Available online at www.sciencedirect.com
ScienceDirect
Journal of Health Economics 27 (2008) 943–958
JOURNAL OF HEALTH ECONOMICS
www.elsevier.com/locate/econbase

The mortality cost to smokers

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Received 29 May 2007; received in revised form 21 December 2007; accepted 14 January 2008
Available online 2 February 2008

Abstract

This article estimates the mortality cost of smoking using the first labor market estimates of the value of statistical life by smoking status. The value of statistical life is $7 million for both smokers and nonsmokers. Using this value in conjunction with the increase in the mortality risk over the life cycle due to smoking, the value of statistical life by age and gender, and information on the number of packs smoked over the life cycle, the private mortality cost of smoking is $222 per pack for men and $94 per pack for women in $2006, based on a 3% discount rate. At discount rates of 15% or more, the cost decreases to under $25 per pack.

JEL classification: I12; I18; J17

Keywords: Smoking; Cigarettes; Mortality cost; Value of statistical life

1. Introduction

Cigarette smoking substantially reduces life expectancy. Although several studies have addressed the financial externalities of smoking, there have been no comparably detailed examinations of the potentially much more substantial value of the mortality cost to smokers.[1] The appropriate valuation of private mortality risks is the value of statistical life (VSL) at the age of death. To provide a basis for this calculation, we develop the first estimates of VSL by smoking status, age, and gender and use these estimates in valuing the mortality risks. These results, which are of independent interest in their own right, are used to calculate the mortality cost of smoking. In addition, our estimates of the mortality cost of smoking take into account the temporal distribution of the increased mortality associated with cigarette smoking, as well as the pattern of smoking over the life cycle.

Previous studies have indicated fairly similar values for the mortality cost per pack with values of $20 by Sloan et al. (2004), $22 by Cutler (2002), and $30 by Gruber and Köszegi (2001). The methodology in the studies assumes that the loss of life due to smoking occurs at the end of smokers' lifetime and that the value of this loss can be based on a value per life year lost of $100,000.[2] This value of statistical life year (VSLY) approach is based on the assumptions that VSL equals the present discounted value of a series of annual values and that each year of life has an identical value.

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[1] For studies that have assessed the financial externalities of cigarettes, see, among others, Shoven et al. (1989), Manning et al. (1989, 1991), Gravelle and Zimmerman (1994), Viscusi (1995, 2002), Evans et al. (1999), Cutler et al. (2000), and Sloan et al. (2004).

[2] Their estimates use Viscusi's (1993) consensus value of life of $6.4 million based on the average VSL from US labor market studies.

0167-6296/$ – see front matter
doi:10.1016/j.jhealeco.2008.01.001

In Section 2 we provide an overview of our estimating methodology. Specifically the present value of the mortality cost of smoking is the discounted value of the incremental probability of death at different ages for smokers relative to otherwise comparable nonsmokers, multiplied by the pertinent VSL. This section also introduces the hedonic wage equation model used to estimate VSL. In Section 3 we estimate hedonic wage equations by smoking status, allowing for age variation in the VSL. We find that the VSL does not vary substantially by smoking status. Moreover, there is no evidence of a significant decline in VSL for the age range of the working population. This absence of a steady drop in VSL with age implies that VSL estimates calculated specifically by age will be much larger than those in which VSL is constructed based on an assumed constant unit value per year of life. Section 4 estimates the mortality cost based on the VSL estimates derived from the results in Section 3. Our cost calculation is on a year-by-year basis, taking into account the differential mortality risk of smokers in each year and recognizing the specific expected age of death and the appropriate discounting of these losses. Use of the appropriate age-specific VSL levels leads to a substantial increase in the estimated mortality cost of smoking.

The results of the analysis are quite striking. The discounted expected mortality cost per pack in $2006 using a 3% discount rate for male smokers is $222 and for female smokers is $94. While the mortality cost varies with the discount rate, at all reasonable rates of discount the mortality cost remains considerably above previous estimates.

2. Procedure for calculating mortality cost

In this section we provide an overview of the approach that we implement in Sections 3 and 4. Intuitively, the mortality cost of smoking is the expected number of years of life lost due to smoking multiplied by the economic value of these years. The general formulation of the present value of the mortality cost of smoking c used in this paper is given by

$$c = \sum_{t=t_0}^{100} \frac{(x_{st} - x_{nt})v(t)}{(1+r)^{t-t_0}}, \tag{1}$$

where t_0 is the age at which the person became a committed smoker, x_{st} is the probability that this smoker dies at age t, x_{nt} is the probability that a comparable nonsmoker would have died at age t, $v(t)$ is the value of death at age t, and r is the rate of discount. The mortality cost per pack is obtained by dividing c by the discounted number of packs smoked, taking into account the life cycle pattern of smoking.

We use t_0 equal to age 24 as the demographic reference point. By that age, short-term smoking experimentation has been completed. This focus on 24 year old committed smokers parallels the assumption embodied in the tables by Sloan et al. (2004) in which life expectancy is based on continued smoking behavior excluding quitters. Our focus on continuing smokers ensures a comparable matchup of smoking-related mortality risks and patterns of cigarette consumption over the life cycle. The scientific estimates for mortality risks of smoking over the life cycle are much more reliable for committed smokers than for quitters at different ages.

To calculate the incremental mortality risk from smoking, $(x_{st} - x_{nt})$, we use the 'nonsmoking smoker' as the reference point, as in Manning et al. (1989, 1991). This approach uses as the baseline the risk profile of a nonsmoker who otherwise has the demographic and risk profile of a smoker and thereby correctly reflects the increased smoking-related mortality risk that will be experienced by smokers specifically due to their smoking behavior. Because our estimates adjust for smokers' demographic risk profiles, the life expectancy loss estimates are lower than those used in some other studies. If we had not used the nonsmoking smoker reference point, our cost estimates would be even higher.

The most critical component of the calculation is the unit mortality value parameter $v(t)$. Following the standard economic approach, the ideal measure of $v(t)$ is the VSL at age t. For smokers age 65 or over, we do not have a VSL based on labor market tradeoffs so instead will construct this value using the VSLY levels for workers age 55–64.

The relation between VSL and VSLY is based on the quantity-adjusted value of life analysis introduced by Moore and Viscusi (1988). If people lived forever and had a constant value per year of life, the VSL would equal VSLY/r, where r is the rate of discount. To account for a finite lifespan, denote the remaining life expectancy by L. The VSL