

Figure 9-9 The risk of lung cancer is determined by the number of cigarettes smoked. (Modified from Stewart BW, Kleihues P (eds): World Cancer Report. Lyon, IARC Press, 2003.)

adducts persist, they can cause mutations in oncogenes and tumor suppressors (Chapter 7). Most tellingly, deep sequencing of the genomes of lung cancers that occur in smokers has revealed the presence of thousands of mutations of a type that is produced by carcinogens in tobacco smoke in experimental settings. The risk of developing lung cancer is related to the number of pack years or cigarettes smoked per day (Fig. 9-9). Moreover, smoking increases the risk of other carcinogenic influences. Witness the ten-fold higher incidence of lung carcinomas in asbestos workers and uranium miners who smoke over those who do not smoke, and the interaction between tobacco consumption and alcohol in the development of oral cancers (Fig. 9-10).

Smoking and Other Diseases. In addition to lung cancer, smoking is linked to many other malignant and nonmalignant disorders that affect numerous organ systems (Fig. 9-11).

- Cigarette smoking is associated with *cancers of the esophagus, pancreas, bladder, kidney, cervix, and bone marrow*.
- The toll taken by nonmalignant conditions associated with smoking is even more terrible. The most common diseases caused by cigarette smoking involve the lung and include *emphysema, chronic bronchitis, and chronic obstructive pulmonary disease*, conditions that are discussed in Chapter 15.
- Cigarette smoking is also strongly linked to the development of *atherosclerosis* and its major complication, *myocardial infarction*. The causal mechanisms probably relate to several factors, including increased platelet aggregation, decreased myocardial oxygen supply (because of significant lung disease coupled with the hypoxia related to the CO content of cigarette smoke) accompanied by an increased oxygen demand, and a decreased threshold for ventricular fibrillation. Smoking has a multiplicative effect on the incidence of myocardial infarction when combined with hypertension and hypercholesterolemia.
- In addition to having deleterious effects on the smoker, smoking also harms the developing fetus. Maternal

smoking increases the risk of *spontaneous abortions* and *preterm births* and results in *intrauterine growth retardation* (Chapter 10). Birth weights of infants born to mothers who stopped smoking before pregnancy are, however, normal.

- Exposure to *environmental tobacco smoke (passive smoke inhalation)* is associated with some of the same detrimental effects that result from active smoking. It is estimated that the relative risk of lung cancer in nonsmokers exposed to environmental smoke is about 1.3 times higher than that of nonsmokers who are not exposed to smoke. In the United States, approximately 3000 lung cancer deaths in nonsmokers older than 35 years can be attributed each year to environmental tobacco smoke. Even more striking is the increased risk of coronary atherosclerosis and fatal myocardial infarction. Studies report that every year 30,000 to 60,000 cardiac deaths in the United States are associated with exposure to passive smoke. Passive smoke inhalation in nonsmokers can be estimated by measuring the blood levels of *cotinine*, a metabolite of nicotine. During the period of 1999 to 2008, the prevalence of elevated cotinine levels in nonsmokers in the United States fell from 52% to 40% thanks to bans on smoking in public places, but exposure to environmental tobacco smoke in the home remains a major public health concern, particularly for children who may develop respiratory illnesses and asthma.

It is clear that the transient pleasure of smoking comes with a heavy long-term price. A new part of the picture is electronic cigarettes, devices that simulate cigarette

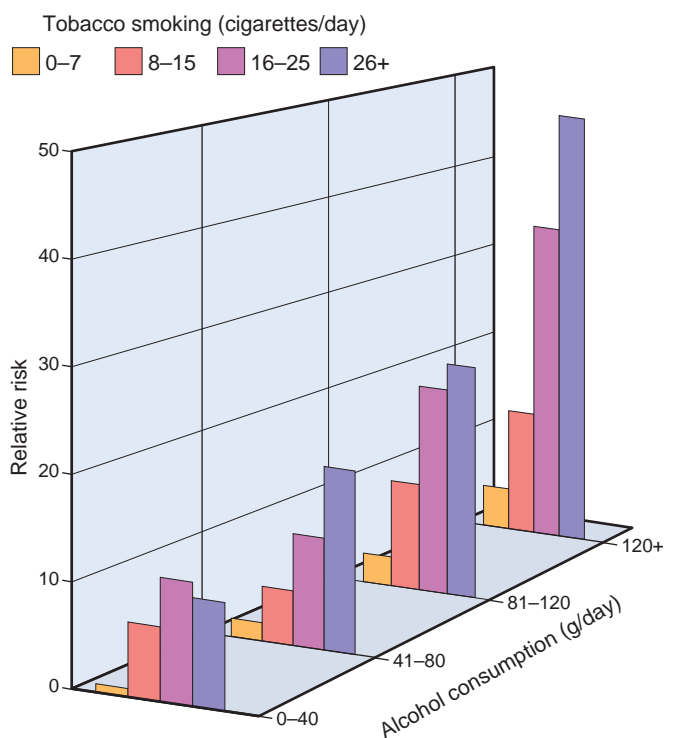


Figure 9-10 Multiplicative increase in the risk of laryngeal cancer from the interaction between cigarette smoking and alcohol consumption. (Modified from Stewart BW, Kleihues P (eds): World Cancer Report. Lyon, IARC Press, 2003.)