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Cancer Epidemiology

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INTRODUCTION

Globally, more than 11 million individuals are diagnosed with cancer and some 7 million die from the disease annually. At the same time, it is estimated that there are more than 22 million cancer survivors worldwide, and their number is increasing dramatically each year. In the United States in 2014, it was estimated that 1.7 million individuals would be diagnosed with cancer, for an age-adjusted incidence rate of 470 per 100,000 population. At the same time, it was estimated that more than 585,000 individuals would die of cancer, for an age-adjusted death rate of 176 per 100,000. Cancer is the leading cause of mortality among both women and men between the ages of 40 and 80 years, and it is the second leading cause of death for most other age groups, including children between 1 and 14 years of age.

The leading types of new invasive cancer cases and cancer-specific deaths are shown in Figure 54-1. Although breast cancer in women and prostate cancer in men are the most common noncutaneous forms of cancer, lung cancer is now the leading cause of cancer-specific mortality, accounting for almost 30% of cancer deaths in both genders. Mortality rates for gastric and cervical cancers have decreased steadily for decades, and overall cancer death rates have decreased some 20% since their height in the early 1990s, with the greatest declines observed for colorectal, prostate, and lung cancers in men and colorectal and breast cancer in women (Fig. 54-2). Death rates over the last decade have also declined by more than 8% for chronic myeloid leukemia and more than 3% for non-Hodgkin's lymphoma. Cancer mortality rates in developed countries are consistently higher among those from racial and ethnic minority groups, especially African Americans in the United States, and among those from lower socioeconomic strata. Greater mortality rates among racial and ethnic minorities are not fully explained by differences in the stage at diagnosis. Socioeconomic factors, access to appropriate treatment, and comorbidities represent additional determinants of greater cancer mortality.

CANCER EPIDEMIOLOGY METHODS

Epidemiologists study disease variation among populations and the factors that influence such variation. The proportion of individuals with disease in the population at a given point in time is the *prevalence*. *Incidence and mortality rates* represent the number of events in a population over a defined period of time (e.g., cancers per 100,000 per year). To facilitate comparisons among populations, rates are often adjusted for age, sex, race, or other demographic characteristics.

The association between a characteristic or exposure and cancer risk is typically assessed in either cohort or case-control studies. Cohort studies are usually prospective and evaluate disease experience in exposed and unexposed individuals. Case-control studies assess the exposure experience of individuals with and without the disease of interest. The *relative risk* (RR) is a measure of association between exposure and disease, with estimates greater than 1.0 representing an increase in risk. In case-control studies, RR is estimated by the *odds ratio* (OR), because the sizes of the exposed and unexposed populations are often not known. The larger the study population, the more precise is the estimate of association between exposure and disease. However, proper interpretation of the results must explore whether any systematic error or bias was introduced during the study design or analysis.

Confounding factors may obscure or weaken a true association or create a false association (i.e., because of an association between the factor itself and both exposure and disease). Confounding can be evaluated and adjusted for in stratified or multivariate analysis if the potential confounder is recognized and has been properly measured in the data. It is usually not safe to assume that all possible confounding factors have been considered. Therefore, causal inference is seldom justified on the basis of a single study but evolves gradually with study repetition and consideration of other information, including results from animal and other laboratory findings, the strength of the association, and a careful consideration of likely confounding factors.

Interventions for cancer prevention and screening are typically studied in randomized controlled trials that require large numbers of participants, close monitoring for adherence to the intervention, long-term follow-up, and appropriate ascertainment of disease and disease-free status.

RISK FACTORS

Genetic

Risk factors for cancer can be grouped as either genetic (inherited) or acquired. Although they are important for understanding carcinogenesis, only a small proportion of cancers are inherited in a mendelian fashion. Neoplasms inherited in an autosomal dominant manner include retinoblastomas, multiple endocrine neoplasia syndromes, and polyposis coli. Several additional preneoplastic conditions demonstrate mendelian inheritance with variable penetrance. Some common malignancies demonstrate familial risk patterns with low penetrance, including breast cancer and colorectal cancer. Genetic testing and potential preventive measures are available for some inherited cancer syndromes