Mammography Screening Utilization in Vermont and Beyond:
Long-term trends and COVID-19 impacts

Vermont Center for Behavior and Health
February 15, 2023

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THE University of Vermont CANCER CENTER

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Overview

- Breast cancer & mammography screening
- Vermont Breast Cancer Surveillance System
  - Evaluating the benefits and harms of mammography screening
  - Partnership with the national Breast Cancer Surveillance Consortium
- Reduced utilization of mammography screening in Vermont and beyond
  - Changes in breast cancer screening guidelines
  - COVID-19 impacts

Breast Cancer Epidemiology

- Breast cancer is the most common cancer diagnosis in women
  - 190,000 cases per year
- 2nd leading cause of cancer death in women
  - 40,000 deaths per year
- Randomized trials support use of screening mammography to reduce breast cancer mortality
  - 20% reduction in mortality in meta-analyses of randomized trials from the 70s and 80s

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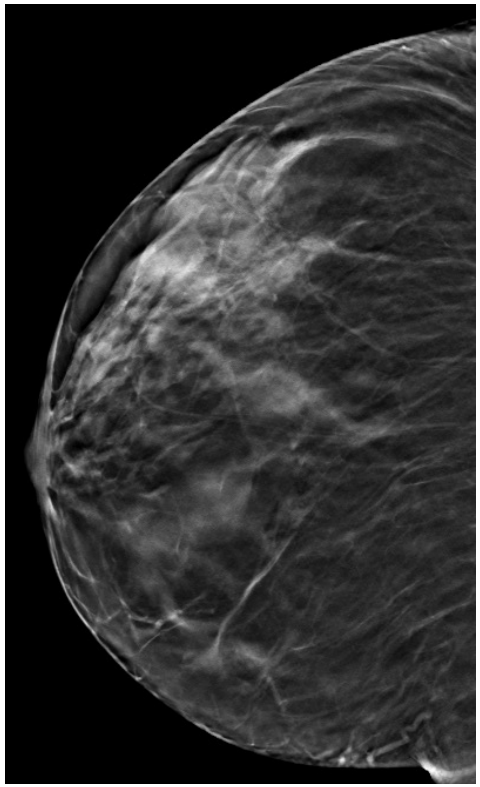
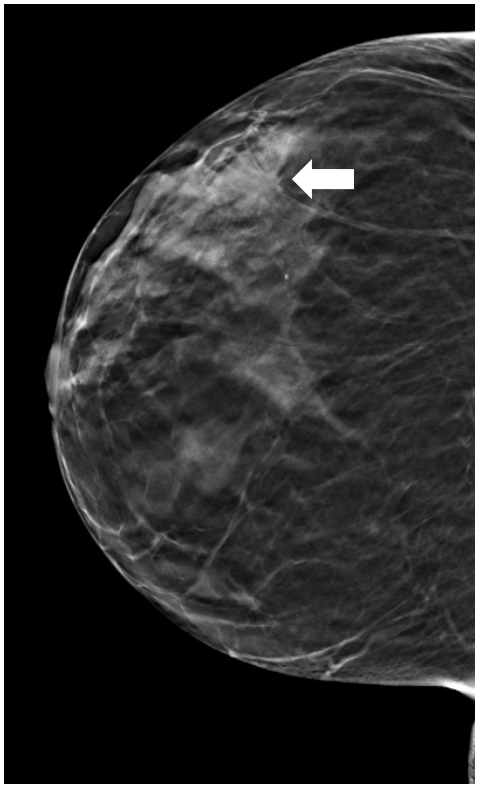
Mammography



66 y.o. woman, 2021



2022

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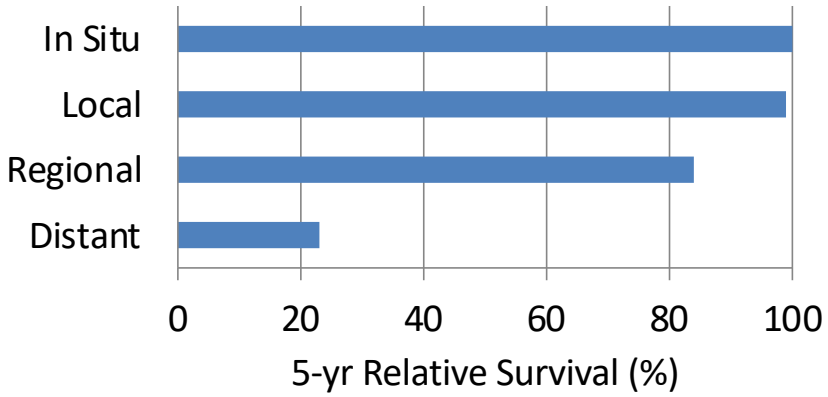
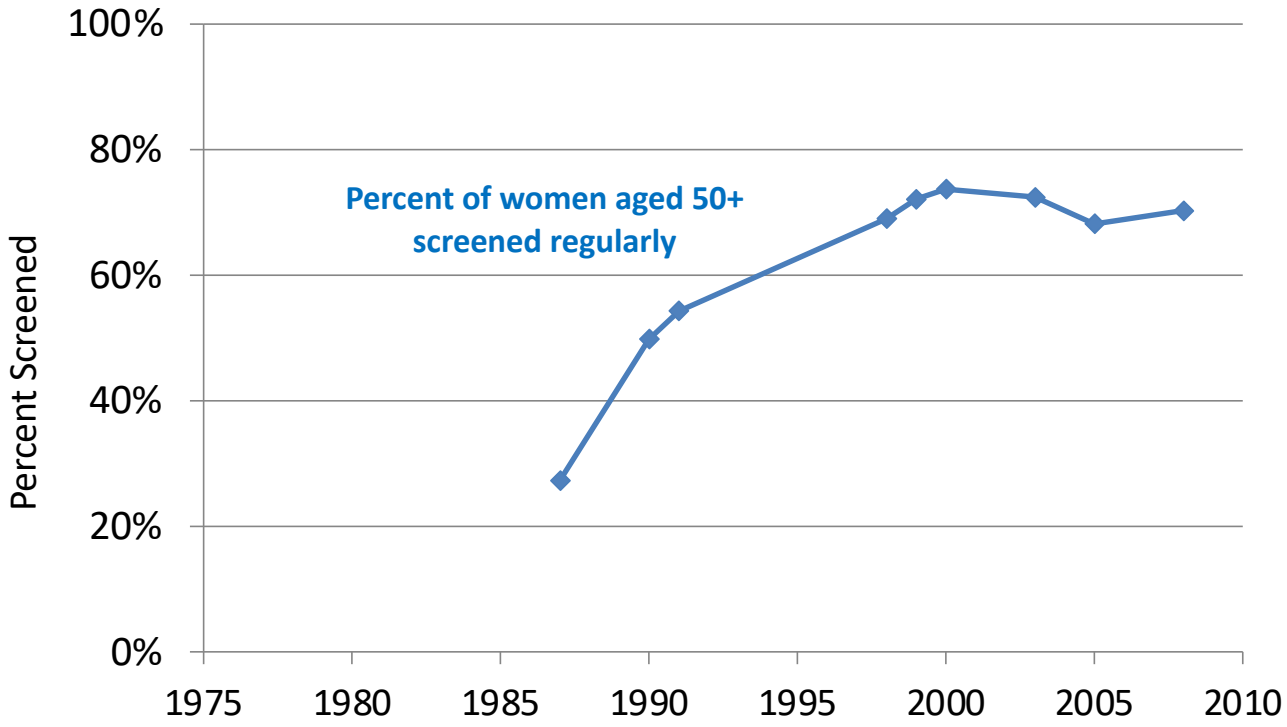
Mammography Screening

- The goal of screening mammography is to detect breast cancer at an early stage
  - Treatment is more effective if cancer is caught early
  - Early stage = better survival



The Rise of Screening Mammography



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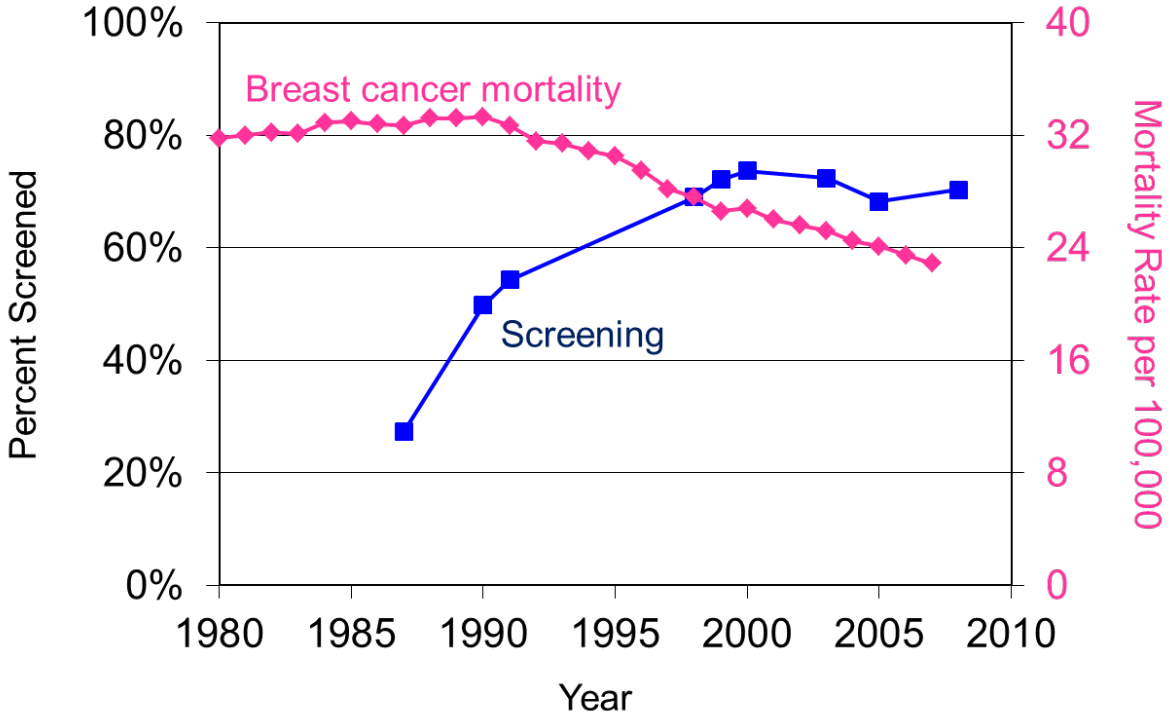
Source: National Health Interview Survey

Screening and Breast Cancer Mortality

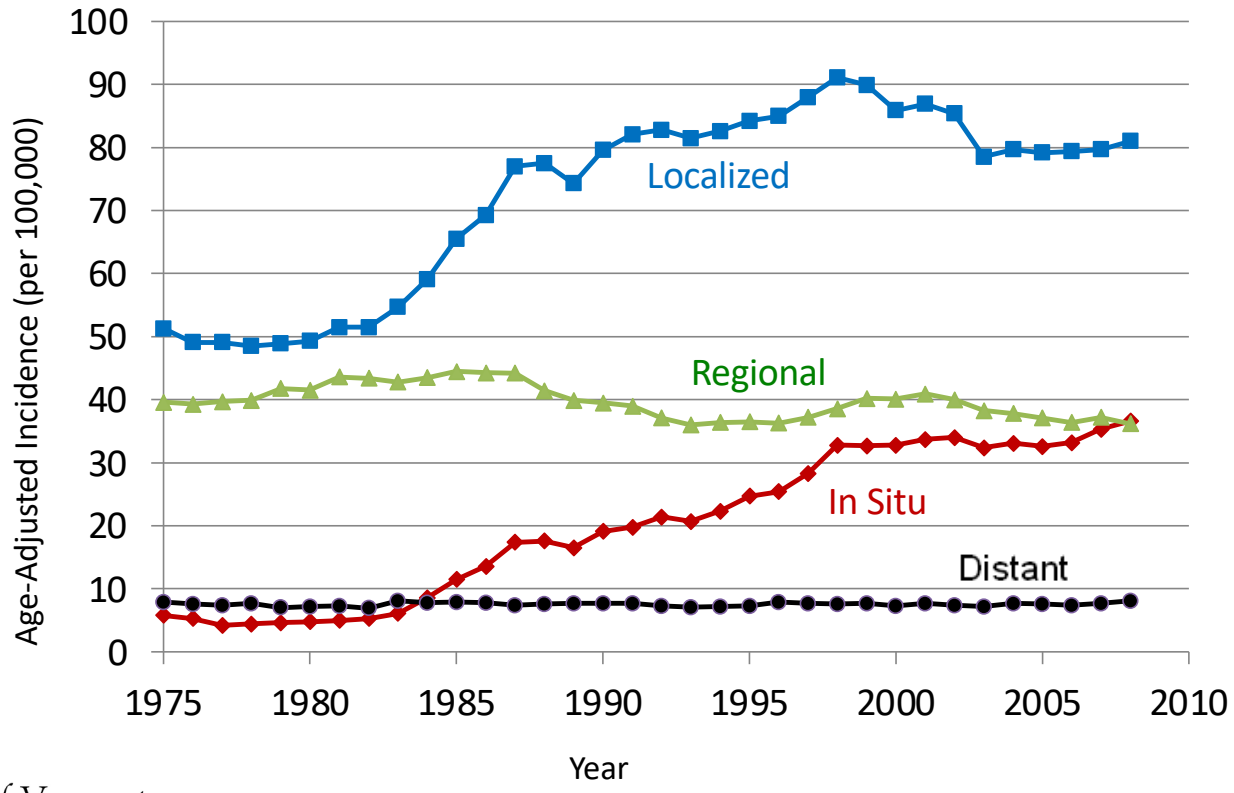


Data from the National Center for Health Statistics

Weighing Potential Benefits and Harms

Benefits	Harms
Reduced morbidity and mortality from breast cancer	Anxiety Radiation False positives Overdiagnosis

Breast Cancer Incidence by Stage



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Source: Surveillance, Epidemiology, and End Results Program, National Cancer Institute.

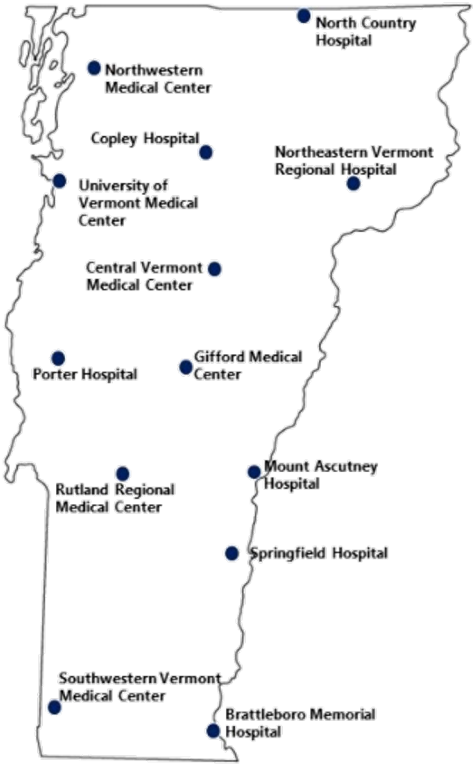
Breast Cancer Screening Recommendations

- Life's persistent questions…
  - Who should get mammography screening?
  - When should they start?
  - How often should they get screened?
  - When should they stop?

The Vermont Breast Cancer Surveillance System

- A quality assurance and research program evaluating breast cancer screening and diagnosis
  - "The Vermont Mammography Registry"
  - Funded by NIH research grants
  - Established in 1993 by Berta Geller, Sally Herschorn, Don Weaver, et al.

- A partnership with Vermont clinics and the Vermont Department of Health
  - 13 breast imaging practices
  - 8 pathology facilities
  - The Vermont Cancer Registry



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The Vermont Breast Cancer Surveillance System

- A multidisciplinary team of investigators
  - Brian Sprague, PhD (Epidemiology)
  - Sally Herschorn, MD (Radiology)
  - Donald Weaver, MD (Pathology)
  - Pamela Vacek, PhD (Biostatistics)
  - Hannah Perry, MD (Radiology)
  - Michelle Sowden, DO (Surgery)

- National Consortia
  - Breast Cancer Surveillance Consortium (BCSC; 1996-present)
  - Population-based Research to Optimize Screening through Personalized Regimens (PROSPR; 2011-2018)
  - Molecular Characterization Laboratories (MCL) for Screen-Detected Lesions (2015-2022)

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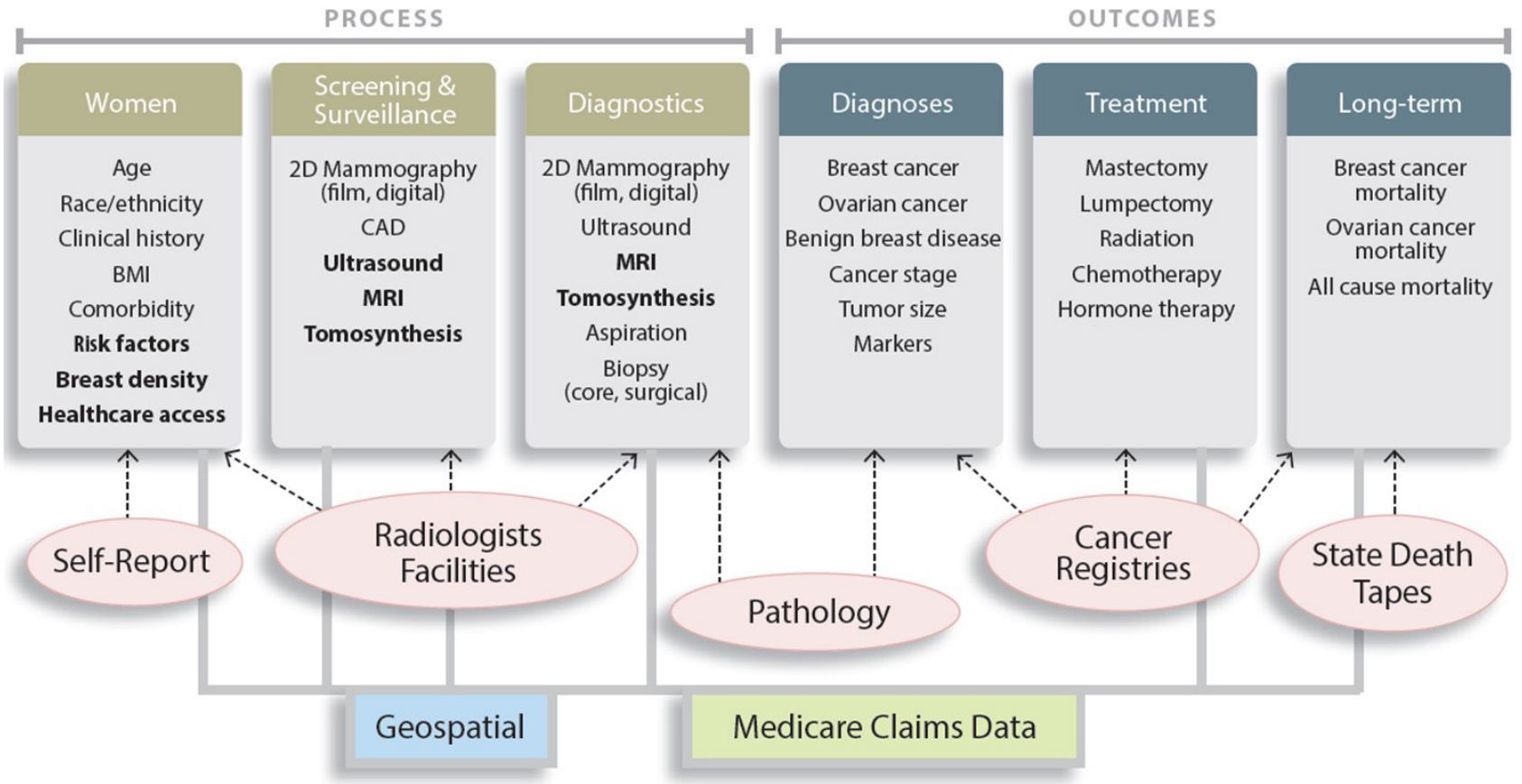
Data Collection



Ancillary Studies
Radiologic images
Tissue specimens
Patient surveys
Provider surveys

Data Collection

- Putting it all together
  - Teleform scanning of paper forms
  - Importing electronic data extracts from 11 different radiology electronic health record systems
  - Abstracting pathology reports
  - Extensive algorithms to ensure patient matching patients across data streams
  - Data validation, error checking
  - Organizing data in secure SQL Server relational databases
  - Data warehouse, analytic datasets

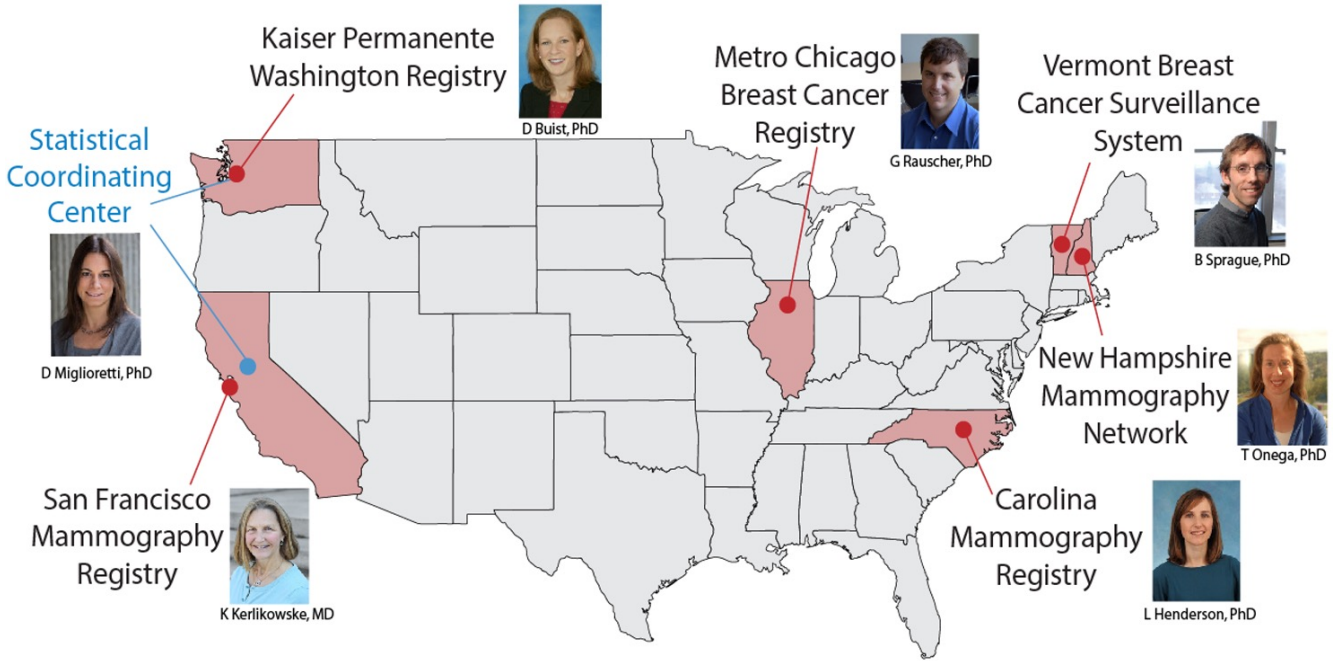
- VBCSS Staff (Office of Health Promotion Research, UHC Bldg)
  - Mark Bowman (Data manager)
  - Ben Isenhart (Application developer)
  - Kathleen Howe (Project manager)
  - Meghan Farrington (Research specialist)
  - Cindy Groseclose (Research specialist)
  - Tiffany Sharp (Research specialist)

VBCSS Data

- About 80,000 women and 500 breast cancers per year
- >25 years of longitudinal data
  - 225,000 women
  - 1.5 million mammography exams
    - 40,000 ultrasounds
    - 7,000 MRIs
  - 60,000 breast pathology records
    - 10,000 breast cancers

The Breast Cancer Surveillance Consortium (BCSC)

The nation's largest longitudinal collection of mammography data from breast cancer screening in community practice (13 million mammograms, 3 million women)



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BCSC Research

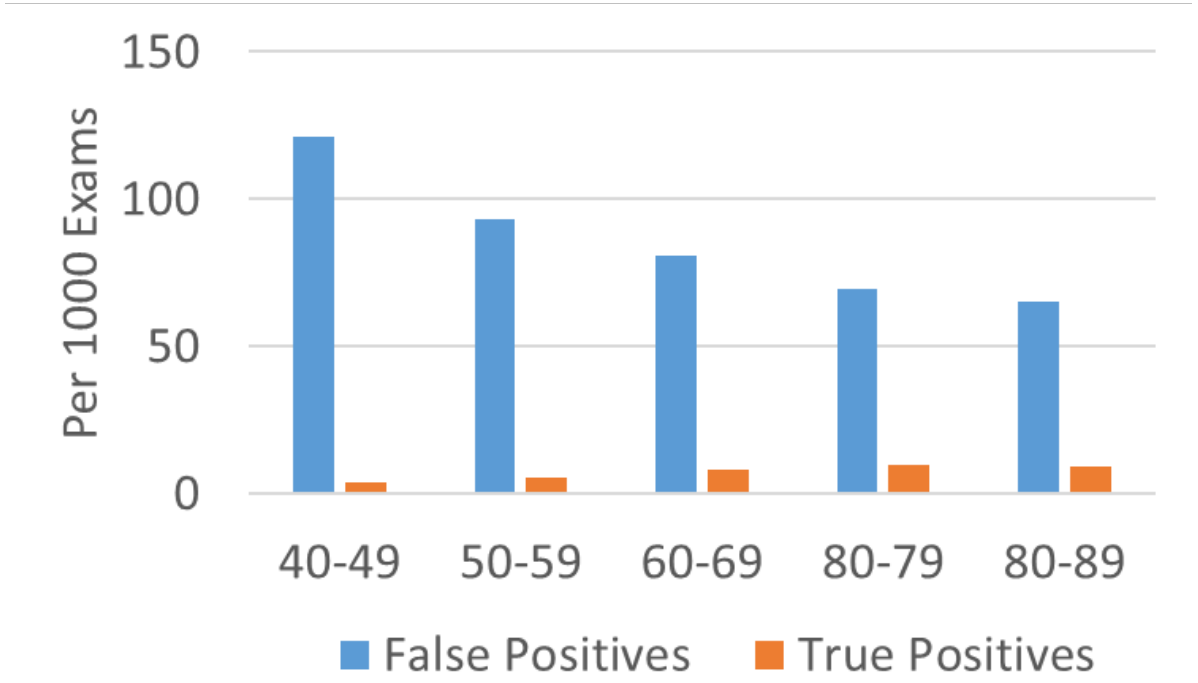
- Screening Research
  - Performance of breast cancer screening modalities (mammography, ultrasound, MRI)
  - Provider and patient factors associated with screening performance
  - Risk prediction models for screening outcomes (e.g., advanced cancer)
- Overall goal is to inform women, providers, and policymakers about screening strategies and outcomes
  - US Preventive Services Task Force
  - American Cancer Society
  - American College of Radiology

Historical Screening Recommendations

Age	American Cancer Society (Pre-2016)	United States Preventive Services Task Force (pre-2009)
40-49	Annual mammography	Every 1-2 years
50-74	Annual mammography	Every 1-2 years
75+	Annual mammography if healthy	Every 1-2 years

American College of Radiology: annual mammography for women aged 40+

Mammography Screening Performance by Age



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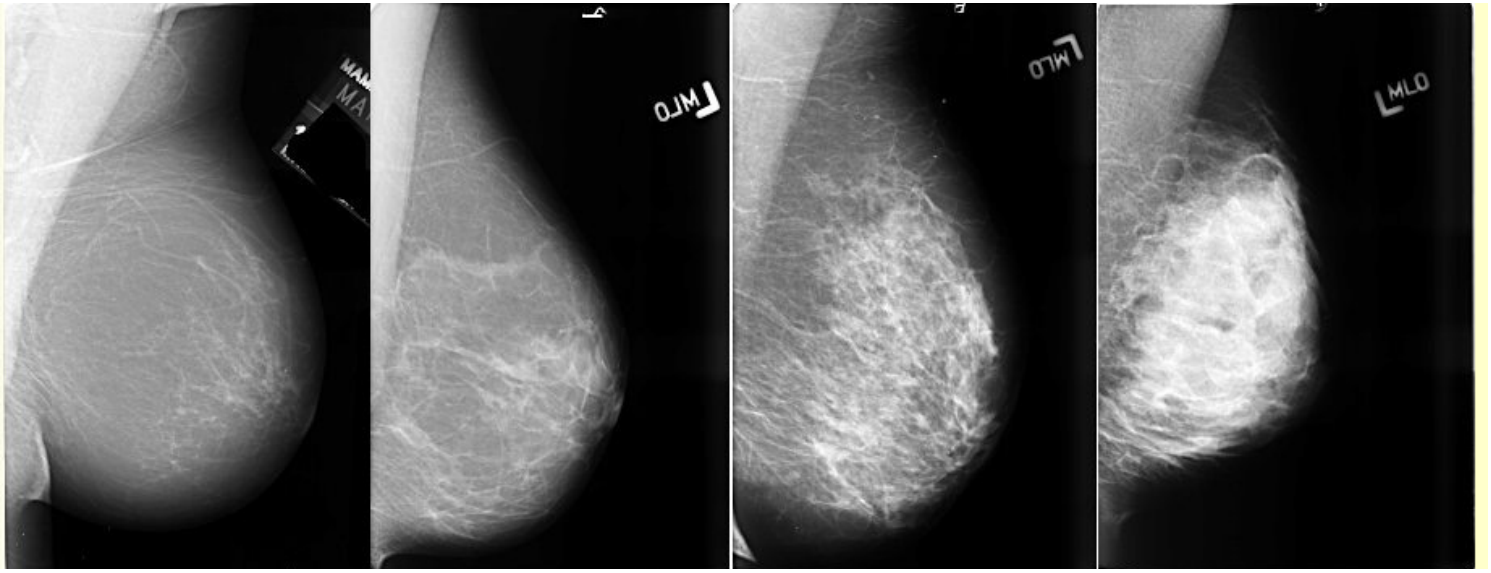
Nelson et al., 2016 *Annals of Internal Medicine*

Mammographic Breast Density



Almost Entirely Fat | Scattered Densities | Heterogeneously Dense | Extremely Dense

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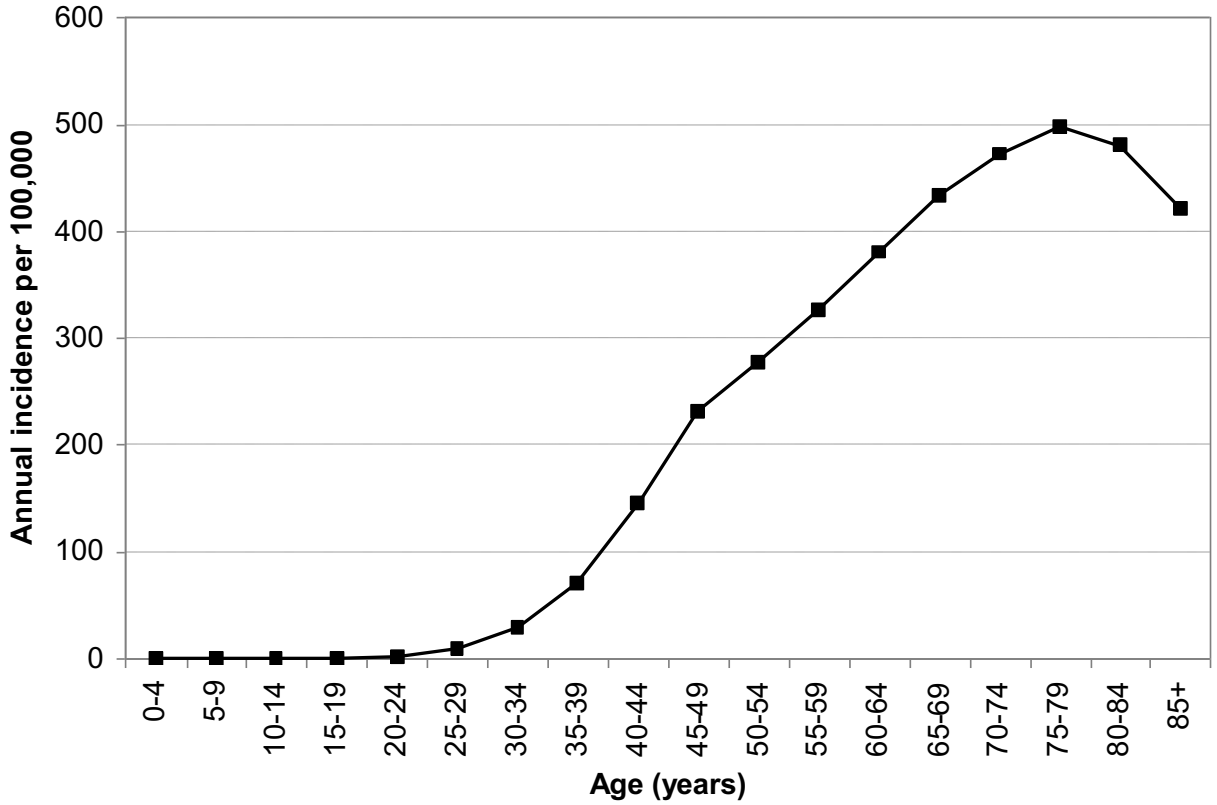
Age-Specific Incidence of Invasive Breast Cancer



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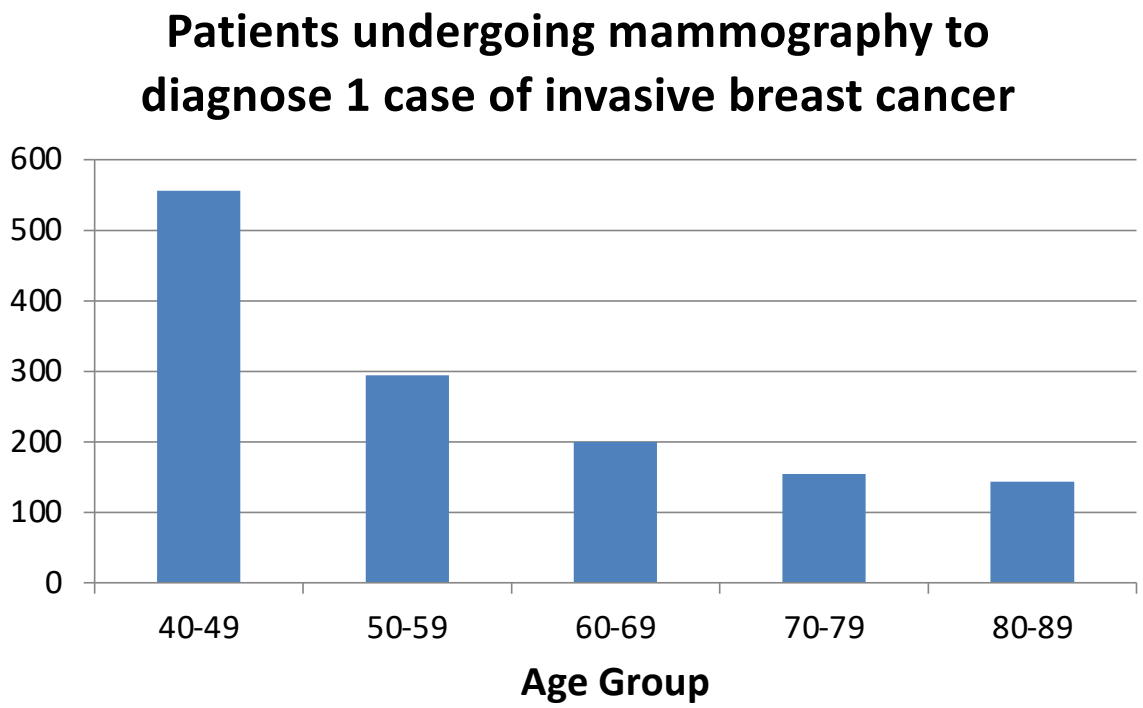
***Age-adjusted to the 2000 US standard population and adjusted for delays in reporting.**
Source: Surveillance, Epidemiology, and End Results Program, Delay-adjusted Incidence database: SEER Incidence Delay-adjusted Rates, 9 Registries, 1975-2004, National Cancer Institute, 2007.

Screening Statistics by Age



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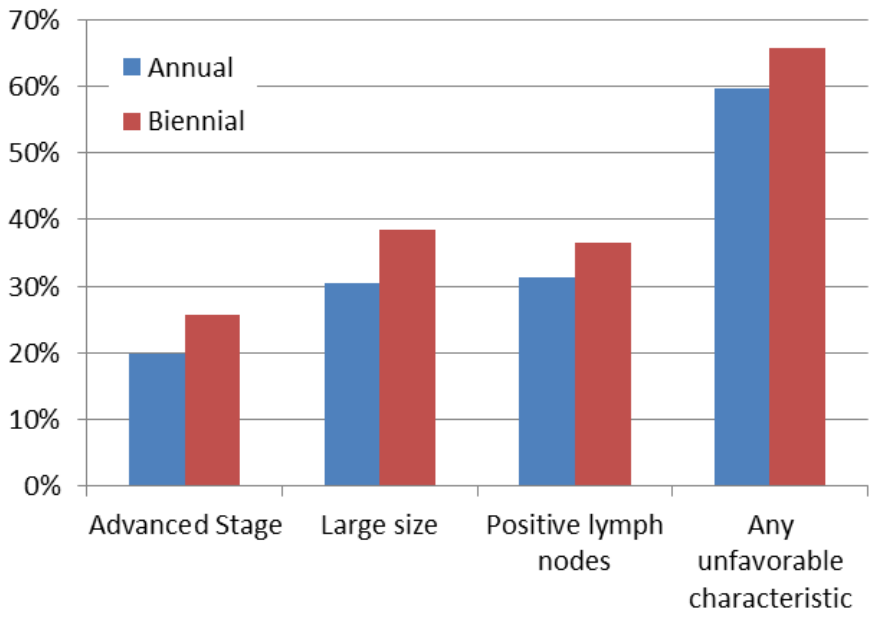
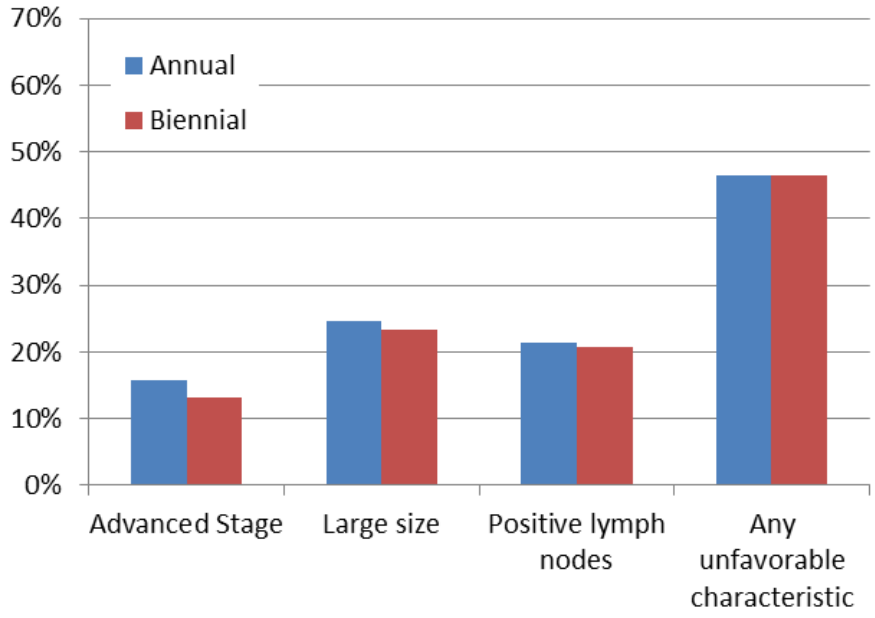
Nelson HD, et al. *Ann Intern Med*. 2009;151:727-37

Screening Interval

Premenopausal Women



Postmenopausal Women



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Miglioretti, et al. 2015 *JAMA Oncology*

Changes to Recommendations

Age	American Cancer Society (Pre-2016)	United States Preventive Services Task Force (pre-2009)	United States Preventive Services Task Force (2009)
40-49	Annual mammography	Every 1-2 years	Discuss with doctor; weigh harms and benefits
50-74	Annual mammography	Every 1-2 years	Biennial mammography
75+	Annual mammography if healthy	Every 1-2 years	No recommendation

American College of Radiology: annual mammography for women aged 40+

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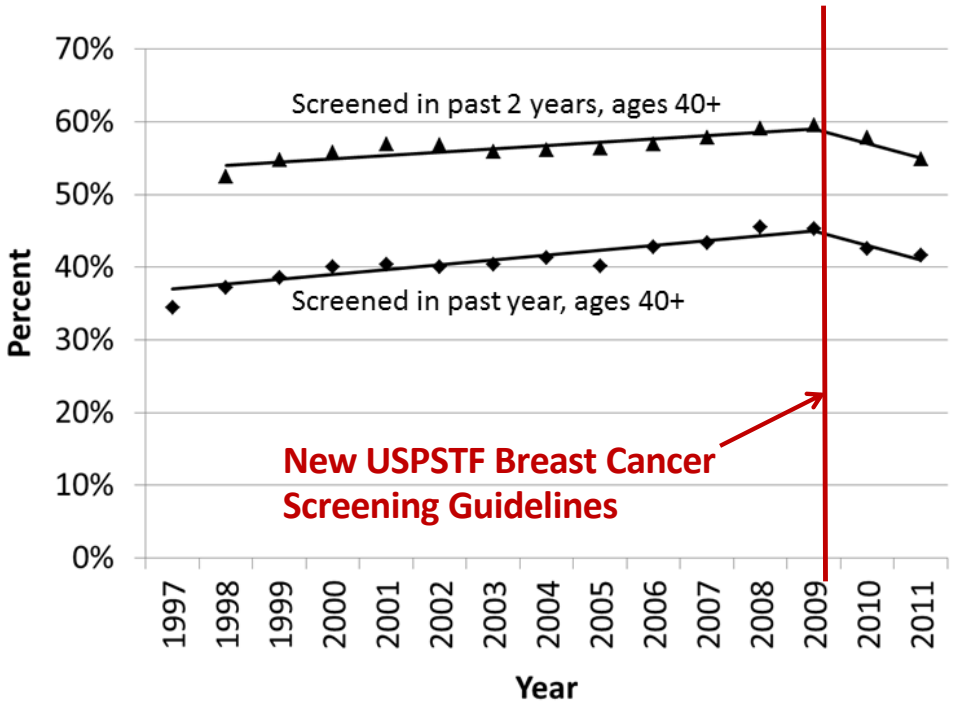
Screening Utilization

- How did screening utilization patterns change in Vermont after the release of the 2009 USPSTF screening guidelines?
  - Study using VBCSS screening data and US Census data on Vermont population
    - Counts of women screened in our database vs. total female population of Vermont

Mammography Screening in Vermont



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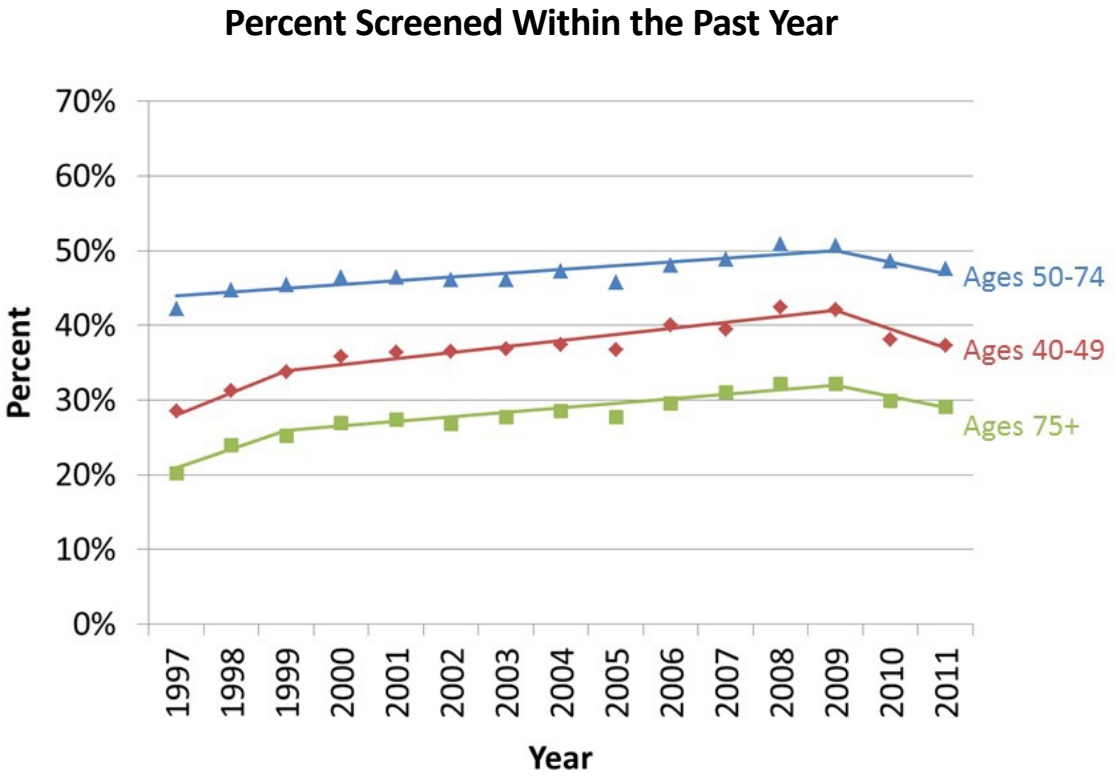
Sprague et al., *Radiology* 2014.

Mammography Screening in Vermont



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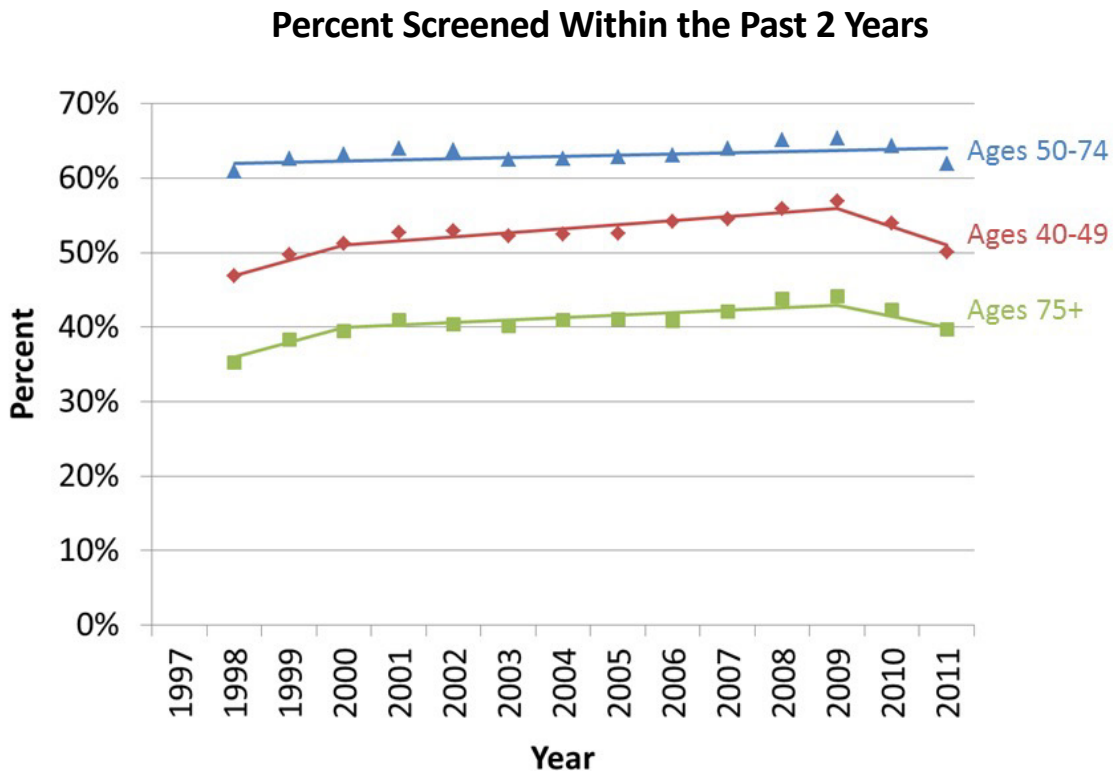
Sprague et al., *Radiology* 2014.

Trends in Breast Cancer Screening



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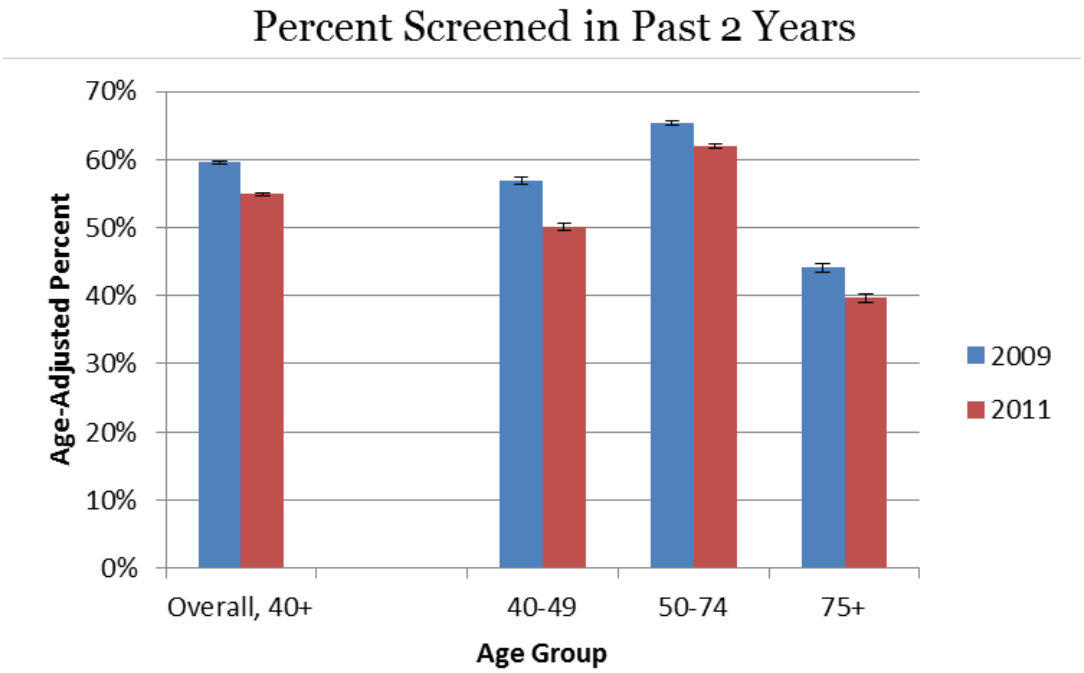
Sprague et al. 2014, *Radiology*

Screening Awareness/Risk Assessment



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Sprague et al. 2014, *Radiology*

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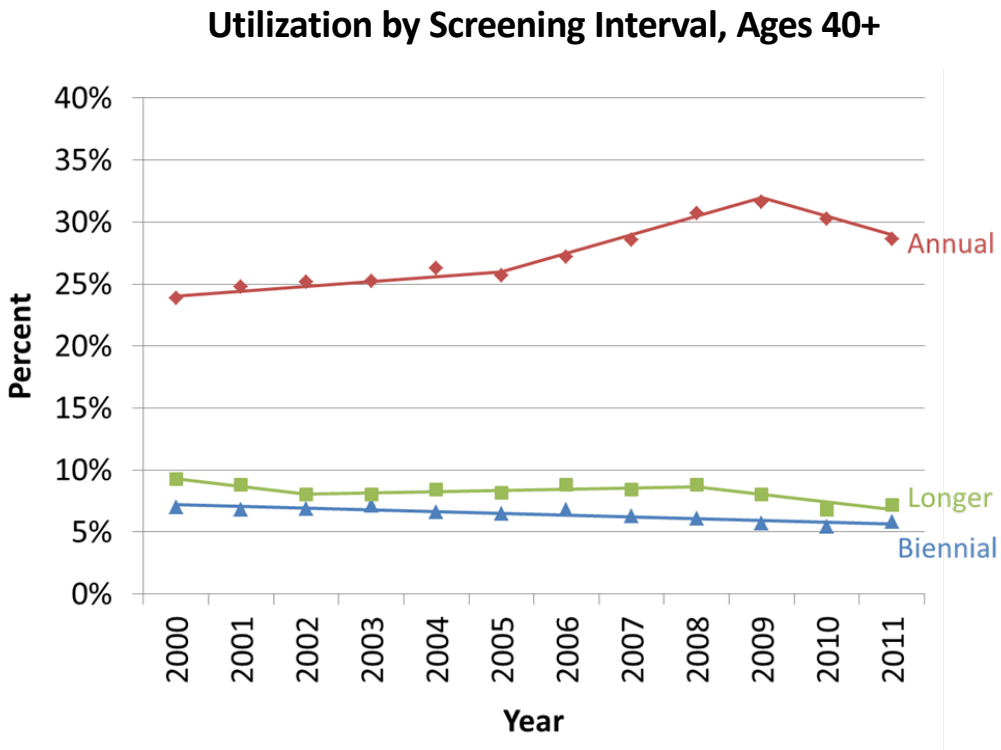

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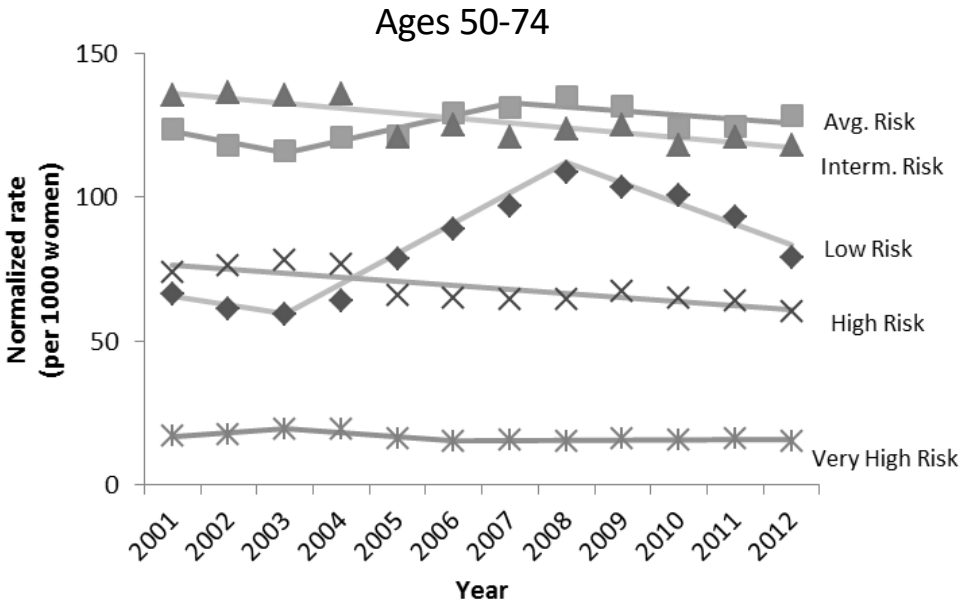
Sprague et al. 2014, *Radiology*

Screening Patterns by Breast Cancer Risk

- Declines in screening strongest among low risk women, but present for other risk groups as well



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Bolton et al. 2014, *JNCI*

Changes to Recommendations

Age	American Cancer Society (Pre-2015)	United States Preventive Services Task Force (pre-2009)	United States Preventive Services Task Force (2009, 2016)	American Cancer Society (2015)
40-49	Annual mammography	Every 1-2 years	Discuss with doctor; weigh harms and benefits	Annual 45-54
50-74	Annual mammography	Every 1-2 years	Biennial mammography	Biennial 55+
75+	Annual mammography if healthy	Every 1-2 years	No recommendation	

American College of Radiology: annual mammography for women aged 40+

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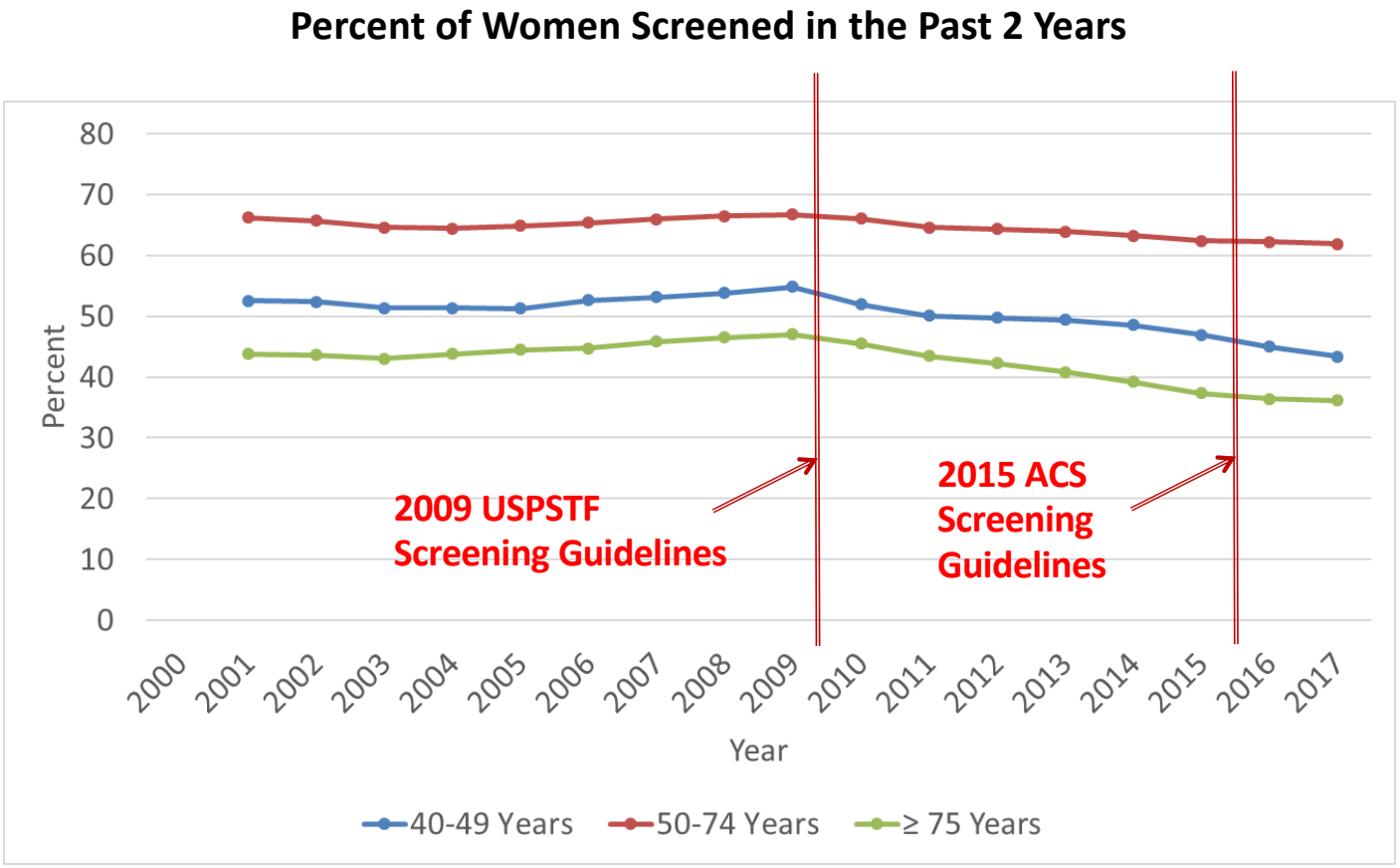
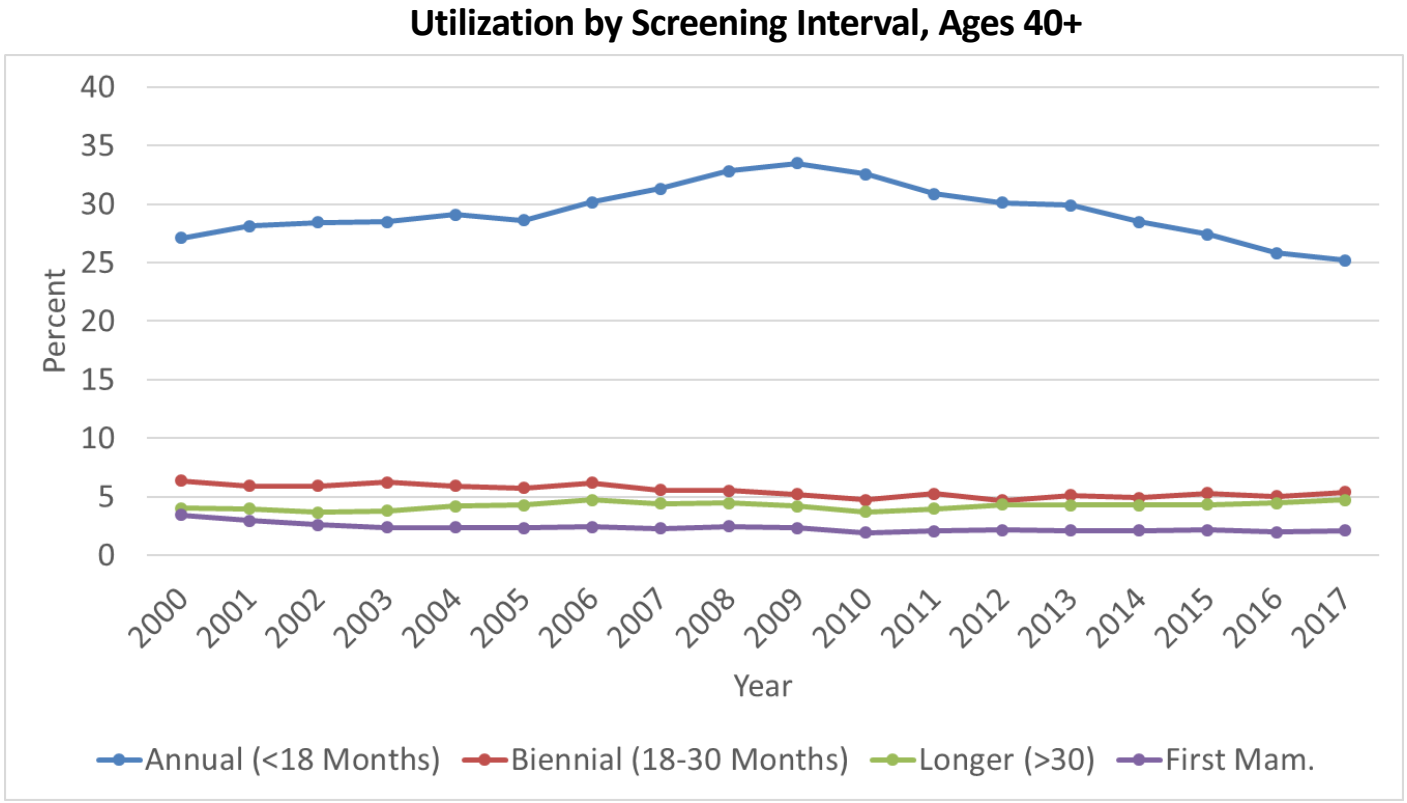
Trends in Breast Cancer Screening



Beaudet et al., unpublished.

Trends in Breast Cancer Screening



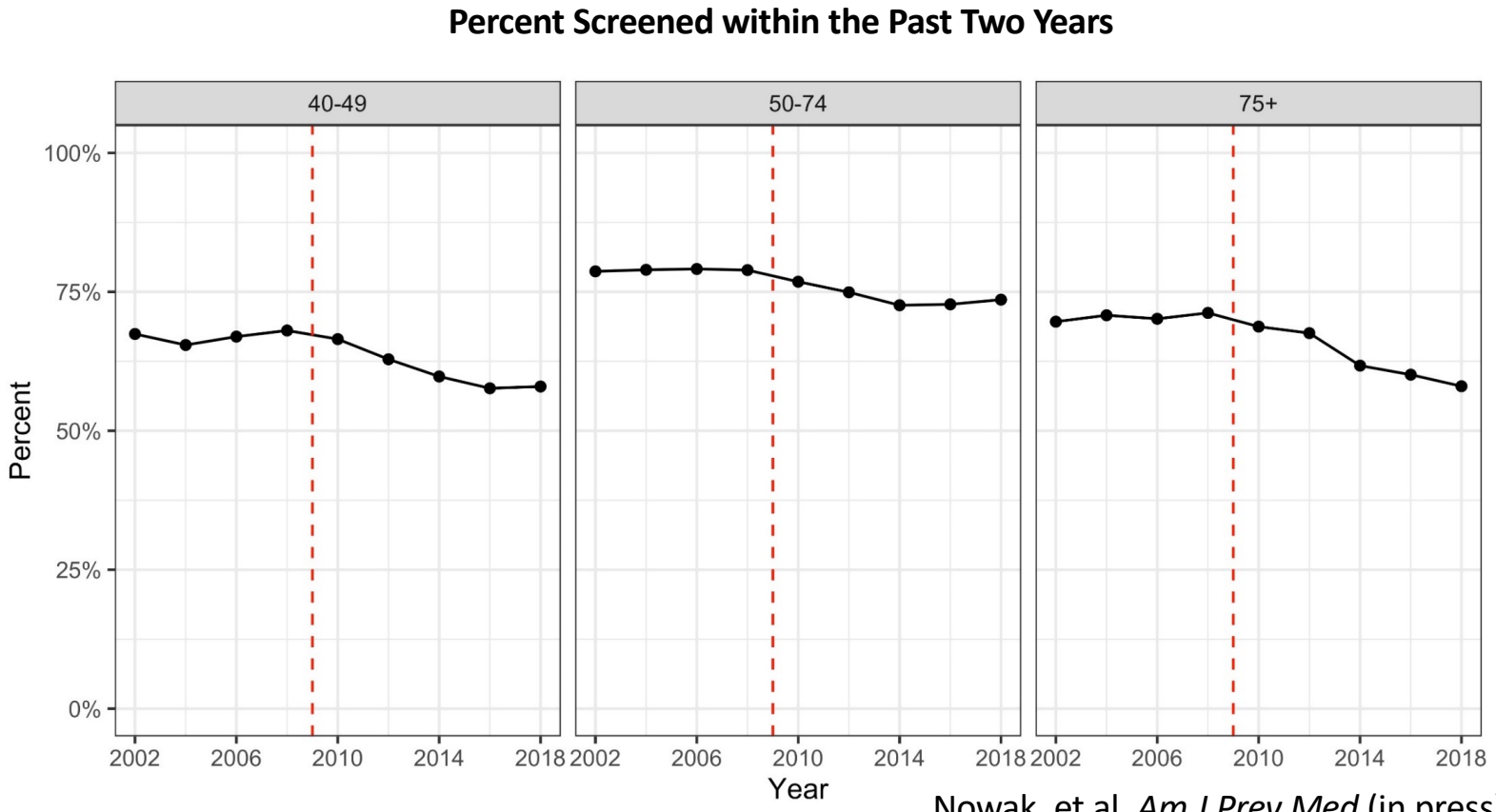
Beaudet et al., unpublished.

Decline in Screening in Vermont

- Mammography screening rates in Vermont have declined steadily since the 2009 USPSTF recommendations
  - Even for biennial screening ages 50-74
  - Unintended 'spillover' effect?
    - Scientific debate & media attention regarding mammography's harms
      - Over-generalization by women and providers ("negative halo")?
    - De-implementation of screening for women 40-49 and 75+
      - Less intensive outreach for women 50-74?

- Exploring national data (Sarah Nowak)
  - Behavioral Risk Factor Surveillance System

BRFSS: National Trends



Nowak, et al. *Am J Prev Med* (in press)

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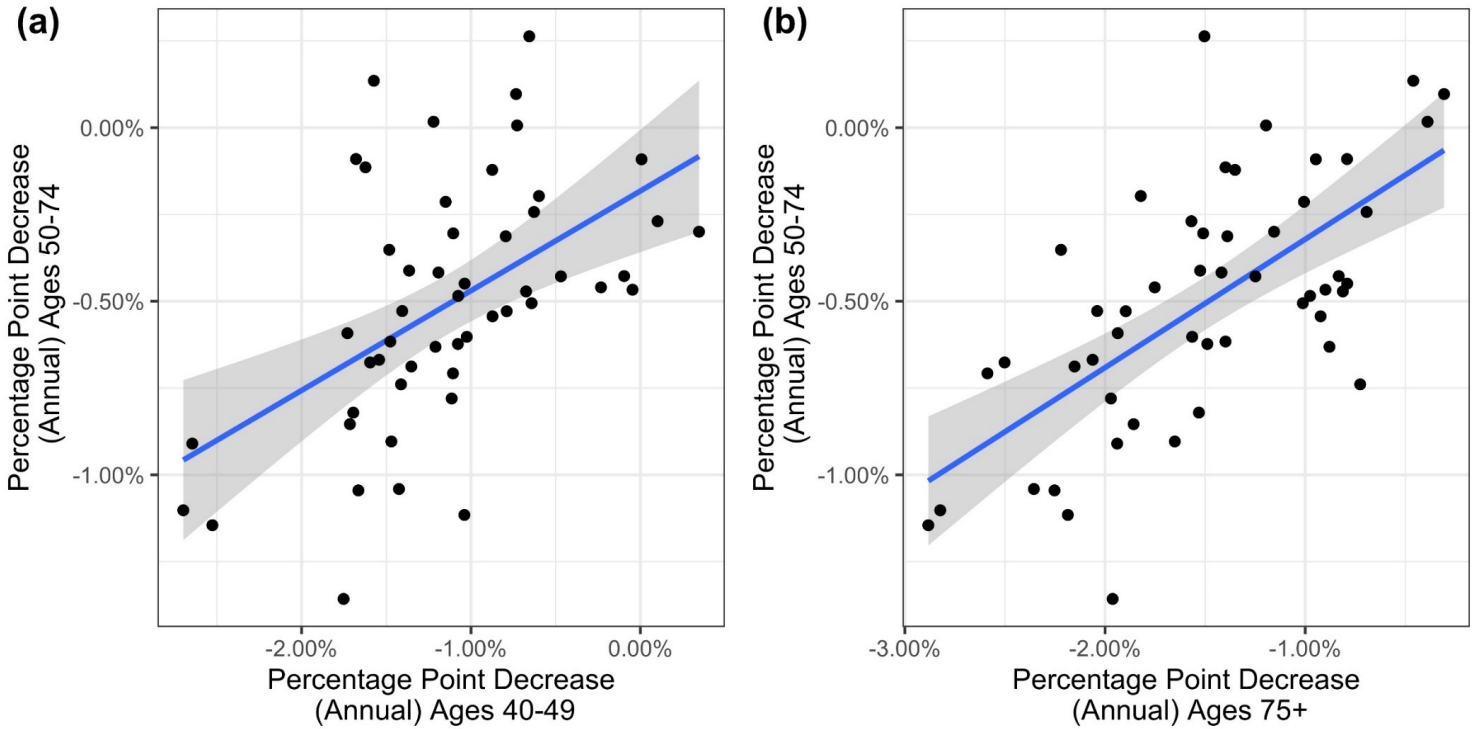
BRFSS: Results by State



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Nowak, et al. *Am J Prev Med* (in press)

2020: COVID Impacts

Mammography Screening Volume in the BCSC

- January 2019 - July 2020 at 62 radiology facilities from 6 BCSC registries

- Compared monthly screening mammography volumes before and during the pandemic
  - overall and by patient characteristics

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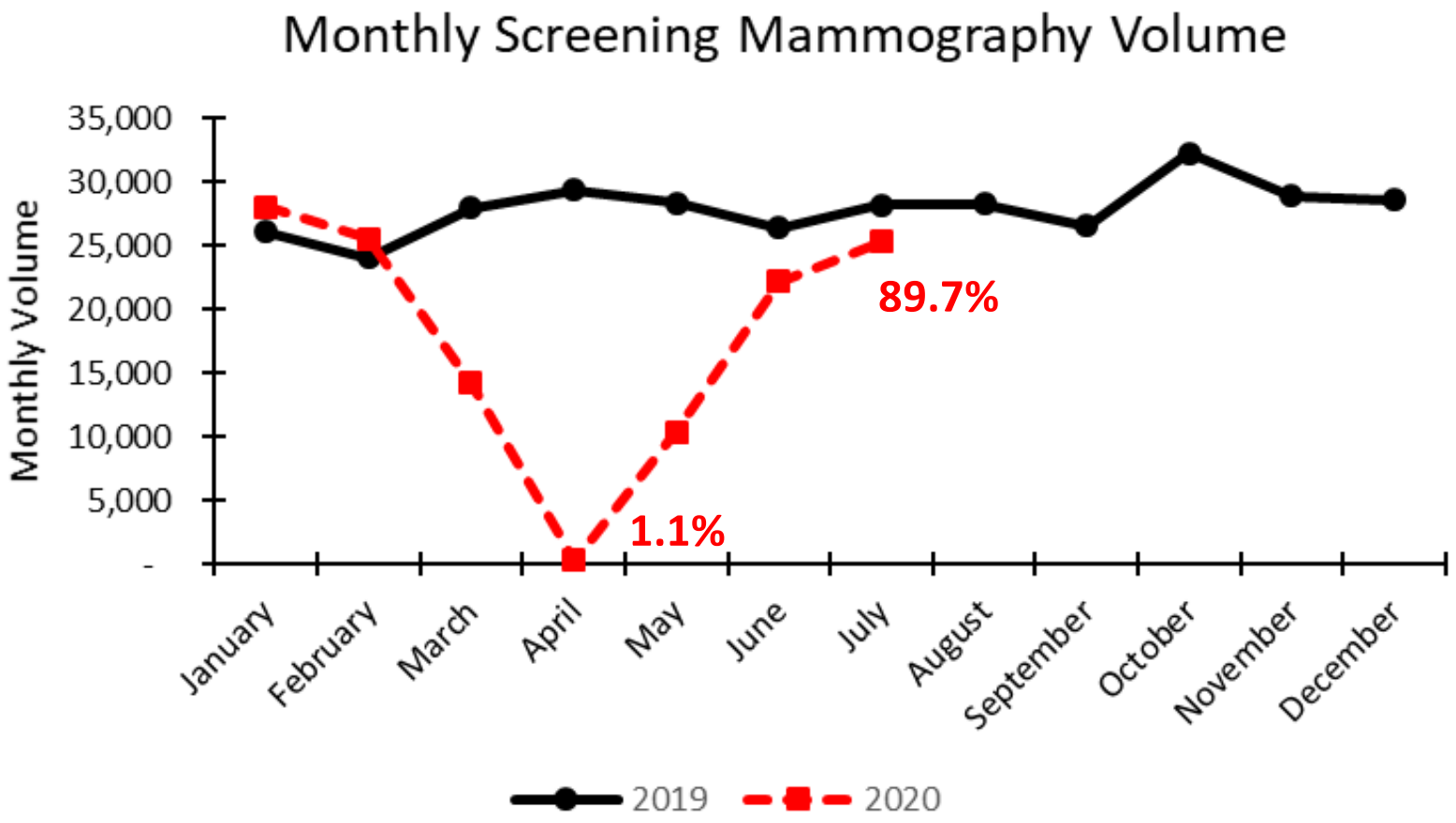
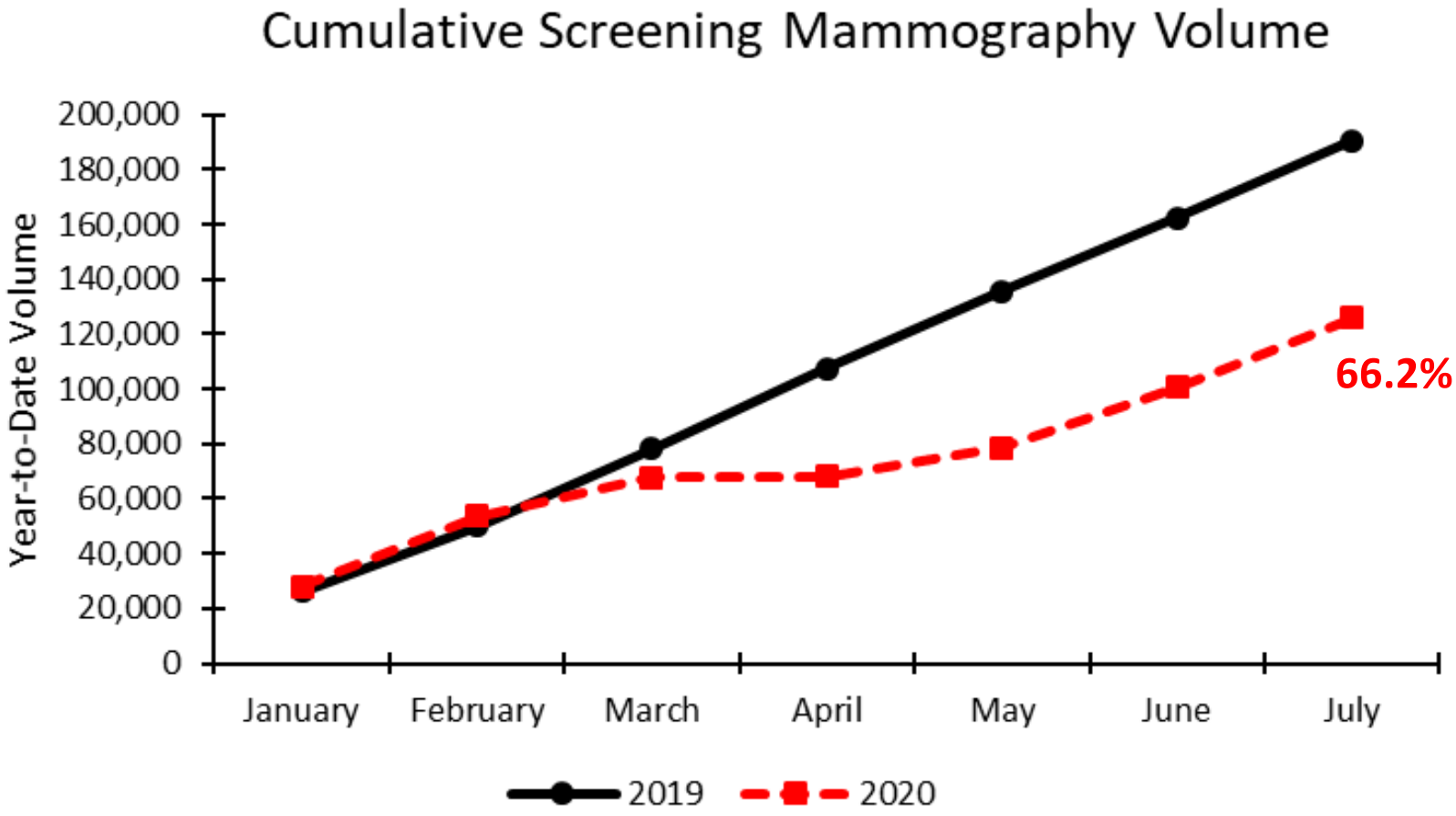
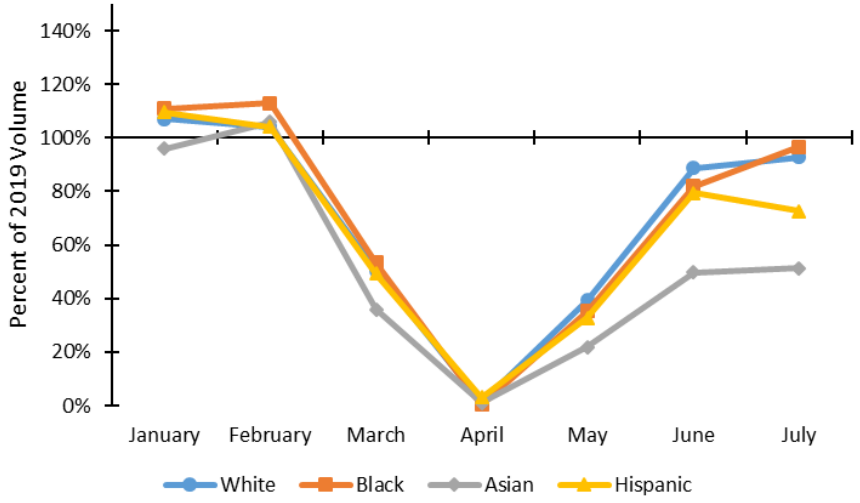


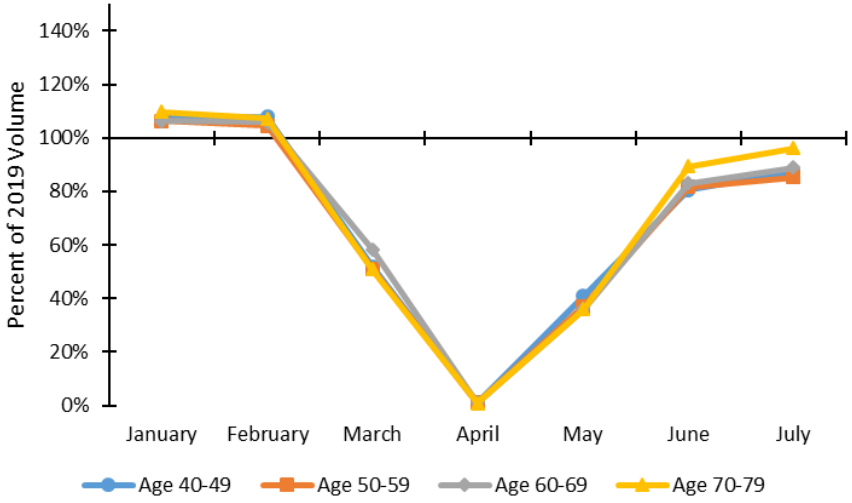
Sprague et al. *JNCI* 2021.

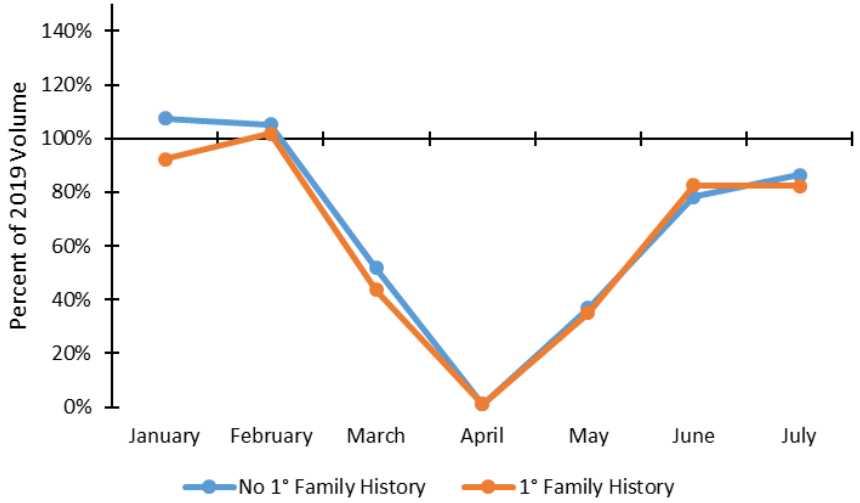


Sprague et al. *JNCI* 2021.

Screening Volumes:
Variation by race, but not age or family history







Sprague et al. *JNCI* 2021.

Breast Cancer Diagnoses

- Compared monthly breast cancer diagnosis volumes before and during the pandemic
- January 2019 through September 2020
- 64 radiology facilities across 7 BCSC registries

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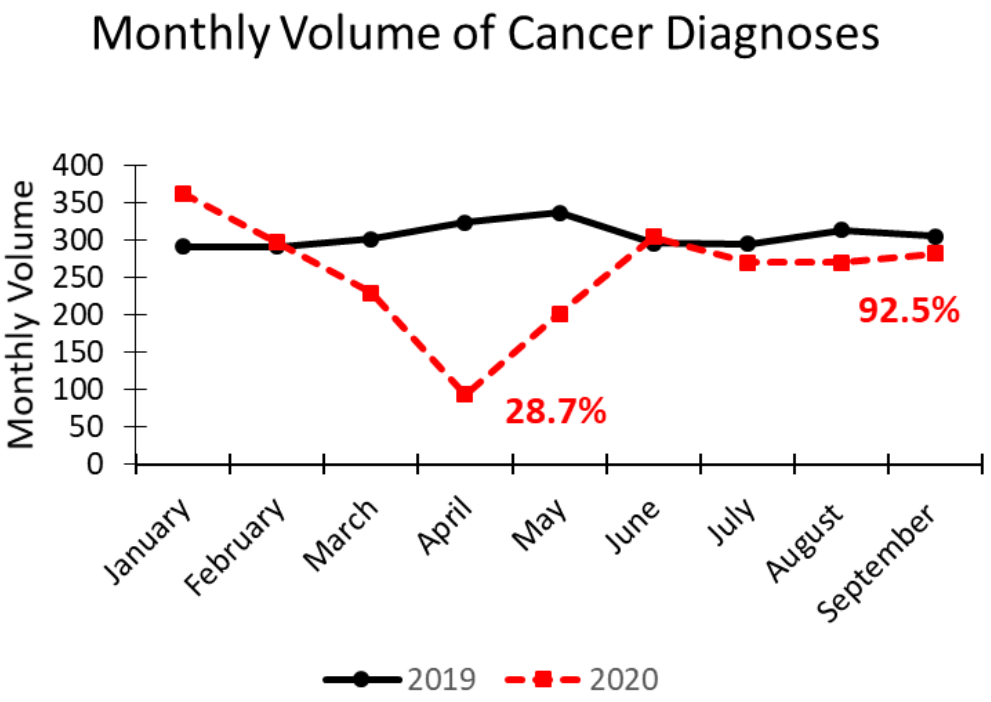
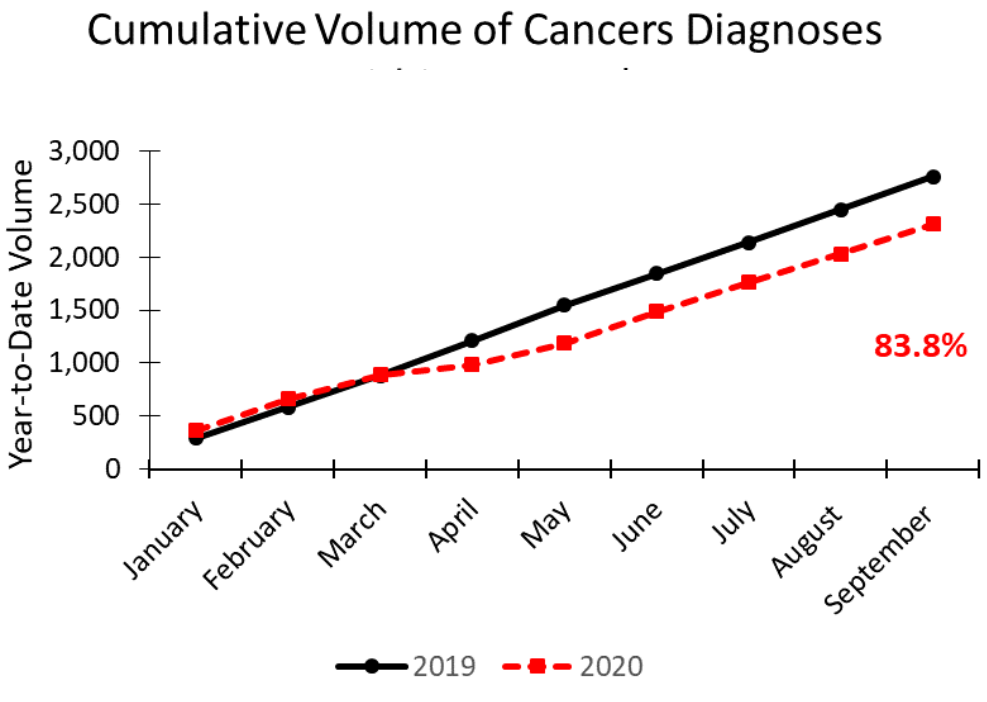
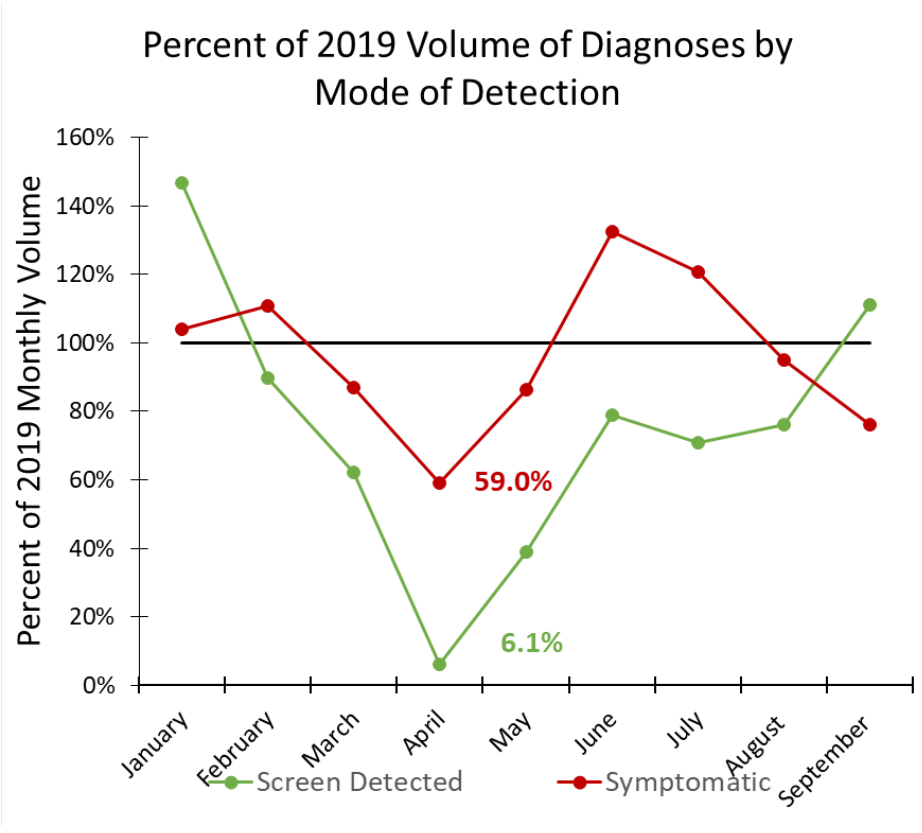
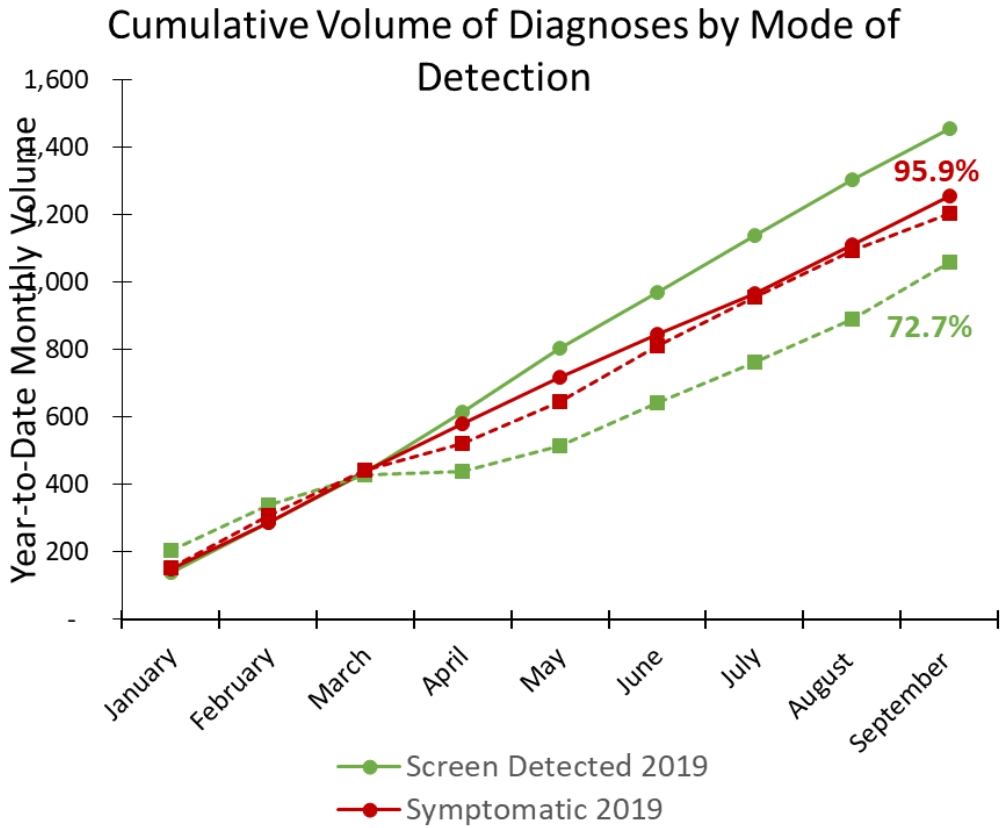




Lowry et al. *Radiology 2022*.





**Month of biopsy recommendation*

Lowry et al. *Radiology 2022*.

COVID Impacts

Race/ethnicity	Percent change in total cancers detected (March-Sept, 2020 vs 2019)
Non-Hispanic White	-17%
Non-Hispanic Black	-27%
Hispanic	-43%
Asian	-53%
>1 or Other	-33%

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Lowry et al. *Radiology 2022*.

Long Term Outcomes

- Collaboration with CISNET computer simulation modeling teams to estimate the long term impacts of COVID disruptions on breast cancer mortality
  - Simulation models of the US population
  - Women are at risk for developing breast cancer, can be detected via screening or symptoms, undergo treatments, may die from breast cancer or other causes
  - Calibrated to match SEER national incidence & mortality statistics
  - Women followed for their lifetimes
- Compare "no COVID" scenario to scenarios with 6-month COVID impacts:
  - reduced screening (50%)
  - delay in diagnosis for women with symptoms (25%)
  - Reduced chemotherapy use among older women with stage I/II breast cancer (25%)

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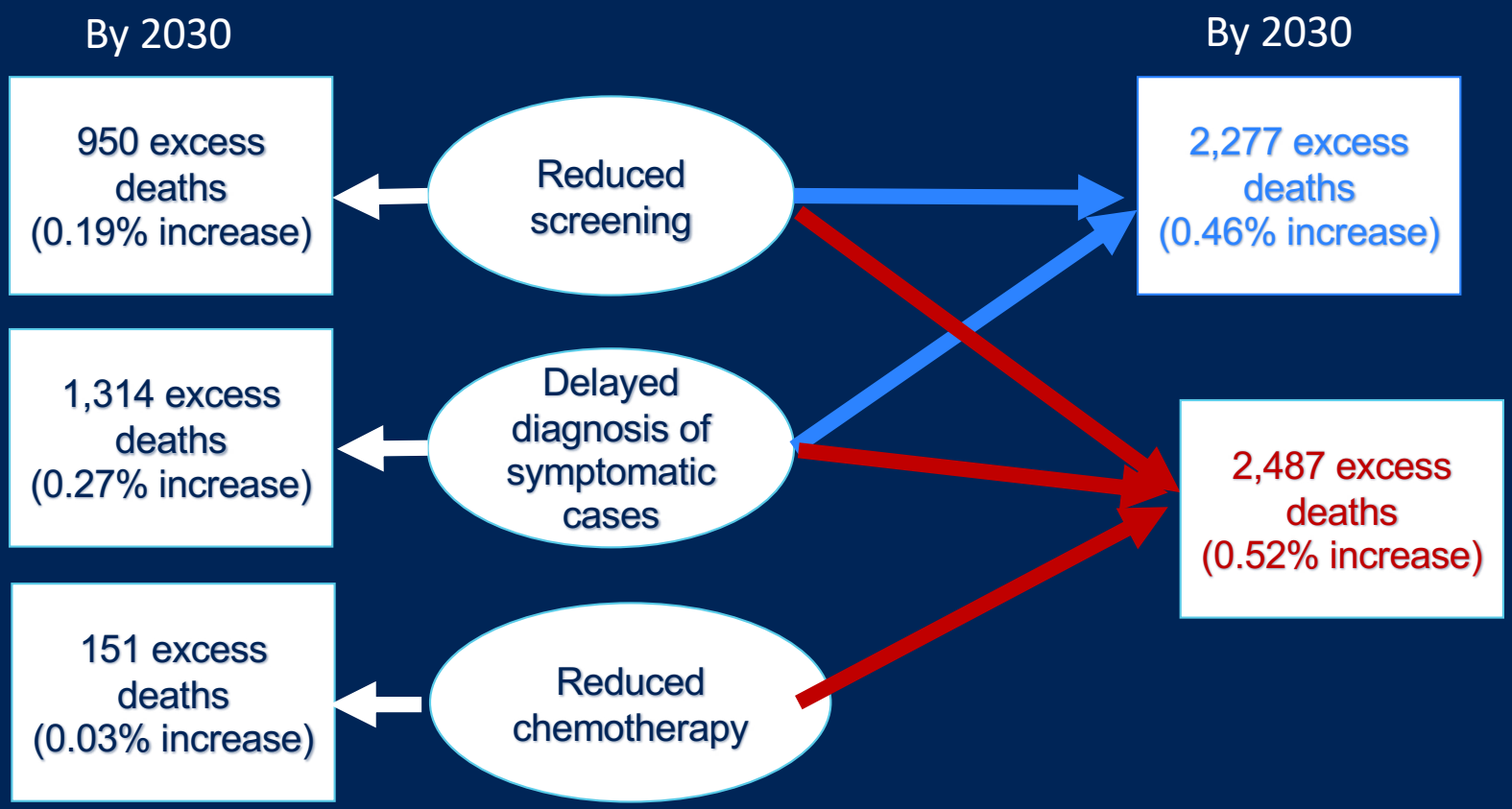
Alagoz et al. *JNCI 2021*

CISNET

Results- Summary



Alagoz et al. *JNCI 2021*

Conclusions: COVID Impacts

- BCSC data: utilization of screening mammography largely recovered to pre-pandemic levels by July 2020
  - But substantial cumulative deficits in screening and screen-detected cancers remain
  - Not clear that a full recovery in volumes had been achieved by September 2020 (~90%)

- CISNET modeling: The impact of the initial pandemic-related disruptions in breast cancer care will have a small long-term impact on breast cancer mortality.

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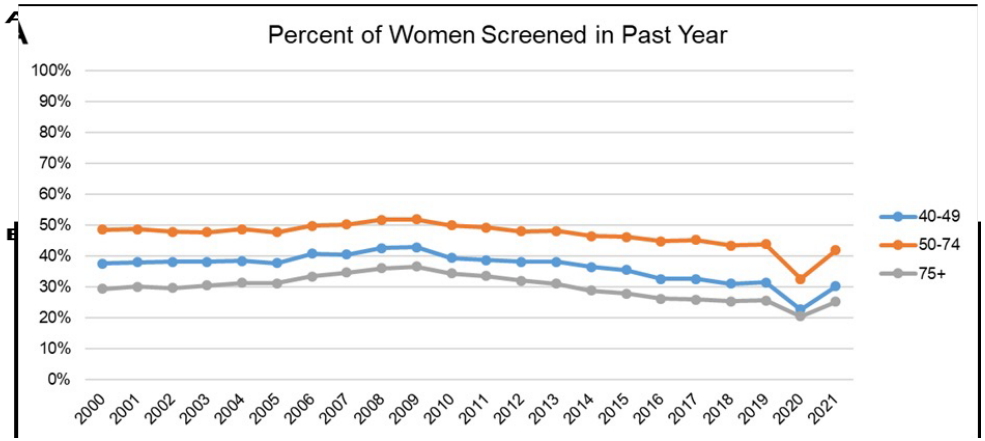
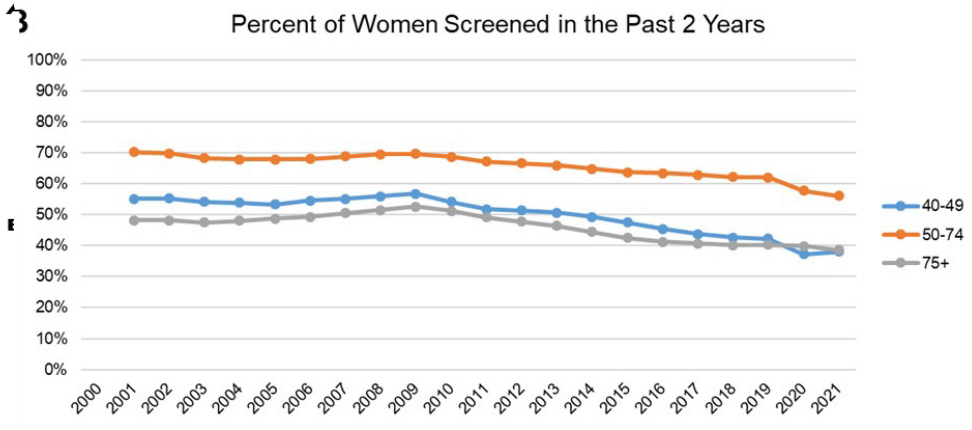
“post-pandemic”

VBCSS Data





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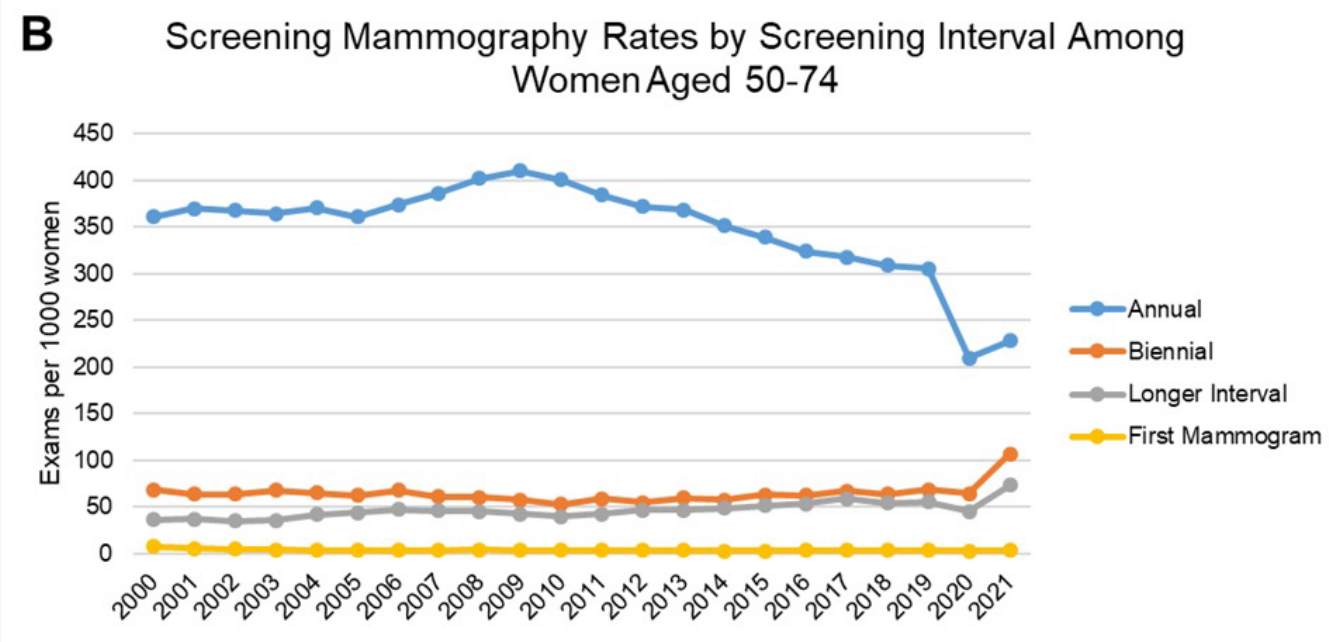
Odde et al., unpublished

VBCSS Data



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Odde et al., unpublished

Predictors of Return to Screening after the Onset of the Pandemic

- Among 96,544 women screened in Vermont during 2018-2020 prior to the pandemic onset, what factors were associated with lower likelihood of returning to screening by end of 2021?
  - Age 40-44 (RR=0.90) or >=75 (RR=0.80)
  - Asian/Black/Native American race and Hispanic ethnicity (RR=0.7-0.9)
  - Lower educational attainment (RR=0.80 for <HS degree)
  - Metropolitan residence (RR=0.92 vs. small town)
  - Low risk women (RR=0.93 for low vs. average risk)

Odde et al., unpublished

Conclusions

- There is a long-term trend towards reduced screening mammography utilization in Vermont and the US
  - Declining adherence to screening at least every 2 years among women aged 50-74
    - ~57% adherence in Vermont in 2021
  - Little uptake of biennial screening
- The COVID pandemic interrupted screening but the direct impact of those short-term disruptions may be small, with some exceptions
  - Increasing disparities due to unequal rebound in screening
- Primary drivers of declining screening adherence are unclear
  - Where to focus to reverse these trends?
- USPSTF is currently reviewing their breast cancer screening recommendations…

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Acknowledgements

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UVM
Sarah Nowak
Donald Weaver
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Mark Bowman, Cindy Groseclose, Tiffany Sharp, Kathleen Howe, Meghan Farrington, Ben Isenhart, Michael Butler, Dusty Quick

Funding
National Institute for General Medical Sciences (P20GM103644)
National Cancer Institute (U54CA163303, P01CA154292, HHSN26120110031C, R01CA248068)
Patient-Centered Outcomes Research Institute (PCS-1504-30370)

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