Life Expectancy and its Relationship to Urologic Cancers

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JOHNS HOPKINS

MEDICINE

Why is it an Important Topic

- Life expectancy is not always obviously apparent
- Some assessment is vital for evidence based guidelines
  - treatment options especially when considering expectant management
  - Screening – when do the risks outweigh the benefits
  - Tracking outcomes
    - People are living longer – thus current models do not always apply for future populations
- Health care professionals are generally not very good at estimating life expectancy
  - Major issue for older patients
  - Older patients are selected to live longer

Health Care Professionals Underestimate the Mean Life Expectancy of Older People

R. Wirth[a, b] C.C. Sieber[b, c]

- 206 health care professionals estimating the mean life expectancy of older subjects at 0, 70, 80 90 years
  - Underestimated by average 20% for patients older patients (>70)

Gerontology
International Journal of Experimental, Clinical Behavioural, Regenerative and Technological Gerontology

Lecture Outline

- What is life expectancy and how is it defined
- What are the different ways to calculate it
  - Life tables
  - Actuarial view
  - Co-morbidity indices
- Life Expectancy Trends in the US
- Urologic Malignancies
  - Influence of life expectancy on management
  - How changing life expectancy influences outcomes

Life expectancy

- The average number of years a newborn is expected to live with current mortality patterns remaining the same.
- **Not the average age an adult could expect to live**

Traditional Ways to Assess Life Expectancy

- Using Actuary formulas
  - Highly complicated – mainly for insurance purposes

$$e_x = \mathrm{E}[K(x)] = \sum_{k=0}^{\infty} k \cdot \Pr(K(x) = k) = \sum_{k=0}^{\infty} k \ {}_kp_x \ q_{x+k}.$$

- From a life table
  - Age
  - Sex
  - race
- Life tables with co-morbidities
  - Charlson co-morbidity index
  - Self reported health

Period Life Table, 2020, as used in the 2023 Trustees Report

Exact age	Male			Female		
	Death probability [a]	Number of lives [b]	Life expectancy	Death probability [a]	Number of lives [b]	Life expectancy
0	0.005837	100,000	74.12	0.004907	100,000	79.78
65	0.018943	76,434	16.94	0.011265	86,032	19.66
66	0.020103	74,986	16.26	0.012069	85,063	18.88
67	0.021345	73,479	15.58	0.012988	84,037	18.10
68	0.022750	71,910	14.91	0.014032	82,945	17.34
69	0.024325	70,274	14.24	0.015217	81,781	16.58
70	0.026137	68,565	13.59	0.016634	80,537	15.82
71	0.028125	66,773	12.94	0.018294	79,197	15.08
72	0.030438	64,895	12.30	0.020175	77,748	14.36
73	0.033249	62,919	11.67	0.022321	76,180	13.64
74	0.036975	60,827	11.05	0.025030	74,479	12.94
75	0.040633	58,578	10.46	0.027715	72,615	12.26
76	0.044710	56,198	9.88	0.030631	70,603	11.60
77	0.049152	53,685	9.32	0.033900	68,440	10.95
78	0.054265	51,047	8.77	0.037831	66,120	10.31
79	0.059658	48,277	8.25	0.042249	63,618	9.70

- National Vital Statistics Annual Report
- Does **not** incorporate health status

Annals of Internal Medicine | ORIGINAL RESEARCH

Comorbidity-Adjusted Life Expectancy: A New Tool to Inform Recommendations for Optimal Screening Strategies

Hyunsoon Cho, PhD; Carrie N. Klabunde, PhD; K. Robin Yabroff, PhD, MBA; Zhuoqiao Wang, MS; Angela Meekins, BS; Iris Lansdorp-Vogelaar, PhD; and Angela B. Mariotto, PhD

- Sample of medicare patients (usually 65 and older)
- Most common co-morbidities
  - Diabetes
  - COPD
  - CHF

- Estimated life expectancy at age 75 years
  - 3 years longer for persons with no comorbid conditions
  - 3 years shorter for those with high comorbidities

2013

Most Significant Co-Morbidities

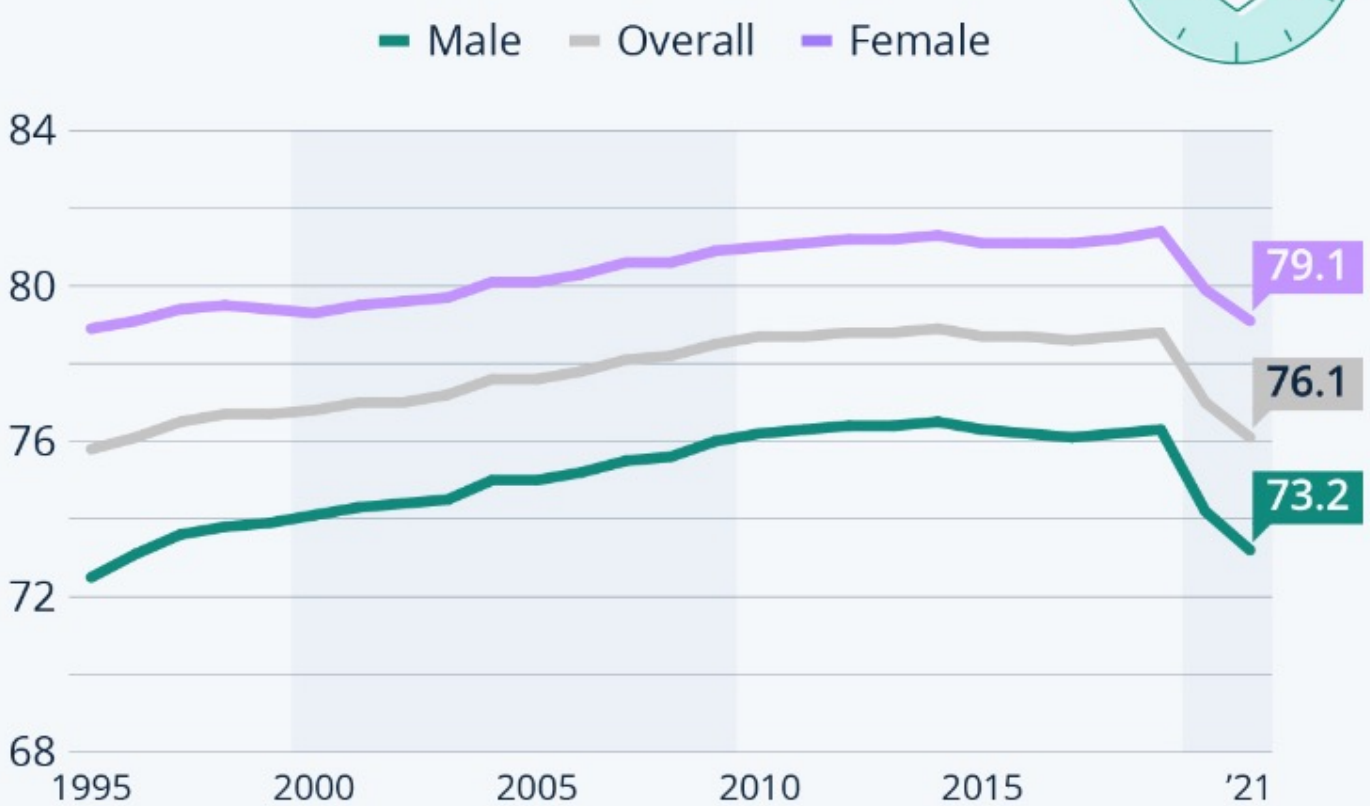
- Decreasing hazard index
  - AIDS
  - Cirrhosis
  - Dementia
  - Chronic Renal Failure
  - Moderate/severe liver disease
  - CHF
  - COPD
  - CVD
  - Paralysis
  - Diabetes
  - Rheumatologic disease

Life Expectancy Trends

- Years of steady increase due to improvement in death rates due to decreased rate of death from cardiovascular disease
  - Smoking cessation
  - Other factors with improved care
- Recent decrease in life expectancy
  - Obvious decrease during Covid years

U.S. Life Expectancy Hits Lowest Point Since 1996

Overall life expectancy at birth in years



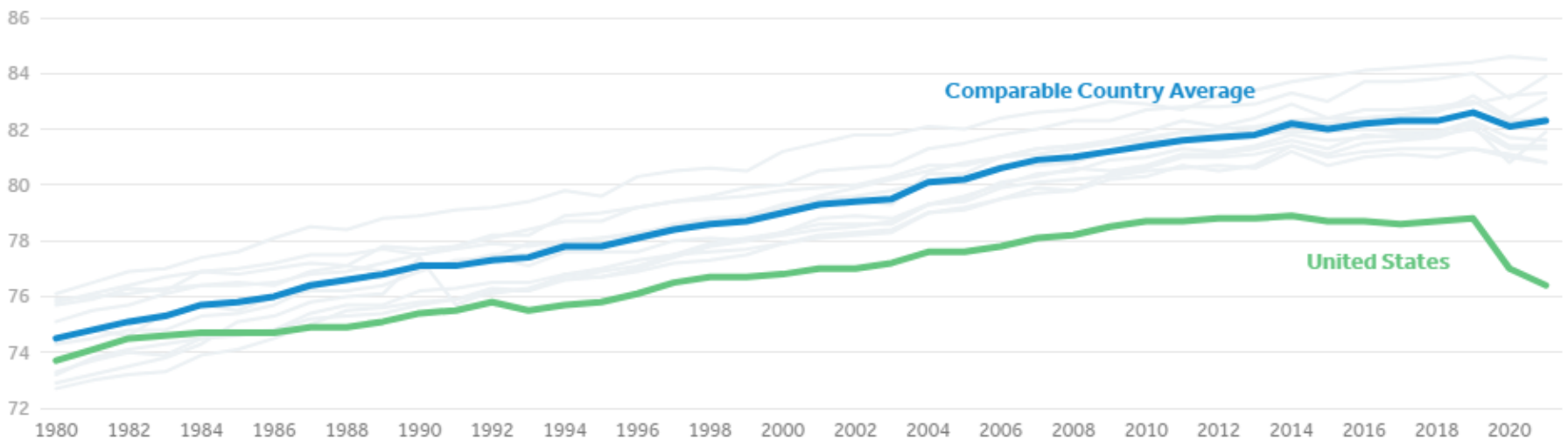
Source: National Vital Statistics System, National Center for Health Statistics

Health & Wellbeing

How does U.S. life expectancy compare to other countries?

By Shameek Rakshit,
Matthew McGough,
Krutika Amin, and Cynthia Cox
KFF

Life expectancy at birth, in years, 1980-2021



Notes: Comparable countries include Australia, Austria, Belgium, Canada, France, Germany, Japan, the Netherlands, Sweden, Switzerland, and the U.K. See Methods section of "How does U.S. life expectancy compare to other countries?"

Source: KFF analysis of OECD and U.K. Office for Health Improvement and Disparities data • Get the data • PNG

Peterson-KFF
Health System Tracker

Is there something beyond COVID going on in US?

The top 10 causes of death accounted for almost 75% of all deaths in the U.S. in 2021.

1. Heart disease (695,547)
2. Cancer (605,213)
3. COVID-19 (416,893)
4. Accidents (224,935)
5. Stroke (162,890)
6. Chronic lower respiratory diseases (142,342)
7. Alzheimer’s disease (119,399)
8. Diabetes (103,294)
9. Chronic liver disease and cirrhosis (56,585)
10. Kidney disease (54,358)

•

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION
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Heart Disease and Stroke Statistics—2011 Update : A Report From the American Heart Association

- The 2007 overall death rate from CVD *was 251.2 per* 100 000.
- From 1997 to 2007, the death rate from CVD declined 27.8%
  - 47% from increased use of evidence-based medical therapies
  - 44% to changes in risk factors in the population due to lifestyle and environmental changes

Causes of Death 1980 and 2019 - CDC

Sex, race, Hispanic origin, and rank order	1980		2019	
	Cause of death	Deaths	Cause of death	Deaths
65 years and over				
Rank	All causes	1,341,848	All causes	2,117,332
1	Diseases of heart	595,406	Diseases of heart	531,583
2	Malignant neoplasms	258,389	Malignant neoplasms	435,462
3	Cerebrovascular diseases	146,417	Chronic lower respiratory diseases[1,2]	133,246
4	Pneumonia and influenza[1]	45,512	Cerebrovascular diseases	129,193
5	Chronic obstructive pulmonary diseases[2]	43,587	Alzheimer's disease	120,090
6	Atherosclerosis	28,081	Diabetes mellitus[3]	62,397
7	Diabetes mellitus	25,216	Unintentional injuries	60,527
8	Unintentional injuries	24,844	Nephritis, nephrotic syndrome and nephrosis[3]	42,230
9	Nephritis, nephrotic syndrome and nephrosis	12,968	Influenza and pneumonia[1]	40,399
10	Chronic liver disease and cirrhosis	9,519	Parkinson's disease	34,435

- Higher percentage of patients dying of cancer
- Patients who used to die of heart disease in their 70's now are dying of cancer in 80's

How does this relate to urologic cancers?

- Management of which cancers are greatly affected by life expectancy

Importance of Life Expectancy

- Non cancer life expectancy is vital when making clinical decisions for current cancer diagnosis
- Considerations for screening especially for prostate cancer

Most Common Urologic Cancers

- Urothelial – Bladder/upper tract
- Testis
- Kidney
- Prostate

Factors

- Age distribution of malignancy
- Prognosis of cancer
- Likelihood of causing symptoms requiring treatment regardless of long-term prognosis

Urothelial – Bladder/Upper tract

- Likely to affect older population
- Rarely asymptomatic
  - Hematuria
  - Urinary obstruction
- High grade/stage disease can rapidly progress and lead to cancer related morbidity and mortality

Table 8. Five-year Relative Survival Rates* (%) by Stage at Diagnosis, US, 2011-2017

	All stages	Local	Regional	Distant		All stages	Local	Regional	Distant
Breast (female)	90	99	86	29	Oral cavity & pharynx	67	85	68	40
Colon & rectum	65	91	72	15	Ovary	49	93	75	30
Colon	64	91	72	14	Pancreas	11	42	14	3
Rectum	67	90	73	17	Prostate	98	>99	>99	31
Esophagus	20	46	26	5	Stomach	32	70	32	6
Kidney†	76	93	71	14	Testis	95	99	96	73
Larynx	61	78	46	34	Thyroid	98	>99	98	53
Liver‡	20	35	12	3	Urinary bladder§	77	70	38	6
Lung & bronchus	22	60	33	6	Uterine cervix	66	92	58	18
Melanoma of the skin	93	99	68	30	Uterine corpus	81	95	69	18

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 18 areas from 2011-2017, all followed through 2018. Rates by stage reflect Combined Summary Stage 2004+ except for testicular cancer, which is based on Combined Summary Stage 2000 (2004-2017). †Includes renal pelvis. ‡Includes intrahepatic bile duct. §Rate for in situ cases is 96%.

Local: an invasive malignant cancer confined entirely to the organ of origin. **Regional:** a malignant cancer that 1) has extended beyond the limits of the organ of origin directly into surrounding organs or tissues; 2) involves regional lymph nodes; or 3) has both regional extension and involvement of regional lymph nodes. **Distant:** a malignant cancer that has spread to parts of the body remote from the primary tumor either by direct extension or by discontinuous metastasis to distant organs, tissues, or via the lymphatic system to distant lymph nodes.

Sources: SEER*Explorer, National Cancer Institute, 2021. Available from https://seer.cancer.gov/explorer/. Testicular cancer survival by stage was calculated using SEER*Stat software (version 8.3.9), National Cancer Institute, 2021.

Urothelial – Bladder/Upper tract

- Patients usually require treatment regardless of age
- Autopsy studies show that this malignancy is almost never incidentally discovered

Testis Cancer

- Likely to affect younger population
- Disease progression rapid
- Not likely to be incidental finding
- With few exceptions, almost always needs to treat due to
  - young age at diagnosis
  - aggressive nature if left to follow natural course

Kidney Cancer

- Likely to affect older population
- Commonly asymptomatic – usually discovered as incidental finding
- Varying biologic potential
  - Small masses rarely progress to systemic disease while larger can follow more aggressive course
- Life expectancy is large part of the decision for treatment options i.e.. active surveillance

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Kidney Cancer

- Tumor size and stage very important when making decisions
- Small T1 tumors highly unlikely to cause problems within following 5 years
  - Strongly supports active surveillance in older patients with limited 5-10 year life expectancy
- Larger/higher stage tumors have high chance of progression in short period of time
- Symptomatic tumors (ie gross hematuria) may need to be treated even in face of short life expectancy

Prostate Cancer

- Mostly in older population
- Commonly asymptomatic – symptoms only with advanced disease
- Both advanced and local cancer have high 5 year survival
- Disease progression is variable with most cancers not rapidly progressing
- Autopsy data shows common finding in men of advanced age
- Life expectancy is definitely a major factor for treatment and screening

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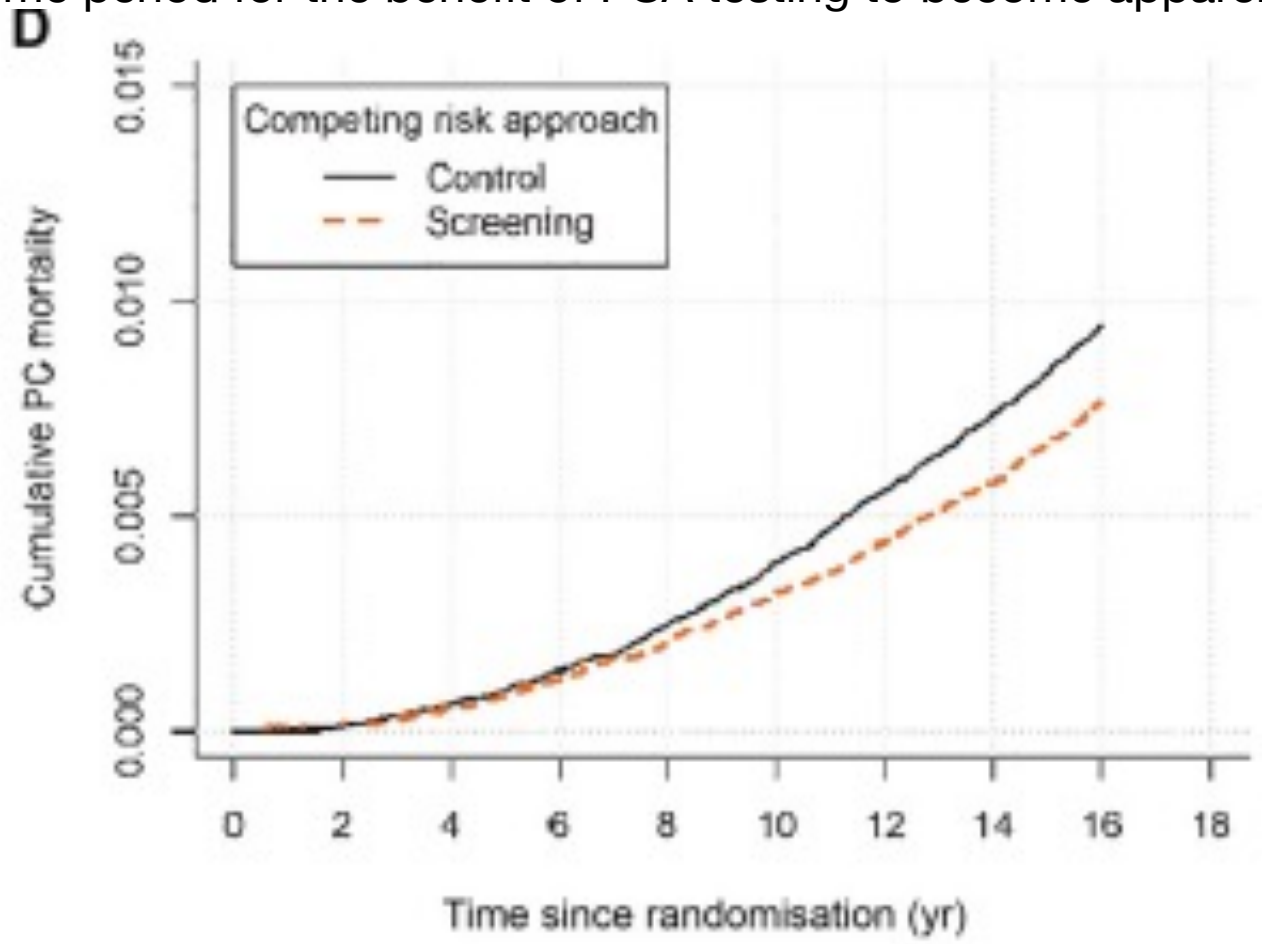
European Association of Urology

Platinum Priority – Prostate Cancer – Editor's Choice
Editorial by Gunnar Steineck, Olof Akre and Anna Bill-Axelson on pp. 52–53 of this issue

A 16-yr Follow-up of the European Randomized study of Screening for Prostate Cancer

Time period for the benefit of PSA testing to become apparent



PSA screening and life expectancy

- Patients should have 7 year life expectancy to see survival benefits of prostate cancer screening
- Patients diagnosed with CAP from screening
  - short life expectancy are highly unlikely to see benefits and may have worse quality of life as a result
  - Medium and long-term quality of life may be improved with screening with the prevention of advanced disease

Conclusion

- Life expectancy rather than chronologic age should used assessing cancer patient
- Life expectancy is not always readily apparent and except for Covid pandemic have been steadily increasing for decades
- Physicians tend to underestimate the life expectancy of older patients
- Multiple ways to assess but life tables are useful tools
- Clinicians should consider interventions by comparing the risk of disease progression/morbidity/mortality with reasonable life expectancy

Case 1

- 75 year old male presented in 1998 with rise psa 2.6, 4.0, 5.0 over three year period. PSA done against advice of primary care.
- PMH unremarkable
- FH – parents lived to 96 and 92
- Requested referral to urologist
- Biopsy – 5 cores Gleasons 4+3
- Recommended EBRT but decided on RRP 1998
- Path – organ confined
- NED for 24 years
- Died - 2023 NED

Case 2

- 92 year old male presents 9/2022 with 3 month history of weight loss and hip pain. Rode bike 12 miles/ day 4 months prior. Told to stop PSA testing at age 72.
- PMH – none
- PSA – 2600
- Biopsy – all cores Gleason 4+3 and 4+4
- PSMA CT – diffuse metastatic disease to lymph nodes and bone
- Responded to hormone therapy (PSA 2.5) and but unable to ambulate without walker
- In home hospice

Case 1

Case 2

Prostate cancer screening

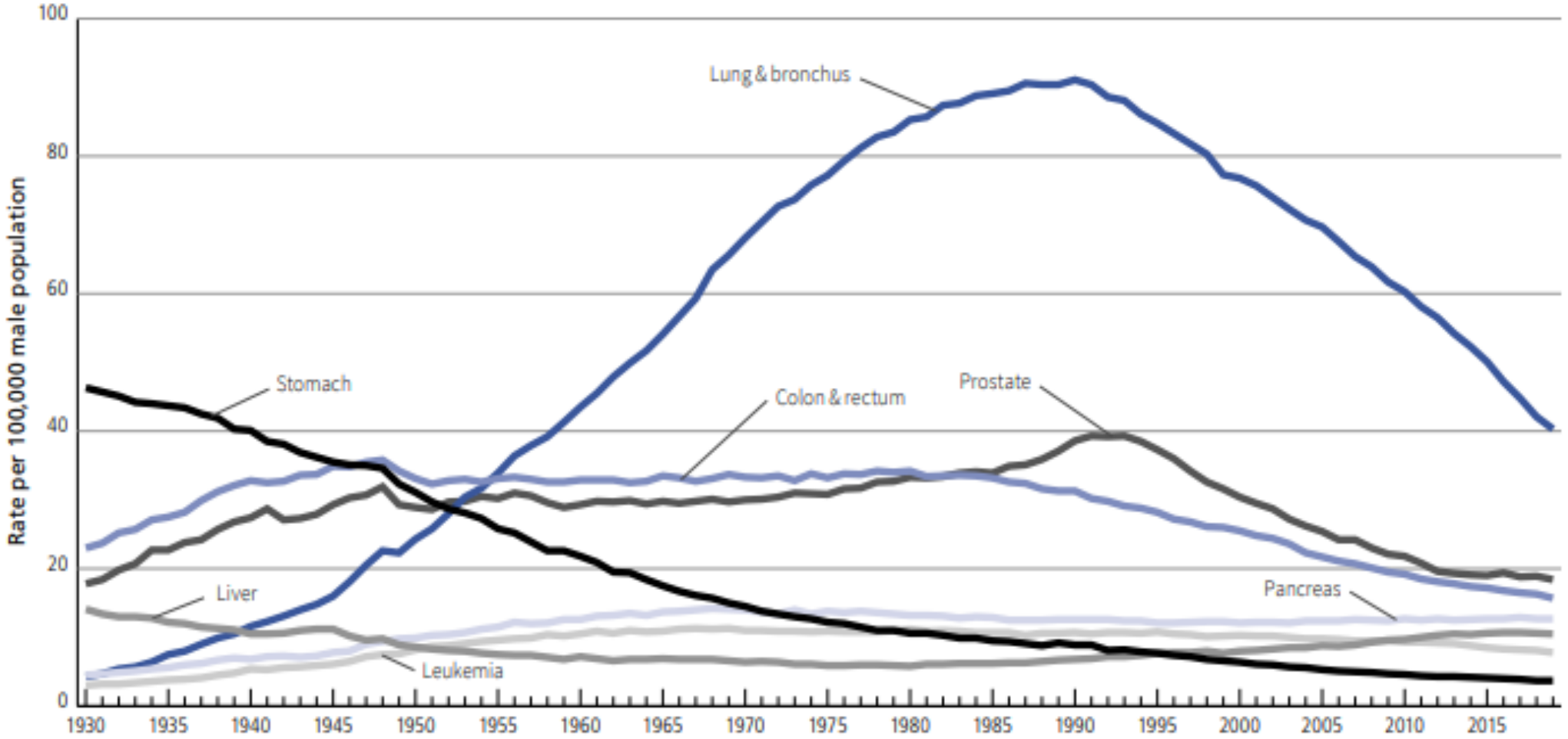
- Overall risk of prostate cancer (2010-1015) has decreased (SEER)
  - Particularly for low risk disease
- Incidence of metastatic disease has increased
  - 6.2 to 7.1 per 100,000; 50 – 74 years
  - 16.8 to 22.6 per 100,000; 50 > 74 years
- Declining incidence was attributed to 2012 USPSTF recommendations against screening
- After 2015 incidence of prostate cancer show stabilization in incidence of low risk disease
- USPTF screening changed to C rating 2015

Jemal et al. JAMA, 2015

PSA testing and life expectancy

- Testing can only be expected to prevent prostate cancer death that would have occurred more than 7 years in the future.
- If prostate cancer is diagnosed after the test, medium- to long-term quality of life may be better due to diagnosis and treatment of a cancer that could have become advanced in less than 7 years.
- If prostate cancer is diagnosed after the test, quality of life in the immediate short term may be poorer due to the harmful effects of treatment.

Figure 1. Trends in Age-adjusted Cancer Death Rates* by Site, Males, US, 1930-2019



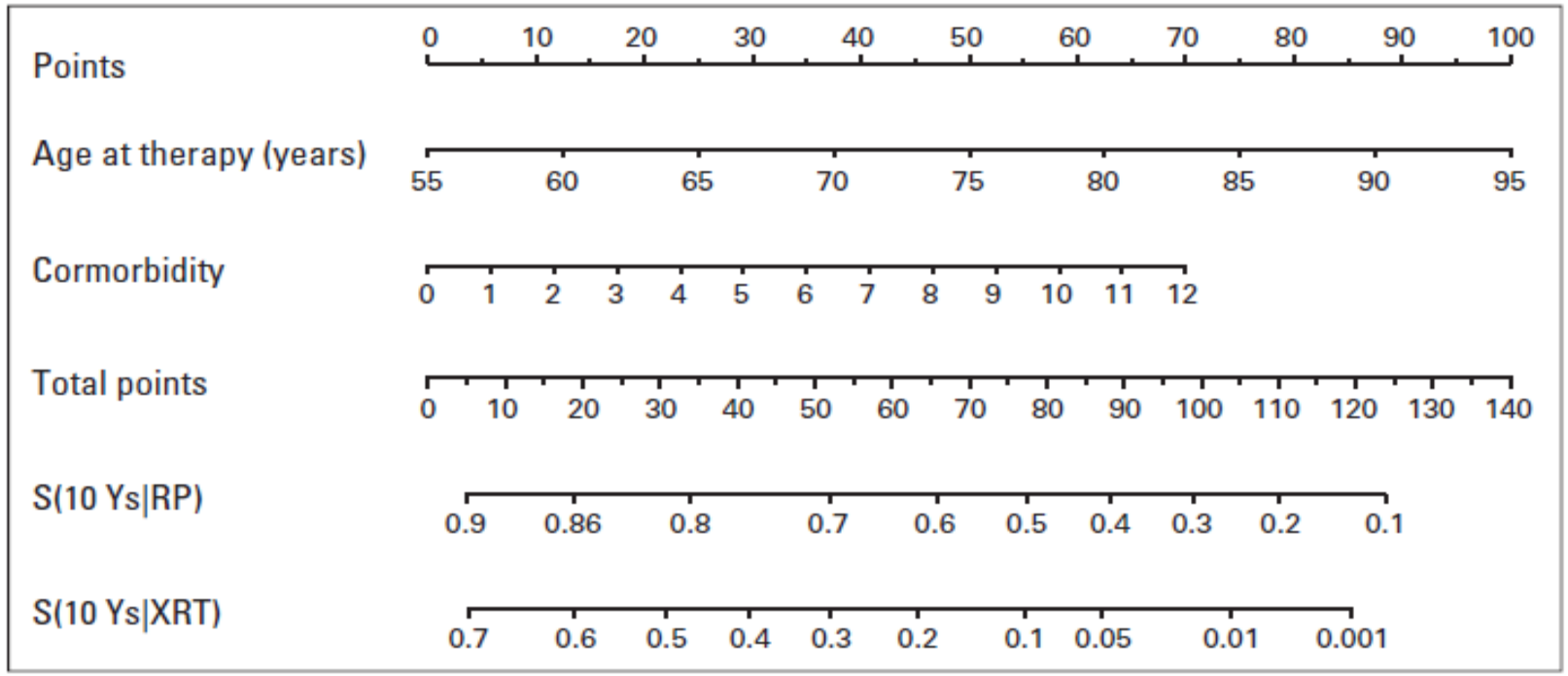
*Per 100,000, age adjusted to the 2000 US standard population. Note: Due to changes in ICD coding, numerator information has changed over time. Rates for cancers of the liver, lung and bronchus, and colon and rectum are affected by these coding changes.

Source: US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2019, National Center for Health Statistics, Centers for Disease Control and Prevention.

A Nomogram Predicting 10-Year Life Expectancy in Candidates for Radical Prostatectomy or Radiotherapy for Prostate Cancer

Jochen Walz, Andrea Gallina, Fred Saad, Francesco Montorsi, Paul Perrotte, Shahrokh F. Shariat, Claudio Jeldres, Markus Graefen, Francois Bénard, Michael McCormack, Luc Valiquette, and Pierre I. Karakiewicz

- Based on 9131 men with prostate cancer
- Uses Charlson co-morbidity index

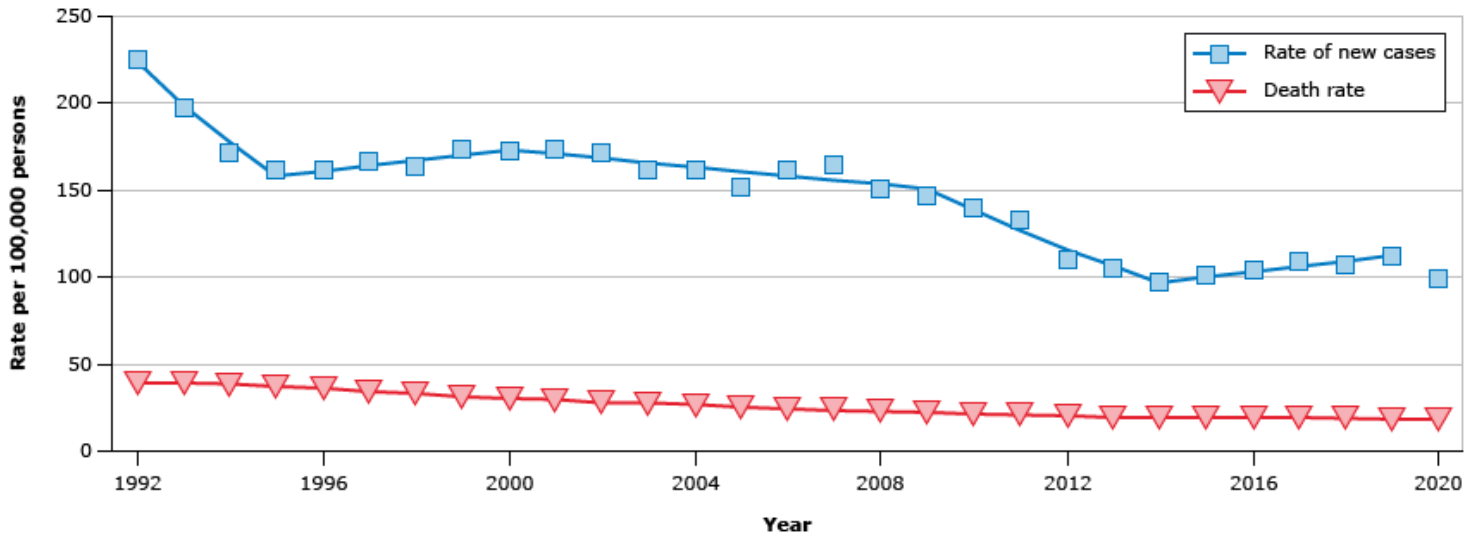


JOURNAL OF CLINICAL ONCOLOGY

Management of Aging Population

- Competing chronic conditions, prognosis and quality of life issues make life expectancy vital in decision making

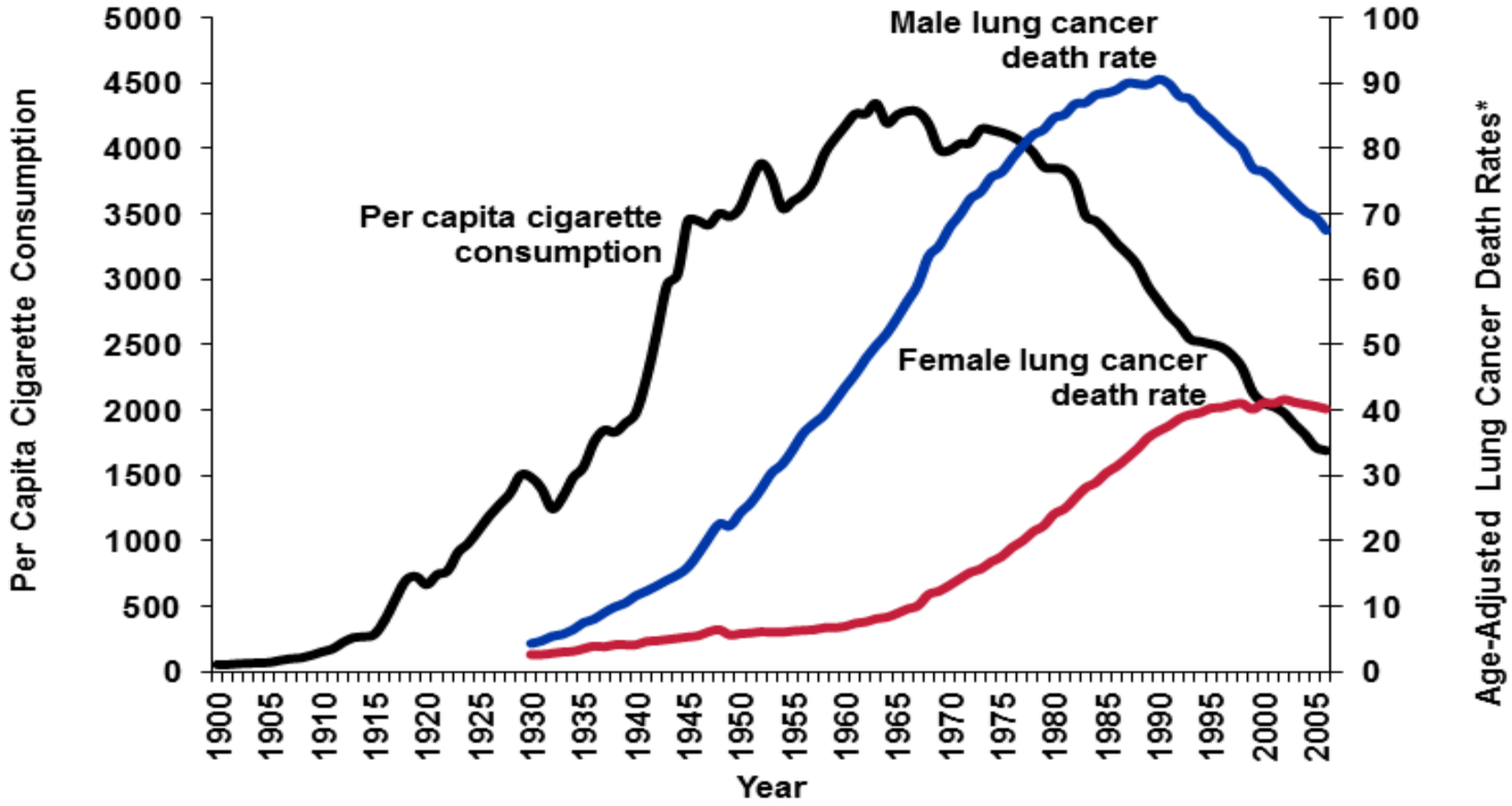
Prostate cancer: Changes over time in average annual age-adjusted incidence and mortality rates in the United States, 1992 to 2020



Incidence of prostate cancer in the United States (US) during the widespread use of screening with prostate-specific antigen (PSA). New cases come from SEER 9 Incidence. Deaths come from US mortality, 1992 to 2020, all races, males. Rates are age-adjusted. Modeled trend lines were calculated from the underlying rates using the Joinpoint Trend Analysis Software.

Reproduced from: Cancer Stat Facts: Prostate Cancer. Surveillance Epidemiology and End Results (SEER) Program. National Cancer Institute. Available at: https://seer.cancer.gov/statfacts/html/prost.html (Accessed on April 5, 2023).

Tobacco Use in the US, 1900-2006



*Age-adjusted to 2000 US standard population.

Source: Death rates: US Mortality Data, 1960-2006, US Mortality Volumes, 1930-1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2009. Cigarette consumption: US Department of Agriculture, 1900-2007.

Top Factors Contributing to Cardiovascular Disease

- Hypertension
- Tobacco
- Serum Cholesterol >260
- Diabetes Mellitus
- Obesity
- Activity level

Nothing is more fatal to health than over care of it.

Ben Franklin

ACCURACY OF SURVIVAL PREDICTION BY PALLIATIVE RADIATION ONCOLOGISTS

EDWARD CHOW, M.B.B.S., M.SC., F.R.C.P.C.,* LORI DAVIS, PH.D.,* TONY PANZARELLA, M.SC.,†
CHARLES HAYTER, M.D.,* EWA SZUMACHER, M.D.,* ANDREW LOBLAW, M.D.,*
REBECCA WONG, M.D.,† AND CYRIL DANJOUX, M.D.*

Purpose: To examine the accuracy of survival prediction by palliative radiation oncologists.
Methods and Materials: After consultation of cancer patients with metastatic disease for referral of palliative radiotherapy, radiation oncologists estimated the survival of the patients. These were compared with the actual dates of death obtained from the Cancer Death Registry. The time to death from all causes was the outcome. The survival times were measured from the date of the first consultation at the palliative radiotherapy clinics.
Results: Six radiation oncologists provided estimates for 739 patients. Of the 739 patients, 396 were men and 343 were women (median age, 69 years). The median survival of all patien[redacted] 15.9 weeks. The mean difference between the actual survival (AS) and the clinician predicted survival (i.e., actual survival minus clinician predicted surviv[redacted]s −12.3 weeks (95% confidence interval, −15.0 to −9.5) for the entire population. The mean difference was −21.9 weeks when the actual survival was ≤12 weeks, −19.2 weeks when the AS was 13–26 weeks, −9.7 weeks when the AS was 27–52 weeks, and +23.0 weeks when the AS was >52 weeks.
Conclusion: In this study, the prediction of survival by radiation oncologists was inaccurate and tended to be overly optimistic.