The role of smoking intentions in predicting future smoking among youth: findings from Monitoring the Future data

Melanie Wakefield[1], Deborah D. Kloska[2], Patrick M. O'Malley[2], Lloyd D. Johnston[2], Frank Chaloupka[3], John Pierce[4], Gary Giovino[5], Erin Ruel[6] & Brian R. Flay[3]

The Cancer Council Victoria, Australia,[1] Institute for Social Research, University of Michigan, MI,[2] University of Illinois at Chicago, IL,[3] University of San Diego, CA[4] and Roswell Park Cancer Institute, Buffalo, NY, USA[5]

Correspondence to:
Melanie Wakefield
Director
Centre for Behavioural Research in Cancer
The Cancer Council Victoria
1 Rathdowne Street
Carlton
Victoria
Australia 3053
Tel: 61 (0) 3 9635 5046
Fax: 61 (0) 39635 5380
E-mail: melanie.wakefield@cancervic.org.au

Submitted 14 July 2003;
initial review completed 29 August 2003;
final version accepted 17 October 2003

ABSTRACT

Aims To demonstrate that intentions predict long-term future levels of smoking, irrespective of level of past smoking experience. A growing body of research suggests that intentions about future smoking might play an important role in addition to the influence of past smoking experience on the likelihood of smoking in future.

Design Using logistic regression analyses, we assessed the relationship between baseline smoking experience and a firm intention 'not to be smoking cigarettes 5 years from now' with four outcome measures of smoking at follow-up: 30-day smoking at a 3/4- and 5/6-year follow-up and current established smoking (self-described regular smokers or former smokers who had smoked in the past 30 days) at a 3/4- and 5/6-year follow-up.

Participants US nationally representative samples of 12th graders who responded to the Monitoring the Future (MTF) survey from the years 1976 to 1993, inclusive. For these panels, we linked stage of smoking and intentions at 12th grade to follow-up measures of smoking collected at 3/4 years after baseline and 5/6 years after baseline.

Findings Analysis of 3/4-year follow-up data (weighted $n = 4544$) and 5/6-year follow-up data (weighted $n = 3885$) for both definitions of smoking outcome indicated that there was a dose–response relationship between levels of baseline smoking experience and the likelihood of future smoking. In addition, independent of baseline smoking experience, there was a statistically significant protective effect for a firm intention not to smoke in five year's time on future smoking behavior.

Conclusions The findings suggest that evaluative studies of tobacco control policies and programs might usefully employ smoking uptake categories that incorporate smoking intentions as early indicators of outcome.

KEYWORDS Adolescence, intention, cohort study, smoking.

INTRODUCTION

Reducing teenage smoking is an important public health and tobacco control priority. Efforts to evaluate preventive interventions, whether through educational programs or policy initiatives, have traditionally used the prevalence of current smoking (either defined as past week or past month smoking) as a primary outcome measure (USDHHS 1994). Some studies have also used level of consumption (number of cigarettes smoked per week or month) as an outcome measure to examine change further within the group of current smokers. However, interventions may need to be in place for a considerable time before change in these outcome measures can be

 doi:10.1111/j.1360-0443.2004.00742.x

observed because the transition from never smoker to regular smoker generally occurs over several years. Interventions aimed at teenagers or young adults, most of whom have not begun to smoke or to smoke regularly, are especially difficult to evaluate for this reason.

A growing body of research has been concerned to identify measures that may serve as early indicators of effective interventions so that more timely feedback can be provided to improve programs and policies. The identification and measurement of 'stages' in the process by which adolescents take up smoking offers a potential set of measures by which this might be accomplished. Many researchers have conceptualized smoking uptake behavior in adolescence as progressing through a sequence of stages. Early work by three groups of authors (Leventhal & Cleary 1980; Flay *et al*. 1983; Stern *et al*. 1987) all suggested that developmental stages of smoking onset exist and attempted to delineate them. These stages were summarized in the 1994 Surgeon General's Report (USDHHS 1994) and reviewed by Mayhew *et al*. (2000).

The first stage is generally understood to mean an adolescent who has never smoked and has no inclination to do so. The next stage occurs when a never smoker begins to think about smoking and starts to form more favorable beliefs about it, referred to variously as a contemplation or preparatory stage, or as being 'susceptible' to smoking (Pierce *et al*. 1996; Wills *et al*. 1996; Jackson 1998). Most authors conceive of a stage of experimentation, and some consider the transitions between never use to experimentation and experimentation to regular use to constitute separate definable stages of their own. Thus, some consider initial use as the end of the contemplation stage (Stern *et al*. 1987; Pallonen *et al*. 1998), others consider it to be the start of a phase of experimentation (Leventhal & Cleary 1980), but most have defined it as a separate stage (Flay *et al*. 1983). Some researchers operationalize this stage by the simple experience of having ever 'puffed' on a cigarette (Choi *et al*. 2001), whereas others use the smoking of one or two cigarettes as a criterion (Mayhew *et al*. 2000). The next stage, that of experimentation, is characterized generally by a gradual increase in the range of situations in which cigarettes are smoked and in the frequency of smoking. In the fifth stage, adolescents progress beyond sporadic smoking to smoking on a more regular, albeit still infrequent, basis. In this stage, cigarettes are not smoked every day, but there is more consistency in the types of situations in which smoking will occur, such as at parties, at weekends or after school. The final stage is established smoking, where adolescents are smoking daily or almost every day and are generally presumed to have developed dependence (USDHHS 1994).

As pointed out in a recent review by Mayhew *et al*. (2000), researchers have differed in their definition of stages according to whether decision-making is driven primarily by theoretical notions or measurement strategies and concerns. For example, some authors consider the smoking of 100 cigarettes in a life-time to be a critical indicator of regular smoking (Flint, Yamada & Novotny 1998; Distefan *et al*. 1998). In addition, definitions of stages may be predicated by the distribution of data, and it may be important to collapse categories so as to yield an adequate number of cases for meaningful statistical analysis.

Researchers have begun to use these stages to predict transition to future established smoking. It is known that increasing levels of smoking experience increase the likelihood of future smoking (USDHHS 1994). For example, analyses undertaken at the Institute for Social Research at the University of Michigan on panels of 12th grade smokers from the Monitoring the Future survey (MTF) and published in the 1994 Surgeon-General's Report demonstrated that level of smoking consumption in the previous 30 days predicted level of 30-day smoking consumption at a 5/6-year follow-up (USDHHS 1994). Aside from smoking experience, several studies have demonstrated that intention to smoke in the future is positively related to likelihood of future smoking behavior and that a firm intention not to smoke is protective against future smoking (McNeill *et al*. 1988; Chassin *et al*. 1984; Pierce *et al*. 1996; Jackson 1998). This is consistent with broader theoretical notions, that having an intention to perform a behavior increases the probability of that future behavior (Ajzen & Fishbein 1980; Bandura 1986).

Recently, Choi *et al*. (2001) used a combination of measures of smoking experience, intentions and self-efficacy to predict successfully the likelihood of future smoking. The study used data from two longitudinal studies each followed-up 4 years after baseline—a sample of US teenagers aged 12–18 years from the Teenage Attitudes and Practices Survey (TAPS) and a sample of California teenagers aged 12–17 at baseline. In the TAPS study, previous smoking experience was categorized as never smoked, puffed, non-recent or recent experimentation (in the past 30 days), and former or current established smoking (on the basis of 100 + cigarettes smoked in a life-time and 30-day smoking). Two smoking intention questions ('Do you think you will try a cigarette soon?' and 'Do you think you will be smoking 1 year from now?') and one self-efficacy question ('If one of your best friends were to offer you a cigarette, would you smoke it?') were used to construct high- and low-risk cognitions. Only those with the strongest intention not to smoke in future and not to accept an offer of a cigarette were considered to have low-risk cognitions.

The TAPS investigators found that, compared with low-risk cognitions, high-risk cognitions significantly increased the probability of future current established smoking within each of the six levels of previous smoking

experience. In the US sample, the 4-year probability of future smoking ranged from 5.6% for never smokers with low-risk cognitions to 83.0% for current established smokers with high-risk cognitions. The pattern of results was replicated in the longitudinal study of California teenagers. The authors suggest that effective smoking intervention programs may be judged on their ability to convert high-risk cognitions to low-risk cognitions, regardless of past smoking experience.

Past work undertaken by Johnston and colleagues on the MTF (USDHHS 1994, pp. 84–87) has focused upon the 'high end' of smoking experience (smoking intensity in the past 30 days), and used an intention question ('Do you think you will be smoking cigarettes 5 years from now?') to determine whether intention offered additional predictive power beyond recent smoking intensity. Adolescents who indicated that they 'probably or definitely would' be smoking in 5 years were defined as having an intention to smoke in the future and those who indicated that they 'probably or definitely would not' be smoking in 5 years were considered to have a low intention to smoke. Once 30-day smoking intensity was controlled, intention had no relationship to 30-day smoking intensity at follow-up for those who smoked at least one cigarette per day or more at baseline. However, among never smokers, those with low intentions to smoke were less likely to be smoking at follow-up (15%) than those who had some intention (45%). In addition, among those who smoked less than one cigarette in the past 30 days at baseline, those with low intentions were less likely to smoke at follow-up (42%) than those who had some intention (58%).

This pattern of findings, and those reported by Choi *et al.* (2001), prompted us to consider further analysis using the MTF to predict future smoking. In the analyses reported here, we were concerned to include adolescents in earlier stages of uptake than that indicated by past 30-day smoking. In addition, we wished to use a more stringent classification of intention, defined on the basis of a firm intention not to smoke, as suggested by Choi *et al.* (2001). Finally, we sought to use two measures of smoking at follow-up—the traditional measure of 30-day smoking (indicating current smoking) and a measure of current established smoking.

METHODS

Sample selection and follow-up procedures

The data for this study used panels drawn from the nationally representative cross-sectional surveys of 12th graders conducted by the Institute for Social Research (ISR) at the University of Michigan. Since 1975, ISR has conducted a nationally representative survey of 15 000–19 000 high school seniors in the spring of each year as part of its research program entitled Monitoring the Future: a Continuing Study of American Youth (MTF).

Approximately 130 public and private schools containing 12th graders within the coterminous United States are selected annually for the MTF survey based on a three-stage sampling procedure (Johnston *et al.* 2002). Stage 1 involves geographic area selection; Stage 2 involves selection of one or more schools in each area based on establishing the probability for inclusion proportionate to the size of the respective grade to be sampled; and Stage 3 focuses on selection of students within each selected school. Up to 350 students per grade are selected for the study; for those schools with a smaller student body in the respective grade, all students are selected. If a school has more than 350 students in the selected grade, a random sample of classrooms or other random method is used to choose the final sample.

Questionnaires are administered by ISR representatives in classrooms during normal class periods whenever possible. Students are informed of the importance of accurate responses and assured that their confidentiality will be protected. Parents are not present during the completion of the survey and neither the parents nor the school are informed of individual student responses. In order to cover the range of topic areas in the study, six different forms of the questionnaire are distributed each year. This occurs in an ordered sequence, so as to ensure virtually identical subsamples for each form. Approximately one-third of the questions on each form are common to all forms. This applies to all of the demographic variables and a small set of questions on cigarette smoking.

Commencing in 1976, approximately 2400 students from each senior class are chosen to participate in follow-up surveys. Half of these are surveyed on even-number calendar years, and half on odd-number calendar years. Thus, one group is followed up for the first time 1 year after baseline, while the other group is followed up 2 years after baseline. Thereafter, subsequent follow-ups are conducted at 2-year intervals. Various subgroups are over-sampled in the follow-up surveys, given that some individuals with particular characteristics have a higher probability of being lost to follow-up. In particular, those fitting certain drug use criteria, such as individuals who reported 20 or more uses of marijuana or use of illicit drugs other than marijuana in the previous month, are selected with a higher probability than other students reporting less drug use. Corrective weighting is used in analyses to offset the effects of unequal probabilities of selection.

Follow-up questionnaires share many of the same questions as those asked at baseline and each respondent is mailed the same form of the questionnaire completed at

baseline. Questions pertaining to high school experiences are replaced with post-high school questions pertaining to employment, college, marital status and so on. Retention rates for the first follow-up survey average 77% (Johnston *et al*. 1995).

The data used for the present study are drawn from the MTF surveys from the years 1976 to 1993, inclusive. For these panels, we linked baseline stage of smoking to follow-up measures of smoking collected 3/4 years after baseline and 5/6 years after baseline.

Questionnaire measures

For the purposes of this study, descriptors of the survey sample at baseline included age, gender and race (white, black, Hispanic, other). The MTF survey asked two questions to assess baseline-smoking experience. First, students were asked, 'Have you ever smoked cigarettes?' with responses being 'never', 'once or twice', 'occasionally but not regularly', 'regularly in the past' and 'regularly now'. Secondly, students were asked 'How frequently have you smoked cigarettes during the past 30 days?' with responses being 'not at all', 'less than one cigarette per day', '1–5 cigarettes per day', 'about one half-pack per day', 'about one pack per day', 'about one and one-half packs per day' and 'two packs or more per day'. These questions were asked of all respondents.

Intention to smoke was assessed in only Form 1 of the baseline questionnaire, by asking 'Do you think you will be smoking cigarettes 5 years from now?' with responses being 'I definitely will', 'I probably will', 'I probably will not' and 'I definitely will not'. Only the response 'I definitely will not' was categorized as a low-risk intention, while other responses were categorized as high-risk intention. There were no other intention or self-efficacy questions asked of MTF respondents that were available for a sufficient number of panels.

Statistical procedures

We used point estimates and 95% confidence intervals to present data in tabular and graphic form. Logistic regression analysis was employed to determine the extent to which the defined levels of baseline smoking experience (Model 1), baseline smoking plus intentions (Model 2) and baseline smoking, intentions and their interactions (Model 3) were related to each of the four outcome variables, these being 30-day smoking at a 3/4- and 5/6-year follow-up; and current established smoking (self-described as a regular smoker or a former smoker who had smoked in the past 30 days) at a 3/4- and 5/6-year follow-up. GEE analyses accounting for clustering within schools were also conducted, although there were very few students from each school in the panel dataset, so that intraclass correlation was thought to be very small. On average, standard errors from the GEE analysis were only slightly smaller than the standard errors from the logistic analyses, and the direction and statistical significance of findings remained the same. We present results from the logistic regressions, as they are more conservative.

RESULTS

Sample characteristics

Complete baseline data on smoking experience and intentions were available for a total of 6319 cases. Of these, 4544 cases (71.9%) completed the 3/4-year follow-up and 3885 (61.5%) completed the 5/6-year follow-up with complete smoking status information. The mean age of panel members at baseline was 17.5 years (range = 14–21, SD = 0.56); 48.5% were male and 77.3% were white, 11.2% were African American, 5.6% were Hispanic and the remaining were of other racial and ethnic groups. Of all students at baseline, 61.7% said they would definitely not be smoking in 5 years time and 38.3% indicated otherwise.

Table 1 shows the distribution of categories of smoking experience and intentions for the 6319 MTF baseline survey participants. Only 88 cases could not be categorized due to conflicting information on the two smoking experience questions. Overall, 28.7% of 12th graders were never smokers with low-risk intentions to smoke in future. The next most frequent category was 'puffers' with low-risk intentions, comprising 20.8% of the sample. At the high end of smoking experience, a total of 18.5% were current established smokers, with almost all these students having high-risk intentions about smoking in future. Few students (4.1%) were classified as former established smokers.

Prediction of future smoking

Table 2 shows the percentage of cases within each baseline category who were smokers at the 3/4- and 5/6-year follow-ups, respectively, using the definitions of being a self-described smoker or having smoked in the past 30 days as the criterion variables, respectively. Of 4480 panel members for whom data were available at the 3/4-year follow-up, 947 (21.1%) were current established smokers and 1403 (31.3%) had smoked in the prior 30 days. At the 5/6-year follow-up, 790 (20.6%) of the 3831 available panel members were current established smokers and 1130 (29.5%) had smoked in the past 30 days. That is, regardless of length of follow-up, about 21% of respondents were established smokers and about 30% had smoked within the past 30 days at follow-up.

Table 1 Baseline frequency distributions of smoking experience and intentions.

Behavior	*Intention*	*Definition*	*n*[1]	%
Never smoker	Low[2]	Never smoked, definitely not intend to smoke in 5 years	1813	28.7
Never smoker	High	Never smoked, may smoke in 5 years	245	3.9
Puffer	Low	Smoked once or twice, definitely not intend to smoke in 5 years	1317	20.8
Puffer	High	Smoked once or twice, may smoke in 5 years	365	5.8
Nonrecent experimenter	Low	Smoked occasionally, >30 days ago, definitely not smoke in 5 years	250	4.0
Nonrecent experimenter	High	Smoked occasionally, >30 days ago, may smoke in 5 years	248	3.9
Former established	Low	Smoked regularly in past OR not smoked in past 30 days, and definitely not smoke in 5 years	169	2.7
Former established	High	Smoked regularly in past, OR not smoked in past 30 days and may smoke in 5 years	87	1.4
Recent experimenter	Low	Smoked occasionally, smoked past 30 days, definitely not smoke in 5 years	125	2.0
Recent experimenter	High	Smoked occasionally, smoked in past 30 days, may smoke in 5 years	441	7.0
Current established	Low	Smoke regularly now or smoked regularly in past AND smoked in past 30 days and definitely not smoke in 5 years	135	2.1
Current established	High	Smoke regularly now or smoked regularly in past AND smoked in past 30 days and may smoke in 5 years	1035	16.4
Total classified cases			6231	98.6
Unclassified			88	1.4
Grand total			6319	100.0

[1]*n* is weighted, and rounded; MTF students are 12th grade (95% aged 17–18) in 1976–93. [2]Low-risk intention indicates that the respondent chose 'will definitely not be smoking cigarettes in 5 years time'; high-risk intention indicates that they chose 'definitely' or 'probably will be smoking', or 'probably will not be smoking in 5 years' time.

The percentage of each baseline category who were current established smokers at 3/4-year follow-up ranged from 2.4% of baseline never smokers with low-risk intentions to 74.6% of baseline current established smokers with high-risk intentions. By 5/6-year follow-up, the range was 2.8–70.4%. The percentage of each baseline category who were 30-day smokers at follow-up ranged from 5.8% of never smokers with low-risk intentions to 83.2% of current established smokers with high-risk intentions at 3/4-year follow-up and 6.1–78.7%, respectively, at 5/6-year follow-up.

Overall, the general pattern of findings was consistent with the notion that a firm intention not to smoke offered some level of protection against the risk of future smoking. The general pattern is for some increase in probability of future smoking when high-risk as opposed to when low-risk cognitions are present.

Logistic regression analysis of predictors of future smoking

Although there was a lower prevalence of smoking at the follow-ups for each level of baseline smoking experience where panel members had low-risk, as opposed to high-risk, intentions about smoking in the future, confidence intervals overlapped in all cases but one for each outcome. This was possibly because, given the 12 categories of smoking experience and intentions, many cell sizes were small.

We used logistic regression analyses to model the relationship of baseline smoking experience and high- versus low-risk cognitions on the probability of future smoking, using all four outcome measures. Adding intentions to the model (Model 2) with baseline behavior (Model 1) significantly improved prediction of future behavior (Table 3). Adding interactions (Model 3) did not improve the fit further. Results from Models 1 and 2 for all four outcomes are shown in Table 3. Overall, we found a dose–response relationship between baseline smoking experience and future smoking. In addition, we found a statistically significant protective effect for a firm intention not to smoke in future, with odds ratios ranging from 0.65 to 0.68 indicating that, on average, the likelihood of individuals with firm intentions of not smoking actually doing so was about two-thirds of the likelihood for individuals without such firm intentions. Although the results in Table 2 suggest that the effects of intentions is stronger for never smokers and puffers than experimenters and established smokers, none of the interactions between intentions and baseline behavior were significant in the logistic regression analyses (Model 3).

DISCUSSION

The findings of this study provide support for the notion that having a firm intention not to smoke in 5 year's time exerts a generally protective effect upon the likelihood of

Table 2 Prediction of established and 30-day smoking at 3/4- and 5/6-year follow-ups.

		At 3/4-year follow-up						*At 5/6-year follow-up*					
		Established smoker			*30-day smoking*			*Established smoker*			*30-day smoking*		
Baseline behavior	*Intention to smoke*	*%*	*95% CI*	*n*[1]	*%*	*95% CI*	*n*[1]	*%*	*95% CI*	*n*[2]	*%*	*95% CI*	*n*[2]
Never smoker	Low	2.4	1.6–3.2	32/1331	5.8	4.5–7.1	77/1331	2.8	1.9–3.7	33/1183	6.1	4.7–7.5	72/1183
Never smoker	High	3.4	0.7–6.1	6/167	10.6	5.9–15.3	18/167	5.8	1.9–9.7	8/139	11.5	6.2–16.8	16/139
Puffer	Low	7.8	6.1–9.5	75/957	17.8	15.4–20.2	171/957	8.7	6.7–10.7	69/800	17.5	14.9–20.1	140/800
Puffer	High	14.0	9.7–18.3	35/252	26.9	21.4–32.4	68/252	15.8	10.9–20.7	33/209	26.2	20.2–32.2	55/209
Nonrecent experimenter	Low	14.1	9.1–19.1	26/187	28.3	21.8–34.8	53/187	17.9	12.0–23.8	29/160	31.6	24.4–38.8	51/160
Nonrecent experimenter	High	16.6	11.3–21.9	31/187	33.8	27.0–40.6	63/187	19.4	13.4–25.4	33/168	34.3	27.1–41.5	58/168
Former established	Low	18.8	12.0–25.6	24/126	31.8	23.7–39.9	40/126	16.3	9.3–23.3	18/108	28.3	19.8–36.8	31/108
Former established	High	25.7	14.5–36.9	15/58	41.1	28.4–53.8	24/58	19.2	8.3–30.1	10/50	28.5	16.0–41.0	14/50
Recent experimenter	Low	26.3	17.4–35.2	25/95	52.3	42.3–62.3	50/95	24.6	15.3–33.9	20/83	41.5	30.9–52.1	34/83
Recent experimenter	High	28.2	23.3–33.1	90/320	55.7	50.3–61.1	178/320	29.3	23.9–34.7	79/270	53.9	48.0–59.8	145/270
Current established (30-day)	Low	64.3	54.1–74.5	55/85	78.8	70.1–87.5	67/85	58.9	47.1–70.7	40/67	70.3	59.4–81.2	47/67
Current established (30-day)	High	74.6	71.4–77.8	533/714	83.2	80.5–85.9	594/714	70.4	66.7–74.1	418/593	78.7	75.4–82.0	467/593

[1]*n* is weighted, and rounded; smoking status at 3/4-year follow-up over baseline level for *n* = 4480 (64 missing values). [2]*n* is weighted and rounded; smoking status at 5/6-year follow-up over baseline level for *n* = 3831 (54 missing values).

Table 3 Odds ratios (95% CI) for logistic regression analyses of four levels of prior smoking experience (Model 1) and prior smoking plus intention to smoke (Model 2) on two measures of smoking at two follow-up times.[1]

	Current established smoking (3/4-year)[2]		*30-day smoking (3/4-year)*[3]		*Current established smoking (5/6-year)*[4]		*30-day smoking (5/6-year)*[5]	
	Model 1 OR (95% CI)	*Model 2 OR (95% CI)*	*Model 1 OR (95% CI)*	*Model 2 OR (95% CI)*	*Model 1 OR (95% CI)*	*Model 2 OR (95% CI)*	*Model 1 OR (95% CI)*	*Model 2 OR (95% CI)*
Puffer	3.88 (2.66–5.66)	3.72 (2.55–5.44)	3.65 (2.84–4.70)	3.52 (2.73–4.53)	3.56 (2.45–5.17)	3.39 (2.33–4.93)	3.37 (2.58–4.40)	3.23 (2.47–4.22)
Non-recent experimenter	7.01 (4.56–10.75)	5.97 (3.85–9.26)	6.70 (4.95–9.01)	5.76 (4.22–7.87)	7.24 (4.77–10.99)	6.04 (3.92–9.29)	6.94 (5.06–9.51)	5.87 (4.23–8.15)
Former established	10.29 (6.37–16.63)	9.47 (5.84–15.35)	7.91 (5.48–11.43)	7.33 (5.06–10.61)	6.56 (3.91–11.00)	5.96 (3.54–10.03)	5.58 (3.71–8.38)	5.11 (3.39–7.71)
Recent experimenter	14.88 (10.09–21.94)	11.47 (7.56–17.34)	18.11 (13.63–24.07)	14.14 (10.39–19.24)	12.37 (8.39–18.26)	9.31 (6.12–14.17)	14.65 (10.85–19.80)	11.26 (8.12–15.63)
Current established	107.64 (75.13–154.22)	79.77 (53.67–118.55)	71.10 (53.86–93.84)	53.11 (38.97–72.38)	71.00 (49.87–101.09)	50.98 (34.32–75.72)	49.47 (37.24–65.71)	36.17 (26.22–49.89)
Low intention		0.67 (0.53–0.85)		0.68 (0.56–0.82)		0.65 (0.51–0.83)		0.66 (0.54–0.81)

[1]For all models, never smoker is the excluded category. [2]Model 1: –2 Log L = 3012.7; Model 2: –2 Log L = 3001.3; Change = 11.4. [3]Model 1: –2 Log L = 3914.3; Model 2: –2 Log L = 3898.7; Change = 15.6. [4]Model 1: –2 Log L = 2721.5; Model 2: –2 Log L = 2709.3; Change = 12.2. [5]Model 1: –2 Log L = 3427.2; Model 2: –2 Log L = 3412.2; Change = 15.0. NB. For 1 degree of freedom, a change in –2 Log L of 3.8 would be significant.

future established smoking. Using two definitions of smoking—the traditional measure of 30-day smoking (current smoking) and a self-designation of regular smoking that included former regular smokers who had smoked in the past 30 days (current established smoking)—we observed a pattern of lower likelihood of smoking with firm intentions not to smoke across each of the levels of smoking experience. Although most of the differences did not achieve statistical significance when analyzed separately, the effect of intentions was significant in all four logistic regression models. Thus, we can conclude that firm intentions to *not* be smoking in 5 years' time has a protective effect, regardless of the level of current smoking experience.

Our study makes an important contribution because we used a nationally representative sample with a long follow-up and two different measures of smoking behavior. We also show that intentions make a difference at both high and low levels of smoking experience, not just at low levels. The study was limited by the numbers of cases available for analysis, and because the panel was limited to 12th graders at baseline. A preferable approach would have been to be able to follow-up 8th, 10th and 12th graders, which would have ensured greater numbers, especially at low levels of smoking experience. However, only 12th grade panels were available that contained the variables of interest in this study. On the other hand, the consistency of the findings with those of Choi *et al.* (2001) across two different outcomes at two different follow-ups suggests that our findings are robust.

The promise offered by the categories of smoking and intentions investigated in this study as predictors of future smoking is that one may be able to assess the extent to which different types of tobacco control programs and policies affect intentions within each level of smoking experience. Thus, for example, antismoking advertising seems more likely to influence pre-adolescents and those in early adolescence than those in mid- to later adolescence (Wakefield *et al.* 2003). This may well be because it has a greater influence on intentions among never smokers and those at the low end of smoking experience than intentions among established smokers. By contrast, some policy interventions, such as higher prices for cigarettes (Emery *et al.* 2001) and more extensive bans on smoking in public places (Wakefield *et al.* 2000), seem more likely to influence intentions among current smokers than never smokers or those at the lower end of smoking experience. Still other policies may have a more even impact; for example, there is some evidence that enforced bans on smoking at school may have a relatively constant effect across all stages of uptake (Wakefield *et al.* 2000). In some instances, however, behavioral changes may occur without prior change in intentions—for example, youth who do not intend to reduce their consumption may none the less find their level of consumption constrained by smoke-free policies making them unable to smoke when they wish. Change in intentions may be an early marker of eventual behavioral change for most, but not all, tobacco control interventions.

This study adds to the body of work suggesting that examining intentions to smoke offers some improvement in predicting eventual smoking status over past smoking experience. Tobacco control program and policy evaluations might consider using uptake measures as alternative or additional outcome measures.

Acknowledgements

This study was supported by grants from the Robert Wood Johnson Foundation (Bridging the Gap) and the National Institute on Drug Abuse (Monitoring the Future).

References

Ajzen, I. & Fishbein, M. (1980) *Understanding Attitudes and Predicting Social Behavior.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1986) *Social Foundations of Thought and Action: a Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice Hall.

Chassin, L., Presson, C. C., Sherman, S. J., Corty, E. & Olshavsky, R. W. (1984) Predicting the onset of cigarette smoking in adolescents: a longitudinal study. *Journal of Applied Social Psychology*, **14**, 224–243.

Choi, W. S., Gilpin, E. A., Farkas, A. J. & Pierce, J. P. (2001) Determining the probability of future smoking among adolescents. *Addiction*, **96**, 313–323.

Distefan, J. M., Gilpin, E. A., Choi, W. S. & Pierce, J. P. (1998) Parental influences predict adolescent smoking in the United States, 1989–93. *Journal of Adolescent Health*, **22**, 466–474.

Emery, S., White, M. M. & Pierce, J. P. (2001) Does cigarette price influence adolescent experimentation? *Journal of Health Economics*, **20**, 261–270.

Flay, B. R., d'Avernas, J. R., Best, J. A., Kersell, M. W. & Ryan, K. B. (1983) Cigarette smoking: why young people do it and ways of preventing it. In: McGrath, P. & Firestone, P., eds. *Pediatric and Adolescent Behavioral Medicine*, pp. 132–183. New York: Springer.

Flint, A. J., Yamada, E. G. & Novotny, T. E. (1998) Back–white differences in cigarette smoking uptake: progression from adolescent experimentation to regular use. *Preventive Medicine*, **27**, 358–364.

Jackson, C. (1998) Cognitive susceptibility to smoking and initiation of smoking during childhood: a longitudinal study. *Preventive Medicine*, **27**, 129–134.

Johnston, L. D., O'Malley, P. M. & Bachman, J. G. (1995) *National Survey Results on Drug Use from the Monitoring the Future Study, 1975–1994.* NIH Publication no. 95–4026. Washington, DC: US Government Printing Office.

Johnston, L. D., O'Malley, P. M. & Bachman, J. G. (2002) *Monitoring the Future National Survey Results on Drug Use, 1975–2001*, Vol. 1. *Secondary School Students.* NIH Publications no. 02–5106. Bethesda, MD: US Department of Health and Human Services, National Institute on Drug Abuse.

Leventhal, H. & Cleary, P. D. (1980) The smoking problem: a review of the research and theory in behavioral risk modification. *Psychological Bulletin*, **88**, 370–405.

Mayhew, K. P., Flay, B. R. & Mott, J. A. (2000) Stages in the development of adolescent smoking. *Drug and Alcohol Dependence*, **59**, S61–S81.

McNeill, A. D., Jarvis, M. J., Stapleton, J. A., Russell, M. D., Eiser, J. R., Gammage, P. & Gray, M. (1988) Prospective study of factors predicting uptake of smoking in adolescents. *Journal of Epidemiology and Community Health*, **43**, 72–78.

Pallonen, U. E., Prochaska, J. O., Velicer, W., Prokorov, A. & Smith, N. (1998) Stages of acquisition and cessation for adolescent smoking: an empirical example. *Addictive Behaviors*, **23**, 303–324.

Pierce, J. P., Choi, W. S., Gilpin, E. A., Farkas, A. J. & Merritt, R. K. (1996) Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psychology*, **15**, 355–361.

Stern, R. A., Prochaska, J. O., Velicer, W. F. & Elder, J. P. (1987) Stages of adolescent smoking acquisition: measurement and sample profiles. *Addictive Behaviors*, **12**, 319–329.

United States Department of Health and Human Services (USDHHS) (1994) *Preventing Tobacco Use Among Young People*. Report of the Surgeon-General. Atlanta, GA: USDHHS, Centers For Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

Wakefield, M. A., Chaloupka, F. J., Kaufman, N. J., Orleans, C. T., Barker, D. C. & Ruel, E. E. (2000) Effect of restrictions on smoking at home, at school and in public places on teenage smoking: cross sectional study. *BMJ*, **321**, 333–337.

Wakefield, M., Flay, B., Nichter, M. & Giovino, G. (2003) Effects of anti-smoking advertising on teenage smoking: a review. *Journal of Health Communication*, **8**, 229–247.

Wills, T., Pierce, J. P. & Evans, R. I. (1996) Large-scale environmental risk factors for substance use. *American Behavioral Scientist*, **39**, 808–822.