

Pre-Service Smoking and First-Year Attrition

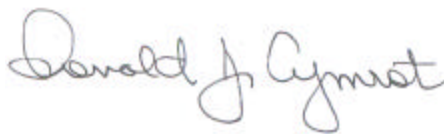
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March 2003

A handwritten signature in black ink that reads "Donald J. Cymrot". The signature is written in a cursive style with a large initial 'D' and 'C'.

Donald J. Cymrot, Director
Workforce, Education and Training Team
Resource Analysis Division

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Pre-Service Smoking and First-Year Attrition

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March 2003

Questions addressed



- How much do first-year attrition rates differ for pre-Service smokers and nonsmokers?
- Is the RTC smoking ban the main reason that smokers have higher attrition?
- Are attrition differences for smokers and nonsmokers as large as differences by education level and waiver status?
- Are attrition differences for smokers and nonsmokers greater for Tier II/III recruits than for Tier I recruits?

In 1999, CNA published a study on the relationship between smoking behavior and attrition from Recruit Training Command (RTC) [1]. The data source for the information on smoking behavior was the RTC-administered Student Health Inventory Profile (SHIP) from August 1995 through December 1996. Combining the survey data with Navy personnel data, the study showed that boot camp attrition for smokers was nearly twice as high as boot camp attrition for nonsmokers (i.e., about 15 percent vs. about 8 percent).

In 1999, new data on recruits' smoking behavior were collected. The research staff for CNRC asked CNA to take a quick look at these new data to see if they also show that smoking behavior is a strong determinant of attrition. CNRC staff asked three specific questions:

1. Is there evidence that the strong effect of smoking on attrition can be attributed to the Navy's policy to totally ban smoking during recruit training?
2. Is smoking behavior as strong a determinant of attrition behavior as education level and waiver status?
3. Is there an interaction effect between pre-Service smoking behavior and education level?

Summary of results



All else equal, in the first year of service:

- Recruits who smoked before enlisting had higher attrition than those who did not.
- Attrition differences for pre-Service smokers and nonsmokers did **not** disappear after boot camp.
- Attrition differences by pre-Service smoking behavior were comparable to attrition differences by education level, and greater than differences by waiver status.
- There was **no** interaction effect between educational tier group and pre-Service smoking. However, higher pre-Service smoking rates for Tier II/III recruits increased their average attrition relative to Tier I recruits.

To address the three questions posed by the CNRC staff, we compared RTC and 12-month attrition rates for recruits who smoked before enlisting and those who didn't. We considered both raw attrition rates and adjusted rates that isolate the effects of smoking from the effects of other recruit characteristics by which attrition behavior has traditionally varied.

Our results are consistent with the results reported in [1]: all else equal, recruits in the sample who smoked before enlisting had higher RTC and 12-month attrition than those who never smoked before enlisting. Furthermore, the difference between 12-month attrition for pre-Service smokers and nonsmokers was as great as the difference between RTC attrition for pre-Service smokers and nonsmokers, all else equal. This result indicates that the RTC ban on smoking was **not** the primary factor contributing to higher attrition rates for recruits who smoked before enlisting.

We also show that, for this sample, differences in attrition by pre-Service smoking behavior were comparable to or greater than differences in attrition by tier category and by waiver status. For example, controlling for other recruit characteristics, the RTC attrition rate of recruits who smoked daily before enlisting was 70 percent higher than the RTC attrition rate of recruits who had never smoked before enlisting. Controlling for other recruit characteristics, however, the RTC attrition rate for Tier II/III recruits was only 30 percent higher than that for Tier I recruits.

Summary of results,
continued...



Finally, in logit models of RTC and 12-month attrition, the coefficients on interactions between pre-Service smoking behavior and educational tier are **not** statistically significant. This means that the effect of smoking on attrition was not different for Tier I and Tier II/III recruits.

Although there is no measurable interaction effect, we calculate that about 30 (40) percent of the difference between Tier I and Tier II/III RTC (12-month) attrition is attributable to the fact that Tier II/III recruits were more likely to have smoked before enlisting.

Study scope



- This was a quick-response project under the rubric of the Scientific Analyst for CNRC.
- The results reported are primarily descriptive; we draw very limited policy conclusions.
- More research is needed before any policy recommendations can be made.

To put this study in the proper context relative to other CNA studies, we need to point out that its scope is very limited.

First, the study was undertaken as a quick-look study under the rubric of CNA's Scientific Analyst program with CNRC. This means that it did not go through the formal internal review and sponsor review processes.

Second, in contrast to our usual taskings, we were not asked to make policy recommendations. The primary goal of the study was to document the relationship between pre-Service smoking behavior and attrition for this particular sample of recruits, paying special attention to likely effects of the RTC smoking ban.

Third, given these constraints, we explicitly note areas where more detailed study would be necessary before policy recommendations could be made based on the results presented here. In particular, although we show that Sailors who smoked before enlisting had higher attrition than those who didn't, we have no information about why this is so; understanding the true nature of this relationship is vital for policy formulation.

Outline



- Data source
 - Descriptive data—smoking rates overall and by subsample
 - Unadjusted attrition rates—smokers vs. non-smokers, plus other comparisons
 - Adjusted attrition rates—smokers vs. non-smokers, holding other factors constant
 - Results, conclusions, and future research

This slide shows the outline for the rest of the briefing. We begin our analysis by describing the data source on which it is based.

Primary data source: The Home-Schooling Survey



- Survey given during boot camp regarding behavior while in DEP and before enlisting
- Sample size = 16,170 enlisted Navy recruits
- Time period = 6 months (September 1999 through February 2000)
 - Attrition rates typically vary by season, so attrition for this sample may be different from average annual attrition.
- Attrition data are from CNA's street-to-fleet database

The 1999 data on smoking behavior were collected as part of a survey given during boot camp to about 67,000 new recruits across the four Services. Although the main focus of the project was identifying recruits who had been home-schooled as well as those who were graduates of National Guard ChalleNGe programs, the survey included a number of general background questions; one question asked recruits to categorize their smoking behavior before enlisting and becoming part of the Delayed Entry Program (DEP). For more details on the survey, see [2].

The survey sample we used includes 16,170 Navy recruits who accessed between September 1999 and February 2000, which is about 75 percent of the total number of recruits who accessed during this 6-month period. The sample for the study of attrition was slightly smaller due to incomplete survey responses (in particular, provision of social security numbers was voluntary).

Because attrition has a seasonal component, overall attrition rates for this sample may be different from the average attrition rate for recruits who accessed during the 12-month period of September 1999 through August 2000. Specifically, the time period for the sample does not include the low-attrition summer months, and it does include the first of the high-attrition months of February through May (FMAM). Furthermore, it may or may not be true that differences in attrition for pre-Service smokers and nonsmokers vary by month of accession. This is an important area of future research.

Outline



- Data source
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The slides in this section show how many recruits in the sample smoked before enlisting and whether certain types of recruits were more likely than others to have smoked.

In particular, the data show that in this sample smoking is correlated with two important determinants of attrition—education level and waiver status. This means that, when we leave smoking behavior out of our analyses, we may be misestimating the importance of other factors as determinants of attrition rates.

National data on smoking rates for 18- to 24-year-olds from the CDC



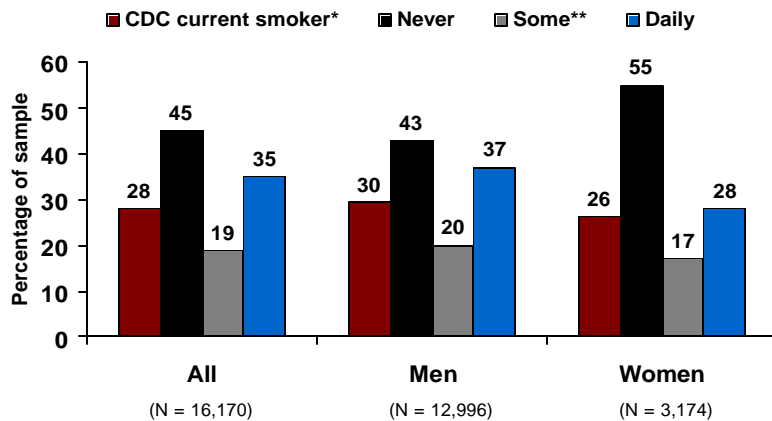
- In 1999, 27.9 percent of 18- to 24-year-olds were current smokers.*
- Men were slightly more likely to smoke than women:
 - Male smoking rate = 29.5 percent
 - Female smoking rate = 26.3 percent.

*The CDC defines current smoking as reporting having smoked at least 100 cigarettes throughout one's lifetime, and smoking some days or every day at the time of the interview.

The data reported on this slide come from the *Morbidity and Mortality Weekly Report* (MMWR) published by the Centers for Disease Control and Prevention (CDC) [3] and are based on data from 1999. These data are provided to show how the smoking rates for our sample compare with those of a nationally representative sample of people in approximately the same age group.¹

¹ The age groups are roughly the same, but the two samples are not exactly comparable. Specifically, 90 percent of the Navy sample is in the relevant age group: about 3 percent of the sample is 17, and about 7 percent is older than 24.

Smoking rates in Navy sample are higher than CDC national rates



*The CDC defines current smoking as reporting having smoked at least 100 cigarettes throughout one's lifetime, and smoking some days or every day at the time of the interview;
 **Some = rarely, or 1 to 5 times per week.

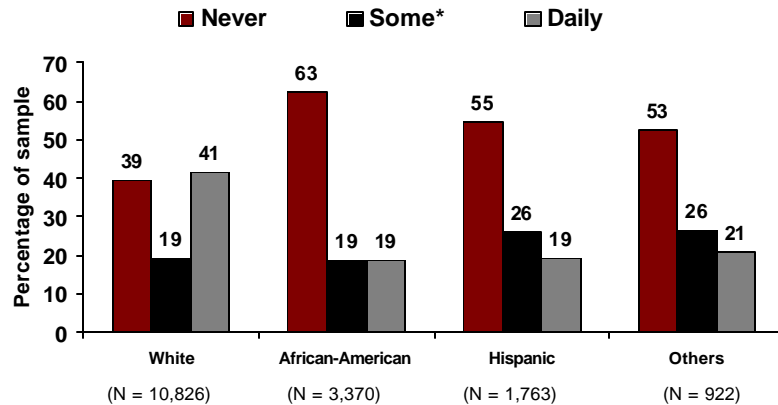
Turning now to the Navy sample, the data show that a little more than one-third of the respondents indicated that they smoked daily before enlisting, and another 20 percent of the sample indicated that they smoked occasionally before enlisting.

It is difficult to make direct comparisons between the Navy sample and the national sample because the definitions of smoking behavior are not exactly the same across the two surveys. Specifically, it is likely that the CDC definition of "current smoker" is broader than the "daily" category, but more restrictive than the "some" category. Comparing the daily smoking rate for the whole sample to the national average indicates that Navy recruits were about 25 percent more likely to smoke than other 18- to 24-year-olds in the U.S. However, comparing the sum of the "daily" and "some" rates to the national average indicates that Navy recruits were as much as 55 percent more likely to smoke. We think that the true difference between the Navy sample and the national average is somewhere between 25 and 55 percent.

Looking at pre-Service smoking rates by gender shows that the differences in smoking rates for Navy recruits and other Americans in the 18- to 24-year age group are larger for men than for women.¹

¹ When going from smoking rates by gender to overall smoking rates, the Navy sample is much more heavily weighted toward men than the national sample. Specifically, the male-female split in the Navy sample is about 80-20, compared with about 40-60 in the national sample.

White recruits were more likely than other recruits to smoke daily



*Some = rarely, or 1 to 5 times per week.

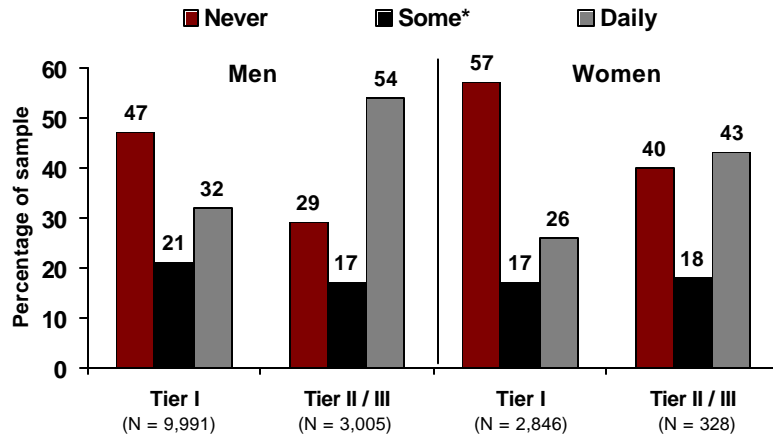
Breakdowns by race show that white recruits in the sample were more likely than other recruits to have smoked before enlisting.

According to CDC data for all adults (as opposed to just those in the 18- to 24-year-old age group), national smoking rates also vary by race. In 1999, adult smoking rates by race were:

- White, non-Hispanic = 24.3 percent
- Black, non-Hispanic = 24.3 percent
- Hispanic = 18.1 percent
- American Indian/Alaska Native = 40.8 percent
- Asian/Pacific Islander = 15.1 percent (see [3]).

Comparing the Navy data with the national data shows that relative smoking rates were especially high for White Recruits whose daily smoking rate was about 70 percent higher than the national smoking rate for whites.

More educated recruits were less likely to smoke daily



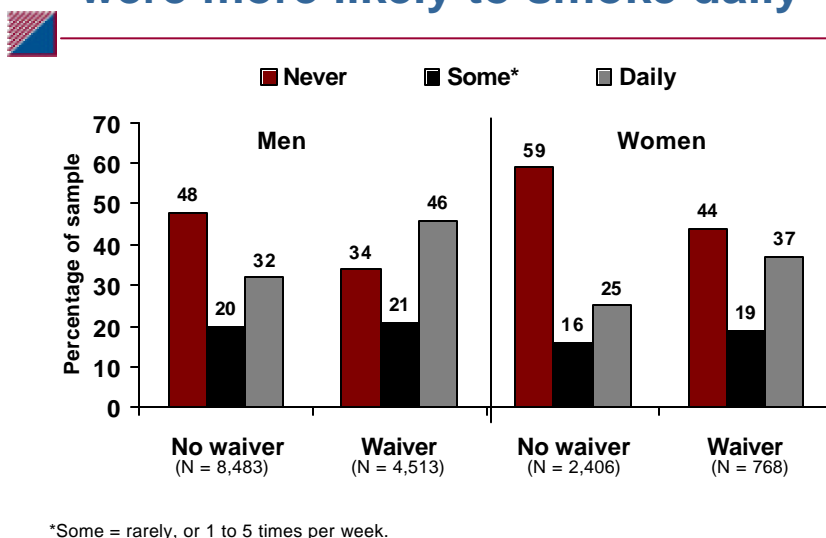
*Some = rarely, or 1 to 5 times per week.

We now turn to smoking rates by recruit characteristics that are typically associated with differences in attrition. The data in this slide show smoking rates by tier or education level: more educated recruits were less likely to have smoked before enlisting. This fact holds for both men and women. However, it's interesting that smoking rates for Tier II/III women were closer to those for Tier I men than Tier II/III men.

According to CDC data for all adults (as opposed to just those in the 18- to 24-year-old age group), national smoking rates also vary with education level. In 1999, adult smoking rates by education level were:

- 12 or fewer years of education, with no high school diploma = 26.0 percent
- General Educational Development diploma (GED) = 44.4 percent
- 12 years of education, with high school diploma = 26.3 percent
- Associate degree = 22.8 percent
- Some college = 25.3%
- Undergraduate degree = 13.0 percent
- Graduate degree = 8.5 percent (see [3]).

Recruits who accessed with waivers were more likely to smoke daily



The second measure of recruit quality is the need for an accession waiver.¹ The data presented above show that, in this sample, recruits without waivers were less likely to have smoked before enlisting.

As with smoking rates by tier, the differences in smoking rates by waiver status were about the same for men and women, but the rates for women with waivers are more closely comparable with those of men without waivers than with those of men with waivers.

¹ We have not made distinctions between types of waivers. However, future work should do so because we think that some types of waivers are more likely than others to be correlated with smoking behavior, as well as attrition behavior (e.g., a dependency waiver vs. a drug waiver).

Outline



- Data source
- Descriptive data—smoking rates overall and by subsample
- **Unadjusted attrition rates—smokers vs. non-smokers, plus other comparisons**
- Adjusted attrition rates—smokers vs. non-smokers, holding other factors constant
- Results, conclusions, and future research

In this section, we present raw, unadjusted data on RTC and 12-month¹ attrition rates by pre-Service smoking status and other recruit characteristics.

¹ 12-month attrition is conditional on completing recruit training.

Why do we expect smoking behavior to affect attrition?



- RTC ban requires recruits to quit “cold turkey.”
- Smoking behavior and other measures of recruit “quality” may capture unmeasured recruit characteristics that affect attrition.
- Perhaps Navy life and smoking just don’t mix.


Before presenting the attrition data, we need to consider why attrition rates might differ by pre-Service smoking behavior.

First, since 1991, the Navy has imposed a total ban on smoking during boot camp. Given the level of supervision imposed at the RTC, it is likely that the ban is effective. Therefore, smokers who don’t quit before shipping must essentially quit “cold turkey” on arrival. This additional trial is likely to make a difficult time even more so, and to increase a smoking recruit’s probability of attriting.¹

If there is a cold-turkey effect associated with the RTC smoking ban, **but smokers and nonsmokers are otherwise the same**, the difference between attrition rates for smokers and nonsmokers should disappear after boot camp so that, conditional on surviving RTC, the likelihood of attrition would be the same for both groups.²

¹ According to [1], while in DEP, most recruits are informed that they will be required to give up cigarettes during recruit training. However, [1] concludes that most pre-Service smokers did not quit during DEP despite the fact that, in CNRC surveys of DEP recruits, most smokers reported that they intended to quit before shipping.

² This does not imply that RTC attrition and 12-month attrition conditional on surviving boot camp should be the same. Indeed, because the RTC attrition changes the composition of the initial sample, leaving only those who didn’t attrite, we expect that 12-month attrition conditional on surviving boot camp will be lower than RTC attrition, overall and for both smokers and nonsmokers, even though the time period between RTC and the first year is longer than the time period covered by RTC itself.



Hypotheses about smoking and attrition, continued..

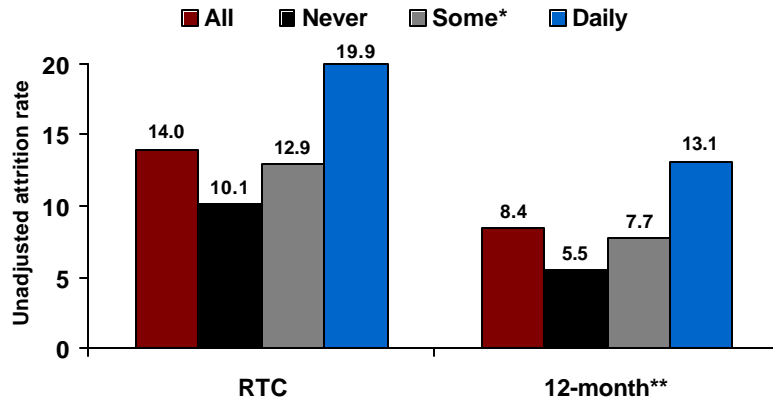
A second potential reason for differences in attrition rates for smokers and nonsmokers is that pre-Service smoking behavior may be correlated with unmeasured recruit characteristics that have an impact on attrition behavior. Specifically, the literature on youth smoking indicates that smoking is correlated with other types of risky behavior (e.g., drug use and violence), as well as low school performance and lack of adult supervision during after-school hours (see [4] and [5]). Furthermore, if smoking is a form of rebellion, it may be that people who smoke are less willing or able to follow rules and conform to group norms, and are thus more likely to attrite.

If attrition differences for smokers and nonsmokers reflect some other unmeasured difference in recruit quality, these differences in attrition may *not* disappear over time. Whether they do depends on the extent to which the unmeasured characteristics drive early attrition versus later attrition.

Third, there may be something about Navy life that is incompatible with smoking. Under this assumption, if recruits who smoked before enlisting regained the habit after RTC, their post-RTC attrition rates would be higher than those of recruits who didn't smoke before enlisting and didn't start after completing RTC. Perversely, this hypothesis also implies that, if there is no cold-turkey effect associated with the RTC ban, we might see that pre-Service smokers and nonsmokers had the same RTC attrition.

We don't have a specific hypothesis about why Navy life and smoking might be incompatible, nor are we asserting it given that Navy careerists have traditionally smoked at higher rates than civilians (see [1]). However, it should be understood that a policy designed to reduce attrition by encouraging Sailors to quit smoking is based on the assumption that it is the smoking itself causing attrition, not the correlation between smoking behavior and other recruit characteristics.

Attrition rates for smokers and non-smokers did not converge after RTC



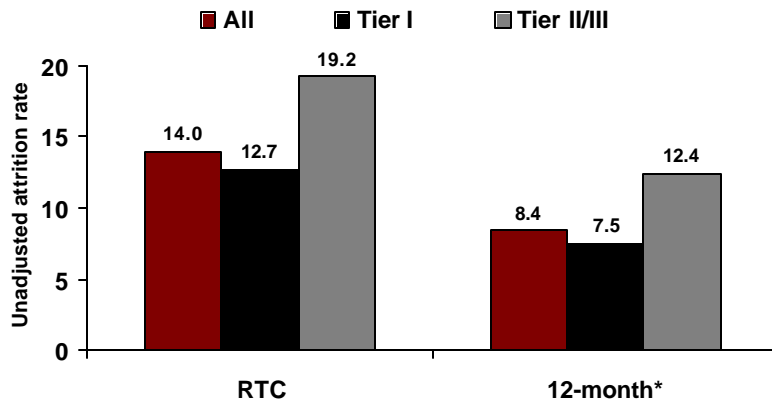
*Some = rarely, or 1-5 times per week; **12-month attrition conditional on completing recruit training.

This slide is important because it shows that attrition rates for pre-Service smokers were substantially higher than attrition rates for nonsmokers, which is consistent with the findings from [1].

The data also show that the difference in 12-month attrition rates for recruits who never smoked before enlisting and recruits who smoked daily was even greater than the difference in RTC attrition rates for recruits who never smoked and those who smoked daily. Specifically, the 12-month attrition rate for recruits who smoked daily is 240 percent higher than the 12-month rate for those who never smoked, whereas the RTC attrition rate for those who smoked daily is just twice as high. This result indicates that the relationship between pre-Service smoking and attrition is **not** primarily driven by the prohibition on smoking during recruit training; there does not seem to be a cold-turkey effect.

However, the raw attrition rates presented here don't control for other recruit characteristics. And, as was shown in the previous section, the recruits who were more likely to have smoked were also more likely to have other characteristics that are associated with higher attrition.

Attrition differences by tier were smaller than differences by smoking

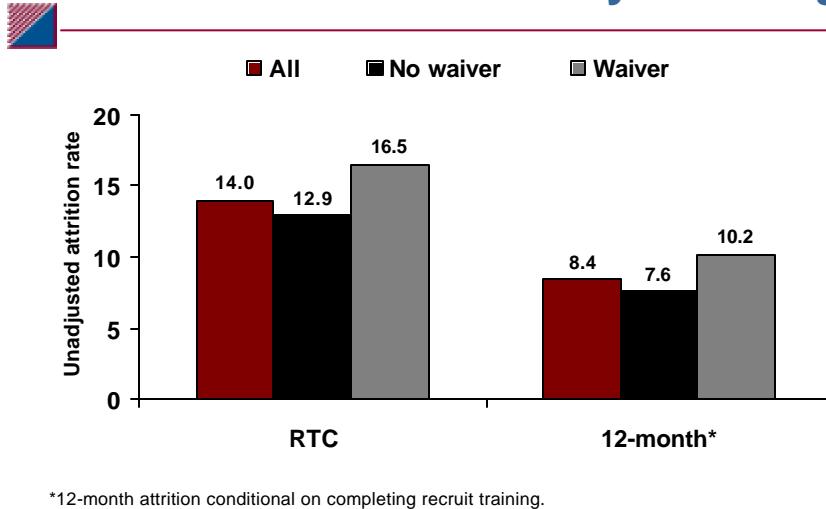


*12-month attrition conditional on completing recruit training.

This slide shows differences in attrition rates by education level, or tier. The data confirm the well-known fact that Tier I recruits have lower attrition rates than Tier II and Tier III recruits.

The data also show that the differences in attrition rates by education level for this sample were actually smaller than the differences by smoking behavior that were shown on the previous slide. Specifically, RTC attrition for Tier II/III recruits was 50 percent greater than RTC attrition for Tier I recruits. However, RTC attrition for daily pre-Service smokers was twice as high as RTC attrition for recruits who never smoked before enlisting. Similarly, 12-month attrition for Tier II/III recruits was 70 percent greater than 12-month attrition for Tier I recruits, whereas 12-month attrition for daily pre-Service smokers was more than twice as high as 12-month attrition for recruits who never smoked before enlisting.

Differences by waiver status were also smaller than those by smoking



The data in this slide show that recruits in the sample who required accession waivers had higher RTC and 12-month attrition than recruits who didn't require waivers. This finding is qualitatively consistent with results for Navy-wide samples.

As with differences in attrition by education level, differences by waiver status were smaller than differences by pre-Service smoking behavior.

Outline



- Data source
- Descriptive data—smoking rates overall and by subsample
- Unadjusted attrition rates—smokers vs. non-smokers, plus other comparisons
- Adjusted attrition rates—smokers vs. non-smokers, holding other factors constant
- Results, conclusions, and future research

In this section, we present **adjusted** RTC and 12-month¹ attrition rates by smoking status and other recruit characteristics. Specifically, to account for the fact that pre-Service smoking behavior is correlated with other determinants of attrition, we estimate logit regression equations that simultaneously control for smoking behavior and other recruit characteristics.

¹ 12-month attrition is conditional on completing recruit training.

Factors held constant, in addition to smoking behavior

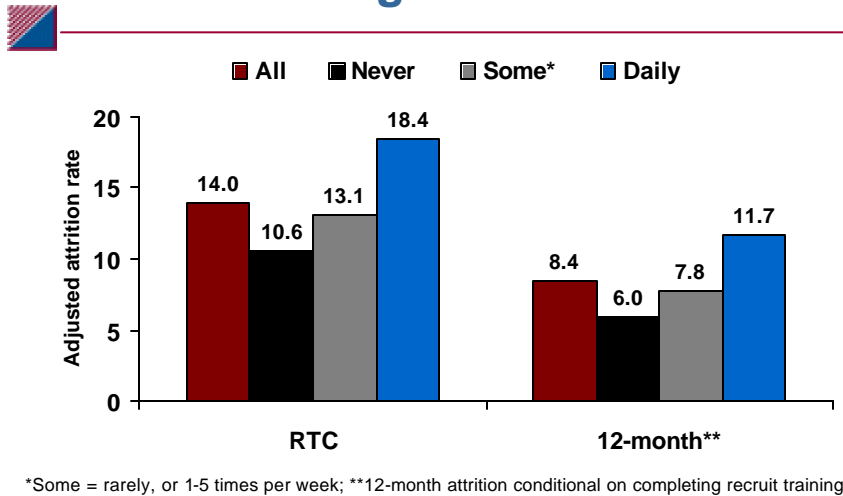


- Sex
- Race
- Age
- Marital status
- Single parent status
- Armed Forces Qualification Test (AFQT) score
- Tier
- Waiver status
- Suspended or expelled from high school
- Month of entry (September-February)

This slide lists the recruit characteristics (other than pre-Service smoking behavior) that are included in the attrition models. See appendix A for more detailed definitions of each variable. See appendix B for estimation results from models that do not include interaction effects between educational tier group and pre-Service smoking behavior, and see appendix C for estimation results from attrition models that do include interaction variables.¹

¹ All the logit models (i.e., those with and without interaction effects) control for the fact that less educated recruits in the sample were more likely to have smoked before enlisting. The models with the interaction effects also measure whether the effect of smoking on attrition differs by education level.

Adjusted attrition rates didn't converge after RTC




The data on this slide are similar to the data shown on slide 17. The difference is that these attrition rates are for people who did and didn't smoke before enlisting, *holding the other factors in the model constant*.

These data show that the general conclusions from before still hold: in this sample, recruits who smoked before enlisting had higher attrition than recruits who didn't smoke, and the attrition differences for smokers and nonsmokers didn't disappear after boot camp.

Although we conclude from this result that the differences in attrition rates for pre-Service smokers and nonsmokers were not primarily driven by the RTC ban on smoking, we do not speculate about what *is* causing these differences. One particular issue that clouds the analysis is that, because we have no follow-on data about smoking, we don't know whether recruits who smoked before enlisting also did so during DEP or after completing recruit training; nor do we know whether recruits who didn't smoke before they joined the Service began to do so after RTC.¹

¹ Reference [6] reports that many Air Force enlistees who hadn't smoked before enlisting began smoking in the year following boot camp.

Higher attrition for smokers could mean ~2,400 additional attrites



Smoking status	Accessions	RTC attrites	12-month attrites	Total
Daily	15,750	3,134	1,653	4,787
Some	8,775	1,132	589	1,721
Never	20,475	2,068	1,031	3,099
Total	45,000	6,334	3,273	9,607
Assume all nonsmokers		4,784	2,397	7,181
Difference				2,426

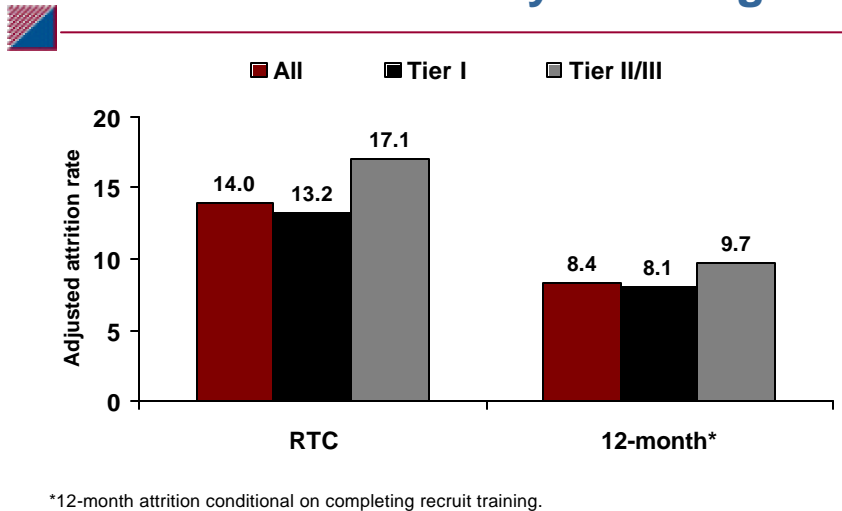
To make the smoke/don't-smoke differences in attrition rates more meaningful, we compare the numbers of Sailors expected to attrite each year under two contrasting scenarios.

In scenario 1, we assume: (a) in a given year, there are 45,000 accessions; (b) smoking among accessions occurs at the rates reported in the survey; and (c) attrition differs by smoking status as estimated in our regression models. Under these assumptions, we expect about 9,600 attrites in a year.

In scenario 2, we assume: (a) in a given year, there are 45,000 accessions; (b) none of these 45,000 accessions smokes (i.e., the smoking rate is zero); and (c) the attrition rates for these nonsmokers are as estimated by our regression models. Under these assumptions, we expect about 7,200 attrites in a year.

Comparing the numbers of attrites in the two scenarios, shows that, under these assumptions, higher attrition for smokers could lead to about 2,400 more attrites each year.

Differences by tier are still smaller than differences by smoking

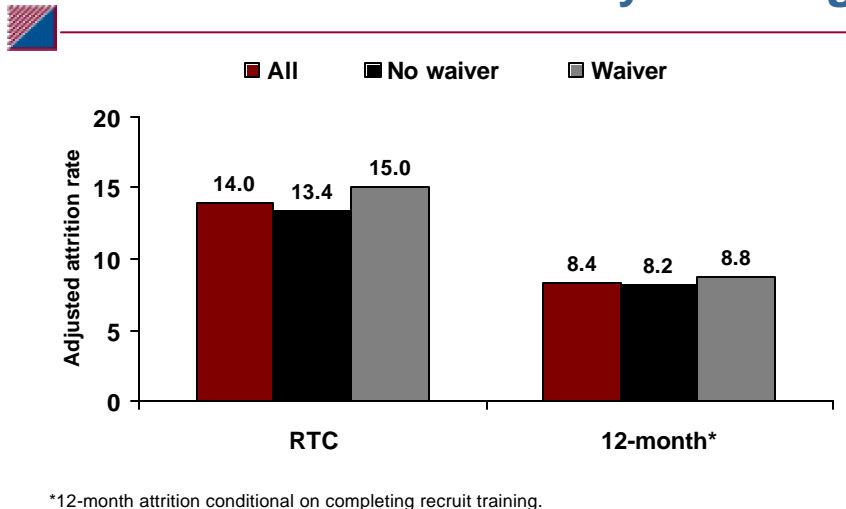


The data on this slide are similar to the data shown on slide 18, but they are adjusted to hold constant the other factors in the model. These adjusted data show that, all else equal, Tier 1 recruits in the sample had lower attrition than Tier II/III recruits.

Furthermore, differences in attrition rates by education level were still smaller than differences in attrition rates by pre-Service smoking behavior, even when controlling for other recruit characteristics.

Finally, note that the differences in adjusted 12-month attrition rates by tier were smaller than differences in RTC attrition by tier. Thus, the effects of education level on attrition declined over time.

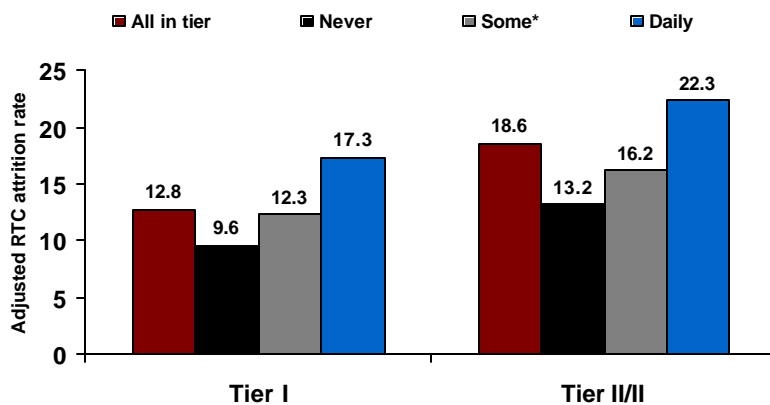
Differences by waiver are still smaller than differences by smoking



The data on this slide are similar to the data shown on slide 19. The difference is that these attrition rates are for recruits who did and did not have waivers, holding the other factors in the model constant.

Again, the adjusted data are similar to the unadjusted data in that recruits with waivers had higher attrition than recruits without waivers, and the differences by waiver status were smaller than the differences by pre-Service smoking behavior. Like the adjusted attrition rates by tier, however, the adjusted rates by waiver status show that the positive relationship between waiver status and attrition declined over time.

The effect of smoking on RTC attrition does not vary by educational tier



*Some = rarely, or 1-5 times per week.

The last question posed by the CNRC staff was whether attrition differences by pre-Service smoking behavior were greater for less educated recruits than for more education recruits. We begin to answer this question by estimating the combined effects of smoking and education level on RTC and 12-month attrition, all else constant.

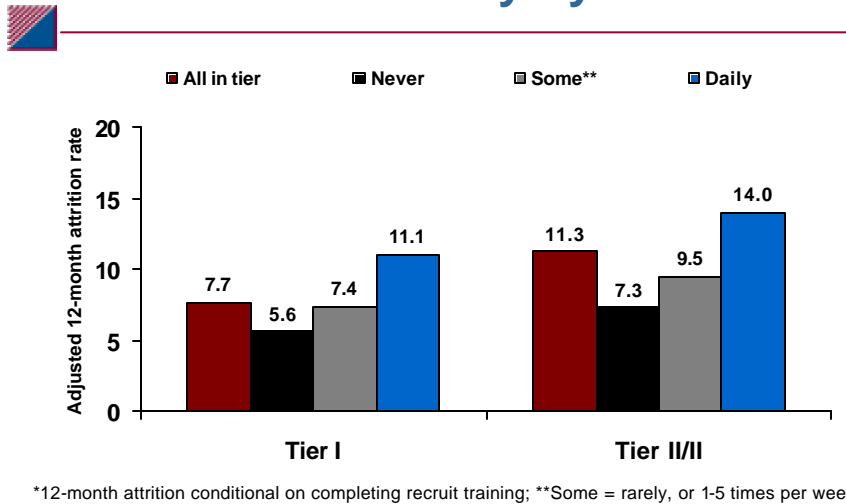
The data on this slide shows that although for each smoking category, Tier II/III recruits in the sample had higher RTC attrition than Tier I recruits, the **differences** by smoking behavior were about the same for Tier I and Tier II/III.¹ More specifically, our regression results for RTC attrition indicate that there was no interaction effect between pre-Service smoking behavior and education level; being less educated didn't make the effect of smoking even larger. (See appendix C for regression statistics.)

However, there is an additive effect: Tier II/III recruits who never smoked before enlisting had higher RTC attrition than Tier I recruits who never smoked. When the extra effect of smoking is added, Tier II/III recruits who smoked daily before enlisting had much higher RTC attrition than Tier I recruits who never smoked.²

¹ Absolute differences by smoking behavior were slightly smaller for Tier I recruits, but percentage differences by smoking behavior were slightly smaller for Tier II/III recruits.

² In theory, the total combined effect on attrition of Tier II/III and smoking daily is equal to the estimated effect of Tier II/III relative to Tier I plus the estimated effect of smoking daily relative to never smoking **plus the estimated interaction effect of smoking daily and being Tier II/III**. In this case, the estimated interaction effect turned out to be zero.

The effect of smoking on 12-month* attrition doesn't vary by tier either



The data on this slide show the combined effects of smoking and education on 12-month attrition, all else constant.

Our regression results for 12-month attrition are similar to those for RTC attrition: there was no interaction effect, so the combined effect of education level and smoking on 12-month attrition was equal to the additive effect,¹ and the differences in 12-month attrition by pre-Service smoking behavior were the same for Tier I and Tier II/III.

¹ Specifically, the coefficients on three of the four interaction terms were statistically insignificant; one coefficient was significant at the five percent level, but had an unexpected negative sign. Therefore, we conclude that smoking effects for Tier II/III recruits are not larger than those for Tier I recruits. (See appendix C for estimation results.)

Higher smoking rates for Tier II/III contribute to Tier II/III attrition

Tier I	Smoking rates	RTC attrition rates	12-month attrition rates
Never	49.4	9.6	5.6
Some	20.1	12.3	7.4
Daily	30.4	17.3	11.1
	Weighted sum	12.5	7.6
Tier II/III	Smoking rates	RTC attrition rates	12-month attrition rates
Never	30.3	13.2	7.3
Some	16.9	16.2	9.5
Daily	52.9	22.3	14.0
	Weighted sum	18.5	11.2
Weighted sum of Tier II/III attrition, using Tier I smoking rates		16.6	9.8

We further explore the relationships between education level, smoking behavior, and attrition by considering the impact of differences in smoking rates by education level. Specifically, the fact that Tier II/III recruits in the sample were more likely to have smoked before enlisting makes the average attrition rates for these recruits higher relative to Tier I recruits than they would have been otherwise. We calculate the impact of this effect as follows.

First, we determine average attrition rates for each tier by calculating the weighted average of each tier's attrition rates by pre-Service smoking behavior, using each tier's own smoking rates for the weights. In the table above, the average RTC and 12-month attrition rates for Tier I recruits are 12.5 and 7.6 percent, respectively; the average RTC and 12-month attrition rates for Tier II/III recruits are 18.5 and 11.2 percent, respectively.

Next, we calculate new weighted attrition rates for Tier II/III recruits using Tier II/III attrition rates by smoking category, and **Tier I smoking rates**. The simulated RTC and 12-month rates for Tier II/III recruits are 16.6 and 9.8 percent, respectively.

These simulated rates are estimates of what Tier II/III attrition would have been if their pre-Service smoking behavior were the same as that of Tier I recruits. Thus, of the estimated 6.0-percentage-point difference between Tier I and Tier II/III RTC attrition, about 30 percent is attributable to the fact that Tier II/III recruits were more likely to have smoked before enlisting. For 12-month attrition, of the estimated 3.6-percentage-point difference between Tier I and Tier II/III, differences in smoking rates accounted for nearly 40 percent of the difference.

Outline



- Data source
- Descriptive data—smoking rates overall and by subsample
- Unadjusted attrition rates—smokers vs. non-smokers, plus other comparisons
- Adjusted attrition rates—smokers vs. non-smokers, holding other factors constant
- Results, conclusions, and future research

Summary of results



All else equal, in the first year of service:

- Recruits who smoked before enlisting had higher attrition than those who did not.
- Attrition differences for pre-Service smokers and nonsmokers did ***not*** disappear after boot camp.
- Attrition differences by pre-Service smoking behavior were comparable to attrition differences by education level, and greater than differences by waiver status.
- There was ***no*** interaction effect between educational tier group and pre-Service smoking. However, higher pre-Service smoking rates for Tier II/III recruits increased their average attrition relative to Tier I recruits.

This slide reiterates our results:

1. The results for this sample are consistent with the results reported in [1]: all else equal, recruits in the sample who smoked before enlisting had higher RTC and 12-month attrition than those who never smoked before enlisting.
2. The difference between 12-month attrition for pre-Service smokers and nonsmokers was as great as the difference between RTC attrition for pre-Service smokers and nonsmokers, all else equal.
3. For this sample, differences in attrition by pre-Service smoking behavior were comparable to or greater than differences in attrition by tier category and by waiver status.
4. Finally, in logit models of RTC and 12-month attrition, the coefficients on interactions between pre-Service smoking behavior and educational tier generally are not statistically significant. However, given that Tier II/III recruits were more likely to have smoked before enlisting than Tier I recruits, we calculate that they were 30 to 40 percent more likely to attrite than they would be if they smoked at the Tier I rates.

Implications of our results



- There is not enough information to allow recommendations regarding the effects of post-RTC smoking cessation programs on overall attrition.
- Removing the RTC smoking ban is not likely to result in substantially lower RTC attrition.
- Pre-Service smoking behavior appears to be an effective recruiting screen, but too many recruits smoke to suggest not recruiting smokers.

Although these results strongly indicate that people who smoked before enlisting may not stay in the Navy as long as people who didn't smoke, the analysis presented here does not explain **why** this is true. Before we draw any real conclusions or make any policy decisions about treating smokers differently from nonsmokers, it is vital to understand the link between smoking behavior and attrition. Furthermore, although the results presented here are consistent with other studies of smoking and attrition, the sample here may not be representative of all recruits because it was drawn during particular months of the year, and we know that there is a seasonal component to RTC attrition.

Even with the above caveats, however, we do feel comfortable concluding that lifting the RTC smoking ban is not likely to lead to significantly lower average RTC attrition rates. The fact that differences in attrition by smoking behavior did not disappear after RTC is a strong indication that the high RTC attrition for smokers is not primarily a result of the ban.

Finally, the data show that pre-Service smoking behavior is at least as powerful a predictor of future attrition behavior as other individual recruit characteristics that have traditionally been used as recruiting screens. However, given the large percentage of recruits who smoke, we cannot suggest that smokers shouldn't be allowed to enlist or that a cap should be placed on smoking accessions.

Future research



- What is the true link between smoking and attrition?
- Do attrition differences by smoking behavior vary by season?
- What about smoking behavior during DEP and after RTC?
- Why is the smoking rate for the Navy sample twice that of the national average?

As we have repeatedly noted, we do not know the exact nature of the link between smoking and attrition. We speculate that smoking is a measure of characteristics that are not captured in this data set. If so, there may be other behaviors that predict attrition in a similar way (e.g., high school academic records or participation in high school activities).


This theory suggests that we might expect the differences in attrition between smoking and nonsmoking recruits to vary by season. For example, because we typically think of summer surge recruits as being of higher quality than recruits who access during other months, the attrition difference between smoking and nonsmoking recruits in the summer group could be smaller than the difference for recruits who access in the winter.

Furthermore, the data used for this study do not include any information about smoking behavior during DEP or after RTC. We don't know whether recruits who smoked before enlisting quit before shipping (i.e., during DEP), nor do we know whether those who were forced to quit during boot camp resumed smoking afterwards. An additional unknown is whether people who didn't smoke before enlisting or during RTC actually took up smoking in the 9 months or so between RTC and our 12-month milestone.

A last point to come out of this study is that smoking rates for this sample of Navy recruits were higher than national smoking rates for the same age group for the same year. What does this finding say about the pool from which the Navy draws its recruits?

Appendix A:

Variable definitions for attrition models



Smoking behavior: Two dummy variables indicating the effect of smoking some or smoking daily relative to never smoking.

Sex: A dummy variable indicating the effect of being male.

Race: Four dummy variables indicating the effects of being African-American, Hispanic, Asian/Pacific Islander, and other relative to being White.

Age: A dummy variable indicating the effect of being 20 or older.

Marital status: Two dummy variables indicating the effects of being married or divorced rather than single.

Single parent status: A dummy variable measuring the effect of being a single parent relative to having no children, or having children and a spouse.

AFQT score: Two dummy variables—low and high—measuring the effects of having an AFQT score less than 40 or greater than 59.

Tier: Two dummy variables indicating the effects of Tier II and Tier III status, according to DMDC classifications.

Waiver status: A dummy variable indicating the effect of accessing with any kind of waiver.

Suspended: A dummy variable indicating the effect of ever having been suspended.

Expelled: A dummy variable indicating the effect of ever having been expelled.

Month of accession: Five dummy variables indicating the effects of accessing in October, November, December, January, or February, rather than in September.

Appendix B:

Logit estimation results for attrition models *without* interaction effects



Variable	RTC attrition		12-month attrition	
	Coefficient	Std. error	Coefficient	Std. error
Smoke some	0.2417 **	0.0677	0.2922 **	0.0917
Smoke daily	0.6475 **	0.0562	0.7416 **	0.0756
Male	-0.4101 **	0.0585	-0.0880	0.0844
African-American	-0.1336 *	0.0646	-0.3162 **	0.0927
Hispanic	-0.1565	0.0921	-0.4476 **	0.1364
Asian/Pacific Islander	-0.1752	0.0984	-0.3309 *	0.1357
Other	0.0227	0.1200	-0.0258	0.1747
20 or older	0.0534	0.0499	-0.1635 *	0.0678
Married	0.2496 **	0.0907	0.1775	0.1290
Divorced	-0.1215	0.2337	-0.1366	0.3232
Single parent	0.2660 **	0.0966	0.3047 *	0.1351
AFQT<40	0.1932 **	0.0652	-0.2307 *	0.1006
AFQT>59	-0.2688 **	0.0532	-0.0519	0.0692
DMDC Tier 2	0.3671 **	0.0762	0.2253 *	0.1028
DMDC Tier 3	0.3071 **	0.0918	0.2052	0.1203
Waiver	0.1330 **	0.0508	0.0775	0.0679
Suspend	0.2642 **	0.0509	0.1633 *	0.0683
Expelled	0.3998 **	0.0916	0.3912 **	0.1269
October	-0.0417	0.1058	0.2156	0.1322
November	-0.0453	0.0868	0.1111	0.1120
December	0.0479	0.0745	0.1241	0.0989
January	0.0560	0.0684	-0.0993	0.0962
February	0.1866 **	0.0702	0.1990 *	0.0947
Constant	-2.0161	0.0803	-2.6697	0.1116
	N = 15,903		N = 13,679	
	LR chi2(23) = 479.83		LR chi2(23) = 288.83	
	psuedo R2 = .0373		psuedo R2 = .0366	
** = significance at the 1 percent level; * = significance at the 5 percent level.				

Appendix C:

Logit estimation results for
attrition models *with*
interaction effects

Variable	RTC attrition		12-month attrition	
	Coefficient	Std. error	Coefficient	Std. error
Smoke some	0.2676 **	0.0734	0.2734 **	0.1009
Smoke daily	0.6928 **	0.0614	0.8291 **	0.0823
Smoke some x Tier 2	-0.3593	0.2387	-0.1289	0.2924
Smoke some x Tier 3	0.0392	0.2854	0.2679	0.3952
Smoke daily x Tier 2	-0.2766	0.1772	-0.7591 **	0.2316
Smoke daily x Tier 3	-0.2646	0.2095	-0.0274	0.2954
Male	-0.4137 **	0.0585	-0.0893	0.0845
African-American	-0.1291 *	0.0647	-0.3105 **	0.0927
Hispanic	-0.1573	0.0922	-0.4393 **	0.1366
Asian/Pacific Islander	-0.1719	0.0984	-0.3335 *	0.1358
Other	0.0258	0.1201	-0.0335	0.1750
20 or older	0.0528	0.0499	-0.1649 *	0.0678
Married	0.2500 **	0.0907	0.1750	0.1290
Divorced	-0.1140	0.2337	-0.1474	0.3234
Single parent	0.2649 **	0.0965	0.3117 *	0.1351
AFQT<40	0.1943 **	0.0653	-0.2326 *	0.1007
AFQT>59	-0.2691 **	0.0532	-0.0532	0.0692
DMDC Tier 2	0.5950 **	0.1544	0.7100 **	0.1960
DMDC Tier 3	0.4657 **	0.1803	0.1692	0.2629
Waiver	0.1316 **	0.0508	0.0747	0.0679
Suspend	0.2638 **	0.0509	0.1615 *	0.0683
Expelled	0.4010 **	0.0915	0.3931 **	0.1267
October	-0.0382	0.1058	0.2188	0.1321
November	-0.0477	0.0868	0.1106	0.1120
December	0.0451	0.0745	0.1130	0.0991
January	0.0551	0.0685	-0.1022	0.0963
February	0.1850 **	0.0702	0.1903 *	0.0949
Constant	-2.0372	0.0813	-2.6989	0.1132
	N = 15,903		N = 13,679	
	LR chi2(27) = 485.07		LR chi2(27) = 302.6	
	psuedo R2 = .0377		psuedo R2 = .0384	

** = significance at the 1 percent level; * significance at the 5 percent level.



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