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Cancer trends among the extreme elderly in the era of cancer screening

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ABSTRACT

Background: The extreme elderly (EE; >84 years) are among the fastest growing segments of the population and bear a substantial cancer burden. We examined cancer incidence and cancer specific mortality changes among the EE during the implementation of cancer screening from the 1980s to 2000s.

Methods: We examined incidence and mortality rates for breast, colon, prostate, and lung cancer by age group between 1973 and 2009 in the SEER database. We compared incidence/mortality between EE and middle aged (MA; age 50–69) patients.

Results: Prostate cancer incidence and mortality rose and then, in the early 1990s, declined (−3.61%/year and −2.91%/year, respectively) among EE. Prostate cancer incidence rose steadily throughout the study period for MA. Breast cancer incidence rose and then declined for both MA and EE, with the decline starting in 1990 for EE (−1.34%/year), and 1998 for MA (−1.24%/year). Both age groups experienced an increase and then decrease in colon cancer incidence. The decrease in colon cancer mortality over the last decade was profound for all patients (−2.88%/year MA, and −3.29%/year EE). Lung cancer incidence (+2.35%/year to 2005) and mortality (+1.25%/year from 1995) increased for EE. Lung cancer incidence and mortality increased and then decreased (−2.54%/year for mortality from 1990) for MA.

Conclusion: Recent trends in incidence and mortality for screened cancers (breast, colon, prostate) show substantial gains for the extreme elderly, likely due in part to the effect of screening. Incidence and mortality from lung cancer, with no recommended screening during the study period, have continued to worsen for the extreme elderly, despite improvements in younger patient populations.

1. Introduction

Cancer incidence and cancer specific mortality rates increase with age [1]. People aged 85 and older, the extreme elderly, are among the fastest growing segment of the population. The growth of this age category is expected to yield at least a four-fold increase in the number of cancer patients aged 85 years and older between 2000 and 2050 [2]. Despite bearing a substantial burden of disease, the elderly remain underrepresented in medical research. Management for elderly patients frequently is extrapolated from clinical trials conducted on younger patients [3].

The American Cancer Society (ACS) has published screening guidelines for breast, colorectal, prostate, and lung cancers over the past three decades, promoting uptake of imaging and

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serologic assays for early cancer detection. In 2010, the breast cancer screening rate was 72.4%, the colorectal cancer screening rate was 58.6%, and the prostate cancer screening rate was 41.3%. All screening rates were defined as the percentage of surveyed responding that had the recommended screening test within the recommended screening interval for the test. No standard screening for lung cancer was recommended at the time [4,5]. In 2011, results from the National Lung Cancer Screening Trial reported a 20% relative reduction in lung cancer mortality with annual screening with low-dose computed tomography (LDCT) [6]. The 2013 ACS guidelines recommended lung cancer screening by LDCT for the first time [7].

We hypothesized that the widespread implementation of screening for prostate, breast, and colorectal cancer would significantly affect the incidence and mortality of these cancers in the extreme elderly by culling and curing cases at a younger age that would have been an incident or resulted in mortality during the extreme elderly years. We used lung cancer incidence and mortality as a comparator because screening has not yet become widespread for lung cancer. We recognize that incidence and mortality rates represent combined effects of exposures, screening, and therapy, and anticipate that population-based studies will complement interventional trials to give a more comprehensive understanding of these common cancers.

This paper describes and quantifies changes in prostate, breast, colorectal, and lung cancer incidence and mortality in individuals aged 85 years and older in the United States between 1973 and 2009, and compares those changes to patterns among those aged 50–69. We did not include analyses of patients age 70–84 to focus the comparison on heavily screened patients (i.e. 50–69), and minimally screened patients (i.e. age ≥85).

2. Methods

2.1. Study Database

We used the Surveillance, Epidemiology and End Results (SEER) database to investigate the incidence and mortality rates of prostate, breast, colorectal, and lung cancers for patients aged 85 years and older between 1973 and 2009. The SEER database is currently composed of 18 different regional registries, but at the inception of the database in 1973, only 9 of the 18 collected data. SEER 9 registries cover incidence and mortality rates between 1973 and 1991, and represent roughly 10% of the US population. SEER 13 registries cover incidence rates between 1992 and 1999, and represent roughly 14% of the US population. SEER 18 registries cover incidence rates between 2000 and 2009, and represent roughly 28% of the US population. Mortality data was provided by the National Center for Health Statistics (NCHS) and analyzed in the SEER program [8]. The addition of more registries and population coverage improves the generalizability of the data for the US population and the oversampling of minority groups improves the ability to accurately characterize disease patterns among minority groups.

2.2. Statistical Analysis

Incidence and mortality rates are per 100,000 and are age-adjusted to the 2000 US Standard population. Our primary comparison for both mortality and incidence was between age groups 50–69, and 85 and older. All mortality and incidence assessments were done using SEERSTAT software. Trends in cancer incidence and mortality rates were analyzed with Joinpoint regression, using software from the National Cancer Institute's Surveillance Research Program [9]. Joinpoint regression involves fitting a series of connected regression lines on a log scale to the trends in rates. Each line segment represents a trend over time; each connection, or Joinpoint, represents a change in trend. An annual percent change (APC) that does not contain zero in its 95% confidence interval (95% CI) is labeled as statistically significant.

The research is IRB exempt in accordance with our institutional IRB policies.

3. Results (Summary of Data Included in Table 1)

3.1. Incidence

3.1.1. Prostate (Fig. 1)

In the 85+ age group, incidence increased by 1.05% (95% CI: 0.31; 1.81) per year from 1973 to 1988, dramatically increased by 11.59% (95% CI: −2.67; 27.94) per year from 1988 to 1991, dramatically decreased by 12.97% (95% CI: −17.83; −7.82) per year from 1991 to 1995, continued to decrease by 3.61% (95% CI: −4.29; −2.92) per year from 1995 to 2007, and decreased by 15.98% (95% CI: −23.65; −7.54) per year from 2007 to 2009. In the 50–69 age group, incidence increased by 3.66% (95% CI: 2.14; 5.20) per year from 1973 to 1988, dramatically increased by 21.44% (95% CI: 8.02; 36.52) per year from 1988 to 1992, and then moderately increased by 0.15% (95% CI: −0.30; 0.60) per year from 1992 to 2009.

3.1.2. Breast (Fig. 2)

In the 85+ age group, incidence increased by 1.09% (95% CI: 0.41; 1.78) per year from 1973 to 1990, and then decreased by 1.34% (95% CI: −1.65; −1.03) per year from 1990 to 2009. In the 50–69 age group, incidence increased by 1.63% (95% CI: 1.31; 1.95) per year from 1973 to 1998, and then decreased by 1.24% (95% CI: −1.81; −0.67) per year from 1998 to 2009.

3.1.3. Colorectal (Fig. 3)

Incidence trends for men and women follow similar patterns in each age group. In the 85+ age group, rates increased by 3.48% (95% CI: 1.50; 5.50) per year from 1973 to 1980, decreased by 1.18% (95% CI: −1.44; −0.93) per year from 1980 to 2001, and then continued to decrease by 3.94% (95% CI: −4.56; −3.31) per year from 2001 to 2009. In the 50–69 age group, incidence increased by 0.70% (95% CI: −0.12; 1.53) per year from 1973 to 1984, and then decreased by 1.09% (95% CI: −1.26; −0.92) per year from 1984 to 2009.

3.1.4. Lung (Fig. 4)

In the 85+ age group, incidence trends for men and women increased by 2.35% (95% CI: 2.21; 2.49) per year from 1973 to 2005, and then decreased by 0.27% (95% CI: −1.62; 1.11) per year from 2005 to 2009. In the 50–69 age group, incidence increased by 2.25% (95% CI: 1.55; 2.96) per year from 1973 to 1986, and then decreased by 1.61% (95% CI: −1.81; −1.42) per year from 1986 to 2009.