# Population Aging and Cancer: A Cross-National Concern

Rosemary Yancik, PhD, *Bethesda, Maryland*

## ABSTRACT

Although malignant tumors occur at all ages, cancer dispro-portionately strikes individuals in the age group 65 years and older. Data from the National Cancer Institute Surveil-lance, Epidemiology, and End Results Program for the most recent five-year period, 1998–2002, reveal that 56% of all newly diagnosed cancer patients and 71% of cancer deaths are in this age group. Median ages of cancer patients at death for the major tumors common to both males and fe-males, all races (lung, colorectal, lymphoma, leukemia, pan-creas, stomach, urinary bladder) range from 71 to 77 years. The median age for prostate cancer is 79 years; for ovarian and female breast cancer, the median age is 71 for each tumor. These cancer statistics when cast against the demo-graphic changes occurring in the U.S. population take on ur-gency and importance for cancer treatment and care in our nation's health care system. The U.S. Census Bureau dem-ographic projections indicate that the number of persons 65 years and older in the United States will double from the cur-rent estimate of 35 million persons to a projected 70 million by 2030. Barring any cancer prevention breakthroughs, the expansion of the aged population will likely increase the ab-solute number of older individuals diagnosed and treated for cancer in coming decades.

The United States is not unique as an aging developed industrial nation with a high proportion of the cancer burden in the elderly. Other developed industrial countries have a potentiality for increased cancer incidence and mortality as their populations grow older. This paper, using U.S. Bureau of Census demographic projections and current age stan-dardized death rates per 100,000 population (from World-wide Cancer Mortality Statistics, Cancer Mondial, WHO, and the International Association for Research on Cancer) com-pares cancer in the elderly in Italy and the United States. Italy is demographically ranked as the oldest nation in the world. Dimensions of the cancer burden challenge ahead are inferred in the context of two countries with aging popu-lations to underscore the possible increase that demo-graphic factors may have on the magnitude of the cancer problem for older persons in the next 25 years. *(Cancer J 2005;11:437–441)*

Demographic projections indicate that the number of persons 65 years and older in the United States will double from the current 35 million persons in this age category to 70 million in the next 25 years.[1–3] Also, population aging (i.e., shifts in age distribution to-ward older ages) is progressing at a rapid pace. The demographic factors increasing population growth or decline are fertility and mortality (more births than deaths) and net migration (more people moving into the country than out).[1] Populations begin to age, ac-cording to demographers, when fertility declines (under 2.1 live births per woman) and mortality rates improve.[1,2]

These change-producing factors in the United States include the low and high rates of fertility in cer-tain eras (e.g., during the depression and after World War II), advancements in medicine and sanitation, and reduced mortality due to elimination of many in-fectious disease across all age groups.[2] The major re-duction in mortality of infectious and parasitic diseases has resulted in increased longevity.[2] Life ex-pectancy at birth has increased from 47 years in 1900 to 77 years.[3]

The aging of the U.S. population in the next 25 years is driven by the "baby boom" cohort born between 1946 and 1964 that numbers 76 million per-sons.[1–3] In 2011, the first born individuals in the co-

hort will turn age 65.[1–3] By 2030, the percentage of persons in the age group 65 years and older will increase from the current 12.6% of the population to 20%.[3] One in five persons in the United States will be in this age group!

There is reason for concern regarding an anticipated increase in the number of cancer cases. Although malignant tumors occur at all ages, the disease disproportionately strikes older individuals. Most major cancers are diagnosed in persons 65 years and older.[4,5] More than half (56%) of all newly diagnosed cancer patients and 71% of cancer deaths are in this age group.[6] The median ages at death for major tumors common to both males and females, all races (lung, colorectal, lymphoma, leukemia, pancreas, stomach, urinary bladder) range from 71 to 77 years.[6] The median age for prostate cancer is 79 years. For breast and ovarian cancers, the median age is 71 for each tumor.[6] Barring any cancer prevention breakthroughs, the expansion of the aged population alone will increase the absolute number of individuals diagnosed and treated for cancer in coming decades.[4,5]

### DEMOGRAPHIC TRANSITION

The United States is not unique as an aging nation, nor is it exceptional in the magnitude of the cancer problem in comparison with other developed industrial nations.[2,7–10] The forecast of the aging trend is a recognized phenomenon in all developed countries. In the approaching decades, fertility and mortality changes are unlikely to reverse population aging.[2] For the most part, the demographic transitions and a potential for an increase in the cancer burden in the elderly are similar in European countries and the United States.[2,8]

Indeed, Europe leads the globe in geographic areas with the highest proportion of persons 65 years and older and anticipation of increases in percentage projections for this age group in the near future.[2] Italy, Sweden, France, the United Kingdom, Denmark and other countries all have percentage proportions of older person that surpass the United States proportion.[2] Fertility decline, especially since the 1970s, has accelerated population aging and led to a reduced size of birth cohorts relative to the older age cohorts.[1,2]

Percentages of population in the age group 65 years and older are compared among developed industrialized countries selected from northern, southern, and eastern regions of Europe and the United States in Figure 1.[2,3] These nations are the demographically oldest nations in the world. Indeed, the United States with a proportion of 12.6% is considered a relatively young nation by "developed" standards.[2]
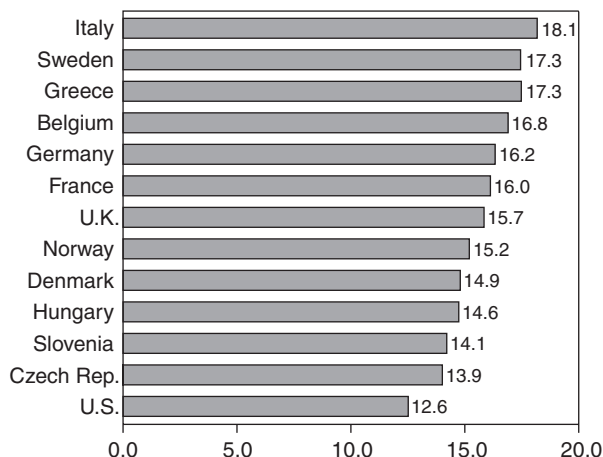


**FIGURE 1** Cross-national comparison of population percentages 65 years and older.

Italy ranks as the oldest country in the world![2] Thus, this nation is a reasonable selection from among European countries to compare with the United States for selected population aging and cancer statistics. The contrast is appropriate in another respect because Italy is the native country of Dr. Paul Calabresi, to whom this paper is dedicated (see p. 441). The International Society of Geriatric Oncology established a Memorial Lecture in Dr. Calabresi's honor, which this author was privileged to give in the Fifth International Meeting, International Society of Geriatric Oncology [Societa Internazionale OncoGeriatria (SIOG)], San Francisco, California, October 2004.

### AGING OF THE AGED POPULATIONS

Progressive aging of the older population itself is another factor of the demographic transition as greater numbers of individuals survive to 80 years and beyond.

As shown in Figure 2, demographic changes in the United States appear less dramatic in comparison with the impending extraordinary shifts in the age structure of Italy. In 2000, 18% of the Italian population is 65 years and older. By 2030, as Figure 2 further reveals, 27% of Italy's population will be 65 years and older; one in four persons will be in this age group.[5]

As the U.S. baby boom cohort, 76 million persons born during 1946 through 1964, reaches 65 years and older, our nation will become ranked among the oldest. Yet percentages of persons within 65+, as shown in Figure 2 reflecting "aging of the aged," still will be lower in the United States than in Italy.

The greatest gains in the population depicted by vertical bars for selected years for both countries are in the three upper age subgroups beginning with age
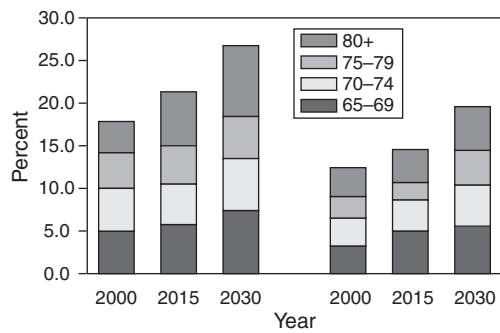
**FIGURE 2** Expansion of the populations of Italy and the United States, 2000–2030.

70–74 in 2015. Both countries increase substantially in the 80+ age group by 2030. In Italy, the 80+ age group will more than double in percentage, 4.0% to 8.7% in the period from 2000 to 2030. Aging of the oldest subgroup in the United States will increase by 1.5 times from 3.3% to 5.4% in this same period. The largest increases in population growth for Italy and the United States are in the 80+ age population by 2030. Yet the number of persons does not increase for Italy (Table 1). According to demographic projections, overall population growth for Italy's population decreases even as the percentage population number increases by 9%. The United States, in contrast, shows incremental increases in both population numbers and a percentage reaching a high of 20.0% by 2030.

Changes in age structure and population aging also are related to infant and childhood mortality, life expectancy gains at birth, medical advancement, sanitation reduction of infectious diseases, high and low rates of fertility in certain eras (e.g., impact of the Great Depression in the U.S. and the post World War II "baby boom"). Population aging is also altered by migration. Immigrants are apt to be younger and have more children.[1,2]

### Median Age in Italy and United States

Population aging describes the increased proportion of older persons within the overall population. The median age of a society is another way to indicate population aging. This is an age that divides the population into equal parts of the young and the old.

Consider that the median age indicates the number of persons under the median age who have already attained that age (i.e., celebrated their 40th birthday).

In the comparison for the targeted years of 2000, 2015, and 2030, median ages are between 40 to 52 years for Italy as compared to 36 to 40 for the United States (Fig. 3).[2] Median age increased by six years every 15 years in Italy, while the there was a 2 year increase for the same period in the United States.

Life expectancy gains are shown for the past century for males and females in Italy and the United States in Table 2. Although life expectancy for both males and females was greater in the U.S. than in Italy through 1950, a gain in life expectancy in the last half of the 20th century for both sexes in Italy surpasses U.S. life expectancy in 2000 by approximately two years or more for each sex.

Demographics provide an appropriate backdrop for cross-national similarities and differences in cancer statistics of Italy and the United States. The following focus on cancer in older persons using Age Standard Rates (ASRs) for mortality.[9] ASR rates allow cross-national comparisons by applying age-specific rates to a standard world population of 100,000.

## CANCER IN THE ELDERLY: DIMENSIONS OF THE CHALLENGE

One far-reaching effect of an aging population in both countries, and by inference other developed nations, is the potentiality for increases in cancer diagnoses and cancer-related deaths and mortality for the age sector already bearing the brunt of the cancer burden.[4,5,7] From a medical standpoint, one can antici-
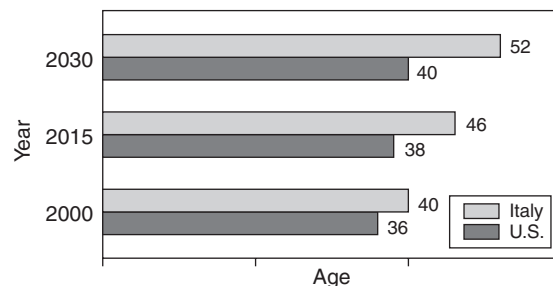


**FIGURE 3** Median ages in Italy and the United States, 2000–2030.

| | 2000 | | 2015 | | 2030 | |
|---|---|---|---|---|---|---|
| **TABLE 1** | **Population Estimates for 2000 and Projected Populations for 2015 and 2030** | | | | | |
| Country | Total Population | % 65+ | Total Population | % 65+ | Total Population | % 65+ |
| Italy | 57,634,000 | 18.1 | 56,631,000 | 22.2 | 52,868,000 | 28.1 |
| U.S. | 275,563,000 | 12.6 | 312,534,000 | 14.7 | 351,326,000 | 20.0 |

**TABLE 2**  Life Expectancy Gain Comparison During the 20th Century

| Country | 1900 | | 1950 | | 2000 | |
|---------|------|--------|------|--------|------|--------|
| | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| Italy | 42.9 | 43.2 | 63.7 | 67.2 | 75.9 | 82.4 |
| U.S. | 48.2 | 51.1 | 66.0 | 71.7 | 74.2 | 79.9 |

pate that oncology practice will involve a large element of geriatrics. Even though there is continuous progress in clinical research, the demographic increases translate into an ever-increasing number of persons in the age stratum highest at risk for developing cancer.[4,5]

### Cancer/Aging Profiles for Italy and United States

Both Italy and the United States nations have similar mortality rates for the major tumors: lung, colorectal, breast, and prostate. ASR mortality rates are used to indicate deaths per 100,000 population for all cancer sites combined for males and females and for specific tumors by sex. Although the major focus in this paper for demographic data is primarily directed at the age group 65 years and older, younger and older comparative age groups are highlighted to show the extreme age dimensions for cancer rates in Figures 4–6.[9]

Mortality rates depicted by ASRs between Italian and U.S. males and females follow essentially the same patterns for all cancer sites combined. For males, peak rates soar to well over 2500.0 per 100,000 population. Peak rates are much lower for females hovering at about 1500.0 per 100,000 population.[9]

Greater differences in ASRs are apparent for other cancers that are illustrated, e.g., stomach, urinary bladder, and pancreas. Tumors of the lung, colon and rectum, breast, and prostate are prominent in both nations and rank highest in overall mortality. Three additional cancer sites common to both older men and women are shown in Figures 5 and 6, illustrating differences. Except for cancer of the pancreas, stomach and cancer mortality rates vary considerably. ASR rates for cancer of the pancreas for both Italy and the United States have surprisingly similar ASR mortality rates.[9]

The demographic data in combination with cancer statistics powerfully emphasize the magnitude of the cancer burden for older persons. The data underscore the potentiality of an even greater magnitude in the future as populations of developed and industrialized nations similar to Italy and the United States advance in age.[10] To the extent that these countries reflect other developed industrialized nations, the number of persons most vulnerable to cancer of older persons in the upper end of the age spectrum will increase.
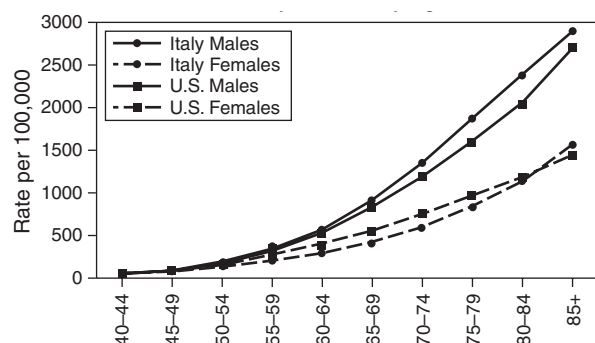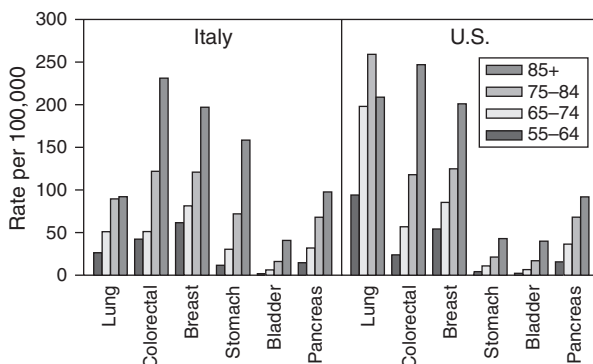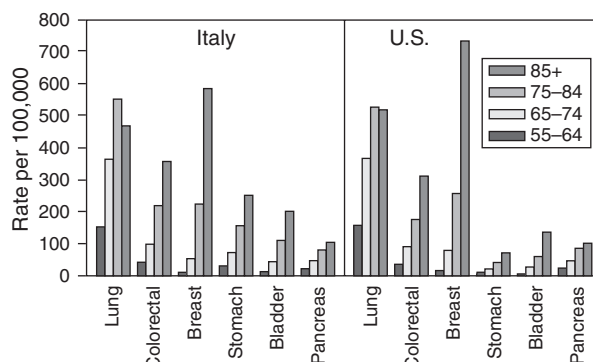


**FIGURE 5**  ASR Mortality Rates for Italy and U.S. Females 55 Years and Older for Selected Tumors



**FIGURE 4**  ASR Mortality Rates for Males and Females in Italy and U.S. by Age



**FIGURE 6**  ASR Mortality Rates for Italy and U.S. Males 55 Years and Older for Selected Tumors

| TABLE 3 | NIA Priority Areas for Integration of Aging/Cancer Research |
|---|---|

- Age-related factors in the development of tumors in older persons
- Time and its importance in developing cancer in a person's lifespan
- Aggressive tumor behavior in the aged patient
- Pharmacology of aging and cancer—anti-tumor drug alterations
- Prognostic indicators for patient evaluation and work-up
- Comorbidity, previous illnesses, and disabilities in older cancer patients
- Occurrence of multiple primary tumors in the elderly
- Cancer survivorship—need long term data on older cancer survivors
- Access issues relevant to older patients, their families, and physicians
- Use generic age-related issues as specified in breast and prostate PAs

## COMMENT

Data on two aging developed nations, Italy and United States, illustrate underscore the urgent need for great attention to cancer in the elderly. Targeted attention to the older age group is becoming increasingly important. The influence and expansion of interest in the concomitant age-associated illness burden of older persons diagnosed with cancer is essential. Medical oncologists must deal with the concurrent health problems of aged individuals in medical practice, for cancer occurs frequently in the presence of one or more other chronic diseases or health problems. Older individuals may have preexisting chronic and disabling conditions such as heart disease, diabetes, hypertension, arthritis, or chronic obstructive pulmonary disease. These are prevalent chronic diseases and conditions that could elevate greater risks for adverse effects from treatment interventions. The main question is how do the concurrent conditions in individuals affect the early detection, diagnosis, and treatment, and survival of cancer patients in clinically complex situations?

National Institute on Aging research initiatives are based on recommendations summarized from several meetings on tumor specific topics (e.g., breast, prostate, ovary, multiple tumors). An interdisciplinary panel, convened for integrating the aging/cancer research interface, established the priorities listed in Table 3.[11]

## DEDICATION

This review is dedicated to the memory of Dr. Paul Calabresi and represents an expansion of a 2004 SIOG presentation. An Italian-born immigrant to the United States, Dr. Calabresi was an early member of the cadre of medical oncology specialists in the United States and served as President of the American Society of Clinical Oncology (ASCO) in 1969–1970. He was an advocate of quality care for older patients and had first-hand experience as a cancer survivor himself. Shortly before his death, he served as President of the International Society for Geriatric Oncology (SIOG). His fine legacy includes inspiration, guidance, and counseling for numerous patients, friends, and colleagues around the world.

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