

Tobacco: an equal-opportunity killer?

Laurel E Curry, Donna M Vallone, Julia Cartwright, Cheryl G Heulton

In their article, Jamrozik *et al* (*see page 258*) have explored the mortality hazard associated with smoking by gender and provide evidence that Australian men and women with similar smoking histories (namely, cigarettes smoked per day and time since quit) experience similar rates of death from smoking.¹ Given the limitations of the data in this study, caution should be used in interpreting these results. In fact, results from studies conducted across the globe provide conflicting evidence as to whether gender influences tobacco-related mortality patterns. More specifically, Freedman *et al* found, using a prospective cohort, that men in the USA have slightly higher incidence rates of lung cancer than women with similar smoking histories.² A case-control study concluded that women have increased risk for developing lung cancer than men across all levels of cigarette use.³ On the other hand, in two other prospective US cohorts, findings indicate that overall risk did not differ by gender.^{4 5} The effect of gender on chronic obstructive pulmonary disease is also controversial, with studies showing conflicting results.⁶

These studies may reflect the complex history of smoking-related gender differences in the USA. Women who smoke have different patterns of tobacco use, cessation attempts and success, and lung cancer rates than men. Women are also influenced differently by tobacco control policy when compared with men.⁷⁻¹⁰ In the USA, as overall smoking rates have decreased over the years, they have not dropped as quickly for women as for men. Since 1965, smoking rates among women have declined by about 46%, compared with a 55% decline among men.^{11 12} In 2009, there was a 4.7% absolute difference in smoking prevalence between white men (24.5%) and women (19.8%), a 4.7% difference between black men (23.9%) and

women (19.2%), a 9.2% difference between Hispanic men (19%) and women (9.8%), and a 9.4% difference between Asian men (16.9%) and women (7.5%).¹³ Currently, there are more former smokers than current smokers in the USA. In 2008, among the 94 million adults in the USA who had ever smoked, 51.1% had quit. However, the percentage of former smokers in the US population is currently higher for men (25.7%) than for women (18.3%).¹⁴ This is probably related to the earlier adoption of smoking among men and the higher rates of smoking among men historically. While the prevalence of smoking among women has peaked in high-income countries, in low-income countries, female smoking rates are still increasing or show no evidence of decline.¹⁵

Female smokers are also more likely to be light daily smokers and less likely to smoke heavily than male smokers.¹⁶ Despite women's higher likelihood of being light daily smokers, lung cancer is the leading cause of cancer death among women in the USA.¹⁷ Between 1950 and 2005, death rates from lung cancer among women increased by more than 600%.¹⁸ In 1950, lung cancer accounted for only 3% of all cancer deaths among women; by 2000, it accounted for an estimated 25% of cancer deaths. Recently, the 'Annual report to the nation on the status of cancer' has reported that lung cancer death rates among women have begun decreasing for the first time in four decades.¹⁹ Incidence rates of lung cancer in women are also approaching a plateau after a long period of increase. Since women took up cigarette smoking later than men in the last century, the decline in lung cancer death rates comes a decade later than a similar drop in lung cancer deaths among men. While this may indicate that we have reached a turning point in the tobacco epidemic, the decline may not last for long. Women born in the 1950s and early 1960s, who were the target of heavy cigarette marketing campaigns for female-centred brands such as 'Virginia Slims', along with 'light' and

'low-tar' cigarettes in the late 1960s and 1970s, will age into those groups that are most at risk for lung cancer, possibly offsetting future decreases in lung cancer death and incidence rates.^{20 21} Furthermore, smoking rates peaked for young women (high school seniors) in 1977 and 1997, the health consequences of which will begin to emerge as these women age.¹⁷ Even if lung cancer mortality rates were to continue their decline, the actual number of women diagnosed with lung cancer might increase due to the boomer population aged 65 years and more, which is expected to double in the next 20 years.²² Thus, there may be a surge in total deaths yet to come.

An estimated 71 080 women were projected to die from smoking-related lung and bronchus cancers in 2010, accounting for over a quarter of all cancer deaths in women, and the vast majority of lung cancer deaths among US women are attributable to smoking.^{17 23} While women have a better relative survival than men for each stage of lung cancer, they are more likely to be diagnosed young and are more likely to be non-smokers than male patients.²⁴ In addition, the proportional occurrence of the different subtypes of lung cancer differs by gender: while adenocarcinoma is the most common subtype in both men and women, women have proportionally more adenocarcinoma than men—the subtype with the highest proportion of non-smokers. Women's higher exposure to secondhand smoke than men may reflect the higher lung cancer rates among female non-smokers.²⁵ Adenocarcinoma has also increased over time in both sexes; however, a greater increase has been observed in women, which has been associated with the introduction of low-tar cigarettes that enhance the delivery of smoke to the peripheral regions of the lungs.²⁶ Sex differences in lung tumour biology, susceptibility to the carcinogenic effects of tobacco, genetics and hormonal factors also contribute to the potential increased risk of lung cancer in women found in some studies.^{24 27 28}

The sum of the evidence on gender and smoking patterns, cancer epidemiology and tumour biology, combined with the conflicting evidence that women and men with similar smoking histories suffer deaths from smoking in equal measure, suggests that there may indeed be gender differences in the health consequences of smoking. However, the limitations of each study prevent conclusive evidence for the role of gender in relation to

Legacy, Washington, District of Columbia, USA

Correspondence to Laurel E Curry, Legacy, 1724 Massachusetts Avenue, NW, Washington, DC 20036, USA; lcurry@legacyforhealth.org

smoking-related mortality. Furthermore, this relationship may vary as a function of an area's historical, social, economic and policy environment with respect to tobacco use and tobacco control policy. Additional research using large, representative longitudinal samples is needed to provide confirmatory evidence of this relationship. In the face of the overwhelming evidence that smoking is harmful to all, regardless of gender, more focus should be placed on funding, implementing and evaluating prevention and cessation interventions to reduce the deadly toll of tobacco.

Competing interests None.

Contributors CGH was commissioned to write this commentary by the editorial staff; CGH and JC conceptualised the editorial; LEC conducted the literature search and drafted the article; DMV and CGH revised and edited the paper; CGH is the guarantor.

Provenance and peer review Commissioned; not externally peer reviewed.

Tobacco Control 2011;**20**:251–252.
doi:10.1136/tc.2011.044479

REFERENCES

1. **Jamrozik K**, McLaughlin D, McCaul K, *et al.* Women who smoke like men die like men who smoke: findings from two Australian cohort studies. *Tob Control* 2011;**20**:259–64.
2. **Freedman ND**, Leitzmann MF, Hollenbeck AR, *et al.* Cigarette smoking and the subsequent risk of lung carcinoma in the men and women of a large prospective cohort study. *Lancet Oncol* 2008;**9**:649–56.
3. **Zang EA**, Wynder EL. Differences in lung cancer risk between men and women: examination of the evidence. *J Natl Cancer Inst* 1996;**88**:183–92.
4. **Friedman GD**, Tekawa I, Sadler M, *et al.* Smoking and mortality: the Kaiser-Permanente experience. In: Burns DM, Garfinkel L, Samet J, eds. *Smoking and Tobacco Control Monograph No. 8: Changes in Cigarette-Related Disease Risks and Their Implication for Prevention and Control*. Bethesda, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute, 1997:477–99.
5. **Bain C**, Feskanich D, Speizer FE, *et al.* Lung cancer rates in men and women with comparable histories of smoking. *J Natl Cancer Inst* 2004;**96**:826–34.
6. **Greaves LJ**, Richardson LA. Tobacco use, women, gender, and chronic obstructive pulmonary disease: are the connections being adequately made? *Proc Am Thorac Soc* 2007;**4**:675–9.
7. **Greaves L**, Vallone D, Velicer W. Special effects: tobacco policies and low socioeconomic status girls and women. *J Epidemiol Community Health* 2006;**60**:1–2.
8. **Greaves LJ**, Hemsing NJ. Sex, gender, and secondhand smoke policies: implications for disadvantaged women. *Am J Prev Med* 2009;**37**(2 Suppl):S131–7.
9. **Dedobbeleer N**, Beland F, Contandriopoulos AP, *et al.* Gender and the social context of smoking behaviour. *Soc Sci Med* 2004;**58**:1–12.
10. **Ellis JA**, Perl SB, Davis K, *et al.* Gender differences in smoking and cessation behaviors among young adults after implementation of local comprehensive tobacco control. *Am J Public Health* 2008;**98**:310–16.
11. **CDC**. Cigarette smoking among adults and trends in smoking cessation—United States, 2008. *MMWR Morb Mortal Wkly Rep* 2009;**58**:1227–32.
12. **National Center for Health Statistics**. Health, United States, 2010: with special feature on death and dying. Table 58: current cigarette smoking among adults 18 years of age and over, by sex, race, and age: United States, selected years 1965–2009. Hyattsville, MD, 2011.
13. **CDC**. Vital signs: current cigarette smoking among adults aged ≥18 years—United States, 2009. *MMWR Morb Mortal Wkly Rep* 2010;**59**:1135–40.
14. **Barnes PM**, Ward BW, Freeman G, Schiller JS. Early release of selected estimates based on data from the January–September 2010 National Health Interview Survey. National Center for Health Statistics. March 2011. <http://www.cdc.gov/nchs/nhis.htm>.
15. **Shafey O**, Eriksen M, Ross H, Mackay J. The Tobacco Atlas, 3rd Edition. American Cancer Society and World Lung Federation, 2009. <http://www.tobaccoatlas.org> (accessed 31 May 2011).
16. **Trinidad DR**, Perez-Stable EJ, Emery SL, *et al.* Intermittent and light daily smoking across race/ethnic groups in the United States. *Nicotine Tob Res* 2009;**11**:203–10.
17. **U.S. Department of Health Human Services**. *Women and Smoking: A Report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2001.
18. **American Cancer Society**. *Cancer Facts and Figures 2008*. Atlanta, GA: American Cancer Society, 2008.
19. **Kohler BA**, Ward E, McCarthy BJ, *et al.* Annual report to the nation on the status of cancer, 1975–2007, featuring tumors of the brain and other nervous system. *J Natl Cancer Inst* 2011;**103**:714–36.
20. **Jemal A**, Ward E, Thun MJ. Contemporary lung cancer trends among U.S. women. *Cancer Epidemiol Biomarkers Prev* 2005;**14**:582–5.
21. **Jemal A**, Thun MJ, Ries LA, *et al.* Annual report to the nation on the status of cancer, 1975–2005, featuring trends in lung cancer, tobacco use and tobacco control. *J Natl Cancer Inst* 2008;**100**:1672–94.
22. **US Census Bureau**. *US Population Projections. Table 5: Population Under Age 18 and 65 and Older: 2000, 2010, and 2030*. US Census Bureau/US Population Projections website. <http://www.census.gov/population/www/projections/projectionsagesex.html> (accessed 27 Apr 2011).
23. **American Cancer Society**. *Cancer Facts & Figures 2010*. Atlanta: American Cancer Society, 2010.
24. **Belani CP**, Marts S, Schiller J, *et al.* Women and lung cancer: epidemiology, tumor biology, and emerging trends in clinical research. *Lung Cancer* 2007;**55**:15–23.
25. **Oberg M**, Jaakkola MS, Woodward A, *et al.* Worldwide burden of disease from exposure to second-hand smoke: a retrospective analysis of data from 192 countries. *Lancet* 2011;**377**:139–46.
26. **Stellman SD**, Muscat JE, Thompson S, *et al.* Risk of squamous cell carcinoma and adenocarcinoma of the lung in relation to lifetime filter cigarette smoking. *Cancer* 1997;**80**:382–8.
27. **Kligerman S**, White C. Epidemiology of lung cancer in women: risk factors, survival, and screening. *AJR Am J Roentgenol* 2011;**196**:287–95.
28. **Henschke CI**, Miettinen OS. Women's susceptibility to tobacco carcinogens. *Lung Cancer* 2004;**43**:1–5.