Title

* Contribution of Screening and Treatment on Improvements in Cancer Survival
* Contribution of Screening and Treatment on Improvements in US Cancer Survival
* Contribution of Screening and Treatment on Improvements in US Cancer Mortality
* The Contribution of Screening and Treatment on Improvements in US Cancer Mortality
* The Contribution of Stage of Diagnosis & Improvements in Treatment on US Cancer Mortality Rates

Introduction

1. What do we know
   1. Advancements in treatment
   2. Greater use of effective screening
   3. Improvements in the care of other diseases (e.g., CVD)
2. What don’t we know/research gap
   1. How much of the improvement in cancer survival is due to improved screening which shifts the stage of diagnosis to earlier
3. How does our study fill this research gap

Methods

1. Data
2. Methodology

Results

Discussion

**ABSTRACT**

**Importance. Previous studies yield conflicting results on whether improvements in cancer mortality rates result from [1] more widespread screening that potentially shifts the stage of diagnosis to earlier and more treatable stages or [2] advancements in treatment.** By knowing the relative contribution of screening versus treatment on improvements in cancer mortality, we can more effectively focus cancer care.

**Objective.**  To assess how much of the gain in life expectancy over time among cancer patients resulted from shifts in the stage of diagnosis versus improvements in mortality rates from cancer and competing causes of death.

**Design, Setting, and Participants.** Retrospective cohort evaluation of N patients aged 40-84 years diagnosed with breast, colorectal, lung, prostate, and 8 other leading cancers; 1973-2011; using the US Surveillance, Epidemiology, and End Results registries.

**Main Outcomes and Measures. The gain in life expectancy over time that resulted from shifts in the stage at diagnosis, improvements in mortality rates from cancer, and improvements in mortality rates from other causes of death.**

**Results:**  Life expectancy for breast cancer patients increased by 13.4 years between 1973 and 2001: 30.6% from shifts to earlier stages at diagnosis, 48.5% from improvements in breast cancer mortality rates, and 20.1% from improvements in mortality rates of other diseases. Most of the 7.4-year gain in life expectancy for colorectal cancer patients over this time period resulted from reductions in colorectal cancer mortality rates (70.3%), rather than stage shift (20.3%).

We observed a more modest gain of 3.6 years in life expectancy for prostate cancer patients: 19.4% from stage shift, 19.4% from improvements in prostate cancer mortality, and 61.1% from improvements in mortality of other diseases.

**Conclusions and Relevance. Life expectancy for cancer patients primarily increased because of improvements in treatment of cancer, rather than screening.**

**INTRODUCTION**

**What do we know**

Since peak mortality in 1989, breast cancer mortality rates in the United States declined by 35%.1 This reduction likely resulted from a combination of advancements in prevention, screening, and treatment. Each of these factors has become the subject of intense controversy, especially screening and treatment. Medical researchers now question the previously held dogmatic belief that mammography screening saves lives by detecting cancer at earlier and more treatable stages. Similarly, pharmaceutical and medical equipment companies face harsh criticism over whether the potentially small gain in life expectancy for breast cancer patients justifies the cost of new chemotherapy drugs and surgical devices.

A recent meta-analysis of randomized control trials found that mammography screening reduced breast cancer mortality by 19%.2 Yet, population-based studies conclude far less, if any, benefit in the U.S. or Europe.

Although previous studies identify the benefits of screening and treatment on reductions in cancer mortality rates, we cannot yet accurately measure the individual effect of each.

**2. METHODS**

**2.1 Patient Data**

We obtained incidence and mortality data from the NCI’s Surveillance, Epidemiology, and End Results (SEER) 9 registry database between 1973 and 2011 for the following cancers: bladder, breast, cervical, colorectal, esophageal, head and neck, kidney, lung, lymphoma, melanoma, ovarian, pancreatic, prostate, stomach, and uterine. The SEER 9 registries, which cover ~10% of the US population, form the largest, most representative and longest running national cancer incidence database. SEER captures virtually all of the cancers occurring in the geographic areas covered by the SEER registries; a person’s entry into the registries begins with their diagnosis and ends, if relevant, with their death. We analyzed N cancer cases diagnosed between 1973 and 2011, included only the first matching record for each person, and excluded deaths from cancers identified only by autopsy or death certificate. SEER classifies cancer as the cause of death based on the death certificate, the identity of a primary tumor, and relevant comorbidities. We placed a further requirement: the cancer death must have occurred within 10 years of its diagnosis.3,4 By allowing this 10-year time window between diagnosis and death, we were able to calculate incidence-based mortality rates between 1973 and 2001 for N incident cancer cases.

An incidence-based mortality rate for a specific cohort of newly diagnosed cancer patients equals the ratio of [1] the number of cancer deaths occurring for this cohort up to 10 years beyond their diagnosis and [2] the total number of person-years lived by this cohort, up to 10 years. For example, 1301women aged 65-69 years were diagnosed with localized breast cancer in 2001. Between 2001 and 2011, 66 of these women died of breast cancer and another 207 died of a competing cause of death. This entire cohort lived a total of 11,591 person-years over the 10-year period. Thus, the incidence-based mortality rate equaled 66/11,591 for cancer and 207/11,591 for competing causes of death. We calculated incidence-based mortality rates by age group at diagnosis (40-44 years to 80-84 years), sex, year of diagnosis (1973-2011), cancer type, stage (in situ, localized, regional, and distant), and cause of death (specific cancer and competing cause of death). Proportion.

**RESULTS**

**DISCUSSION**

**REFERENCES**