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## Gender differences in age of smoking initiation and its association with health

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### Abstract

**Background**—It is generally accepted that smoking starts in adolescence and earlier initiation is associated with more negative health outcomes. Some research suggests that women initiate smoking at later ages and have more negative health outcomes than men. The purpose of this study was to examine gender differences in age of initiation and its association with health.

**Methods**—The sample included men (n=8,506) and women (n=8,479) with a history of smoking from the 2001-2002 National Epidemiological Survey of Alcohol Related Conditions. Logistic regression was used to examine gender differences in the effect of late smoking initiation on physical and mental health status after adjusting for covariates.

**Results**—At mostly all ages after 16, women exceeded men in rates of smoking initiation (59.8% vs. 50.3%,  $p < .001$ ). Among late initiators ( $\geq 16$ ), women were more likely than men to have hypertension (OR:1.24, CI:1.09-1.41), heart disease (OR:1.20, CI:1.00-1.45), major depressive disorder (OR:2.54, CI:2.22-2.92) and generalized anxiety disorder (OR:2.34, CI:1.84-2.99). Among early initiators ( $< 16$ ), women were more likely than men to have major depressive disorder (OR: 2.42, CI:2.11-2.77) and generalized anxiety disorder (OR:2.01, CI:1.59-2.54) but there were no gender differences in the likelihood of having hypertension (OR:1.04, CI:0.89-1.22) and heart disease (OR:1.11, CI:0.90-1.36).

**Conclusions**—In late adolescence and adulthood, women exceed men in smoking initiation. Late initiation was associated with more significant physical health risks for women than men. Our findings raise questions about generally accepted notions on the age at which smoking initiation occurs and its association with health.

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Cigarette smoking remains the leading cause of preventable morbidity and mortality in the United States (Centers for Disease Control and Prevention (CDC), 2008). The number of women who die of smoking-attributable diseases is on the rise and the risk of death is now nearly similar to that of men (Thun et al., 2013). Although smoking is believed to begin and become established in adolescence, (Elders, Perry, Eriksen, & Giovino, 1994) studies have determined that smoking initiation also occurs during later developmental periods such as

late adolescence and adulthood, and that this is more common in women when compared to men (Geronimus, Neidert, & Bound, 1993; Jha et al., 2013; King et al., 2006; Moon-Howard, 2003; Pirie, Peto, Reeves, Green, & Beral, 2013; Thompson, Moon-Howard, & Messeri, 2011). One national study found that 33% of women who smoke initiated at age 20 or later, compared to 25% of men (Jha et al., 2013).

It is also generally believed that earlier smoking initiation is associated with more negative consequences (Glieb, 2003). This notion is based on studies that find a number of differences in the smoking behaviors and health status among smokers who initiate early and those who initiate later. Late initiators are less likely to become daily smokers (Hassmiller, Warner, Mendez, Levy, & Romano, 2003), smoke fewer cigarettes per day (Lenk, Chen, Bernat, Forster, & Rode, 2009) and are more likely to quit (Breslau, 1993; Chen & Millar, 1998; Khuder, Dayal, & Mutgi, 1999). They are less likely to develop physical health problems like cardiovascular disease (Huxley & Woodward, 2011; Kawachi et al., 1993; Planas et al., 2002) and mental health problems like depression (Ajdacic-Gross et al., 2009; Grant, 1998; Hanna, Yi, Dufour, & Whitmore, 2001; Jamal, Does, Penninx, & Cuijpers, 2011).

Some of the differences observed among early and late initiators are similar to differences observed among men and women. Women are less likely to be daily smokers (Johnson & Novak, 2009; Schane, Glantz, & Ling, 2009) and smoke fewer cigarettes per day (Haiman et al., 2006). However, there are some important distinctions. Women who smoke are less likely to quit (CDC, 2012; United States Department of Health and Human Services (USDHHS), 2001) and are more likely to cardiovascular disease (Huxley & Woodward, 2011) and depression (Husky, Mazure, Paliwal, & McKee, 2008).

Rates of late smoking initiation and its associated smoking behaviors and health risks may have been underestimated. The excess hazards of smoking among a population depend on smoking behaviors observed over a period of at least 40 years (Pirie et al., 2013). Smoking among women peaked nearly two decades after men in the 1960's (Forey, Hamling, & Wald, 2009). Therefore, the full effects of prolonged smoking among women can only be observed during the 2000s. Moreover, a recent body of literature has put into question the generally accepted notion that later smoking initiation is associated with a lower probability of negative smoking behaviors and health outcomes (Reidpath, Ling, Wellington, Al-Sadat, & Yasin, 2013; Thompson et al., 2011). For example, a global study of smoking behaviors found the direction of the relationship between age of initiation and smoking behaviors varied by country and gender (Reidpath et al., 2013). Thus, an analysis of age of smoking initiation utilizing data from the 2000s can better inform our understanding of late smoking initiation and the development of disease among women who smoke.

The purpose of this study was to examine gender differences in age of smoking initiation and its association with health. We use data from 2001-2002 National Epidemiologic Survey on Alcohol and Related Condition (NESARC). The NESARC occurred 40 years after the peak of smoking rates among women, the period of time it takes to observe the full risks of smoking among a population (Pirie et al., 2013). Studies on differences by age at initiation typically compare adolescent (age <18) to adult initiators (age ≥ 18). In order to highlight

gender differences in age of smoking initiation, we conducted our comparisons at the age at which women exceed men in rates of initiation.

We posit that women will exceed men in smoking initiation by late adolescence. We also hypothesize that the lower frequency of health problems observed among smokers who initiate late relative to those who initiate early applies to men but not women; based on prior work documenting that women are at increased risk for mental and physical health problems like heart disease and depression.

## METHOD

### Study sample

Data were drawn from the 2001 to 2002 NESARC, a nationally representative sample of adults in the United States conducted by the National Institute on Alcohol Abuse and Alcoholism (NIAAA). Data were collected by personal interviews from 43,093 civilian, non-institutionalized adults (age ≥ 18 years) in the United States. The NESARC oversampled Blacks, Hispanics and adults 18 to 24 years of age. Further details on sampling, purpose, and weighting have been published elsewhere (Grant et al., 2003). The study sample included those who reported smoking at least 100 cigarettes in their entire lifetime. Smokers who did not know the age they smoked their first cigarette and with missing data on variables of interest were removed from analysis. The final analytic sample included 8,506 men and 8,479 women.

### Sociodemographics

The following sociodemographic variables are known to be associated with smoking (Barbeau, Krieger, & Soobader, 2004, Centers for Disease Control and Prevention (CDC), 2013 Wood, , Goesling & Avellar, S, 2007) and were used in the analysis: age (years), race/ethnicity (White, non-Hispanic; Black, non-Hispanic; Hispanic or Latino; Asian/Native Hawaiian/Pacific Islander; American Indian/Alaska Native), education (no high school diploma/GED, high school diploma/GED, at least some college education), employment status (unemployed (e.g., looking for work, not looking for work and permanently disabled), region of residence (South, Midwest, Northeast, West), marital status (never married, currently married/partnered, formerly married (e.g., divorced, separated, widowed), number of children, and household income.

### Smoking behaviors

**Daily smokers**—Smokers were asked “about how often did they usually smoke.” If smokers reported smoking seven days, they were classified as daily smokers. *Cigarettes smoked per day*. Smokers were asked “on the days smoked about how many cigarettes did they usually smoke. *Former* smokers were those who reported not smoking a cigarette within the past 12 months. *Duration since last smoked*. Smokers were asked “when was the most recent time you smoked”. *Nicotine dependence* was assessed with the Alcohol Use Disorders and Associated Disabilities Interview Schedule-DSM-IV (AUDADIS-IV) which is reliable and valid (Grant et al., 2003).

## Health status

Physical health status included cardiovascular disease and hypertension. Cardiovascular disease is the leading cause of death for men and women in the United States (Murphy, Xu, & Kochanek, 2013). Hypertension is the leading cause of cardiovascular disease and is also a risk factor for other physical health problems such as stroke and kidney disease (Chobanian et al., 2003). Cigarette smoking is a risk factor for both cardiovascular disease and hypertension (CDC, 2013). Participants were asked if they were ever diagnosed by a health professional with high blood pressure/hypertension and cardiovascular disease (i.e., rapid heartbeat, heart attack, heart disease). Mental health status included major depressive disorder (MDD), generalized anxiety disorder (GAD), alcohol use disorder (abuse or dependence) (AUD) and substance use disorder (abuse or dependence) (SUD). MDD, GAD, AUD and other SUD are some of the most prevalent psychiatric disorders in the United States (Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Kessler, Berglund, et al., 2005), are associated with cigarette smoking (Breslau, Novak, & Kessler, 2004) and often co-occur with cardiovascular disease (Ormel et al., 2007). Participants were assessed for these disorders with the AUDADIS-IV, and were based on DSM-IV diagnoses. Substance use disorder was an aggregate of disorders related to all substances except nicotine and alcohol (i.e., cannabis, cocaine, opioid, amphetamine, hallucinogen, sedatives, tranquilizers, inhalants, solvents, and all others).

## Data analysis

Chi-square and *t*-tests were used to compare differences by gender in age of initiation, sociodemographics, smoking behaviors and physical and mental health status for the study sample and then among those who initiate early and those who initiate late. We assess gender and its association with smoking behaviors and health status in terms of odds ratios using logistic regression models. This analysis was stratified by age of initiation. We then assess whether gender and its association with smoking behaviors and health is moderated by age of initiation by including an age of initiation-by-gender interaction term. All models were adjusted for sociodemographics. Models for physical health status were also adjusted for smoking behaviors. We present adjusted odds ratios (ORs) and their associated 95% confidence intervals (95% CIs), as well as interaction ORs and their associated 95% confidence intervals (CIs). The interaction OR is a ratio of the gender-specific associations between age of initiation and the outcome of interest; 95% CIs that do not include 1.0 indicate a statistically significant gender difference ( $p < 0.05$ ).

Survey weights were applied to all analyses. Weighting allowed for sample estimates to closely approximate the US population in 2001-2002. All statistical analyses were performed using STATA® Version 12.1. Due to the relatively large sample size of the study, we consider results that achieve statistical significance at the .001, unless otherwise noted.

## RESULTS

### Age of initiation by gender

Women exceed men in the rate of smoking initiation at age 16 and at every age after except for the age of 24 (Figure 1). Forty percent (40.2%) of women and 49.7% of men initiated

smoking prior to the age of 16, compared to 59.8% of women and 50.3% of men who initiated at age 16 or later. We dichotomized all subsequent analysis by this crossover age: those who had their first full cigarette before the age of 16 were labeled 'early initiators' and those who had their first full cigarette at the age 16 or later were labeled 'late initiators'.

### Descriptive statistics

Sociodemographics, smoking behaviors and health status by gender and age of initiation are presented in Table 1.

**Sociodemographics**—Among late initiators, women were slightly older than men, more likely to have been born before 1950 (55.8% vs. 41.1%, respectively) and to be White. Men and women late initiators differed on every familial characteristic. Women were more likely to be formerly married, had more children and more likely to have a household income of less than \$20,000.

Among early initiators, women were younger than men early initiators and more likely to have been born after 1950 (75.5% vs. 60.5%). Women were also more likely to be unemployed, formerly married and to have a household income of less than \$20,000.

**Smoking behaviors**—Among late initiators, women smoked fewer cigarettes per day than men and were more likely to be former smokers. There were no gender differences in daily smoking status and nicotine dependence.

Among early initiators, women smoked fewer cigarettes per day than men, were less likely to be former smokers and more likely to be nicotine dependent. There was no difference in daily smoking status.

**Health status**—Among late initiators, women were more likely than men to have hypertension and there was no differences the rates of cardiovascular disease. Women late initiators were more likely than men late initiators to have major depressive and generalized anxiety disorders and less likely to have an alcohol or substance use disorder.

Among early initiators, there was no gender difference in the rates of hypertension or cardiovascular disease. Women early initiators were more likely than men early initiators to have major depressive and generalized anxiety disorders and less likely to have an alcohol or substance use disorder.

### Multivariate analysis

**Smoking behaviors**—Logistic regression models show that even when sociodemographics are taken into account, women late initiators smoke fewer cigarettes per day than men late initiators. There were no gender differences in daily smoking status or the likelihood of being nicotine dependent or a former smoker (Table 2-a).

Among early initiators, women smoked fewer cigarettes per day than men. There were also no gender differences in daily smoking status or the likelihood of being nicotine dependent or a former smoker (Table 2-b).

In general, early initiators had more negative smoking behaviors than their gender age of initiation counterparts. There was a significant interaction such that the difference between men and women in cigarettes smoked per day was greater among early than late initiators (Table 2-c).

**Health status**—Logistic regression models show that when sociodemographics and smoking behaviors are taken into account, women late initiators are more likely than men late initiators to have hypertension, major depressive and generalized anxiety disorders and less likely to have an alcohol or substance use disorder. Logistic regression models also show that women late initiators are more likely to have cardiovascular disease (OR: 1.20, CI: 1.00-1.45,  $p=.05$ ) but the analysis did not reach statistical significance at the .001 level (Table 3-a).

Among early initiators, there were no gender differences in the likelihood of having hypertension and cardiovascular disease. Yet there were gender differences in mental health status. Women early initiators were more likely than men early initiators to have major depressive and generalized anxiety disorders and less likely to have an alcohol or substance use disorder (Table 3-b).

There were no significant interactions. In general, early initiators had more negative physical and mental health than men but not women late initiators. Women late initiators and early initiators of both genders had a similar likelihood—as reflected in their overlapping confidence intervals—of having hypertension and heart disease. In regards to mental health, women late and women early initiators had a similar likelihood—as reflected in their overlapping confidence intervals—of having major depressive and generalized anxiety disorders. Women late initiators had a greater likelihood of have these disorders than men early initiators (Table 3-c).

## DISCUSSION

The purpose of this study was to examine gender differences in age at initiation and its association with health in a large nationally representative sample of adults in the United States. It is generally accepted that smoking begins in adolescence, (USDHHS, 2012; Elders et al., 1994) and earlier initiation is associated with more negative health outcomes (Ajdacic-Gross et al., 2009; Grant, 1998; Hanna et al., 2001; Huxley & Woodward, 2011; Jamal et al., 2011; Kawachi et al., 1993; Planas et al., 2002). We found this to be the case generally for men but less so for women. In early adolescence, males exceeded females in rates of smoking initiation but in late adolescence and adulthood, women exceeded men in rates of smoking initiation. Late smoking initiation was associated with a decreased likelihood having mental and physical health problems among men and with mental health problems among women. We also found that gender disparities in physical health were most evident among late smoking initiators. Women who initiate smoking late were more likely than men who initiate smoking late to have hypertension and heart disease. There were no differences in physical health status among men and women who initiate early.



Our first key finding was that women exceed men in smoking initiation during late adolescence and adulthood. This finding is consistent with previous research on historical patterns of smoking uptake among women. During the 1930's and 1940's, smoking initiation among women occurred across all birth cohorts. In other words, initiation was spread across all age groups and not confined to adolescence and early adulthood (D. M. Burns et al., 2012). Women from older age cohorts would have initiated smoking during the Women's Rights Movement (Second Wave, 1965 to 1972) but prior to the antismoking environment that emerged following the publication of the US Surgeon General's report on smoking and health in 1964 (Warner, 1977). Thus their relatively high smoking uptake in adulthood may be attributable to efforts by tobacco companies to expand their market by equating women's liberation with smoking (O'Keefe & Pollay, 1996). Among birth cohorts of men and women born after the 1960s, the mean age of smoking initiation decreased. However, there is data to suggest that birth cohorts born after the 1990s, the mean age of initiation is on the rise (SAMHSA, 2011). Future research should examine factors associated with period changes in late smoking initiation among men and women.

Another key finding is that gender disparities in physical health are most evident among late smoking initiators. Men late initiators had rates of hypertension and heart disease lower than women late initiators and women late initiators had rates of hypertension no different from women and men early initiators. The underlying mechanisms by which smoking might differentially affect the physical health of women late initiators are unclear (Huxley & Woodward, 2011). However, it might be attributable to the demographic characteristics of women who initiate smoking late. Women late initiators compared to men late initiators had lower incomes and were more likely to be widowed or divorced. Studies consistently find an association between low-income (Barbeau, Krieger, & Soobader, 2004; CDC, 2013; Wood, R.G., Goesling, B & Avellar, S, 2007) and being divorced or widowed and an increased risk of physical and mental health problems (Baune et al., 2012; Bivanco-Lima, Santos, Cortez Vannucchi, & Sampaio de Almeida Ribeiro, 2013). Future research should focus on panel data to better understand the relationship between gender, age of smoking initiation, and the development of disease.

Our findings on gender differences in mental health status are consistent with the literature on smoking, gender and mental health and less consistent with the literature on age of initiation and mental health status. It is argued that the mental health characteristics associated with smoking initiation in adolescence might be less relevant to smoking initiation later in life (Ajdacic-Gross et al., 2009). We found that women regardless of age of initiation, women were more likely than men to have depression and anxiety which is consistent with a number of studies on differences in mental health status among men and women who smoke (Husky et al., 2008). Conversely, regardless of age of initiation, men were more likely than women to meet criteria for alcohol and substance use disorders. Combined, these findings suggest that mental health problems among women who initiate late appear to be more of an effect of gender than age of initiation.

## Limitations

This study utilizes a nationally representative sample of U.S. adults from 2001 and 2002 which includes smoking information, health status, and DSM-IV diagnosis. While this data is the most currently available data assessing these domains, it is possible that findings may have changed in the intervening 10 years. Future research should seek to replicate the study in samples involving younger aged cohorts. Second, our primary variable -- age at smoking initiation -- is sensitive to self-report error. This is a limitation of all self-report assessments on drug use. However, this limitation does require consideration of the potential effect of self-report error on our findings of gender differences in physical health among the late initiation group. We found that gender disparities in hypertension and cardiovascular disease existed among the late and not the early initiation group and given that women late initiators were more likely than men late initiators to be born before 1950, our findings of gender disparities could be due to the positive association between older age and the development of disease. We do not believe this to be the case. First, men and women late initiators are relatively close in age, on average two years apart (48.3 vs. 50.2 years). Moreover, we conducted an analysis whereby we limited our sample to those born after 1950. Studies suggest that if self-report error occurs, individuals who recall onset behaviors that occur within 50 years are more likely to report a younger age of onset when compared to those reporting onset behaviors that occur more than 50 years ago (Bright & Soulakova, 2014). The findings from this analysis showed gender disparities in hypertension and heart disease among both initiation groups but disparities in hypertension were greater among the late initiation group and a similar trend was observed for cardiovascular disease. Finally, we don't know if reported health problems are smoking related. However, smoking is the leading cause of actual death, and it is likely that our physical health outcomes of interest—hypertension and heart disease—are attributable to smoking (Mokdad et al., 2004). Moreover, our findings are indicative of a health profile smokers and can inform interventions related to women's health regardless of whether the health problems are smoking related.

Our findings raise questions about notions related to the age at which smoking initiation occurs and its association with physical and mental health. In late adolescence and adulthood, women exceed men in smoking initiation rates. Smoking initiation during this period carried more significant physical health risks for women than men. Tobacco policies should not be shaped by the notion that later smoking initiation is associated with less severe consequences (Glied, 2003) but that smoking initiation at all ages carries similar risks.

## References

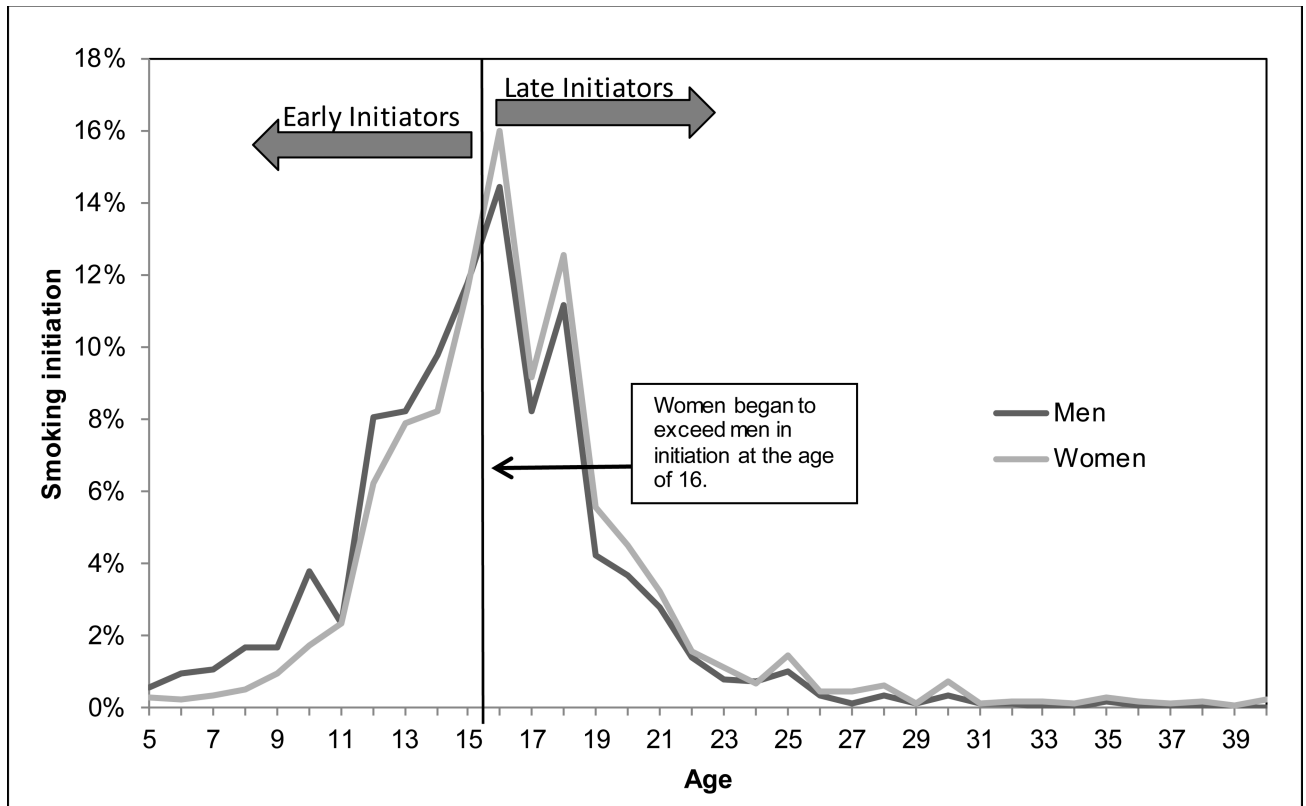
- Ajdacic-Gross V, Landolt K, Angst J, Gamma A, Merikangas KR, Gutzwiller F, Rossler W. Adult versus adolescent onset of smoking: How are mood disorders and other risk factors involved? *Addiction*. 2009; 104(8):1411–9. doi:ADD2640 [pii] 10.1111/j.1360-0443.2009.02640.x. [PubMed: 19624327]
- Baune BT, Stuart M, Gilmour A, Wersching H, Arolt V, Berger K. Moderators of the relationship between depression and cardiovascular disorders: a systematic review. *General Hospital Psychiatry*. 2012; 34(5):478–492. doi:10.1016/j.genhosppsych.2012.05.013. [PubMed: 22771109]



- Barbeau EM, Krieger N, Soobader MJ. Working class matters: socioeconomic disadvantage, race/ethnicity, gender, and smoking in NHIS 2000. *American Journal of Public Health*. 2004; 94:269–278. [PubMed: 14759942]
- Bivanco-Lima D, Santos I. de S. Cortez Vannucchi AM, Sampaio de Almeida Ribeiro MC. Cardiovascular risk in individuals with depression. *Revista Da Associacao Medica Brasileira*. 2013; 59(3):298–304. doi:10.1016/j.ramb.2012.12.006. [PubMed: 23684214]
- Breslau N. Daily cigarette consumption in early adulthood: age of smoking initiation and duration of smoking. *Drug and Alcohol Dependence*. 1993; 33:287–291. [PubMed: 8261892]
- Breslau N, Novak SP, Kessler RC. Psychiatric disorders and stages of smoking. *Biological Psychiatry*. 2004; 55(1):69–76. doi:10.1016/S0006-3223(03)00317-2. [PubMed: 14706427]
- Bright BC, Soulakova JN. Evidence of telescoping in regular smoking onset. *Nicotine & Tobacco Research*. 2014; 16(6):717–724. [PubMed: 24379148]
- Burns D. Cigarette smoking among the elderly: Disease consequences and benefits of cessation. *American Journal of Health Promotion*. 2000; 14:357–361. [PubMed: 11067570]
- Burns, DM.; Lee, L.; Shen, LZ.; Gilpin, E.; Tolley, HD.; Vaughn, J.; Shanks, TG. In *Smoking and Tobacco Control Monograph 8*. National Cancer Institute; 2012. Cigarette Smoking Behavior in the United States..
- CDC. Smoking-attributable mortality, years of potential life lost, and productivity losses--United States, 2000-2004. *MMWR. Morbidity and Mortality Weekly Report*. 2008; 57(45):1226–1228. [PubMed: 19008791]
- CDC.. Prevalence of current smoking among adults aged 18 and over: United States, 1997–September 2011. 2012. Retrieved from [http://www.cdc.gov/nchs/data/nhis/earlyrelease/201203\\_08.pdf](http://www.cdc.gov/nchs/data/nhis/earlyrelease/201203_08.pdf)
- Centers for Disease Control and Prevention (CDC). Vital signs: avoidable deaths from heart disease, stroke, and hypertensive disease - United States, 2001-2010. *MMWR. Morbidity and Mortality Weekly Report*. 2013; 62(35):721–727. [PubMed: 24005227]
- Chen J, Millar WJ. Age of smoking initiation: implications for quitting. *Health Reports / Statistics Canada, Canadian Centre for Health Information = Rapports Sur La Santé / Statistique Canada, Centre Canadien D'information Sur La Santé*. 1998; 9(4):39–46. 39–48.
- Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, National High Blood Pressure Education Program Coordinating Committee. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA: The Journal of the American Medical Association*. 2003; 289(19):2560–2572. doi:10.1001/jama.289.19.2560. [PubMed: 12748199]
- Dept. of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Preventing tobacco use among youth and young adults : a report of the Surgeon General. Washington, DC.: Atlanta, GA.: 2012.
- Elders MJ, Perry CL, Eriksen MP, Giovino GA. The report of the Surgeon General preventing tobacco use among young people. *Amer J Public Health*. 1994; 84(4):543–547. [PubMed: 8154552]
- Forey, B.; Hamling, J.; Wald, N. *International Smoking Statistics*. 2nd ed.. Oxford University Press; Oxford: 2009.
- Geronimus AT, Neidert LJ, Bound J. Age patterns of smoking in US black and white women of childbearing age. *Amer J Public Health*. 1993; 83(9):1258–64. [PubMed: 8363001]
- Glied S. Is smoking delayed smoking averted? *Am. J. Public Health*. 2003; 93(3):412–416. [PubMed: 12604483]
- Grant BF. Age at smoking onset and its association with alcohol consumption and DSM-IV alcohol abuse and dependence: Results from the National Longitudinal Alcohol Epidemiologic Survey. *Journal of Substance Abuse*. 1998; 10(1):59–73. doi:10.1016/S0899-3289(99)80141-2. [PubMed: 9720007]
- Grant BF, Dawson DA, Stinson FS, Chou PS, Kay W, Pickering R. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS IV): reliability of alcohol consumption, tobacco use, family history of depression and psychiatric diagnostic modules in a general population sample. *Drug and Alcohol Dependence*. 2003; 71(1):7–16. doi:10.1016/S0376-8716(03)00070-X. [PubMed: 12821201]

- Haiman CA, Stram DO, Wilkens LR, Pike MC, Kolonel LN, Henderson BE, Le Marchand L. Ethnic and racial differences in the smokin-related risk of lung cancer. *N Engl J Med*. 2006; 354(4):333–42. [PubMed: 16436765]
- Hanna EZ, Yi HY, Dufour MC, Whitmore CC. The relationship of early-onset regular smoking to alcohol use, depression, illicit drug use, and other risky behaviors during early adolescence: results from the youth supplement to the third national health and nutrition examination survey. *Journal of Substance Abuse*. 2001; 13(3):265–282. doi:10.1016/S0899-3289(01)00077-3. [PubMed: 11693451]
- Hassmiller KM, Warner KE, Mendez D, Levy DT, Romano E. Nondaily smokers: Who are they? *Amer J Public Health*. 2003; 93(8):1321–7. [PubMed: 12893622]
- Husky MM, Mazure CM, Paliwal P, McKee SA. Gender differences in the comorbidity of smoking behavior and major depression. *Drug and Alcohol Dependence*. 2008; 93(1-2):176–179. doi: 10.1016/j.drugalcdep.2007.07.015. [PubMed: 17850991]
- Huxley RR, Woodward M. Cigarette smoking as a risk factor for coronary heart disease in women compared with men: a systematic review and meta-analysis of prospective cohort studies. *Lancet*. 2011; 378(9799):1297–1305. doi:10.1016/S0140-6736(11)60781-2. [PubMed: 21839503]
- Jamal M, Does A. J. W. V. der, Penninx BWJH, Cuijpers P. Age at smoking onset and the onset of depression and anxiety disorders. *Nicotine & Tobacco Research*. 2011; 13(9):809–819. doi: 10.1093/ntr/ntr077. [PubMed: 21543549]
- Jha P, Ramasundarahettige C, Landsman V, Rostron B, Thun M, Anderson RN, Peto R. 21st-century hazards of smoking and benefits of cessation in the United States. *The New England Journal of Medicine*. 2013; 368(4):341–350. doi:10.1056/NEJMsa1211128. [PubMed: 23343063]
- Johnson EO, Novak SP. Onset and persistence of daily smoking: The interplay of socioeconomic status, gender, and psychiatric disorders. *Drug and Alcohol Dependence*. 2009; 104(Supplement 1)(0):S50–S57. doi:10.1016/j.drugalcdep.2009.04.007. [PubMed: 19487086]
- Kawachi I, Colditz GA, Stampfer MJ, Willett WC, Manson JE, Rosner B, Speizer FE. Smoking cessation in relation to total mortality rates in women. A prospective cohort study. *Ann Intern Med*. 1993; 119(10):992–1000. [PubMed: 8214996]
- Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*. 2005; 62(6):593–602. doi:10.1001/archpsyc.62.6.593. [PubMed: 15939837]
- Kessler RC, Chiu WT, Demler O, Merikangas KR, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*. 2005; 62(6):617–627. doi:10.1001/archpsyc.62.6.617. [PubMed: 15939839]
- Khuder S, Dayal H, Mutgi A. Age at smoking onset and its effect on smoking cessation. *Add Behav*. 1999; 24:673–677.
- King G, Polednak A, Fagan P, Gilreath T, Humphrey E, Fernander A, Noubary F. Heterogeneity in the smoking behavior of African American women. *Amer J Health Behav*. 2006; 30(3):237–46. [PubMed: 16712438]
- Lenk KM, Chen V, Bernat DH, Forster JL, Rode PA. Characterizing and comparing young adult intermittent and daily smokers. *Substance Use & Misuse*. 2009; 44(14):2128–2140. doi: 10.3109/10826080902864571. [PubMed: 20001699]
- Mokdad A, Marks J, Stroup D, Gerberding J. Actual Causes of Death in the United States, 2000. *JAMA*. 2004; 29(10):1238–1245. doi:10.1001/jama.293.3.293. [PubMed: 15010446]
- Moon-Howard J. African American women and smoking: Starting later. *Am J Public Health*. 2003; 93(3):418–20. [PubMed: 12604485]
- O'Keefe AM, Pollay RW. Deadly Targeting of Women in Promoting Cigarettes. *Journal of the American Medical Women's Association*. 1996; 51(1 & 2):67–69.
- Ormel J, Von Korff M, Burger H, Scott K, Demyttenaere K, Huang Y, Kessler R. Mental disorders among persons with heart disease - results from World Mental Health surveys. *General Hospital Psychiatry*. 2007; 29(4):325–334. doi:10.1016/j.genhosppsych.2007.03.009. [PubMed: 17591509]

- Pirie K, Peto R, Reeves GK, Green J, Beral V. The 21st century hazards of smoking and benefits of stopping: a prospective study of one million women in the UK. *Lancet*. 2013; 381(9861):133–141. doi:10.1016/S0140-6736(12)61720-6. [PubMed: 23107252]
- Planas A, Clará A, Marrugat J, Pon J-M, Gasol A, de Moner A, Vidal-Barraquer F. Age at onset of smoking is an independent risk factor in peripheral artery disease development. *Journal of Vascular Surgery*. 2002; 35(3):506–509. doi:10.1067/mva.2002.120030. [PubMed: 11877699]
- Reidpath DD, Ling M-L, Wellington E, Al-Sadat N, Yasin S. The Relationship Between Age of Smoking Initiation and Current Smoking: An Analysis of School Surveys in Three European Countries. *Nicotine & Tobacco Research*. 2013; 15(3):729–733. doi:10.1093/ntr/nts177. [PubMed: 22990215]
- SAMHSA. Results from the 2010 NSDUH: Summary of National Findings. Rockville, MD.: 2011. (No. NSDUH Series H-41, HHS Publication No. (SMA) 11-4658)
- Schane RE, Glantz SA, Ling PM. Nondaily and Social Smoking: An Increasingly Prevalent Pattern. *Archives of Internal Medicine*. 2009; 169(19):1742–1744. doi:10.1001/archinternmed.2009.315. [PubMed: 19858429]
- Sherry Murphy, Jiaquan Xu; Kochanek, Kenneth D. Deaths: Final Data for 2010. *National Vital Statistics Report*. 2013; 61(4)
- Thompson AB, Moon-Howard J, Messeri PA. Smoking cessation advantage among adult initiators: Does it apply to black women? *Nicotine & Tobacco Research*. 2011; 13(1):15–21. doi:10.1093/ntr/ntq200. [PubMed: 21078832]
- Thun MJ, Carter BD, Feskanich D, Freedman ND, Prentice R, Lopez AD, Gapstur SM. 50-year trends in smoking-related mortality in the United States. *The New England Journal of Medicine*. 2013; 368(4):351–364. doi:10.1056/NEJMsa1211127. [PubMed: 23343064]
- Trinidad D, Gilpin E, Lee L, Pierce J. Do the majority of Asian-American and African American smokers start as adults? *American Journal of Preventative Medicine*. 2004; 26(2):156–158.
- United States Department of Health and Human Services. *Women and Smoking: A Report of the Surgeon General*. Rockville, MD: 2001. Retrieved from <http://www.ncbi.nlm.nih.gov/books/NBK44311/>
- Warner KE. The effects of the anti-smoking campaign on cigarette consumption. *Amer J Public Health*. 1977; 67(7):645–650. [PubMed: 879393]
- Wood, RG.; Goesling, B.; Avellar, S. The Effects of Marriage on Health: A Synthesis of Recent Research Evidence. U.S. Department of Health and Human Services; 2007. The effects of marriage on health behaviors.. Chapter, 2.
- Wilkinson AV, Schabath MB, Prokhorov AV, Spitz MR. Age-related differences in factors associated with smoking initiation. *Cancer Causes & Control*. 2007; 18(6):635–644. doi:10.1007/s10552-007-9008-6. [PubMed: 17473909]



**Figure 1.** Smoking initiation by age and gender among NESARC respondents who smoked >100 cigarettes (men: mean=15.6, median=16.0; women: mean=16.7, median=16.0) (n=16,985) Notes: Smoking initiation estimates weighted to approximate the US population in 2001-2002.

**Table 1**

Sociodemographics, smoking behaviors and health status by gender

			Late Initiation (age <16)		Early Initiation (age 16)	
	Men	Women	Men	Women	Men	Women
	n=8,506 (54.2%)	n=8,479 (45.8%)	n=4,470 (49.9%)	n=5,303 (50.1%)	n=4,036 (59.5%)	n=3,217 (40.5%)
Age, y (se)	47.5 (.22)	46.7 (.21)	48.3 (.31)	50.2 (.27)*	46.8 (.30)	41.6 (.31)*
Birth cohort						
1911-1929	10.4	9.5	11.8	13.5*	8.9	3.6*
1930-1949	29.4	27.7	29.3	32.3	29.6	20.9
1950-1969	38.8	41.1	38.0	37.5	39.6	46.6
1970-1984	21.4	21.6	20.8	16.7	21.9	28.9
Race/ethnicity (%)						
White, non-Hispanic						
Black, non-Hispanic	77.3	80.2*	74.1	78.3*	80.5	83.0
Hispanic	8.3	9.0	10.0	10.7	6.5	6.3
Asian/Pacific Islander	8.9	6.6	9.6	6.6	8.2	6.6
American Indian/Alaskan	3.0	1.6	4.2	2.1	1.8	0.9
Native	2.5	2.6	2.1	2.3	3.0	3.2
Education (%)						
<HS	18.9	15.4*	15.7	12.7	22.1	19.4
=HS	26.6	27.4	27.0	33.9	26.2	25.3
College	54.5	57.1	57.3	54.4	51.7	55.3
Unemployed (%)	3.8	4.3	3.9	3.1	3.7	6.0*
Region (%)						
South	35.5	34.3	35.4	33.9	35.7	34.8
Midwest	24.9	24.9	23.3	25.1	26.5	24.6
Northeast	19.8	21.0	20.2	20.8	19.3	21.3
West	19.8	19.9	21.1	20.2	18.5	19.4
Marital status (%)						
Currently	66.7	58.0*	68.0	58.0*	65.5	58.0*
Formerly	14.7	26.9	13.7	28.9	15.7	24.4
Never	18.6	15.1	18.3	13.3	18.8	17.6
# of children (se)	2.1 (.02)	2.2 (.02)	2.0 (.03)	2.2 (.03)*	2.2 (.04)	2.1 (.04)
Household income (%)						
\$19,999	20.0	26.7*	18.1	26.5*	22.0	27.0*
\$20,000-39,999	28.9	27.2	28.4	26.4	29.3	28.4
\$40,000-69,999	28.5	25.4	29.0	26.3	28.0	24.1
\$70,000	22.6	20.7	24.5	20.8	20.7	20.5
Daily smoker (%)	83.9	83.5	88.3	89.6	86.5	85.4

			Late Initiation (age <16)		Early Initiation (age 16)	
	Men	Women	Men	Women	Men	Women
	n=8,506 (54.2%)	n=8,479 (45.8%)	n=4,470 (49.9%)	n=5,303 (50.1%)	n=4,036 (59.5%)	n=3,217 (40.5%)
>10 Cigarettes per day (CPD) (%)	60.9	48.8 *	57.8	45.8 *	66.3	55.7 *
Nicotine dependence (%)	38.8	41.2	32.5	34.5	45.5	51.6 *
Former (%)	45.1	43.0	40.0	47.7 *	44.1	35.1 *
Hypertension (%)	21.2	21.6	20.7	24.6 *	21.8	17.0 *
Cardiovascular disease (%)	9.0	9.6	7.7	9.7	10.3	9.5
Major Depressive Disorder (%)	15.6	31.3 *	12.5	26.6 *	18.7	38.4 *
Generalized Anxiety Disorder (%)	4.0	8.3 *	3.1	7.3 *	4.8	9.9 *
Alcohol use disorder (%)	16.2	8.1 *	13.1	5.8 *	19.4	11.7 *
Substance use disorder (%)	20.9	14.6 *	15.2	8.7 *	26.6	23.4

Note: P-values are calculated from chi-square tests for categorical variables and t-tests for continuous variables.

Data were weighted to approximate the US population in 2001-2002.

SE is linearized standard errors.

\* p<.001



**Table 2**

Adjusted ORs for smoking behaviors by age of initiation and gender

	Daily smoker	10> CPD	Former smoker	Nicotine dependence
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
<i>Model to assess gender differences among late initiators (2-a).</i>				
Late initiators				
Men	1.00	1.00	1.00	1.0
Women	0.98 (0.87-1.12)	0.53 (0.48-0.59)*	1.10 (0.98-1.23)	1.07 (0.96-1.20)
<i>Model to assess gender differences among early initiators (2-b).</i>				
Early initiators				
Men	1.00	1.00	1.00	1.00
Women	0.95 (0.80-1.12)	0.63 (0.56-0.71)*	0.99 (0.87-1.13)	1.00 (0.88-1.13)
<i>Model to assess interaction between gender and age of initiation (2-c).</i>				
Late initiators				
Men	1.00	1.00	1.00	1.00
Women	0.99 (0.87-1.12)	0.53 (0.48-0.59)	1.10 (0.99-1.24)	1.09 (0.98-1.22)
Early initiators				
Men	1.45 (1.26-1.67)	1.48 (1.32-1.65)	1.07 (0.95-1.21)	1.69 (1.51-1.89)
Women	1.37 (1.17-1.60)	0.92 (0.82-1.04)	1.05 (0.92-1.19)	1.73 (1.54-1.96)
Early initiators × women	0.96 (0.78-1.18)	1.17 (1.00-1.37)	0.88 (0.74-1.05)	0.94 (0.80-1.10)

Adjusted for age, race/ethnicity, education, employment and marital status, number of children and household income. Data were weighted to approximate the US population in 2001-2002.

\* p<.001

Table 3

Adjusted ORs for health status by gender and age of initiation

		Hypertension		CVD	MDD	GAD	AUD	SUD
		OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
<i>Model to assess gender differences among late initiators (3-a).</i>								
Late initiators								
Men	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Women	1.24 (1.09-1.41) *	1.20 (1.00-1.45)	2.54 (2.22-2.92) *	2.34 (1.84-2.99) *	0.41 (0.33-0.49) *	0.53 (0.45-0.63) *		
<i>Model to assess gender differences among early initiators (3-b).</i>								
Early initiators								
Men	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Women	1.04 (0.89-1.22)	1.11 (0.90-1.36)	2.42 (2.11-2.77) *	2.01 (1.59-2.54) *	0.39 (0.33-0.46) *	0.61 (0.53-0.71) *		
<i>Model to assess interaction between gender and age of initiation (3-c).</i>								
Late initiators								
Men	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Women	1.24 (1.09-1.41)	1.19 (1.00-1.43)	2.66 (2.33-3.04)	2.46 (1.93-3.13)	0.43 (0.35-0.52)	0.57 (0.48-0.67)		
Early initiators								
Men	1.10 (0.96-1.26)	1.30 (1.08-1.56)	1.54 (1.33-1.79)	1.47 (1.12-1.93)	1.87 (1.59-2.21)	2.16 (1.87-2.51)		
Women	1.17 (0.74-1.85)	1.49 (0.79-2.79)	4.03 (2.52-6.44)	3.16 (1.36-7.36)	0.78 (0.42-1.42)	1.41 (0.83-2.40)		
Early initiators × women	0.86 (0.70-1.04)	0.96 (0.74-1.25)	0.98 (0.81-1.18)	0.87 (0.63-1.22)	0.97 (0.75-1.25)	1.15 (0.93-1.43)		

Adjusted for age, race/ethnicity, education, employment and marital status, number of children and household income, frequency of cigarette use, cigarettes smoked per day and duration of cigarette smoking.

CVD=Cardiovascular disease, MDD=Major Depressive Disorder, GAD=Generalized Anxiety Disorder, AUD=Alcohol Use Disorder, SUD=Substance Use Disorder

\* p&lt;.001