

---

# Estimating the impact of cancer on working age adults

Cathy J. Bradley, PhD.

---

The research was supported by NCI grant R01-CA86045.

---

# Two Lines of Inquiry

- Estimate the extent to which cancer influences a transition from employment to non-employment or causes absenteeism from work.
    - Patient and family
    - Employer
  - Value of Loss Productivity.
    - Societal loss
-

---

# Relevant policy questions following each type of research

- What is the impact of cancer on working age individuals?
    - Used to better understand the needs of cancer survivors (e.g., rehabilitation, protective legislation).
    - Used to understand the impact of trade-offs and incentives of policies such as employment-based health insurance on cancer patients.
-

---

# Relevant policy questions following each type of research

- What is the value of productivity loss due premature death from cancer?
    - Used to inform cost-effectiveness analysis.
    - Used for priority setting (e.g., some cancers result in greater productivity losses than others) in making investments in cancer treatment.
-

---

# Impact of cancer on working age adults — Overview

- Due to a national emphasis on early stage cancer detection and screening aimed at working age people, individuals are likely to bear the consequences of cancer during their working years.
  - For most people diagnosed with cancer, work is a financial and to some extent, an emotional, necessity.
  - Workers are likely unprepared for the considerable trade-offs between work and treatment that are often required when cancer is detected.
-

---

# Physician-patient treatment discussions exclude work demands

- The effects of cancer and its treatment on work were not discussed between cancer patients and their physicians.
  - Physicians likely choose the best course of treatment under the assumption that patients can dedicate themselves exclusively to treatment and recovery.
-

---

# Impact of cancer on working age adults — Labor Market Outcomes Study

- Longitudinal assessment of the employment situations of nearly 500 women newly diagnosed with breast cancer and 300 men newly diagnosed with prostate cancer.
  - Data collected 2001 through 2003 in the Detroit Metropolitan Area.
-

---

# Study design

- Population-based enrollment of newly diagnosed patients.
  - Adults employed prior to diagnosis.
  - Inclusion of a non-cancer control group from a secondary dataset.
  - Sufficient sample size to statistically distinguish between employment changes in the cancer and control groups.
-

---

# Role of the control group

- Causal effect of cancer can only be inferred if people with the disease make labor supply changes at a higher rate than the control sample.
  - Labor market conditions over the course of the study can confound the effects of cancer.
-

---

# Study sample

- Study sample from the Detroit Surveillance Epidemiology and End Results (SEER) program.
    - 496 women with breast cancer.
    - 294 men with prostate cancer.
    - Control sample from the Current Population Survey.
  - 4 interviews: 3 months prior to diagnosis (retrospective) and 6, 12, and 18 months following diagnosis.
-

---

# Control Sample — Current Population Survey

- Can match respondents from one survey to the next (month-in-sample) so that the interview match the primary data collection time span.
  - Not a “perfect” match to a cancer sample.
  - Much less expensive than additional primary data collection.
-

---

# Statistical Issues

- Differences in the cancer and control groups can lead to biased estimates of the effect of cancer.
  - Age, education, and marital status differences were apparent in the two groups.
  - Statistically correct for differences using propensity score methods.
-

---

# Outcomes

- Primary

- Employment
- Hours worked

- Secondary

- Absenteeism
  - Disability
  - Accommodation & discrimination at work
-

---

# Selection

- Dedicated workers remain at work regardless of cancer.
    - Study changes in hours worked.
  - Minimally effected by the disease and/or its treatment.
    - Will bias the negative affect of cancer toward zero.
-

---

# Employment & breast cancer, 6 months post-diagnosis

- 18% less likely to be employed relative to women without cancer (all stages combined).
    - In situ, not statistically different from non-cancer controls
    - 18% less likely to employed if diagnosed with local stage
    - 34% less likely to employed if diagnosed with regional and distant stage
-

---

# Hours worked & breast cancer, 6 months following diagnosis

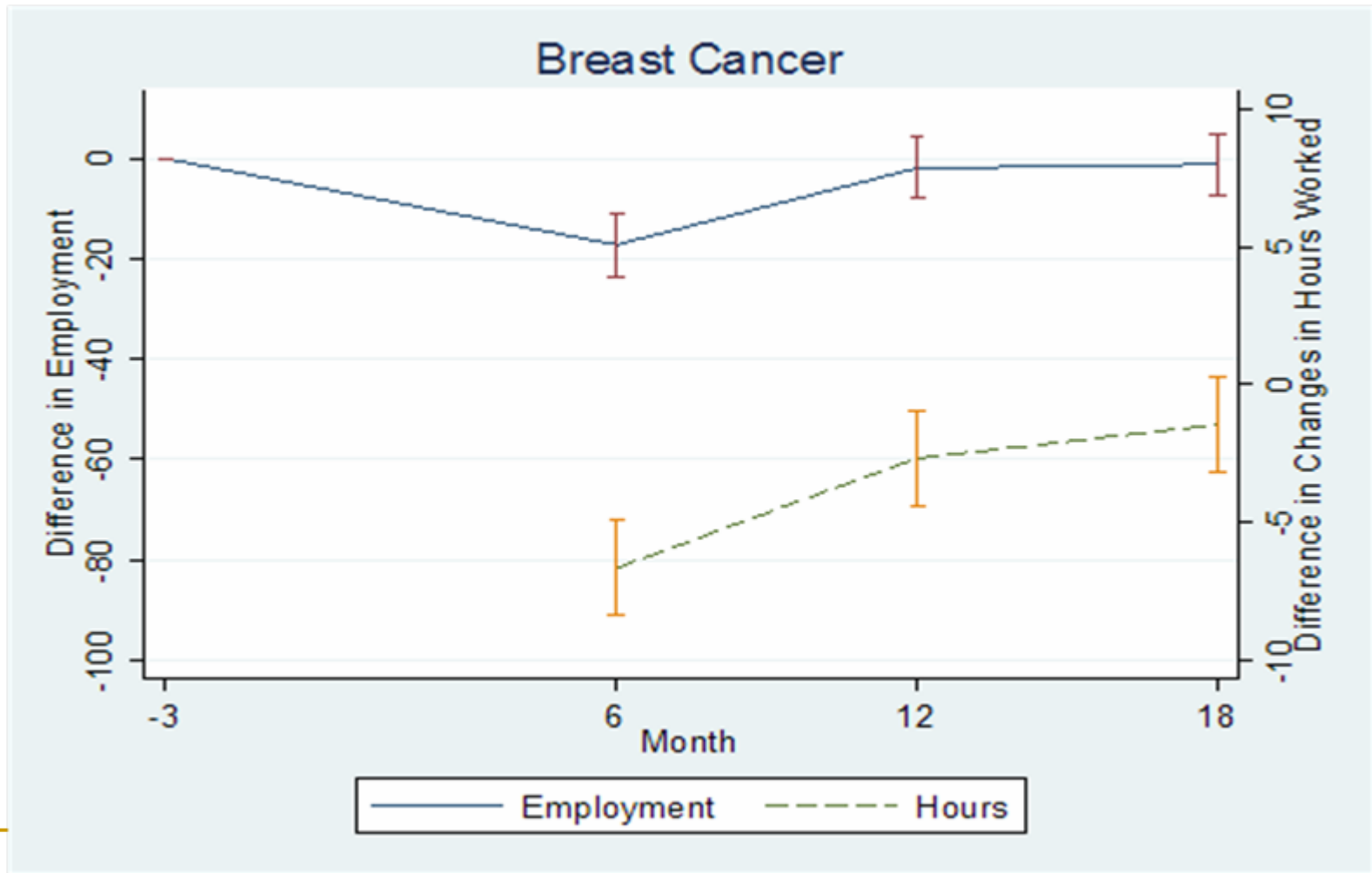
- Among those who remained working, hours worked were lower relative to pre-diagnosis period.
    - 12% lower if diagnosed with in situ stage cancer
    - 18% lower if diagnosed with local stage cancer
    - 28% lower if diagnosed with regional and distant stage cancer
-

---

## 12 & 18 months following diagnosis

- The probability of employment was not statistically significantly different ( $p > .05$ ) for breast cancer patients relative to the control subjects.
  - Weekly hours worked were still slightly lower.
-

Differences in the probabilities of employment and changes in hours worked between breast cancer and control subjects 6, 12, and 18 months following diagnosis

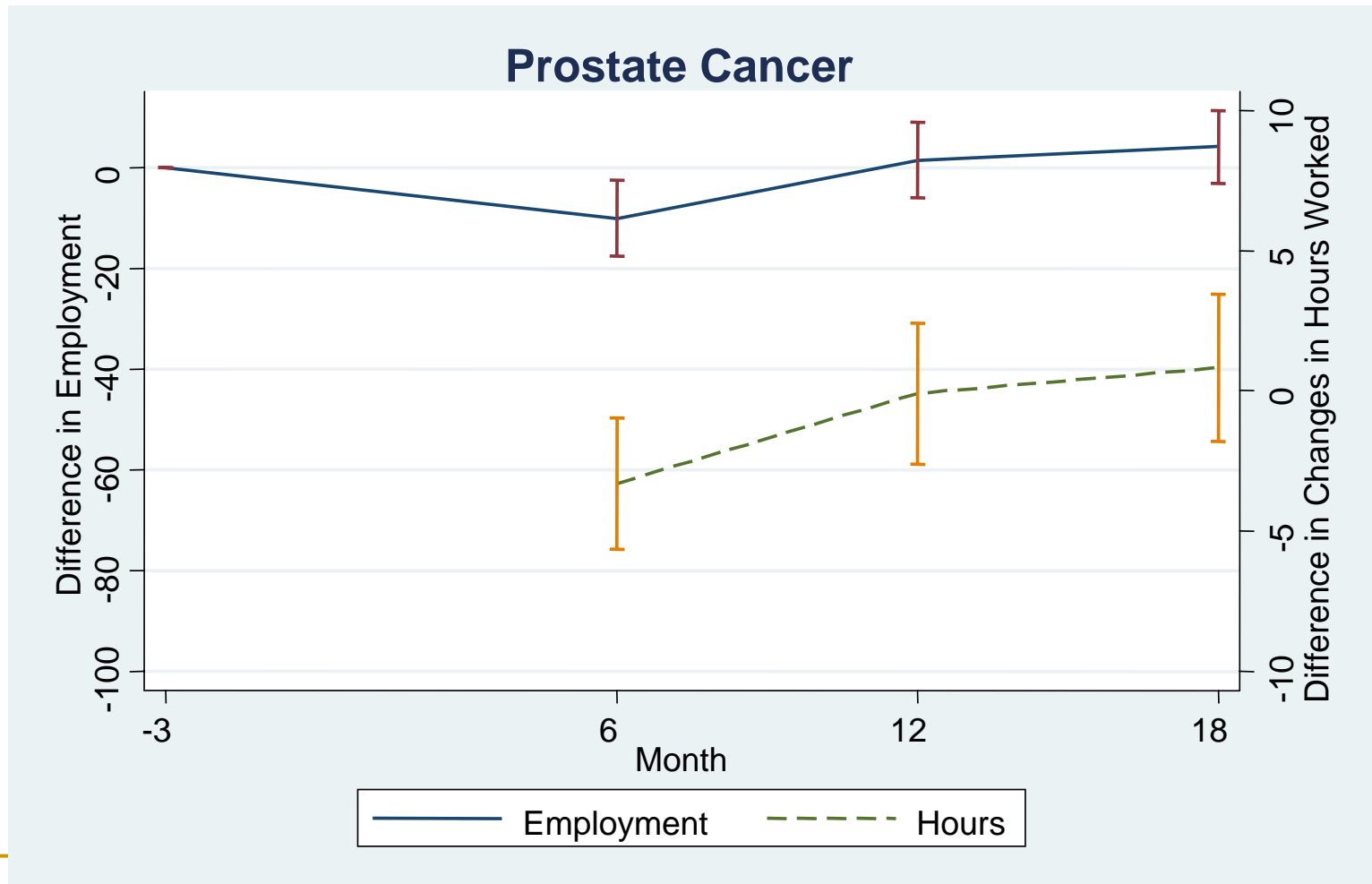


---

# Employment & hours worked, Prostate Cancer

- Relative to men who did not have cancer, men with prostate cancer were 10% less likely to be working 6 months following diagnosis.
    - Retire and leave the workforce altogether.
  - Among those who remained employed, diminished their weekly hours worked by only 3.3 hours less relative to the non-cancer controls.
  - No differences in employment and weekly hours worked at 12 & 18 months following diagnosis.
-

Differences in the probabilities of employment and changes in hours worked between prostate cancer patients and control subjects 6, 12, and 18 months following diagnosis



---

# Absenteeism among those who continue to work

- Breast cancer

- Missed an average 44.5 days from work and the median number of days they missed was 22.

- Prostate cancer

- Missed an average of 27 days from work and the median missed days for men treated surgically was 25.
-

---

# Employer accommodation and discrimination

- Nearly 90% of breast cancer patients and 85% of prostate cancer patients reported that their employer was accommodating to their need for treatment and the time away from work.
  - The perceived willingness of the employer to accommodate their workers' illness and treatment needs was an important predictor for return to work in breast cancer patients.
-

---

# Disability

- Breast cancer
    - 62% report difficulties with physical tasks.
    - 1/3 report difficulties with cognitive tasks.
  - Prostate cancer
    - 22% to 30% report difficulties with physical tasks.
    - 5% to 16% report difficulties with cognitive tasks.
-

## Work-related disabilities experienced by men with prostate cancer and women with breast cancer

Job requirements	Breast cancer				Prostate Cancer			
	No.†	Cancer interfered, No. (%)	95% CI	P value	No.†	Cancer interfered, No. (%)	95% CI	P value
Physical effort	271	134 (49)	(43.49 to 55.40)	<.001	126	33 (26)	(18.51 to 33.87)	<.001
Heavy lifting	145	90 (62)	(54.17 to 69.97)	<.001	74	22 (30)	(19.32 to 40.14)	<.001
Stooping	237	77 (32)	(26.53 to 38.45)	<.001	119	26 (22)	(14.42 to 29.27)	<.001
Concentration	399	123 (31)	(26.30 to 35.36)	<.001	219	26 (12)	(7.52 to 16.01)	.382
Analysis	331	93 (28)	(23.25 to 32.94)	<.001	197	17 (9)	(4.68 to 12.49)	.507
Keeping up with the pace set by others	275	108 (39)	(33.50, 45.04)	<.001	148	23 (16)	(9.70 to 21.38)	.025
Learning new things	355	72 (20)	(15.26 to 23.25)	.717	212	11 (5)	(2.19 to 8.13)	.019

† Number of patients reporting that their job involves the listed task. For example, 271 breast cancer patients and 126 prostate cancer patients report that their job involved physical effort.

---

# Health insurance

- At all time periods, women with breast cancer and health insurance through their spouse's employer were more likely to have quit work than those who depend on their own employer.
    - Trade-offs between treatment and/or recovery and work?
  - These same women reduced their weekly hours worked by more than women who had health insurance through their own employer.
-

---

# Conclusions

- Substantial work loss (non-employment and absenteeism) and disability attributable to cancer 6 months following diagnosis.
    - Disability associated with breast and prostate cancer are most likely to be minimal relative to other sites.
  - Many cancer survivors enter the work force 12 and 18 months following diagnosis.
  - Clear link between work loss and health insurance.
-

---

# Value of Loss Productivity

- Shift from individual to societal level analysis and implications.
  - Human capital approach
    - Estimates earnings loss from premature death from cancer.
  - Population-based
-

---

# Human Capital Method

- Conservative interpretation
    - Costs represent forgone earnings that would have benefited the individual and society had the disease been avoided.
  - Criticism
    - Method is dependent on labor force participation and that it undervalues segments of the society that historically have low wages: women, minorities, volunteers.
  - Other methods: Friction cost method
-

---

# Model Inputs

- Population (age- and sex-adjusted)
    - Average Person Years of Life Lost
    - Person Years of Life Lost
    - Counts of those who die
  - Wages (age- and sex-adjusted)
    - Average over all occupations, race, and education levels.
-

---

# Model Inputs

- Employment rates
    - Percent employed
      - Full- and part-time
    - Percent unemployed (i.e., looking for work)
    - Percent not in the labor force
  - Caregivers
    - Estimate number of people not employed or not in the labor force because they are caregivers (<65 years of age)
    - Estimate number of people 65+ that provide care to another individual, including full-time care
    - Assign a wage to unpaid caregiver time
-

---

# Heroic Assumptions

- Mortality rate remains constant over time.
  - Apply average rate within 5 year age groups.
  - Full-time workers work 52 weeks and part-time workers work 26 weeks.
  - Unpaid caregivers assigned a wage based on annual median earnings for maids & housekeepers, child care workers, & personal & home care aides.
  - Unpaid caregivers older than age 65 that provide constant care assigned a wage based on the average annual cost of nursing home care (\$74,000), which applied to approximately 1% of caregivers.
  - 99% of other older caregivers provide a median of 100 hours of care per year.
-

---

# Less Heroic Assumptions

- Wages beyond 2006 are inflated by the Consumer Price Index.
  - Caregiver wages are the same across age groups (e.g., earnings do not increase with more experience).
  - Percent employed, unemployed, and not in labor force in future years is the average of these rates in 2000 through 2006 (i.e., remains constant from 2006 forward).
-

---

# Data Sources

- U.S. Census Bureau
    - Age- and sex-adjusted population estimates
  - National Cancer Institute
    - Mortality rates
  - U.S. Bureau of Labor Statistics (Current Population Survey)
    - Employment rates & wages
    - Caregivers under age 65
  - Health & Retirement Survey
    - Caregivers age 65 and older
-

---

# Methods

- Examined 16 cancers in women and 18 cancers in men.
  - Life-cycle approach.
  - Estimated future costs in a single year.
    - Discounted future earnings.
  - Provided ability to perform multi-way sensitivity analysis
    - Mortality rates
    - Wages
    - Employment rates
-

---

# Life-cycle Earnings Approach

- All estimates are grouped in 5-year increments.
  - In other studies, it is assumed that the wage an individual earns at the time of death would have remained the same and that an individual's probability of employment would have remained the same.
  - Correct assumption: Wages and labor market participation fluctuate over a lifetime.
-

# Life-Cycle Approach - Example

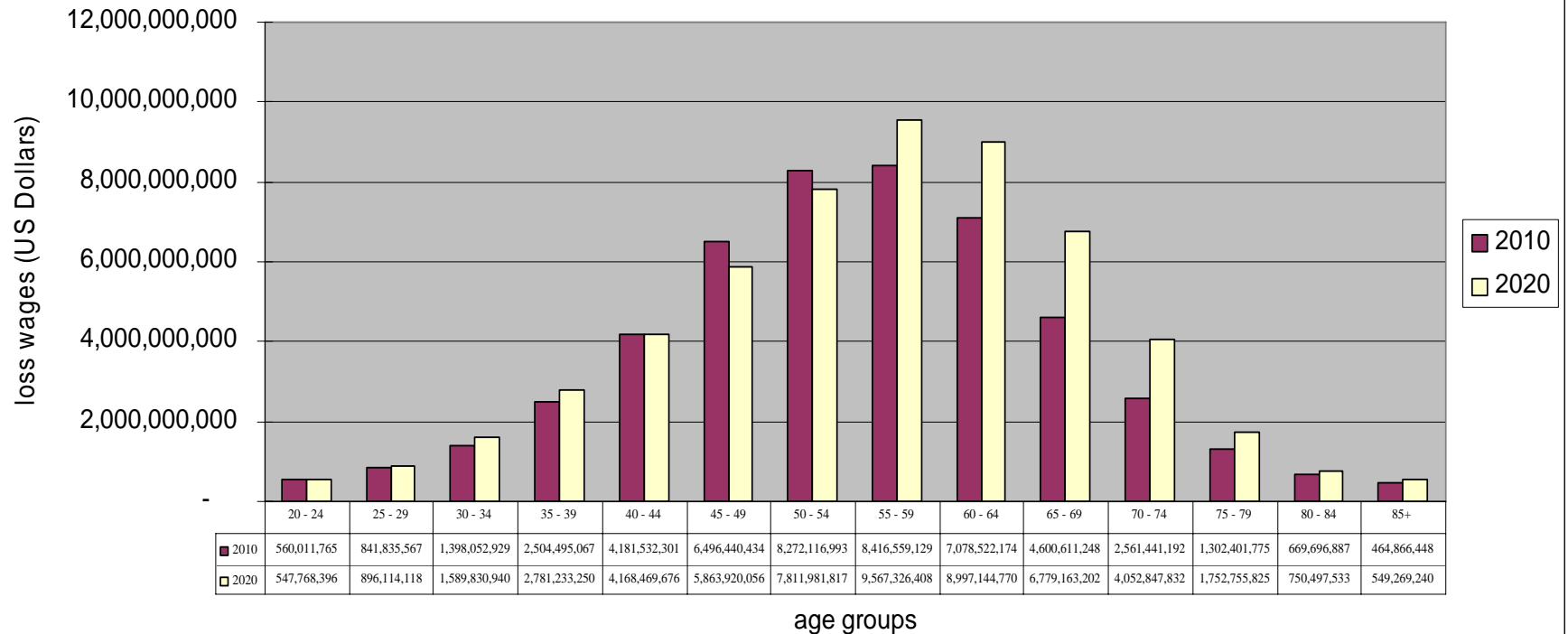
- Females
- At each age group, the percent employed changes, as does the annual wage.
- Need to account for movement between age groups and changes in employment and wages.

Age Group	Employed (%)	Wage (\$)
20 - 24	0.68	19,032
25 - 29	0.74	25,116
30 - 34	0.73	26,260
35 - 39	0.73	26,884
40 - 44	0.76	27,196
45 - 49	0.77	29,380
50 - 54	0.72	29,328
55 - 59	0.60	26,884
60 - 64	0.39	25,428
65 - 69	0.19	20,956
70 - 74	0.10	19,448
75 - 79	0.03	19,448
80 - 84	0.03	19,448
85+	0.03	19,448

# Results – Females 2010 and 2020

(PRELIMINARY DO NOT QUOTE)

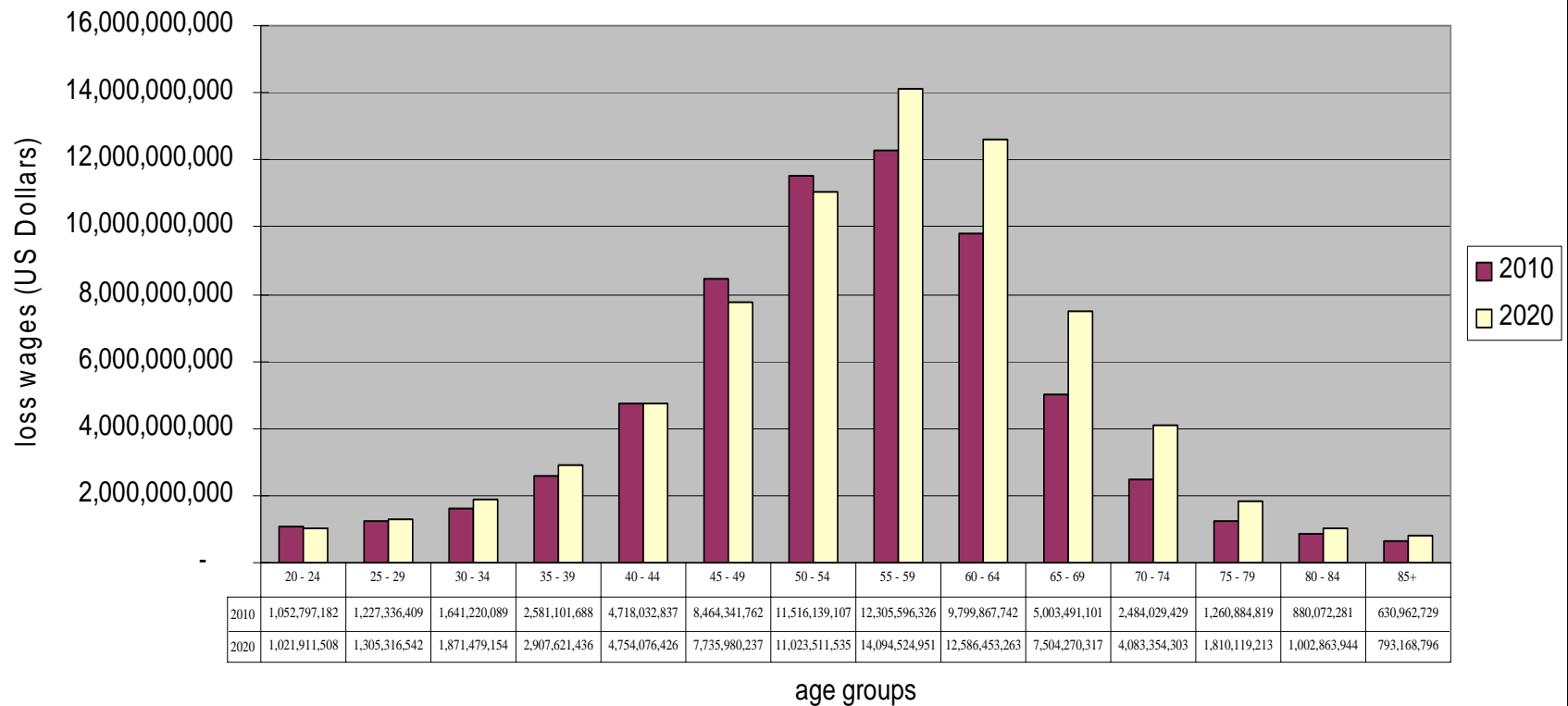
Female: All Malignant Cancers



# Results – Males 2010 and 2020

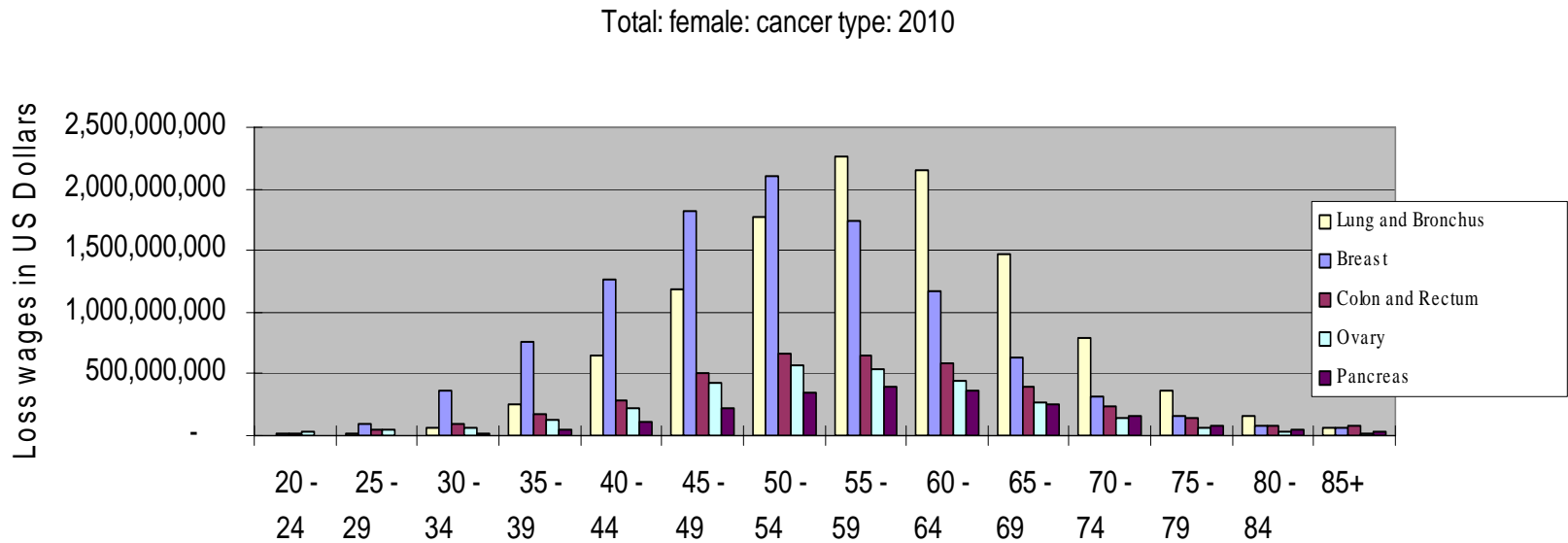
(PRELIMINARY DO NOT QUOTE)

TOTAL: Male: All Malignant Cancers



# Results – Most Costly Cancer Sites, Females 2010

(PRELIMINARY DO NOT QUOTE)



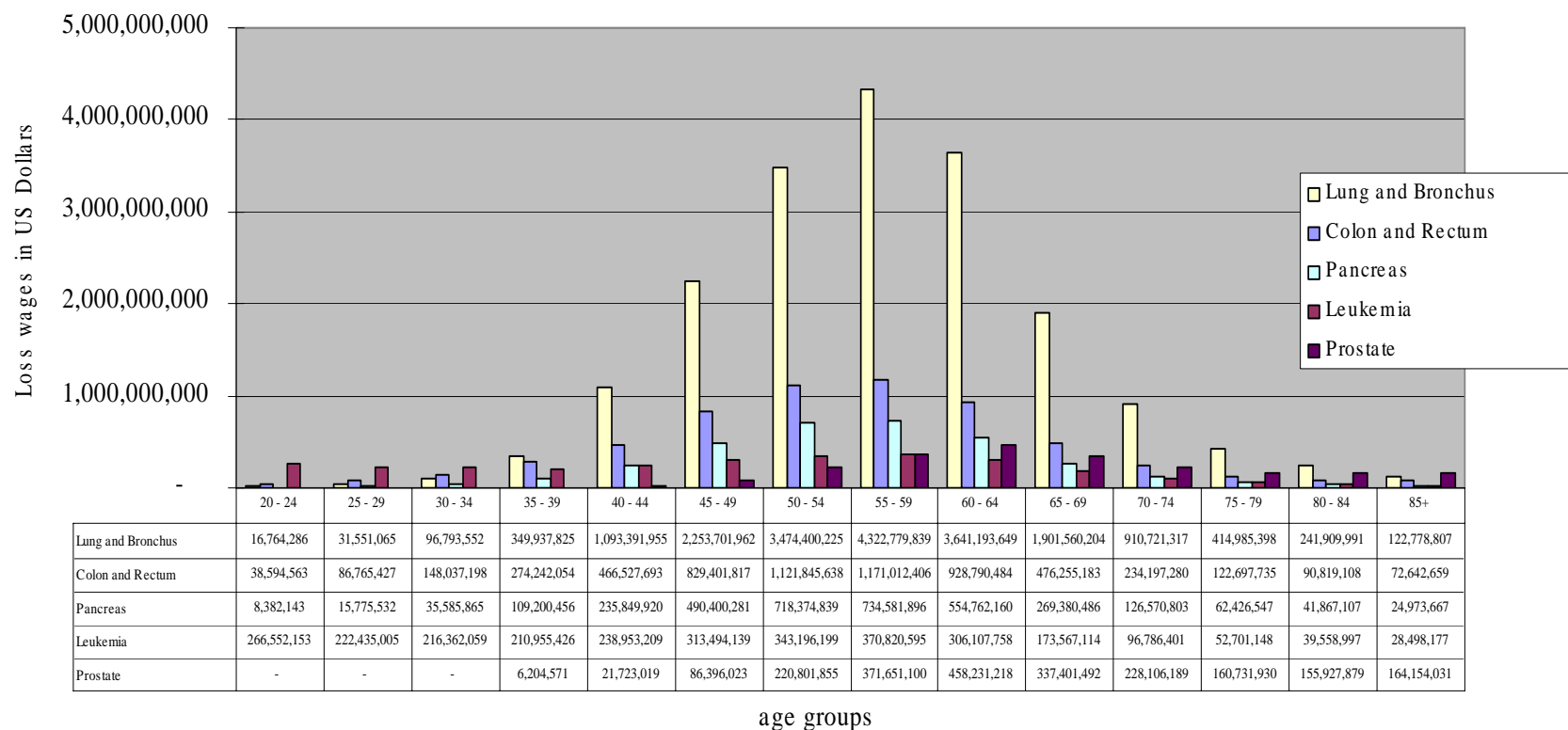
	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	65 - 69	70 - 74	75 - 79	80 - 84	85+
Lung and Bronchus	6,264,114	23,248,350	65,097,808	246,137,607	652,346,315	1,187,952,241	1,773,579,86	2,263,711,53	2,148,191,589	1,467,645,23	794,848,132	364,604,021	154,481,368	70,292,195
Breast	12,528,227	95,214,505	365,787,684	766,260,506	1,263,778,92	1,821,074,68	2,097,818,36	1,745,580,48	1,174,913,073	638,300,696	322,784,067	156,178,914	81,588,284	64,130,906
Colon and Rectum	18,792,341	47,607,253	90,930,272	166,187,800	283,365,298	504,895,114	657,022,090	652,891,580	583,591,004	400,452,385	241,019,341	137,611,269	83,337,318	78,554,459
Ovary	25,056,455	40,684,612	59,931,316	120,373,866	225,025,384	424,753,033	569,672,332	538,046,391	442,551,287	267,435,876	134,623,416	69,134,848	33,897,950	18,192,718
Pancreas	-	5,812,087	15,499,478	51,203,809	116,679,829	216,383,620	342,752,853	394,987,789	362,524,308	260,421,583	158,779,634	84,048,223	44,625,360	31,223,489

age groups

# Results – Most Costly Cancer Sites, Males

## 2010 (PRELIMINARY DO NOT QUOTE)

Total :males:cancer types : 2010



---

# Results

- Total cost of cancer (2010)
    - Females: \$ 49.5 billion
    - Males: \$ 63.6 billion
  - Total cost of cancer (2020)
    - Females: \$ 56.2 billion
    - Males: \$ 75.6 billion
-

---

# Results

- Females: Breast and lung cancer are the most costly cancer, each totaling over \$5 billion in 2010.
    - Differences by age. The cost of breast cancer is higher for women under age 55 years, but the cost of lung cancer is higher for women age 55 years and older.
  - Males: Lung cancer is by far the most costly cancer, totaling over \$15 billion in 2010.
-

---

# Conclusions

- Policies aimed at reducing breast and lung cancer mortality will have the greatest impact on reducing productivity losses in female labor supply.
  - Policies aimed at reducing lung cancer mortality will have the greatest impact on reducing productivity losses in male labor supply.
  - Interventions for these diseases are likely to have favorable cost-effectiveness ratios.
-