores 1–3 (%)	23	26	34	40	49	46	18
Boys: HONC scores 4–6 (%)	5	5	3	4	5	15	25
Girls: HONC scores 4–6 (%)	5	4	5	5	10	23	27
Boys: HONC scores 7–10 (%)	2	2	0	1	3	5	41
Girls: HONC scores 7–10 (%)	0	1	2	2	2	11	51
<i>p</i> *	0.15	0.21	0.0001	0.0001	0.0001	0.0001	0.0001

* Significance of gender differences in the distribution of HONC scores using the chi-square with SUDAAN to correct for design effects.

The proportion of subjects reporting one or more HONC symptoms increased from 25%–30% of those who had smoked one cigarette to 93% of those with a lifetime consumption of ≥ 100 cigarettes (Tables 3 and 4). The prevalence of each HONC symptom increased with increasing lifetime consumption. The

Table 3

Percentage of current smokers reporting any and each HONC symptom as a function of lifetime use: 2002 and 2003 surveys

	How many cigarettes in total have you smoked in your life?						
	1	2	3–4	5–9	10–19	20–99	≥ 100
Current smokers (<i>n</i>)	287	384	1019	1418	2130	5047	7482
Any HONC symptom (HONC ≥ 1)	25	27	35	40	52	73	93
<i>HONC item</i>							
#1: Have you ever tried to quit, but couldn't?	14	11	9	8	11	21	50
#2: Do you smoke now because it is really hard to quit?	3	3	3	3	5	12	43
#3: Have you ever felt like you were addicted to tobacco?	5	5	5	7	11	25	63
#4: Do you ever have strong cravings to smoke?	5	5	9	12	18	34	68
#5: Have you ever felt like you really needed a cigarette?	10	13	21	26	38	59	85
#6: Is it hard to keep from smoking in places where you are not supposed to, like school?	9	6	8	9	13	24	59
<i>When you tried to stop smoking, or if you haven't smoked for a while...</i>							
#7: Did you find it hard to concentrate because you couldn't smoke?	5	4	4	3	5	11	42
#8: Did you feel more irritable because you couldn't smoke?	6	3	5	4	7	18	53
#9: Did you feel a strong need or urge to smoke?	4	7	7	9	15	28	65
#10: Did you feel nervous, restless or anxious because you couldn't smoke?	5	4	4	5	6	17	47

Table 4

Percentage of current smokers reporting any and each HONC symptom as a function of lifetime use: 2004 survey

	How many cigarettes in total have you smoked in your life? ^a						
	1–2 puffs	1	2–5	6–15	16–25	26–99	≥100
Current smokers (<i>n</i>)	97	92	549	749	777	1433	3307
Any HONC symptom (HONC ≥ 1)	28	30	35	49	60	76	93
<i>HONC item</i>							
#1: Have you ever tried to quit, but couldn't?	14	9	11	11	17	26	51
#2: Do you smoke now because it is really hard to quit?	3	2	3	5	9	15	44
#3: Have you ever felt like you were addicted to tobacco?	5	4	8	10	16	28	62
#4: Do you ever have strong cravings to smoke?	4	9	10	20	23	38	68
#5: Have you ever felt like you really needed a cigarette?	14	13	22	35	47	62	85
#6: Is it hard to keep from smoking in places where you are not supposed to, like school?	8	16	9	11	17	29	58
<i>When you tried to stop smoking, or if you haven't smoked for a while...</i>							
#7: Did you find it hard to concentrate because you couldn't smoke?	9	3	3	5	9	13	42
#8: Did you feel more irritable because you couldn't smoke?	7	5	4	6	12	21	50
#9: Did you feel a strong need or urge to smoke?	7	9	8	14	18	31	65
#10: Did you feel nervous, restless or anxious because you couldn't smoke?	3	7	4	6	11	16	45

^a Categories of lifetime use differ between the 2002–2003 and 2004 surveys.

results from the different survey years were quite consistent. The most common symptom overall was feeling the need for a cigarette (Table 3). A failed quit attempt was reported by 14% of participants who reported having “smoked *in total*” one cigarette, rising to 50–51% among those who had smoked ≥ 100 cigarettes (Tables 3 and 4).

Table 5

Sensitivity analysis and HONC scores as a function of lifetime use: 2002 and 2003 surveys

	How many cigarettes in total have you smoked in your life?						
	1	2	3–4	5–9	10–19	20–99	≥100
Current smokers <i>n</i> = 17,767	287	384	1019	1418	2130	5047	7482
Former smokers <i>n</i> = 16,190	6253	2425	2746	1768	1325	1243	430
Current smokers with HONC ≥ 1 (%)	25	27	35	40	52	73	93
Worst-case sensitivity analysis (%) ^a	25	25	25	25	32	59	88
<i>HONC score distribution—current smokers</i>							
HONC score 0 (%)	75	73	65	60	48	27	7
HONC scores 1–3 (%)	19	22	29	34	42	44	20
HONC scores 4–6 (%)	5	4	5	5	8	20	26
HONC scores 7–10 (%)	1	1	1	1	2	9	47
Median HONC score—current smokers	0	0	0	0	1	2	6

^a Assumes maximal preferential retention of subjects with lost autonomy in the population of current smokers (see text for details).

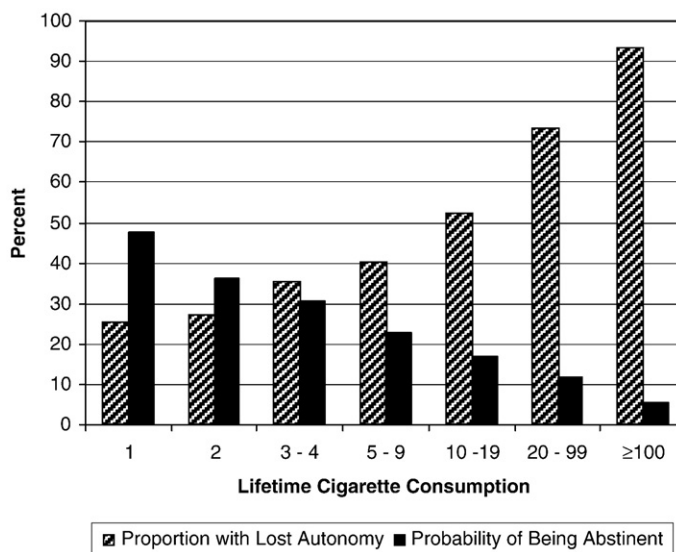


Fig. 1. The impact of lifetime cigarette consumption on autonomy and the likelihood of maintaining abstinence. Striped bars depict the prevalence of lost autonomy among current smokers with the indicated level of lifetime cigarette consumption. The solid bars indicate the proportion of subjects who, having achieved the indicated level of lifetime consumption, indicated that they currently “never” smoke ($n=33,957$).

There were 17,767 current smokers with complete data on the HONC, and 16,190 former smokers who were not asked to complete the HONC. Table 5 depicts the measured prevalence of lost autonomy ($\text{HONC} \geq 1$), the distribution of HONC scores, and median HONC scores in relation to lifetime cigarette consumption for current smokers. Also shown is the worst-case sensitivity analysis for preferential retention of subjects with HONC symptoms as current smokers. Even under the extreme assumption of preferential retention (i.e., that having a HONC symptom made it impossible to quit) one third of subjects who had smoked 10–19 cigarettes had lost autonomy.

Fig. 1 reveals that as lifetime cigarette consumption increases, there is a stepwise increase in the prevalence of lost autonomy, and a decrease in the prevalence of former smokers. Of all subjects who had ever smoked a single cigarette (up to and including those who had smoked more than 100 cigarettes), 48% responded that they currently “never” smoke, but this was true of only 5% of those who had ever smoked 100 cigarettes.

4. Discussion

Our observation of the onset of symptoms of lost autonomy with very infrequent smoking and a stepwise increase in the prevalence of lost autonomy with increasing frequency of smoking confirms previous studies. Diminished autonomy was reported by 46% of current smokers who smoked less often than once per month, and by 66% of monthly, 82% of weekly, and 95% of daily smokers. Although the prevalence of symptoms among New Zealand youth may seem quite high, they are lower than those reported for Canadian adolescents: diminished autonomy was reported by 78% of less-than-monthly smokers, 94% of monthly smokers, and 100% of weekly and daily smokers (O’Loughlin et al., 2003).

These differences may be the result of local social or policy factors that discourage the continued use of tobacco among youth who have not lost autonomy resulting in a higher prevalence of lost autonomy among those who persist with smoking.

Our very large sample allowed us to measure the prevalence of lost autonomy in a population of subjects who had smoked “in total” only one cigarette, and recently enough that they considered themselves to be currently smoking. A loss of autonomy was reported by 25–30% of these youth. In the DANDY-2 study, among the youth who had developed symptoms of lost autonomy, 10% had done so within two days of smoking their first cigarette, and 25% within one month of that event (DiFranza et al., 2007). As novice smokers often start to smoke at a frequency of less than once per month, many of the subjects who developed symptoms within a month of their first cigarette in the DANDY-2 study may have smoked only one cigarette. Therefore, our data indicating a prevalence of lost autonomy of 25–30% among subjects who had smoked “in total” one cigarette is consistent with previous studies.

The reliability of our data is also supported by its consistency with the 1993 U.S. Teenage Attitudes and Practices (TAP) survey. In our 2002–2003 surveys, 11% of subjects who had smoked 10–19 cigarettes reported a failed quit attempt, while in the TAP survey, 8% of subjects with a lifetime use of <20 cigarettes reported “it’s really hard to quit.” We report failed cessation in 21% of those who smoked 20–99 cigarettes; in the TAP survey 21% of those who had smoked 20–99 cigarettes reported it was really hard to quit (Barker, 1994).

It may seem logically impossible that, across all survey years, 14% of subjects who had smoked only one cigarette in their lifetimes reported a failed attempt at cessation. One author (JRD) has spoken with adolescents who claimed ‘love at first puff’, knowing from their reaction to their first cigarette that they would be smokers for life. However, it is also conceivable that the wording of the item assessing lifetime use, which emphasized how many cigarettes “in total” had been smoked, prompted subjects to report only on how many whole cigarettes they had consumed. Data from NDIT indicates that the first whole cigarette follows the first puff on average by about one month (Gervais, O’Loughlin, Meshefedjian, Bancej & Tremblay, 2006). Thus, it is possible that subjects had failed a quit attempt before smoking one whole cigarette. Future research should examine why some youth feel they cannot quit after smoking one cigarette.

Until the onset of daily smoking, a higher proportion of girls than boys report diminished autonomy. This is in accordance with previous reports from DANDY-1 (DiFranza et al., 2000, 2002b) and NDIT (O’Loughlin et al., 2003).

Strengths of this study include the very large sample size, the inclusion of ethnic groups that have not been previously studied in this context, and the stability of our findings across the three survey years. This study is subject to some limitations. First, levels of cigarette consumption were self-reported. There is no evidence that youths keep a tally of how many cigarettes they have smoked in their lifetimes, but recall is not an issue if the total is one or two. Second, symptoms are self-reported, and the high prevalence of diminished autonomy at very low levels of tobacco use has in the past raised speculation that adolescents falsely endorse HONC symptoms. If this were true, the HONC would have poor psychometric properties, would correlate poorly with indicators of tobacco use, and would lack predictive validity. To the contrary, the HONC has excellent internal consistency and good test–retest reliability (Wellman et al., 2006; Wheeler et al., 2004). HONC scores correlate well ($r=0.65$) with cigarette consumption and the number of smoking days in the preceding month (Wellman et al., 2006). In the DANDY-1 study, progression to heavier smoking was seen almost exclusively among those smokers who had endorsed at least one HONC symptom (Wellman, DiFranza, Savageau & Dussault, 2004). Over a 30-month follow-up, endorsement of a single item on the HONC other than a failed quit attempt was highly predictive of a failed quit attempt (odds ratio (OR)=29), continued

smoking until the end of follow-up (OR=44), and daily smoking (OR=58) (DiFranza et al., 2002b). In a prospective study of 215 adolescent smokers, each additional HONC symptom at baseline increased the likelihood of current smoking at six month follow-up by 29%, and at one year by 21% (Wellman et al., 2006). These data, and those depicted in Fig. 1, are incompatible with the theory that youth are reporting false symptoms, or that their symptoms have no clinical significance. Fig. 1 provides support for the use of the loss of autonomy as a sensitive indicator of the onset of dependence.

Russell recognized the impact of the first cigarettes smoked during adolescence: “it takes no more than three or four casual cigarettes in this sensitive period virtually to ensure evolution to regular dependent smoking within a few years” (Russell, 1971). While regular daily smoking does take years to develop in most youth (DiFranza et al., 2002b), it is now established that symptoms of lost autonomy appear with infrequent smoking. Fig. 1 is rather ominous in its depiction of the relationship between early tobacco use, the loss of autonomy, and the dwindling prospects for early cessation. Beginning with the first, each cigarette appears to increase the likelihood that autonomy will be lost, and to decrease the likelihood of quitting. In our opinion, in light of the strength of the accumulated evidence, it would be irresponsible to withhold from youth a clear warning that experimentation with even one cigarette may initiate addiction. Legislation world-wide should aim to end the sale of single cigarettes and small packs, and ban the distribution of free samples of tobacco products.

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