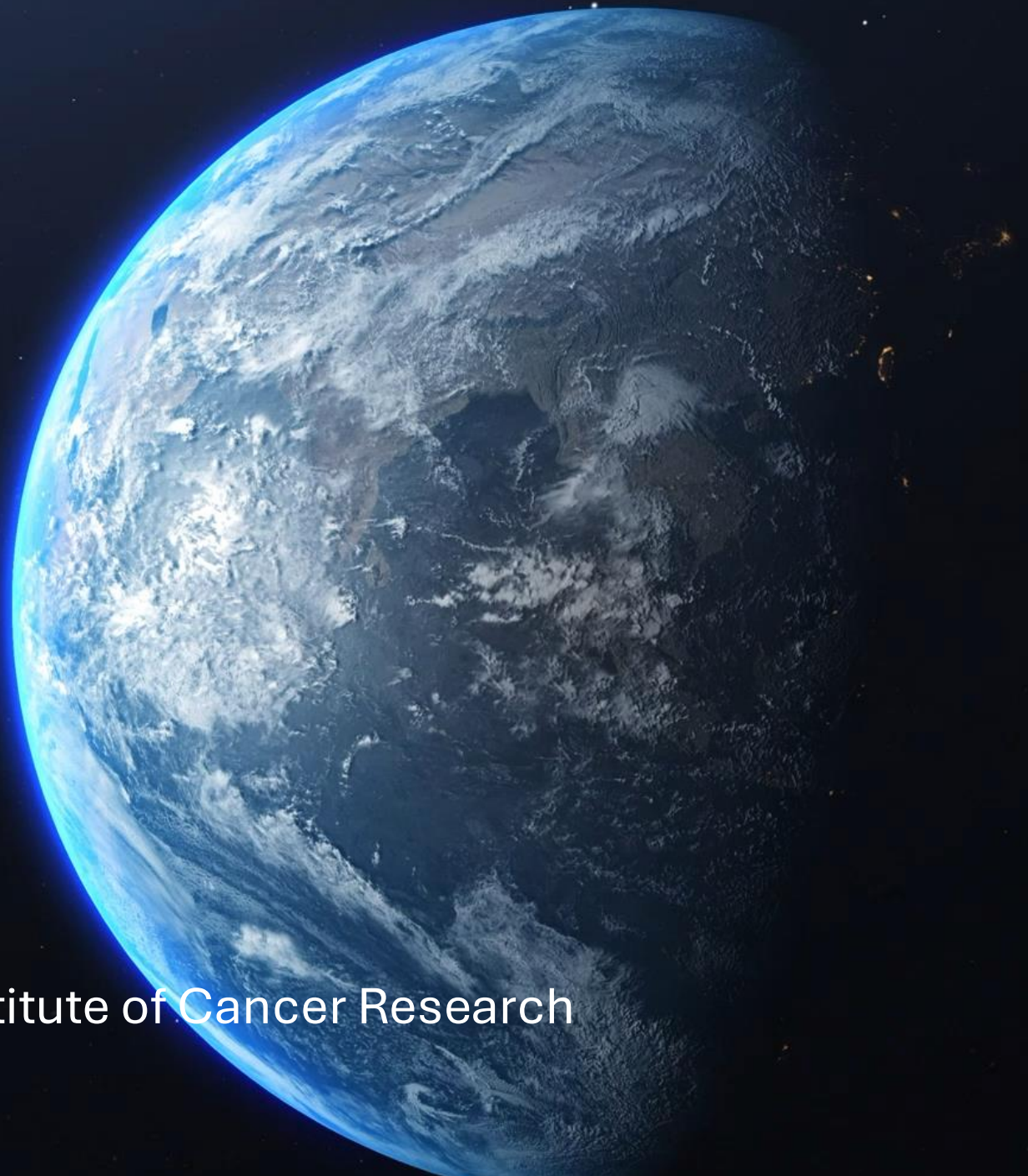
# Global trends in Radiation Oncology



Dr Alison Tree

The Royal Marsden Hospital and The Institute of Cancer Research

# Potential conflicts of interest

- Research funding from Elekta, Varian, Accuray, Artera
- Honoraria/Travel grants from Elekta, Accuray, Janssen, Bayer, Astellas
- Chair of the MR linac consortium

# Outline

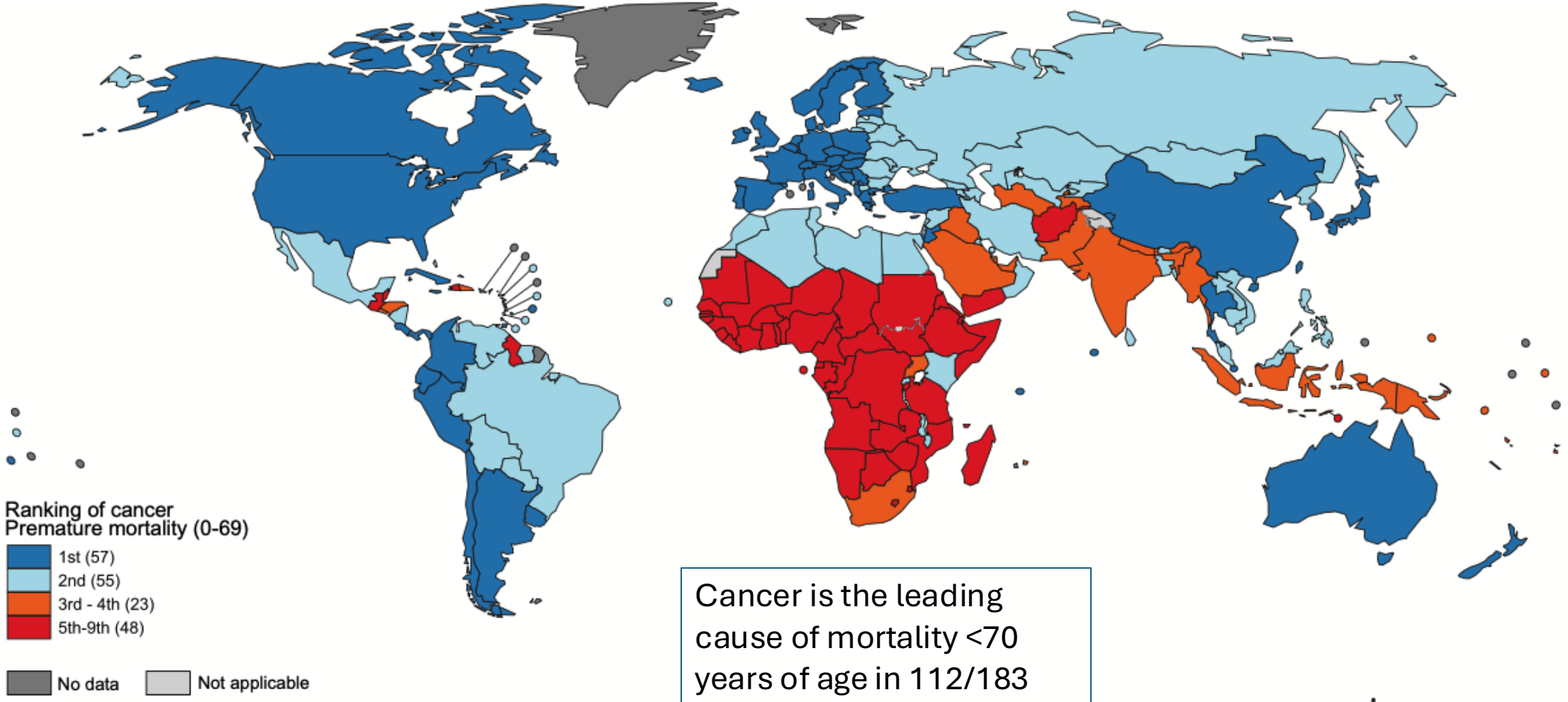
- Global cancer statistics
- Trends in prostate cancer epidemiology, global and US
- How has evidence translated to a change in practice in prostate cancer?
- Where next?

# Firstly, lets scope out the global oncology landscape

In which countries of the world is cancer the leading cause of premature mortality?

CA CANCER J CLIN 2021;71:209–249

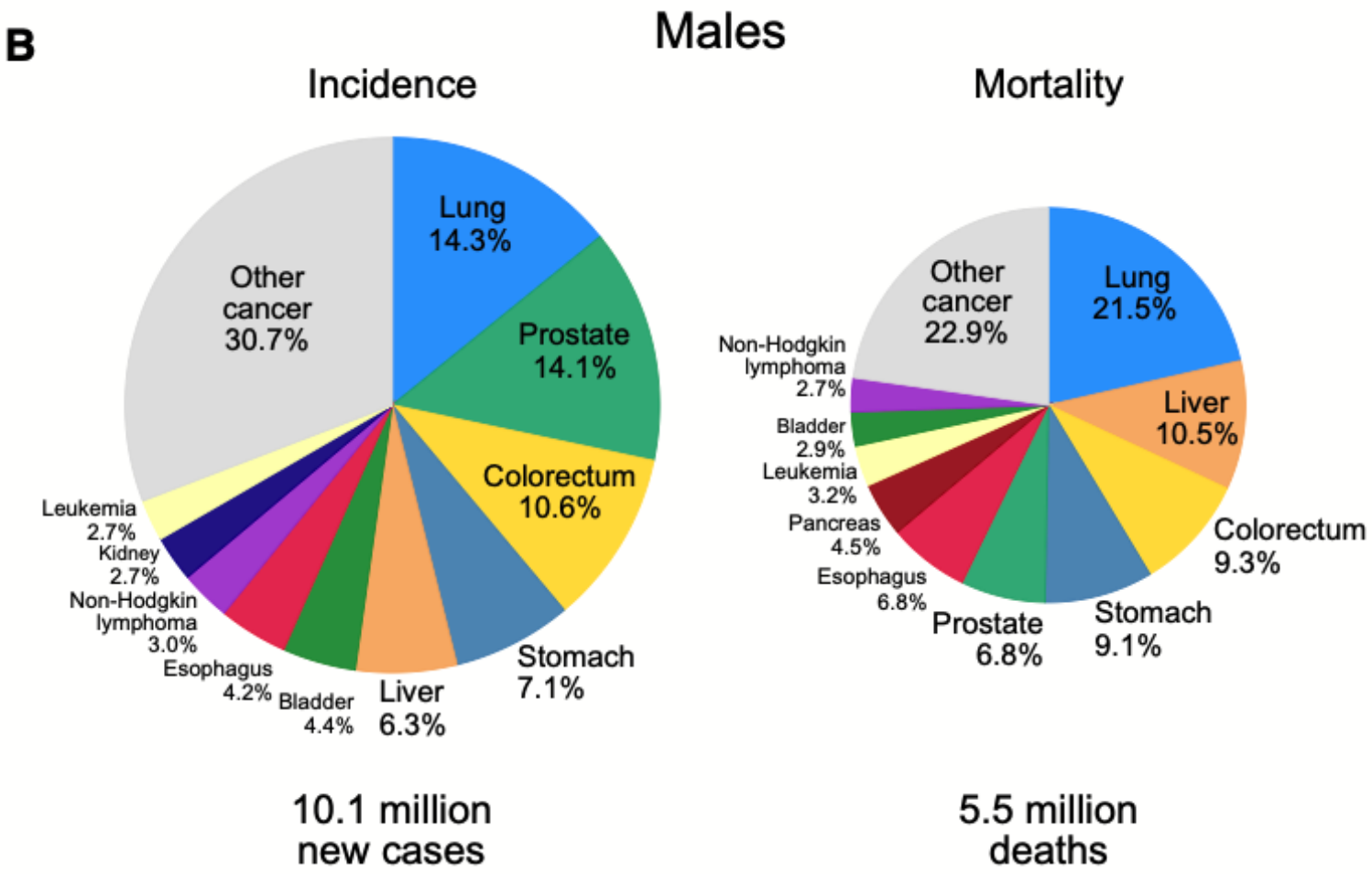
# GLOBOCAN




Cancer is the leading cause of mortality <70 years of age in 112/183 countries

Sung et al, CA Cancer J Clin 2021

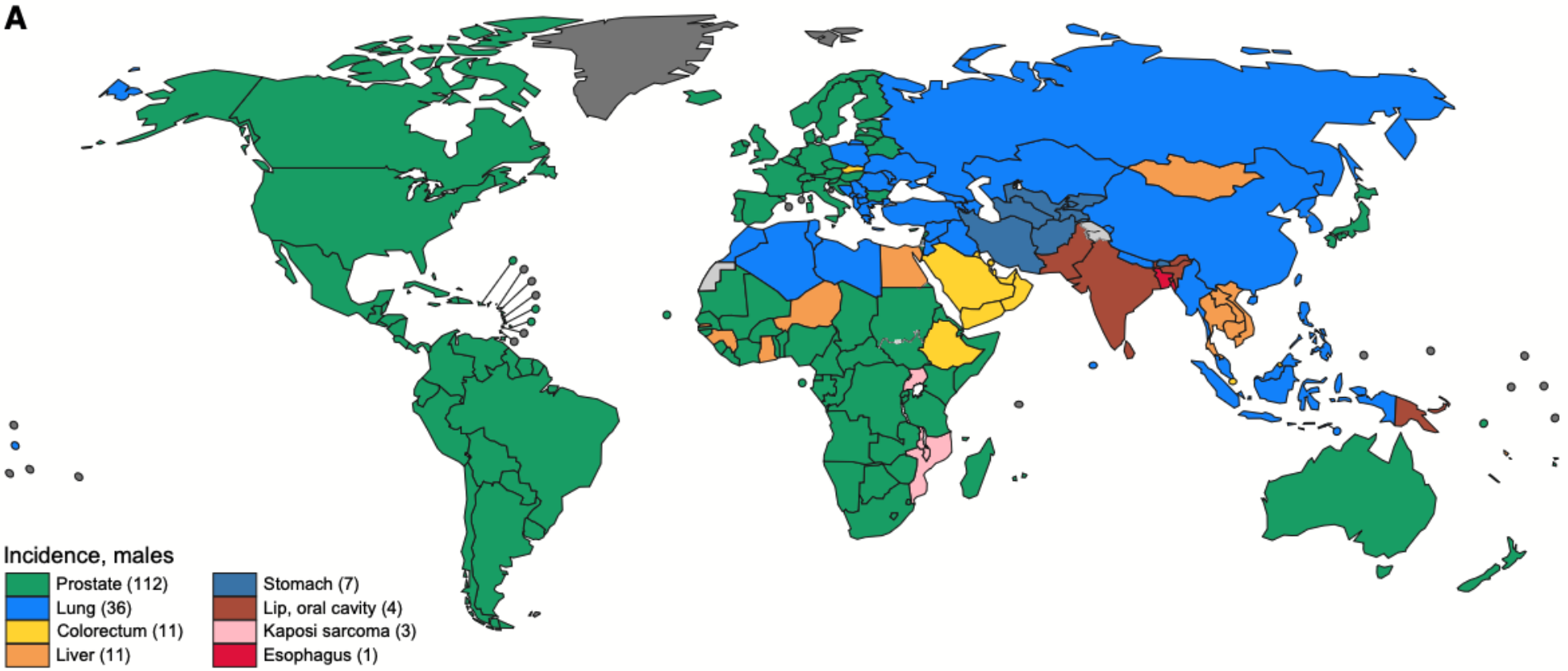
# Types of cancer in males only




Lung and prostate most common cancers globally
Lung cancer still globally the leading cause of cancer death

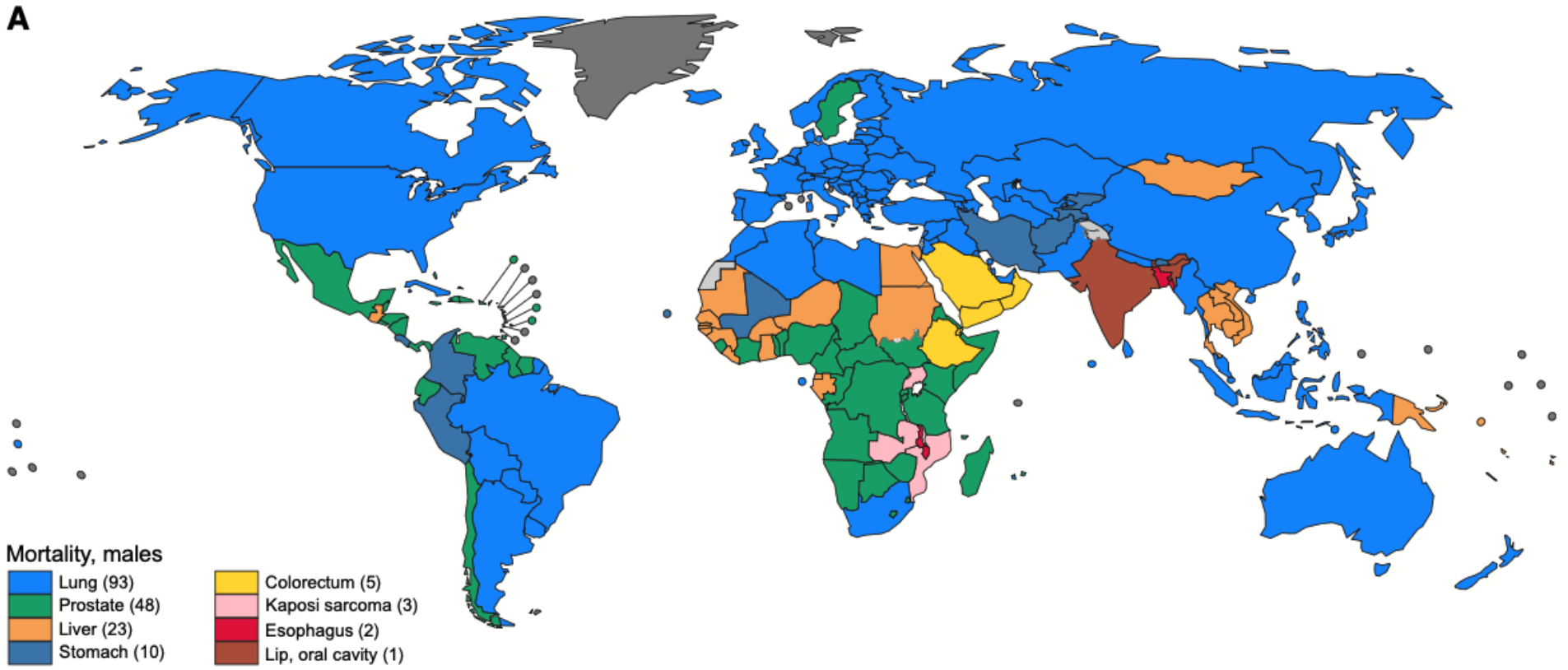
Sung et al, CA Cancer J Clin 2021

# Prostate cancer – most commonly **diagnosed** male cancer in 112 countries




Sung et al, CA Cancer J Clin 2021

# Lung cancer still a more common cause of **death** outside sub-Saharan Africa

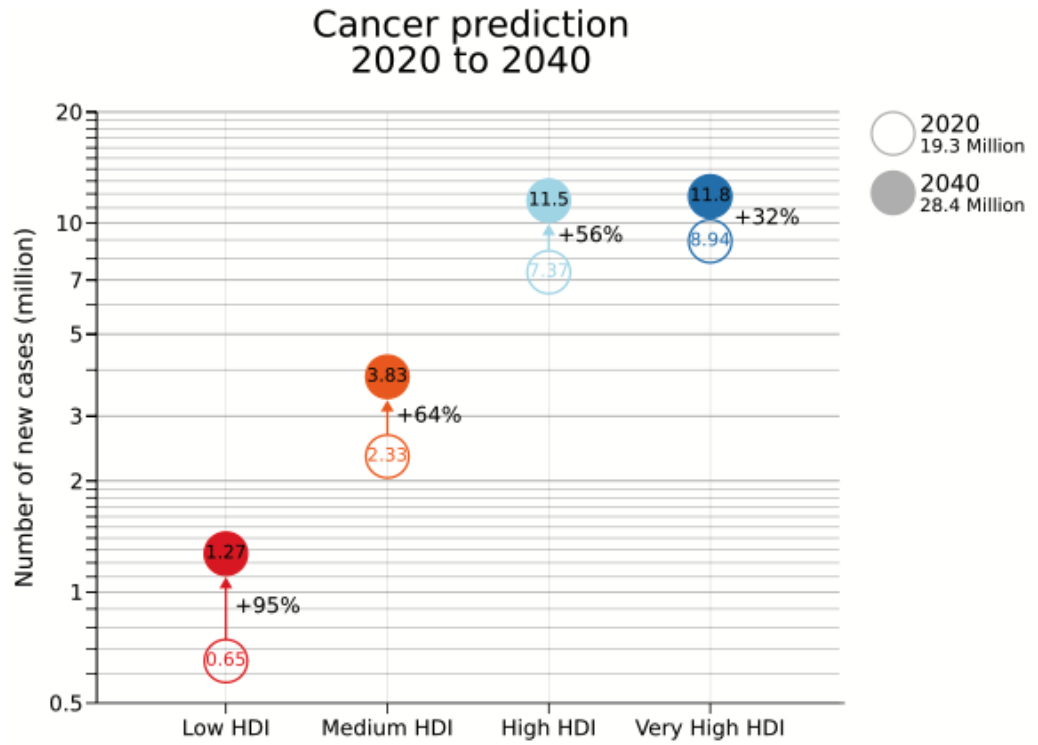



Sung et al, CA Cancer J Clin 2021

# What's changing in cancer incidence globally?

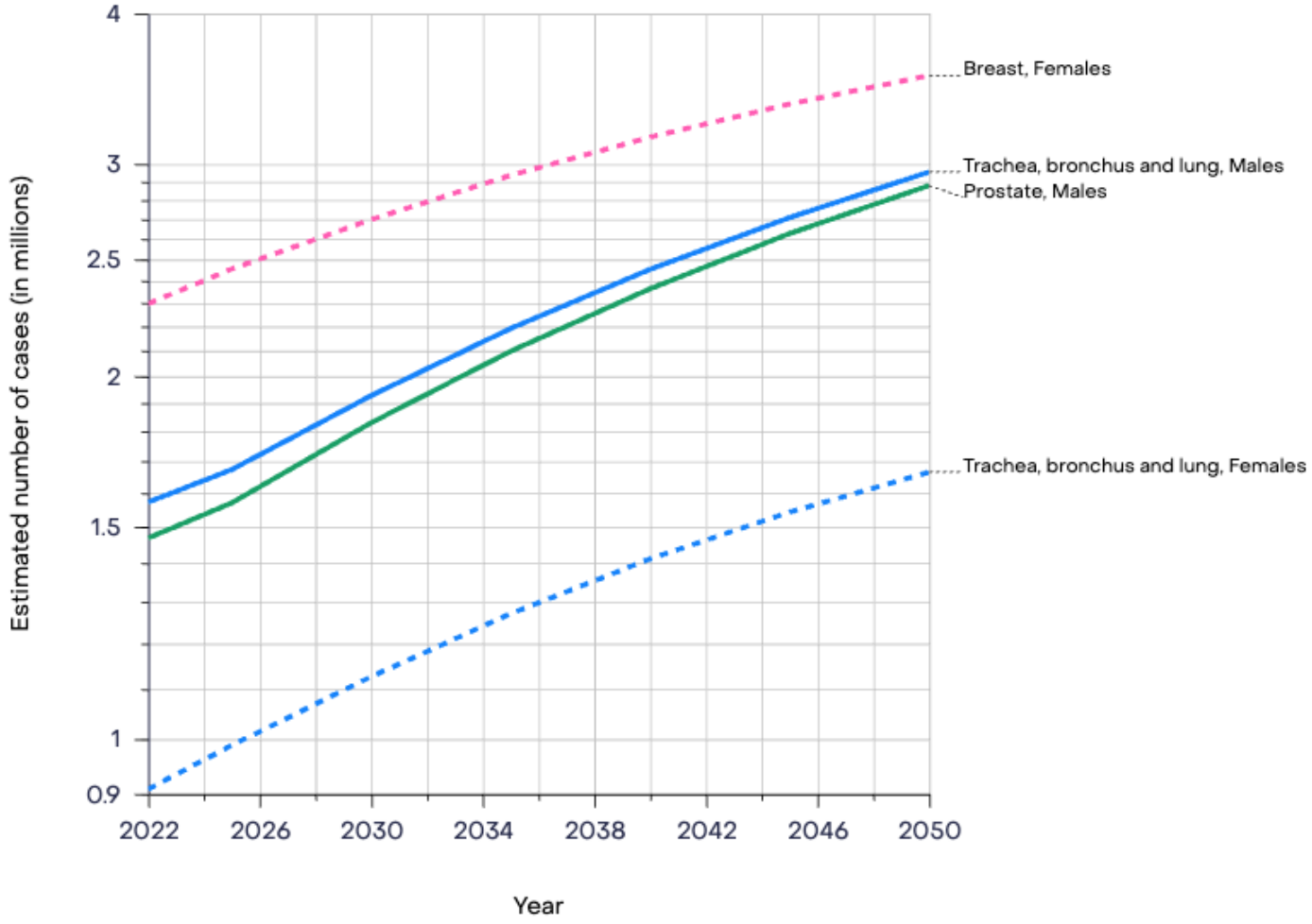
- In 2020
  - 19.2 million new cancer cases globally
  - Nearly 10 million cancer deaths

- By 2040
  - 28.4 million cases (47% rise)



**Estimated number of new cases from 2022 to 2050, Males and Females, age [0-85+]**

World



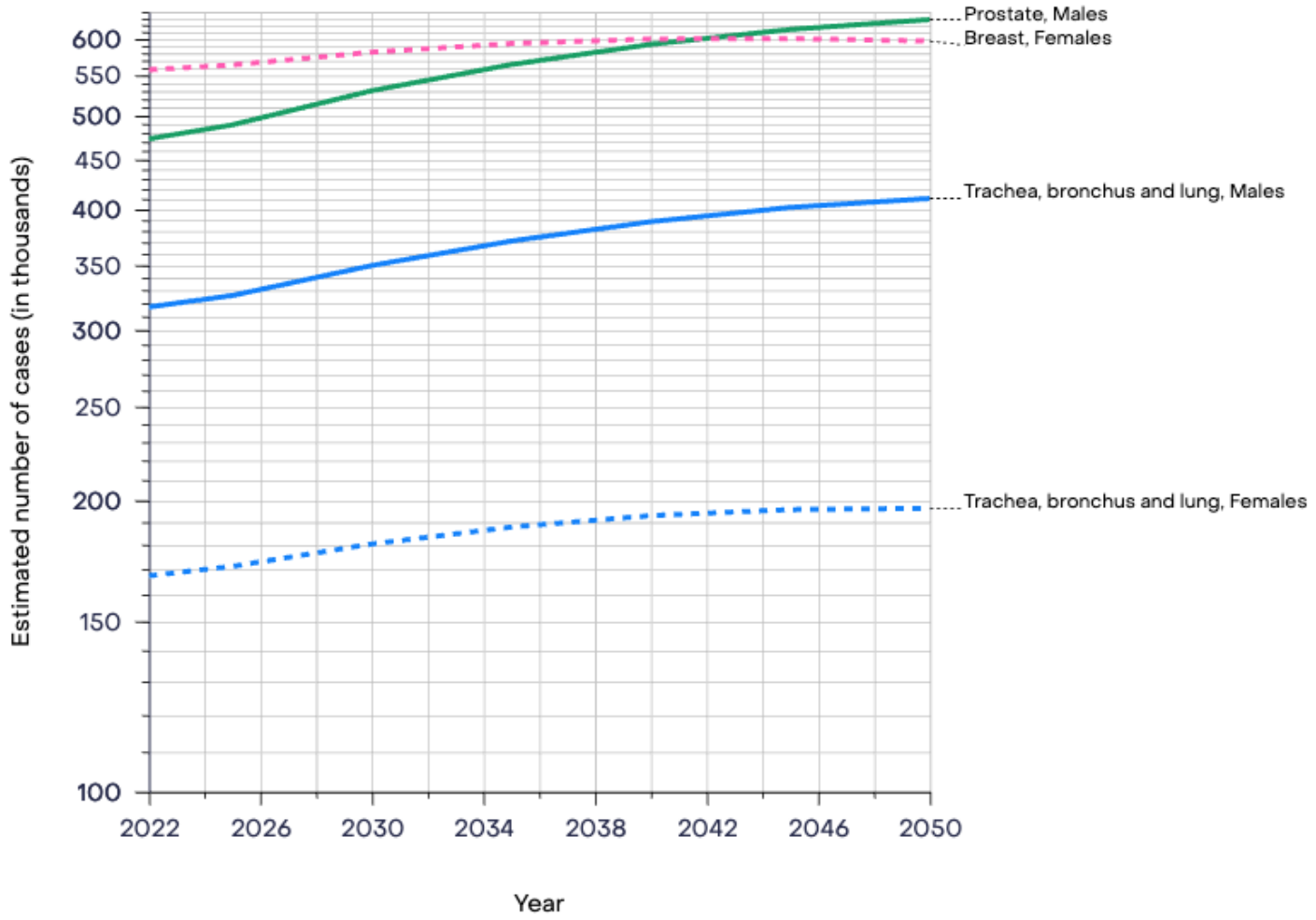

**Cancer Tomorrow** | **IARC** – https://gco.iarc.who.int

**Data version**: Globocan 2022 (version 1.1) – 08.02.2024



https://gco.iarc.who.int/tomorrow/en/dataviz/trends?multiple_populations=0&mode=cancer&multiple_cancers=1&cancers=27_20_15&types=0&populations=908

**Estimated number of new cases from 2022 to 2050, Males and Females, age [0-85+]**
Europe

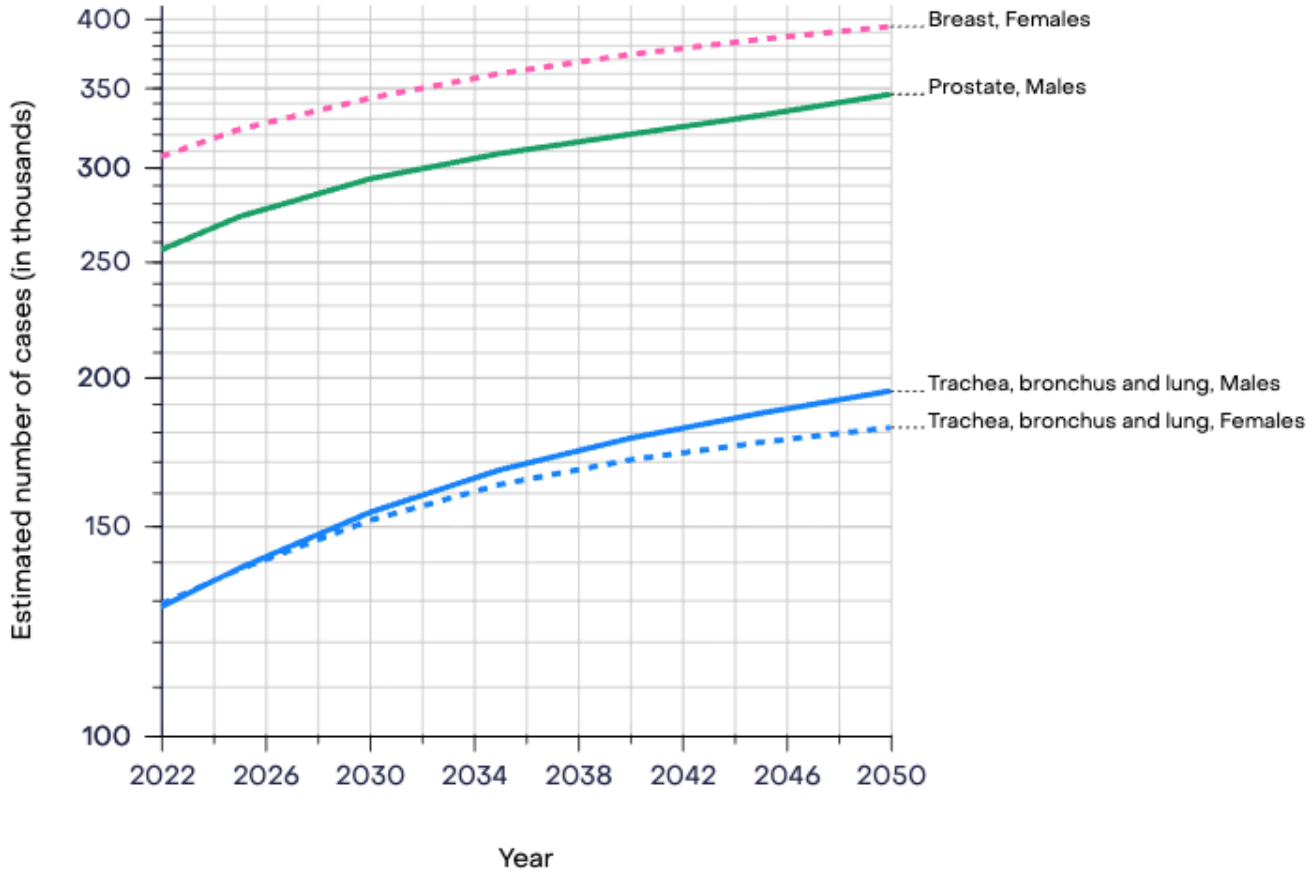



**Cancer Tomorrow** | **IARC** – https://gco.iarc.who.int
**Data version**: Globocan 2022 (version 1.1) – 08.02.2024


https://gco.iarc.who.int/tomorrow/en/dataviz/trends?multiple_populations=0&mode=cancer&multiple_cancers=1&cancers=27_20_15&types=0&populations=908

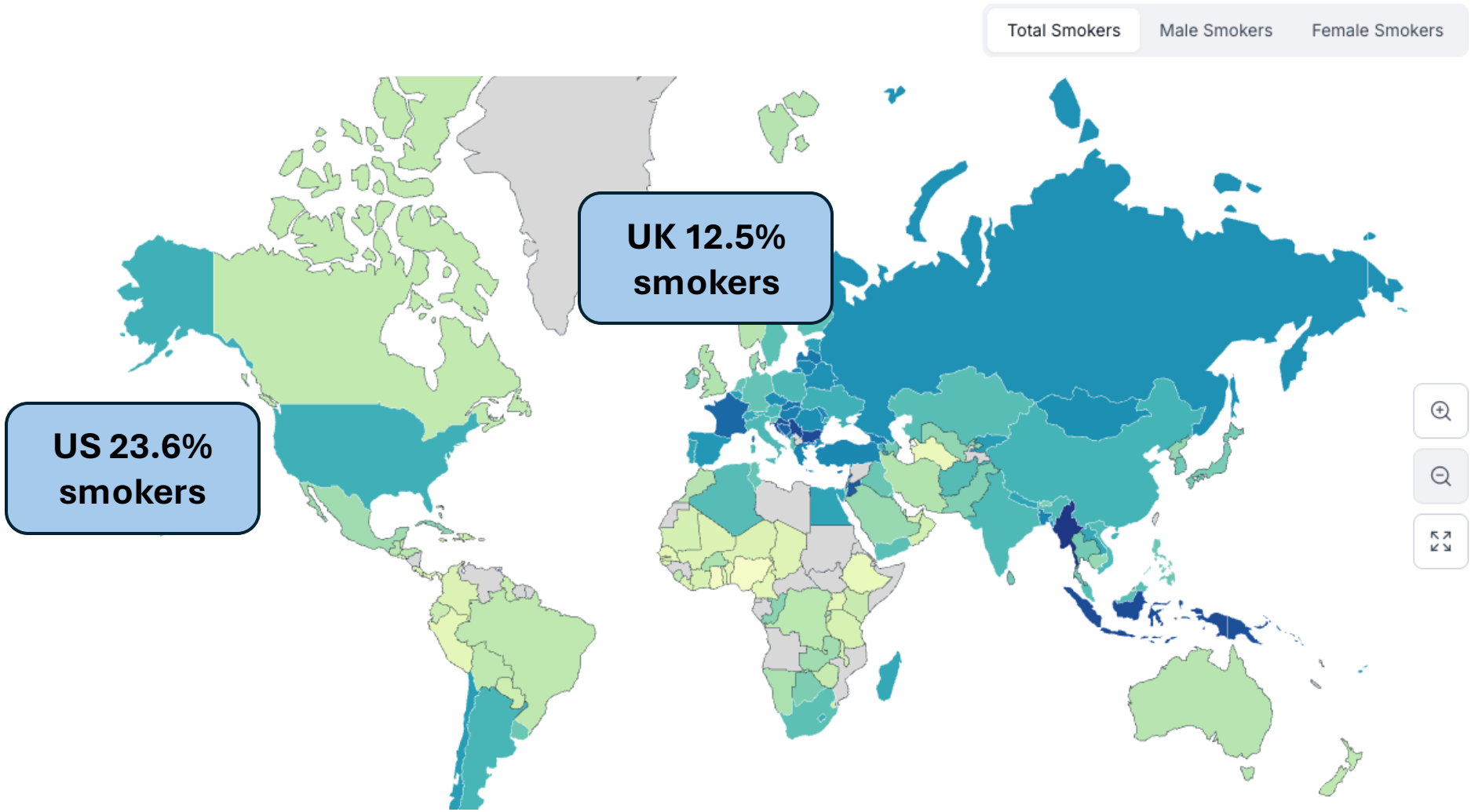
**Estimated number of new cases from 2022 to 2050, Males and Females, age [0-85+]**

Canada + United States of America




https://gco.iarc.who.int/tomorrow/en/dataviz/trends?multiple_populations=0&mode=cancer&multiple_cancers=1&cancers=27_20_15&types=0&populations=908

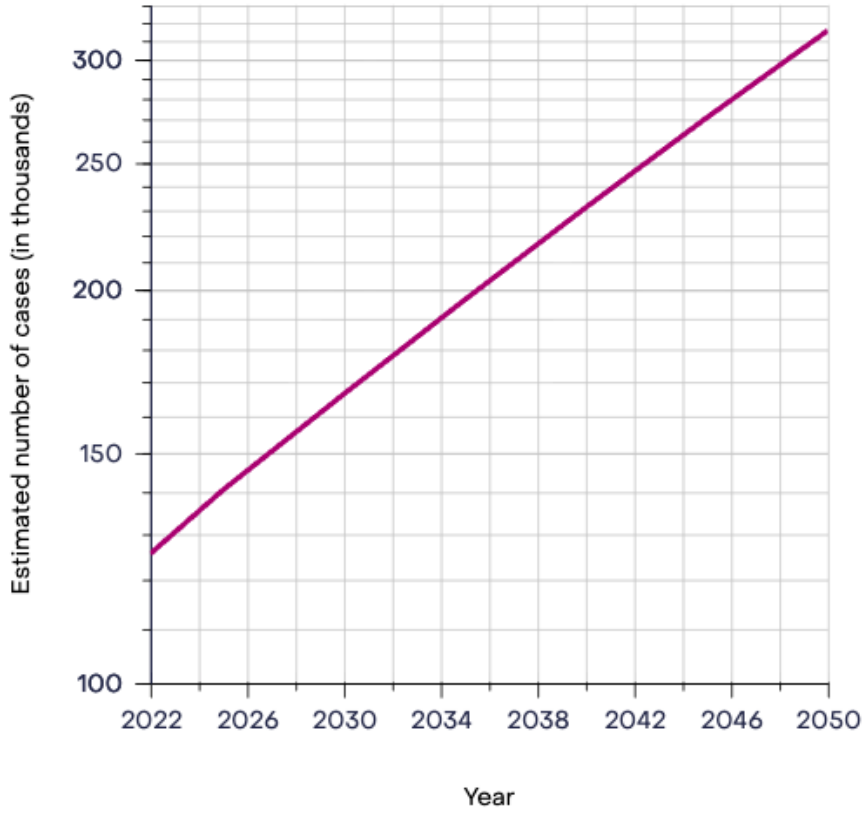
# Smoking Rates by Country 2026



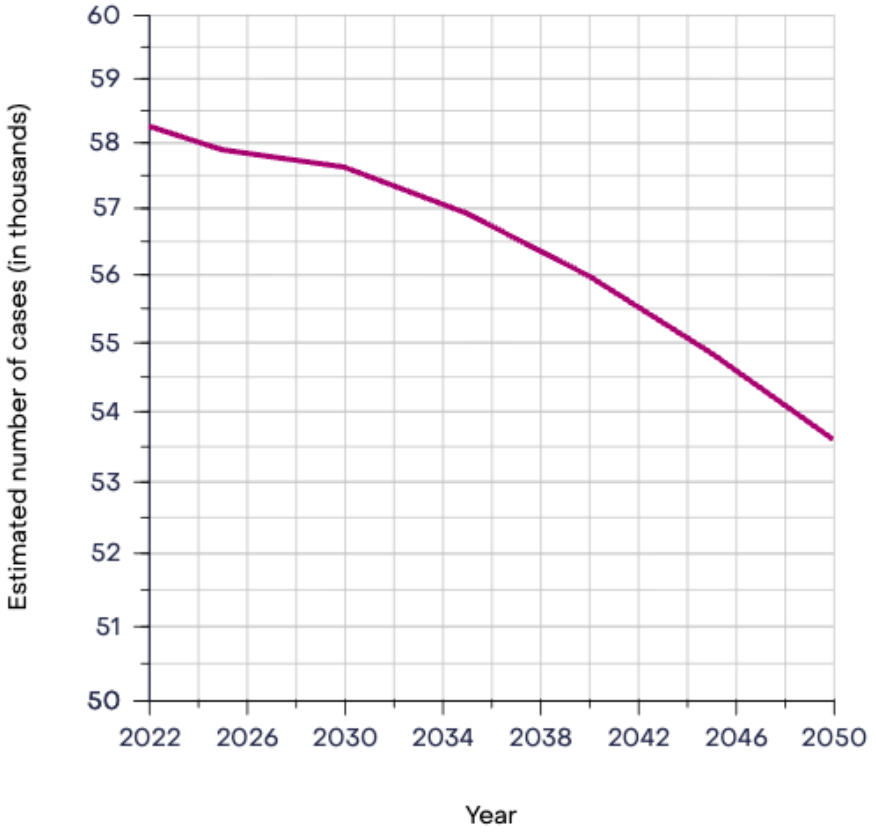

https://worldpopulationreview.com/country-rankings/smoking-rates-by-country

# Importance of HPV vaccination

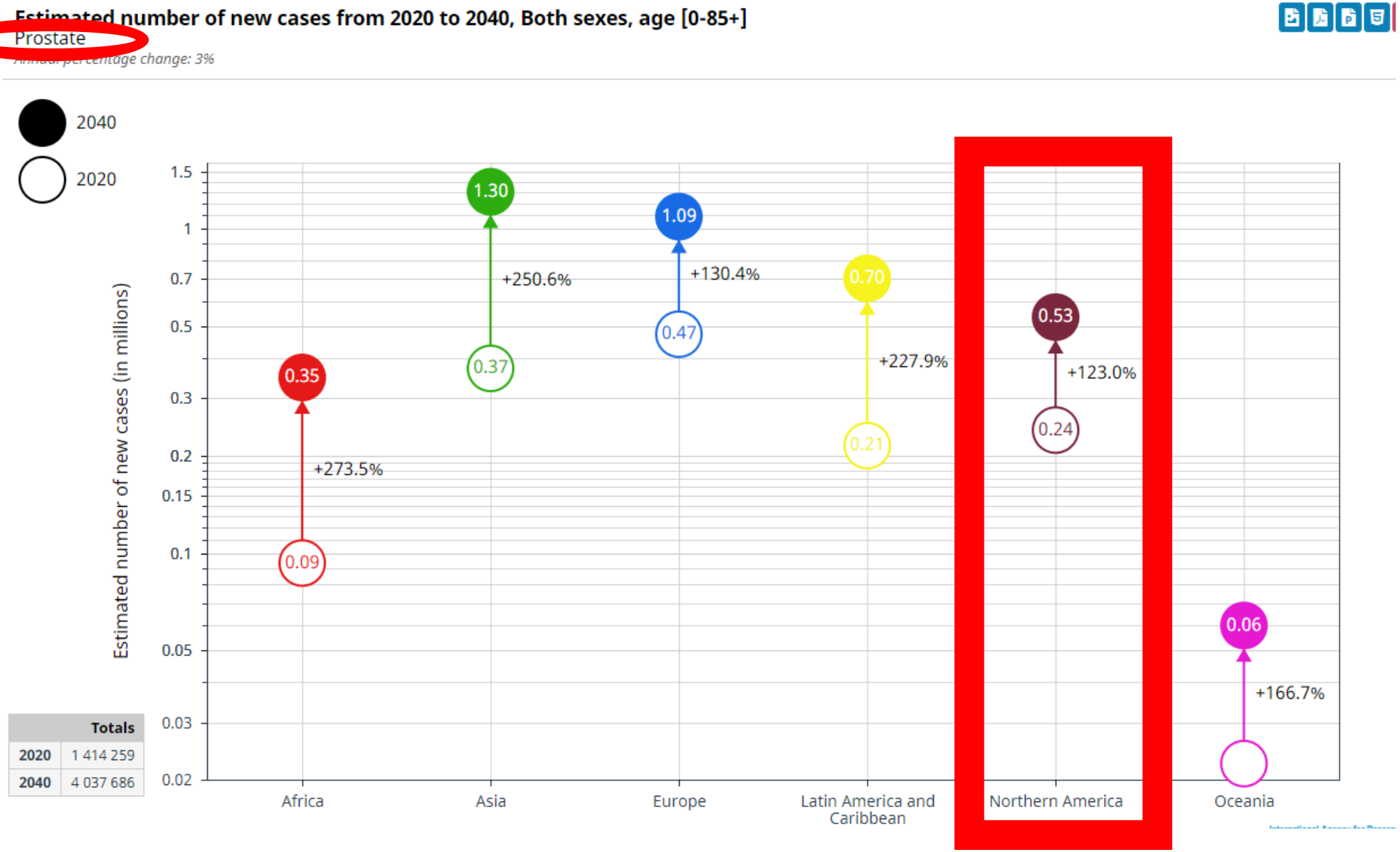
Predicted cervix cancer incidence Africa




Predicted cervix cancer incidence Europe




Data: IARC




Slide credit: Nick James, source IARC

# Key findings – new cases

- New cases of prostate cancer annually will rise from 1·4 million in 2020 to **at least 2·9 million by 2040** driven by changing age structures and improving life expectancy

- The projected rise in cases cannot be prevented by lifestyle changes or public health interventions.

James et al, Lancet Commission 2024

# Global radiotherapy demands and corresponding radiotherapy-professional workforce requirements in 2022 and predicted to 2050: a population-based study

*Hongcheng Zhu, Melvin Lee Kiang Chua, Imjai Chitapanarux, Orit Kaidar-Person, Catherine Mwaba, Majed Alghamdi, Andrés Rodríguez Mignola, Natalia Amrogowicz, Gozde Yazici, Zouhour Bourhaleb, Humera Mahmood, Golam Mohiuddin Faruque, Muthukkumaran Thiagarajan, Abdelkader Acharki, Mingwei Ma, Martin Harutyunyan, Hutcha Sriplung, Yuntao Chen, Rolando Camacho, Zhen Zhang*, May Abdel-Wahab**

## Summary

**Background** Addressing the challenge of cancer control requires a comprehensive, integrated, and global health-system response. We aimed to estimate global radiotherapy demands and requirements for radiotherapy professionals from 2022 to 2050.

*Lancet Glob Health* 2024; 12: e1945–53

Published Online October 11, 2024

Zhu et al, Lancet Glob Health, 2024

| | Incidence, 2022 | Incidence, 2050 | Radiotherapy use, 2022 | Radiotherapy use, 2050 | Absolute increase in radiotherapy u | Demand fo teletherapy units, 2022 | Demand for teletherapy units, 2050 | Absolute increase in teletherapy units | Current supply of teletherapy units by DIRAC | Current demand gap |
|---|---|---|---|---|---|---|---|---|---|---|
| Low-income countries (n=26) | 500 002 | 1 254 048 | 320 001 | 802 591 | 482 589 | 711 | 1784 | 1072 | 38 | 673 |
| Lower-middle-income countries (n=51) | 3 798 875 | 7 449 684 | 2 431 280 | 4 767 798 | 2 336 518 | 5403 | 10 595 | 5192 | 1715 | 3688 |
| Upper-middle-income countries (n=47) | 7 811 817 | 12 354 623 | 4 999 563 | 7 906 959 | 2 907 396 | 11 110 | 17 571 | 6461 | 5537 | 5573 |
| High-income countries (n=54) | 7 775 879 | 10 779 087 | 4 976 563 | 6 898 616 | 1 922 053 | 11 059 | 15 330 | 4271 | 8723 | 2336 |

Data are n. DIRAC=Directory of Radiotherapy Centres.

***Table 1:*** **Estimated absolute increases in global radiotherapy use and teletherapy units between 2022 and 2050, by country income level**

Zhu et al, Lancet Glob Health, 2024

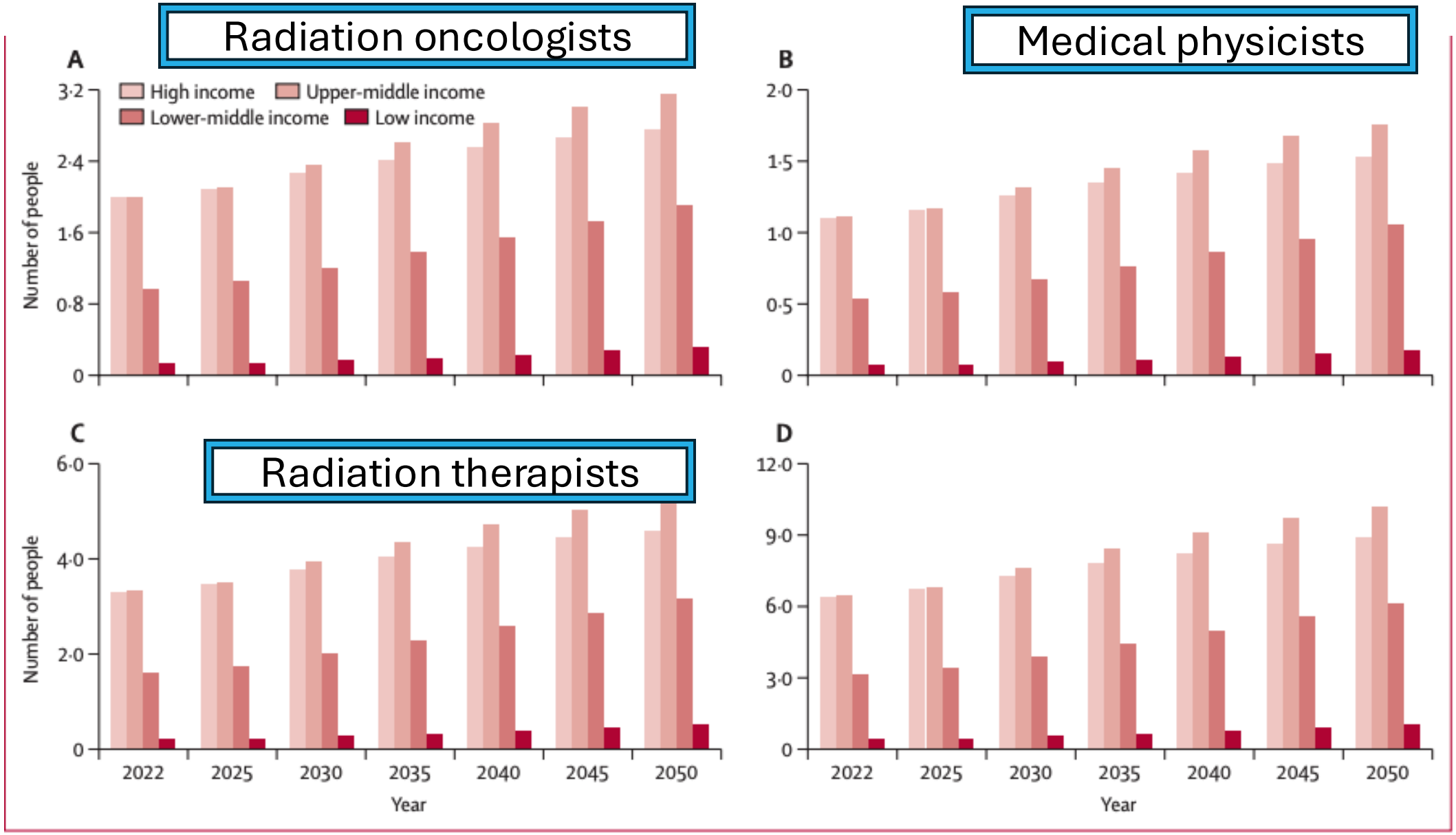
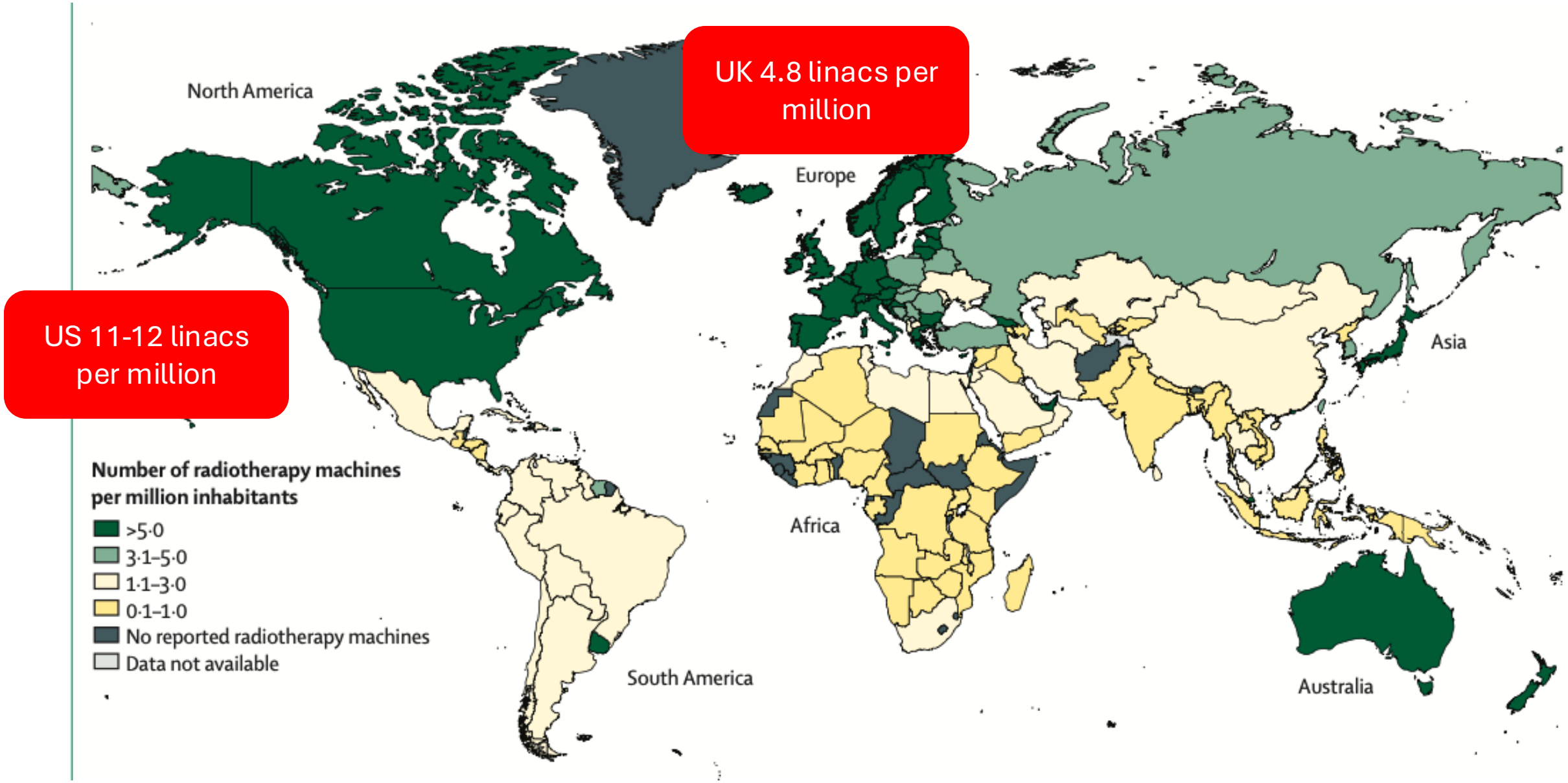



***Figure 2:*** **Estimated radiotherapy-professional workforce requirements from 2022 to 2050, by country income level**
(A) Radiation oncologists in tens of thousands. (B) Medical physicists in tens of thousands. (C) Radiation therapists in tens of thousands. (D) Overall radiotherapy-professional workforce in tens of thousands.

Zhu et al, Lancet Glob Health,




Abdel-Wahab et al, Lancet Oncology 2024

# It’s not all bad news

# Science to the rescue

Int. J. Radiation Oncology Biol. Phys., Vol. 44, No. 4, pp. 747–748, 1999

0360-3016/99/$–see front matter

ELSEVIER

PII S0360-3016(99)00024-3

**EDITORIAL**

## WHAT IS THE $\alpha/\beta$ RATIO FOR PROSTATE CANCER? RATIONALE FOR HYPOFRACTIONATED HIGH-DOSE-RATE BRACHYTHERAPY

GILLIAN M. DUCHESNE, M.D., F.R.C.R., F.R.A.C.R., AND
LESTER J. PETERS, M.D., F.A.C.R., F.R.A.C.R.

Division of Radiation Oncology, Peter MacCallum Cancer Institute, Melbourne, Australia

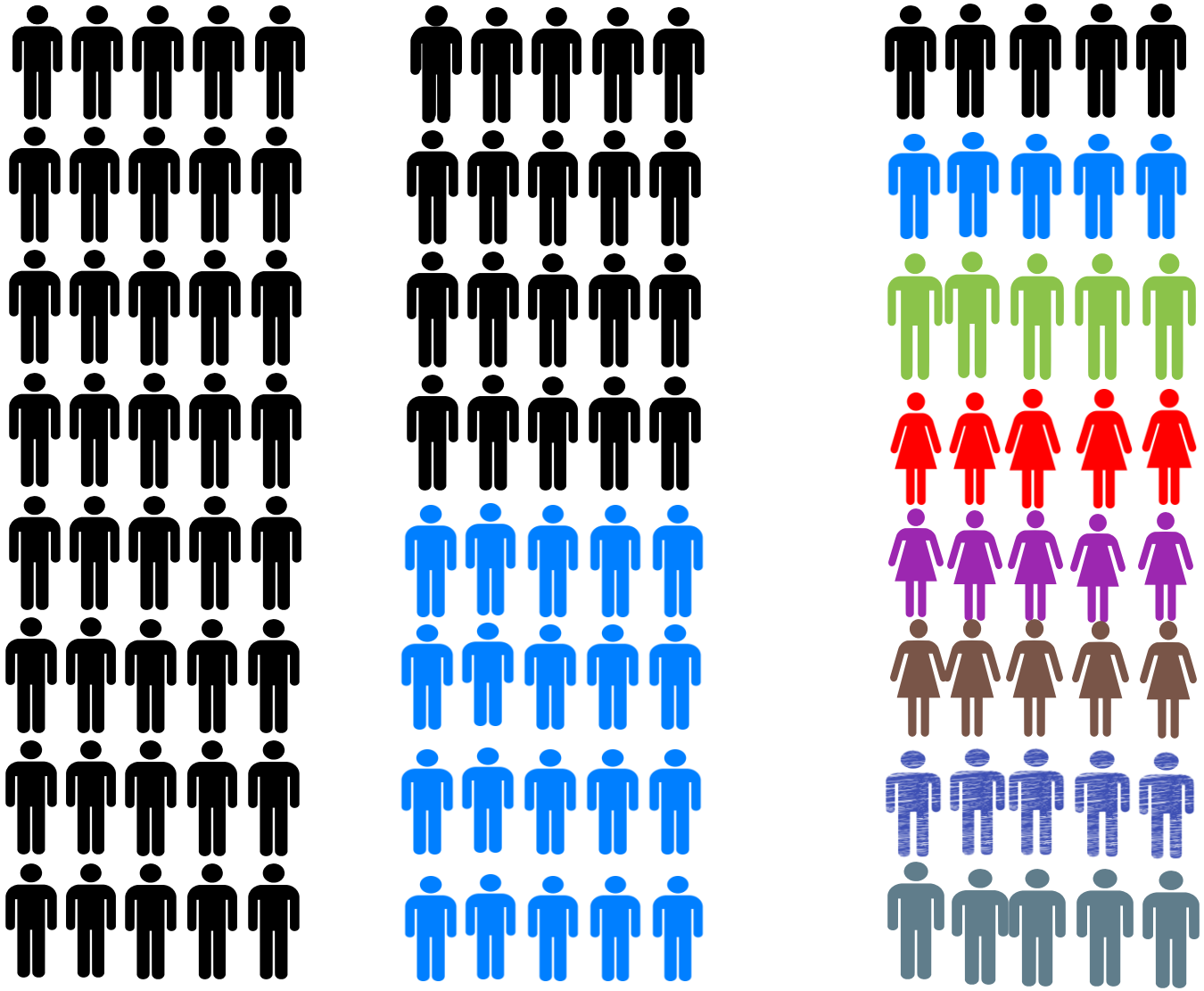

*Clinical Oncology* (2006) **18**: 166–178
doi:10.1016/j.clon.2005.11.011

*Overview*

## Radiobiology of Breast Cancer

A. Tutt*, J. Yarnold†

**Department of Oncology, Guys and St Thomas' Hospital, London, UK; and Breakthrough Breast Cancer Research Centre, Institute of Cancer Research, London, UK; †Section of Radiotherapy, Institute of Cancer Research, Sutton; and Royal Marsden Hospital, Sutton, UK*



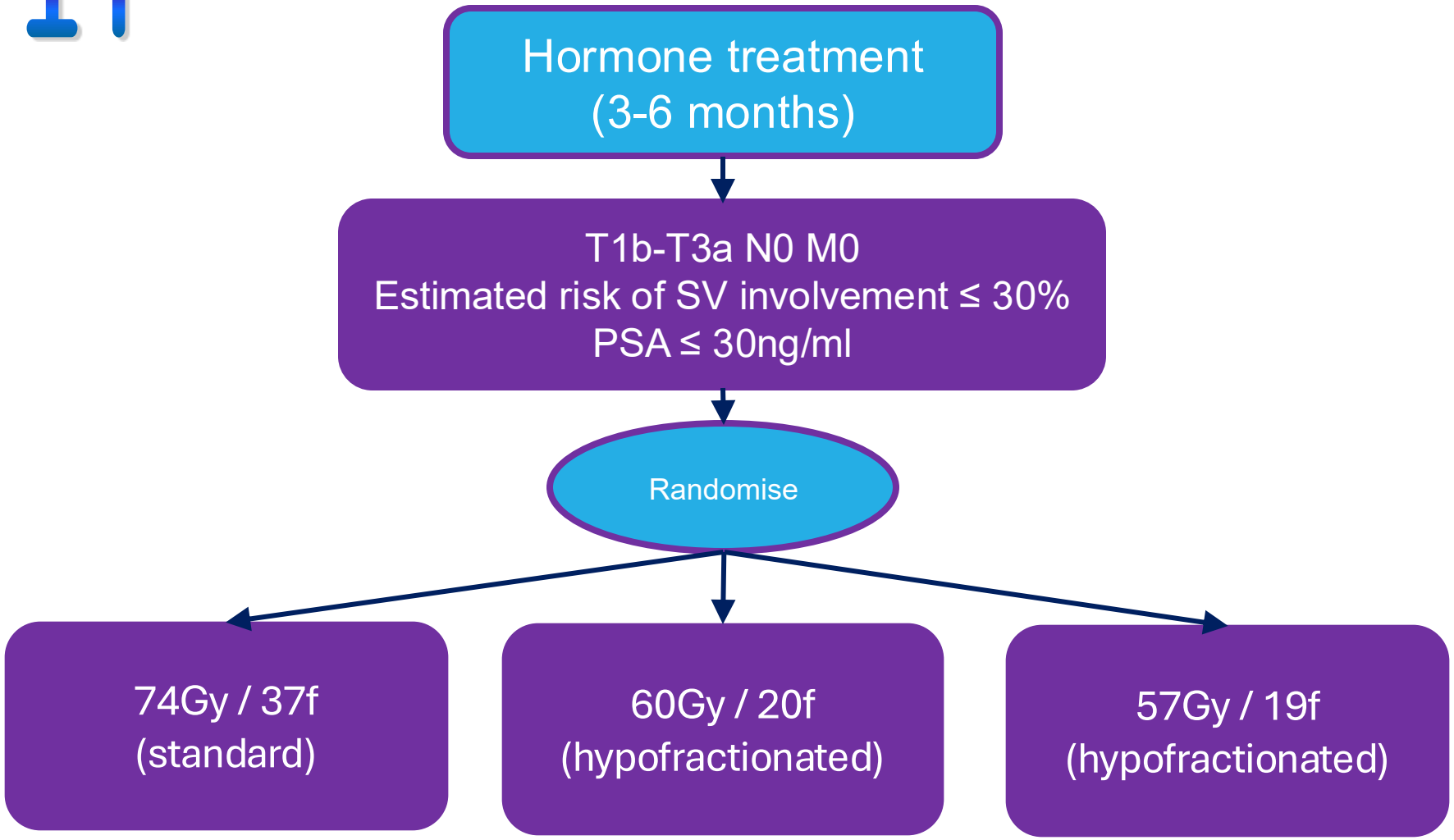
- At 2 Gy per fraction 33.1 million fractions for prostate cancer and 55.1 million for breast cancer
- At 2.5-3 Gy per fraction 17.9 million fractions for prostate and 31.1 million for breast cancer
- Even mod hypofrac allows treating 2.2 million patients more with same resources

Abdel-Wahab et al, Lancet Oncol 2024

- Back of the envelope, if all could be 5 fractions, would be 4.5 million fractions for prostate and 10.5 million fractions for breast

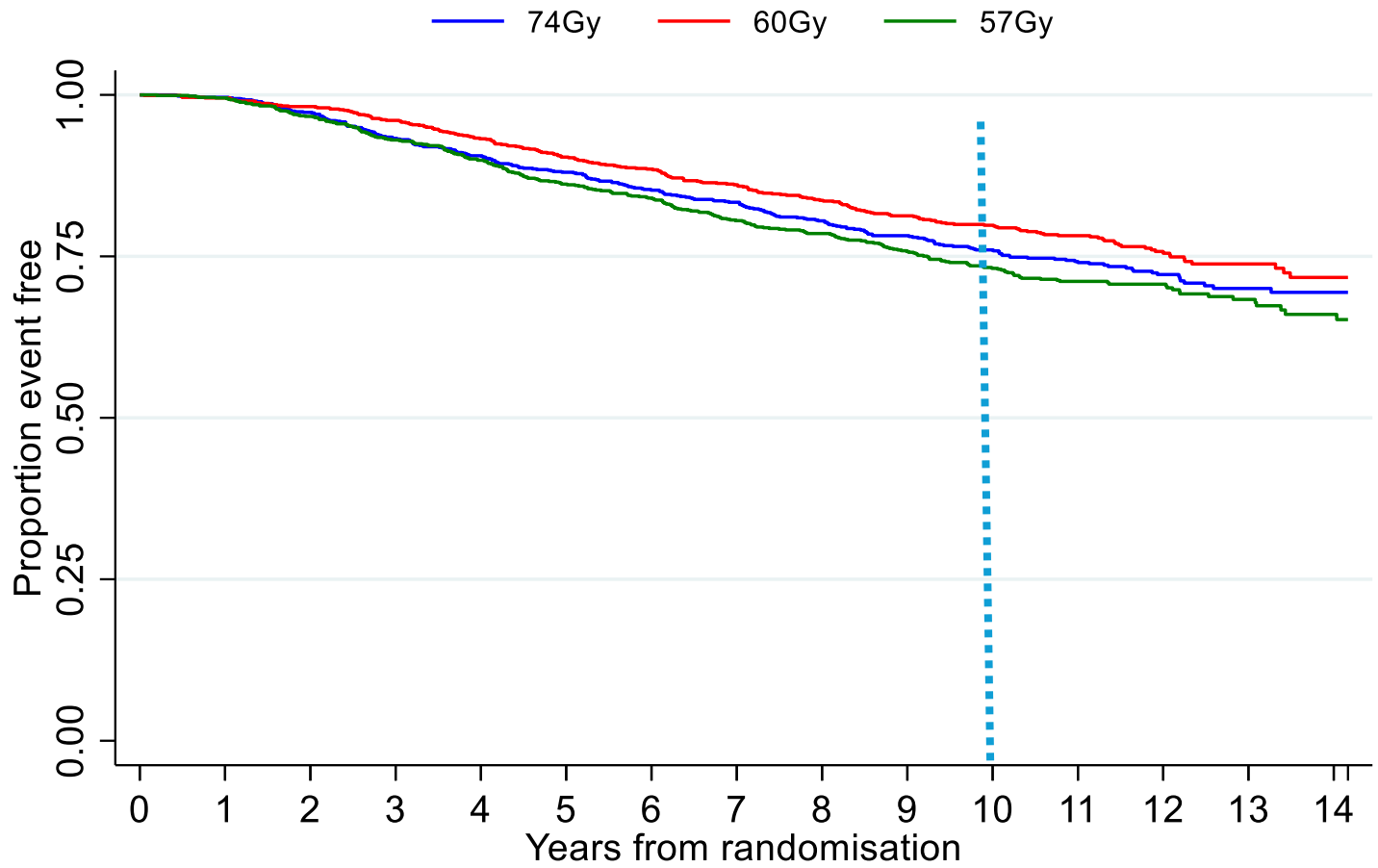
So what is the evidence over the last decade and how has this changed global practice?

# Trial schema




Dearnaley et al, Lancet Oncol. 2016 Aug

# CHHiP trial: Biochemical failure/recurrence at 10 years




Number at risk (events)

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 74Gy | 1065 | (4) | 1039 | (24) | 997 | (41) | 944 | (27) | 900 | (25) | 844 | (26) | 787 | (17) | 740 | (25) | 680 | (19) | 623 | (17) | 550 | (12) | 431 | (9) | 266 | (6) | 150 | (1) | 86 |
| 60Gy | 1074 | (5) | 1047 | (14) | 1019 | (22) | 986 | (29) | 933 | (28) | 882 | (18) | 847 | (23) | 801 | (22) | 751 | (21) | 687 | (12) | 610 | (11) | 455 | (11) | 282 | (6) | 151 | (3) | 91 |
| 57Gy | 1077 | (5) | 1051 | (30) | 1012 | (38) | 961 | (32) | 908 | (37) | 845 | (21) | 811 | (33) | 743 | (18) | 702 | (24) | 637 | (21) | 556 | (14) | 407 | (2) | 259 | (7) | 144 | (4) | 83 |

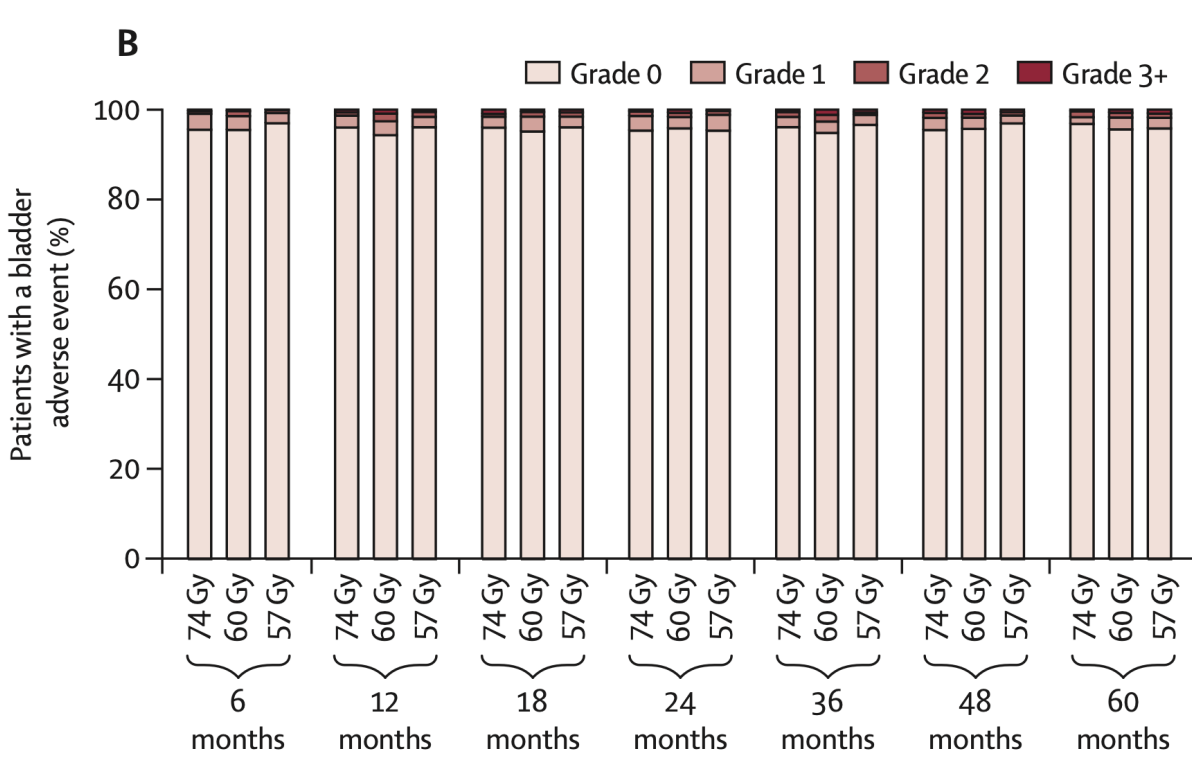
10 year event-free rates:

74Gy: 76.0% (95%CI 73.1-78.6)
60Gy: 79.8% (95%CI 77.1-82.3)
57Gy: 73.1% (95%CI 70.2-75.9)

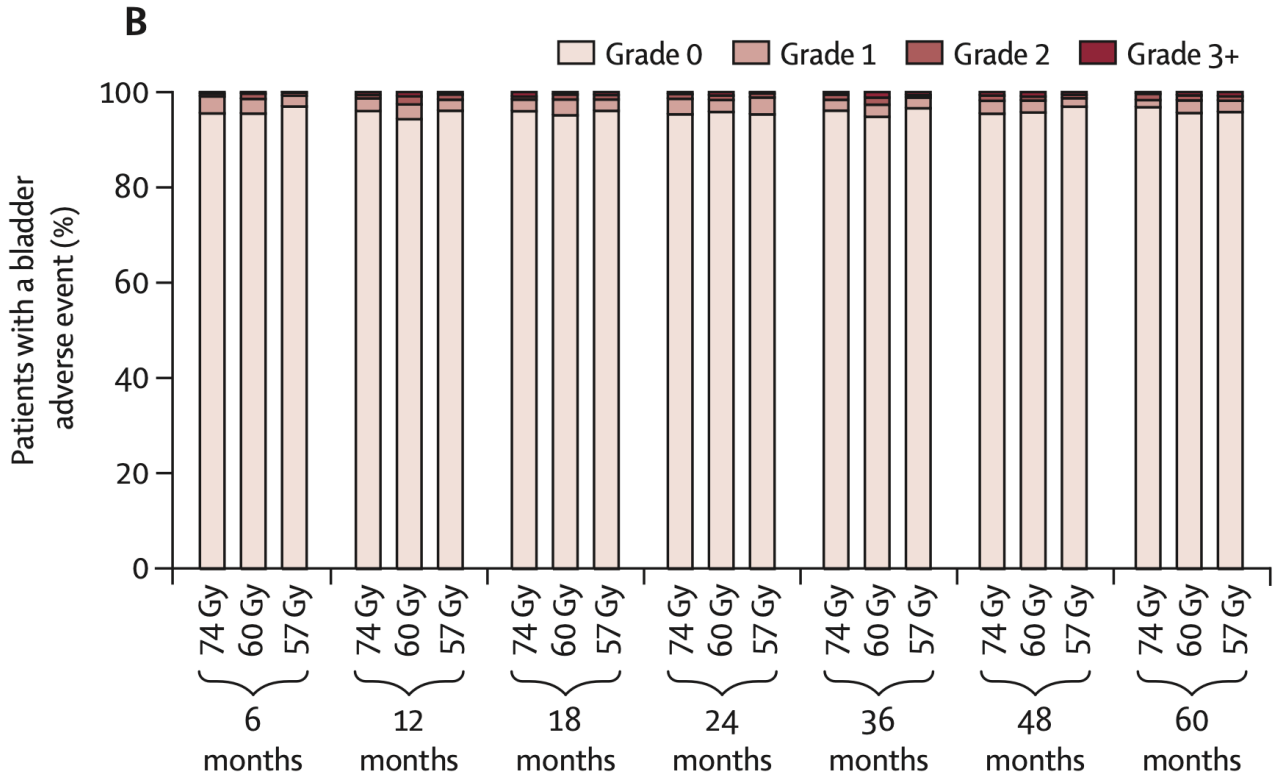
O'Sullivan et al, ASCO 2023

# What about long term side effects?

Bowel




Bladder




Dearnaley et al, Lancet Oncology 2016

# Prostate cancer radiotherapy – evolving standard of care

2010

Radiotherapy over 7.5 weeks (74 Gy)

2016

Radiotherapy over 4 weeks (60 Gy)

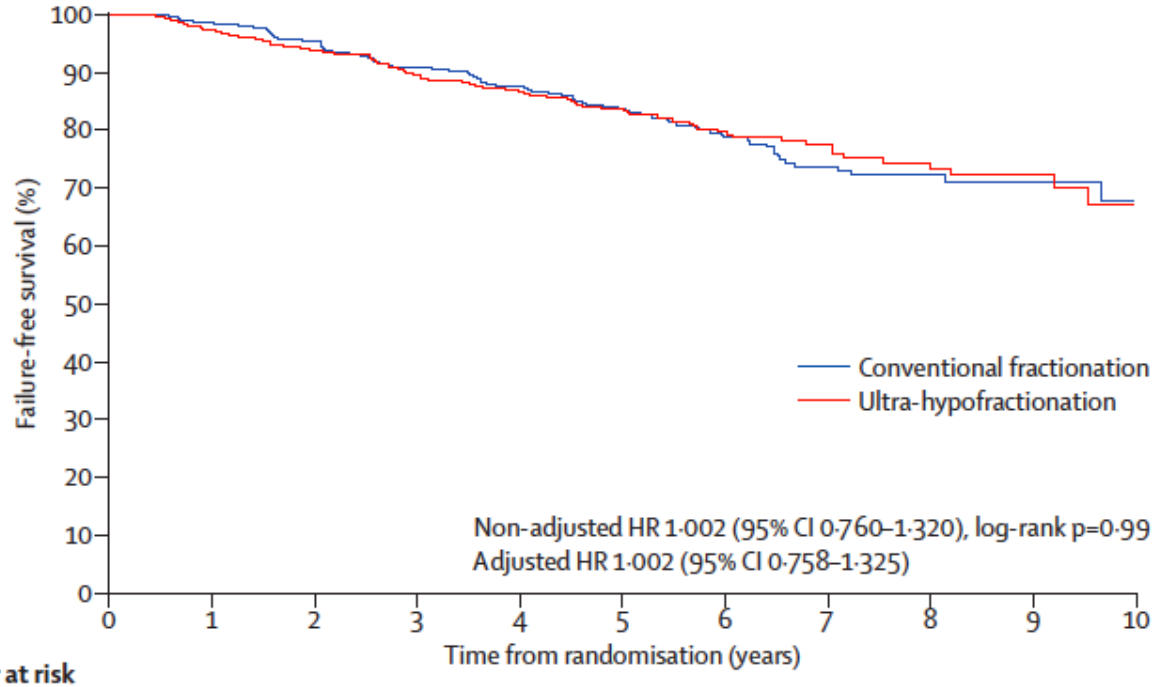
Radiotherapy over 5 days

*RT01 trial*

*CHHiP trial*

*PACE trial*

# HYPO – not technically SBRT but UHF



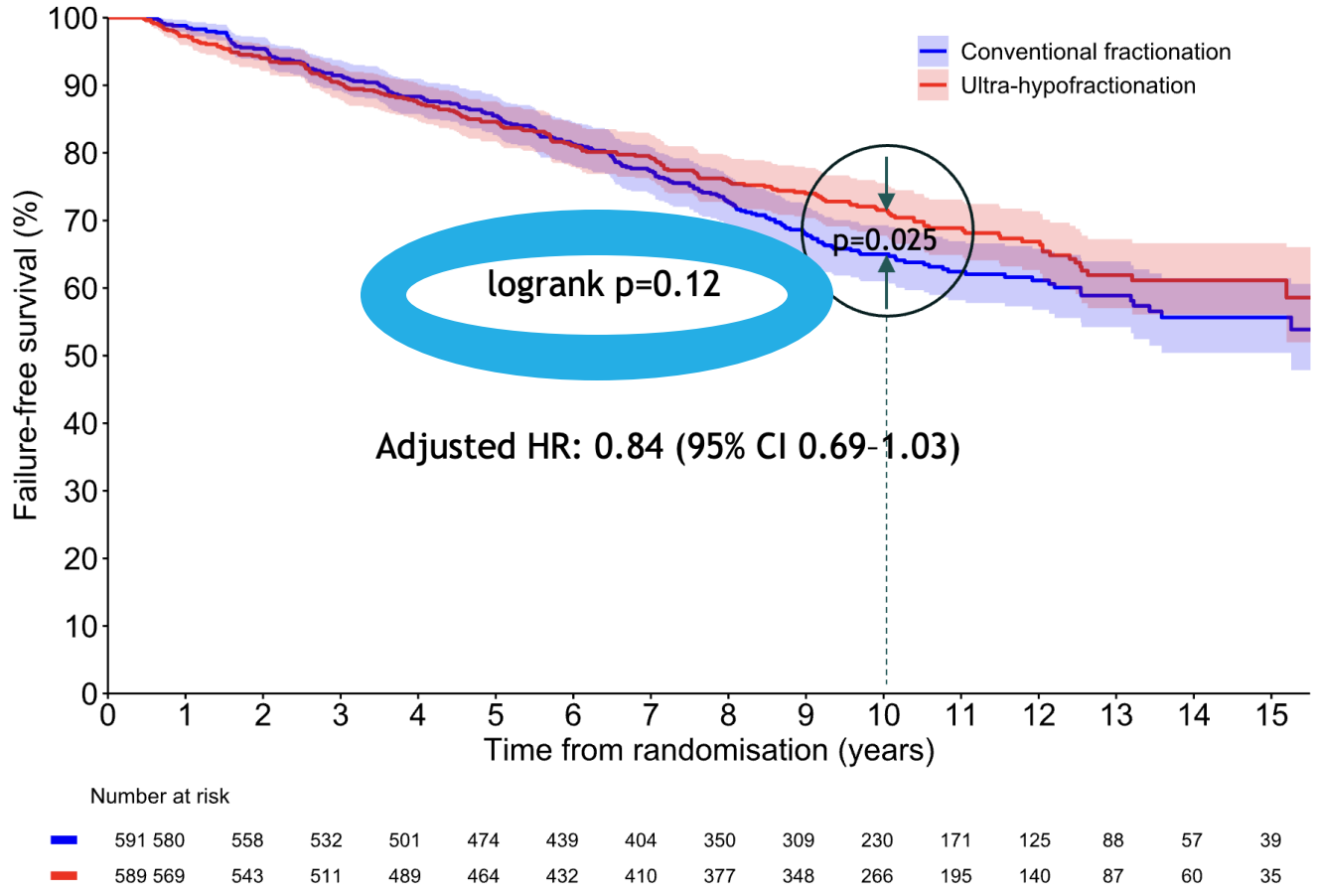

| Number at risk (number censored) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Conventional fractionation | 591 (0) | 580 (4) | 540 (24) | 433 (108) | 332 (196) | 242 (273) | 171 (332) | 108 (386) | 67 (425) | 37 (454) | 23 (467) |
| Ultra-hypofractionation | 589 (0) | 569 (4) | 527 (27) | 408 (125) | 325 (196) | 242 (269) | 160 (342) | 113 (385) | 71 (423) | 38 (454) | 20 (470) |

78 Gy in 39 fractions vs 42.7 Gy in 7 fractions

Supports UHF for all intermediate risk, some high risk

Widmark et al, Lancet Oncology 2019

# Is UHF superior?



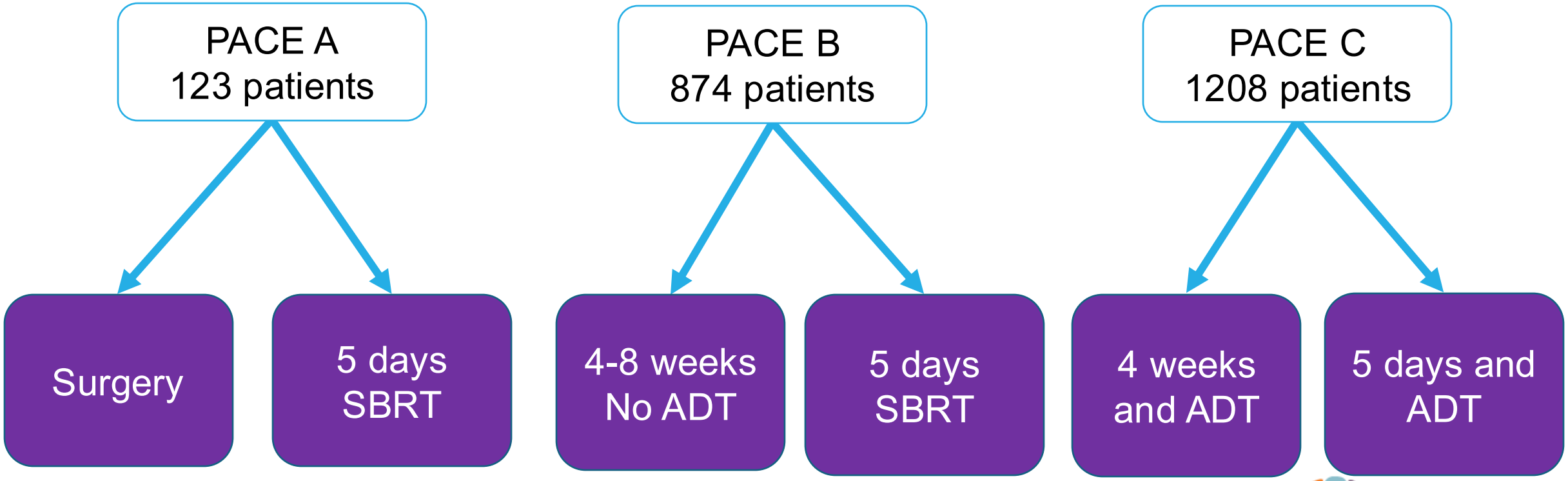

Failure-free survival at 10 years

UHF: 72% (95% CI 68–76)

CF: 65% (95% CI 61–69)

Slide courtesy of Camilla Thellenberg Karlsson, ESTRO 2025

# The PACE umbrella
# Localised prostate cancer
# CI Dr Nick van As

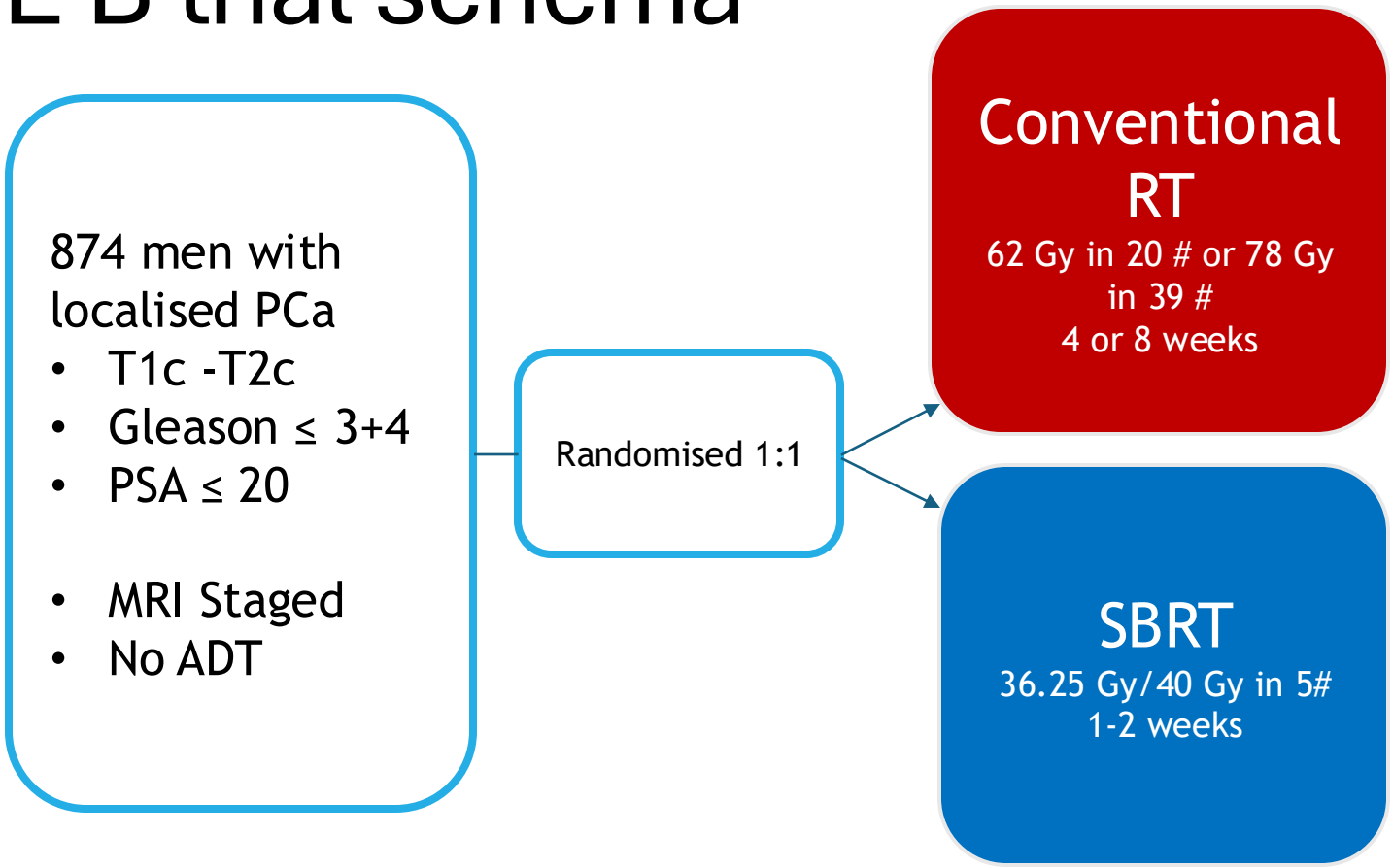



varian

ACCURAY

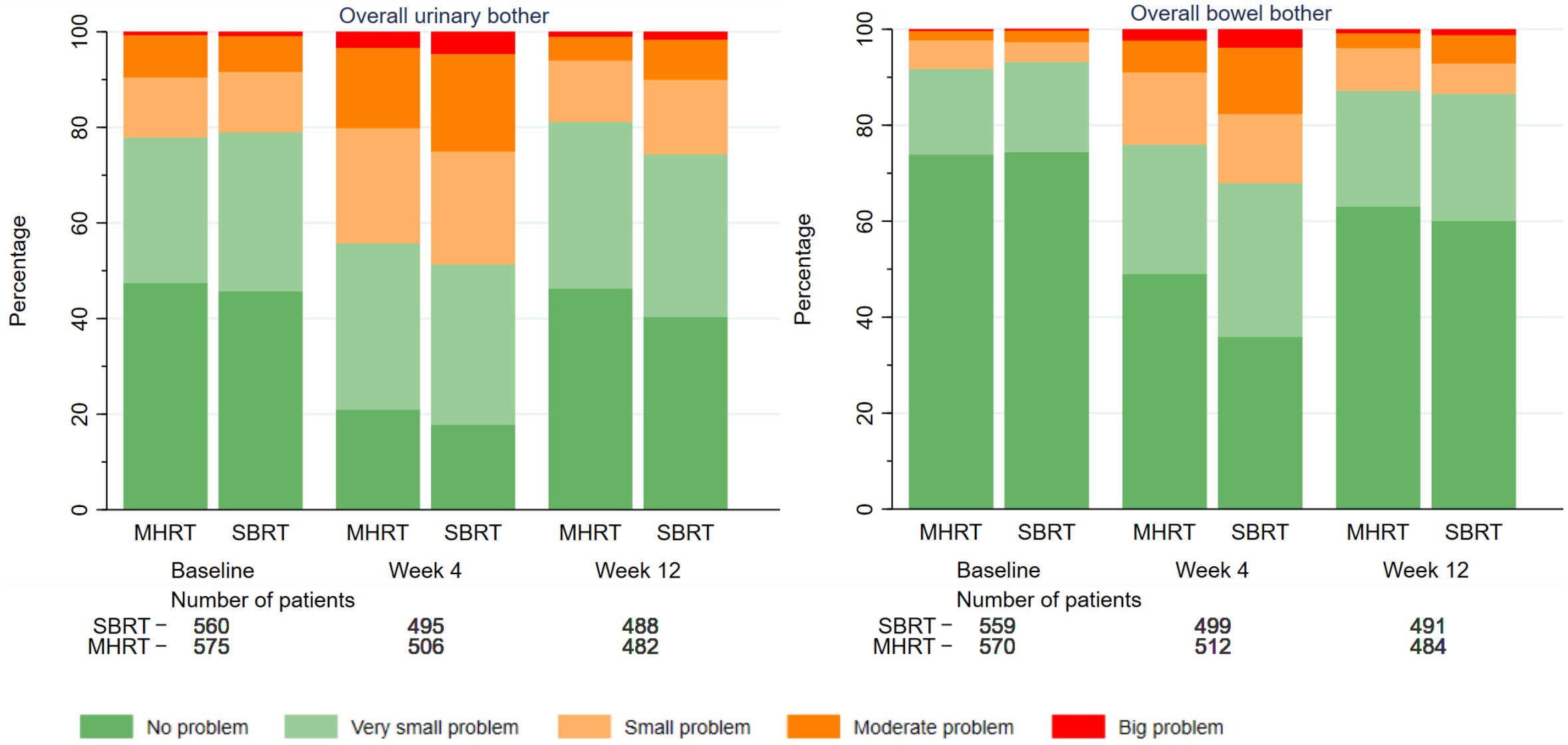
The ROYAL MARSDEN Cancer Charity

# PACE B trial schema

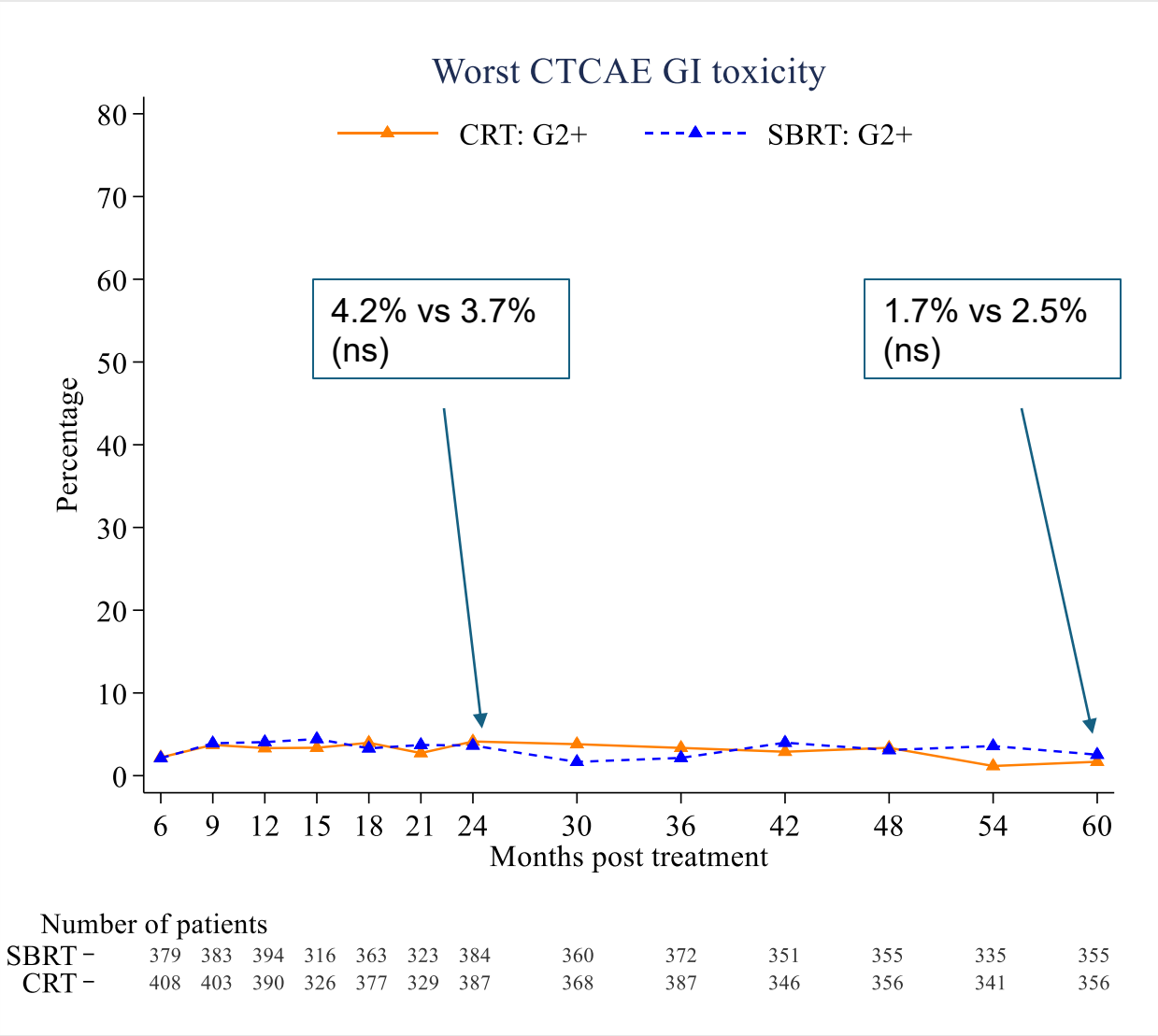



>90% patients intermediate risk, 82% Gleason 3+4, 31% PSA >10 ng/ml

# PACE C Patient- reported “bother”

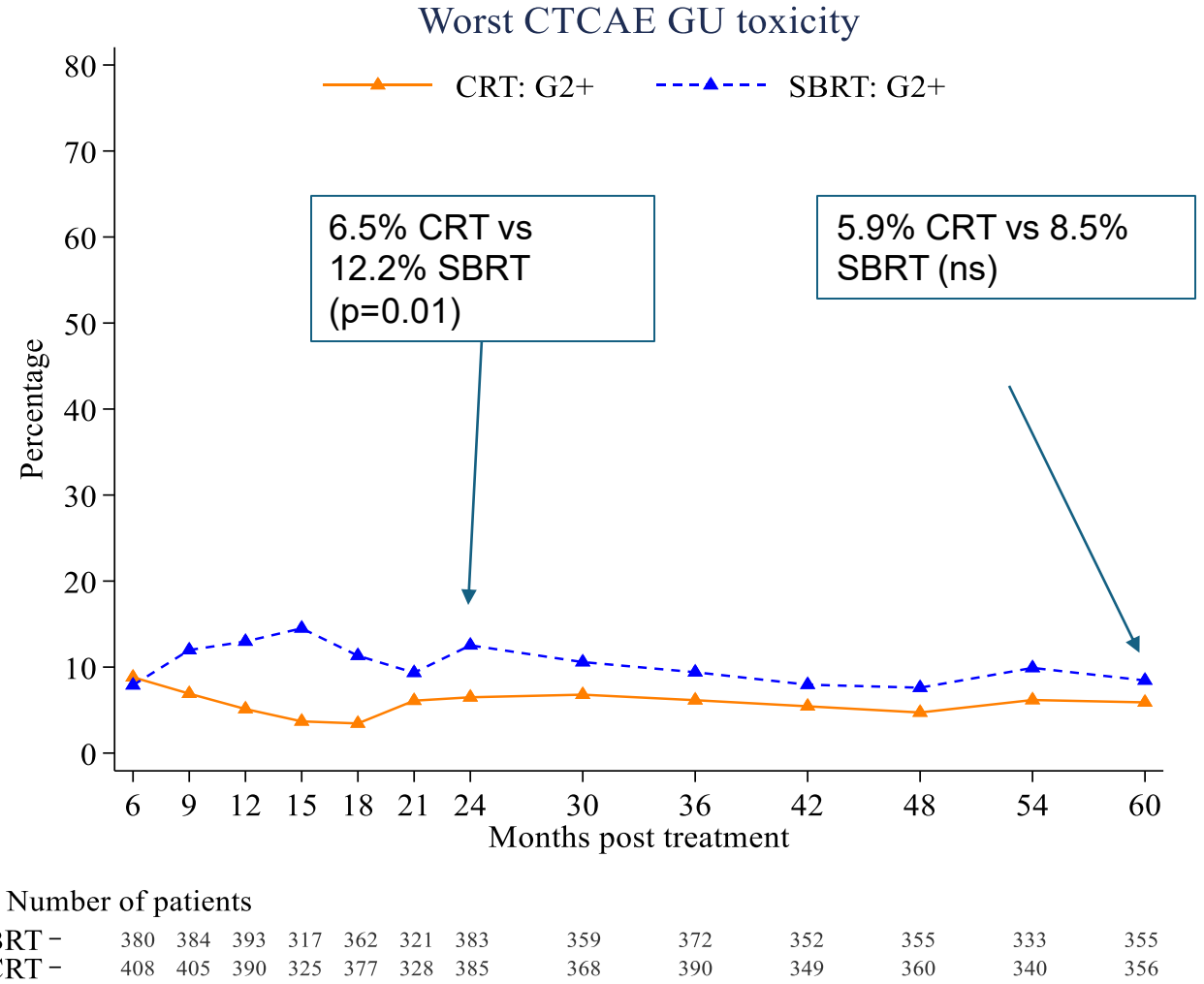


# CTCAE GI G2+ adverse events – long term



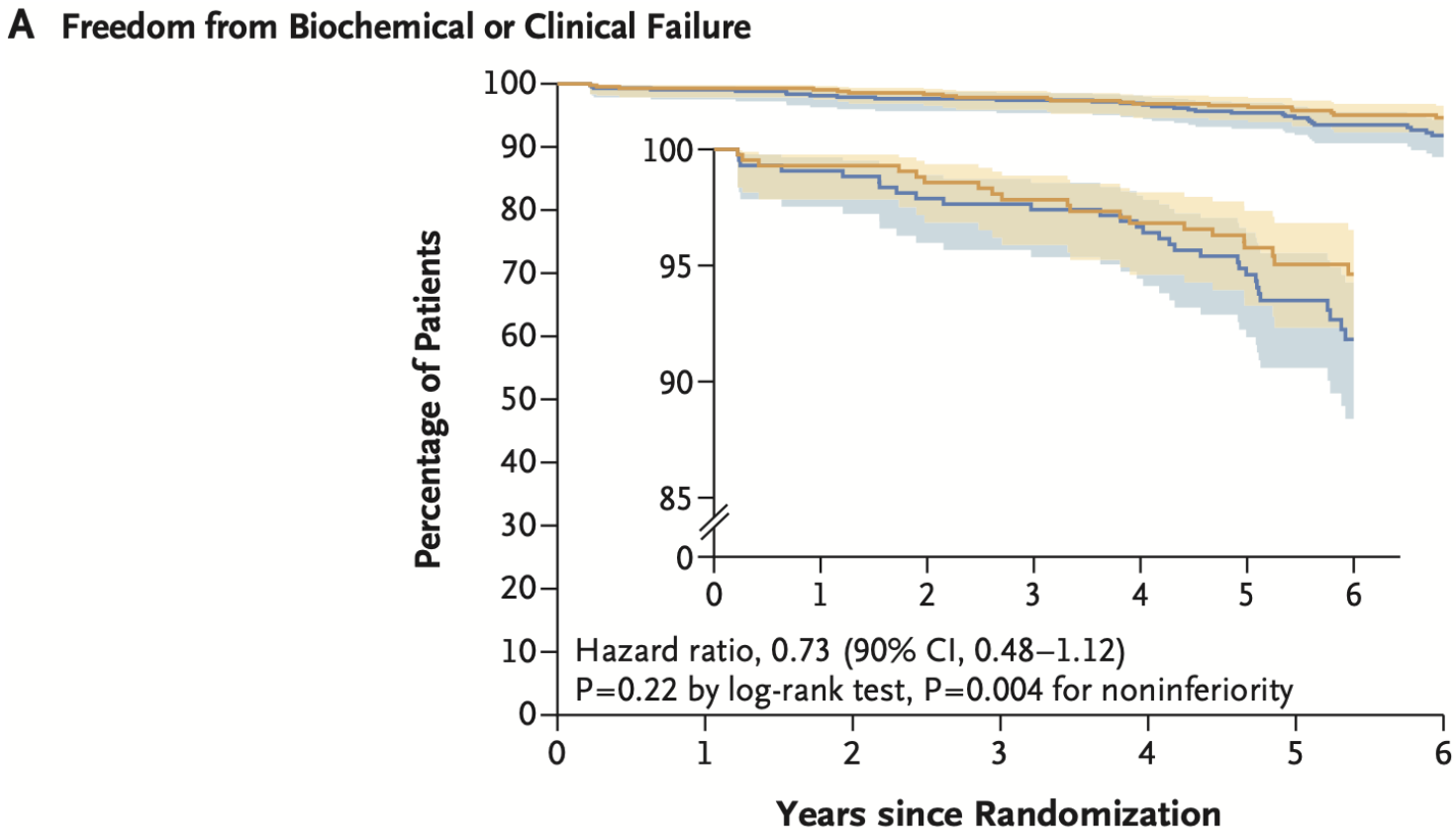

van As et al, NEJM 2024

# CTCAE GU G2+ adverse events – long term




van As et al, NEJM 2024

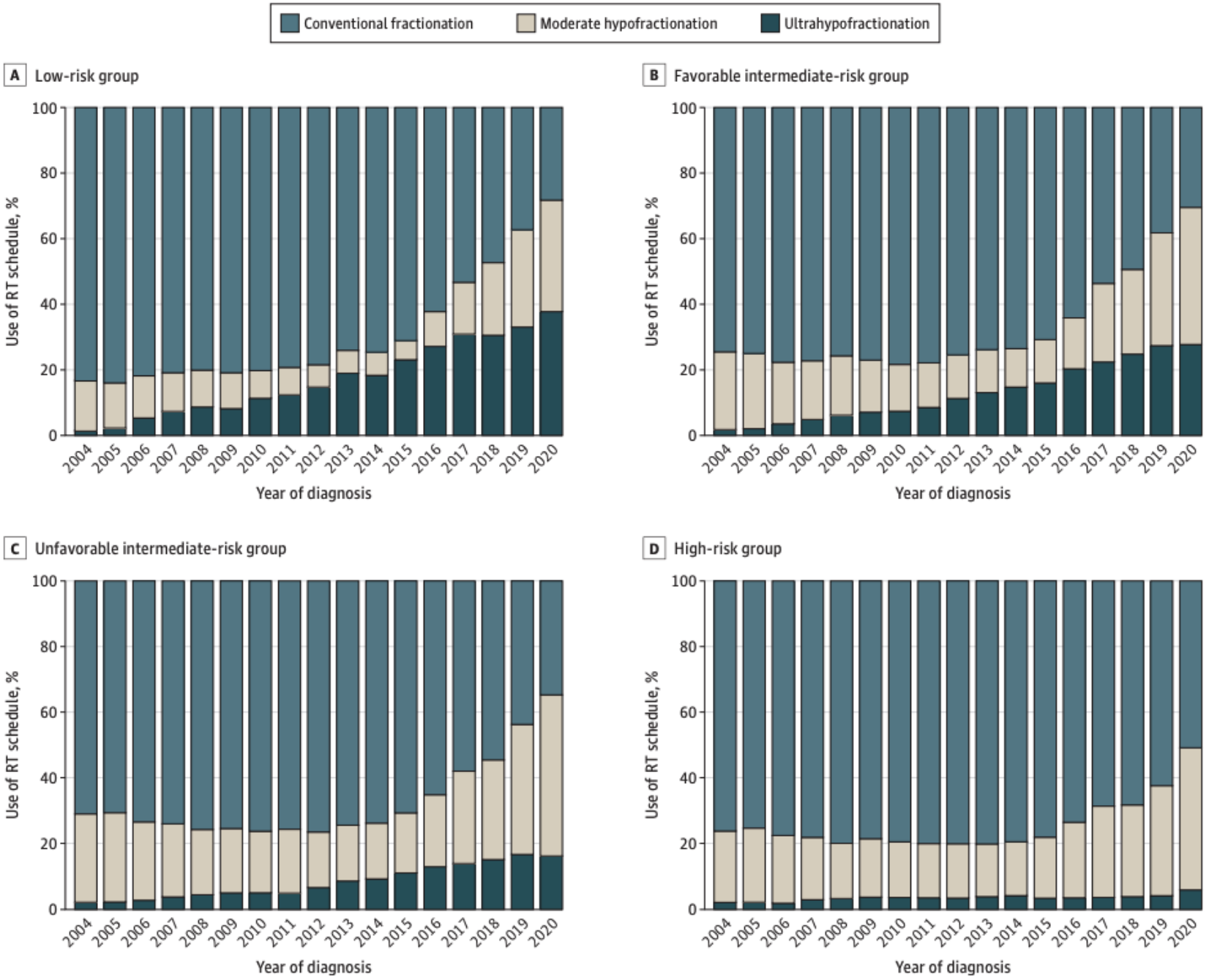
# Biochemical/clinical failure at 5 years in PACE B




CRT 94.6% vs
SBRT 95.8%

van As et al, NEJM 2024

# Are RCTs enough to change global practice?




NCDB data USA
316519 patients
2004-2020

Yu et al, JAMA Oncol 2023

| | Mod hypofrac | | SBRT | |
|---|---|---|---|---|
| Race | | | | |
| American Indian and Alaska Native | 1.23 (1.03-1.48) | .03 | 2.37 (1.83-3.07) | <.001 |
| Asian or Pacific Islander | 1 (0.94-1.06) | .97 | 0.84 (0.76-0.94) | .001 |
| Black | 0.90 (0.87-0.92) | <.001 | 0.78 (0.75-0.81) | <.001 |
| White | 1 [Reference] | NA | 1 [Reference] | NA |
| Other or unrecorded[d] | 0.98 (0.91-1.04) | .47 | 0.88 (0.79-0.97) | .01 |
| Median income | | | | |
| ≥$57 857 | 1.28 (1.25-1.31) | <.001 | 1.52 (1.47-1.58) | <.001 |
| ≤$57 856 | 1 [Reference] | NA | 1 [Reference] | NA |
| Insurance type or status | | | | |
| Medicaid | 1 [Reference] | NA | 1 [Reference] | NA |
| Medicare | 1.49 (1.41-1.57) | <.001 | 1.58 (1.43-1.74) | <.001 |
| Not insured | 0.92 (0.83-1.02) | .11 | 1.16 (0.97-1.39) | .12 |
| Other government | 1.00 (0.93-1.07) | .99 | 1.06 (0.93-1.20) | .41 |
| Private insurance or managed care | 1.54 (1.45-1.62) | <.001 | 1.62 (1.46-1.78) | <.001 |
| Unknown | 1.46 (1.34-1.60) | <.001 | 2.35 (2.06-2.70) | <.001 |
| Facility type | | | | |
| Academic or research program | 1 [Reference] | NA | 1 [Reference] | NA |
| Community cancer program | 0.54 (0.52-0.56) | <.001 | 0.21 (0.19-0.23) | <.001 |
| Comprehensive community cancer program | 0.63 (0.61-0.64) | <.001 | 0.46 (0.45-0.48) | <.001 |
| Integrated network cancer program | 0.81 (0.79-0.83) | <.001 | 0.60 (0.58-0.63) | <.001 |

Less likely to receive SBRT (or mod hypofrac) if black

More likely to receive SBRT if higher income

More likely to receive SBRT if Medicare or privately insured

Less likely to receive SBRT or moderate hypofrac if in non-academic centre

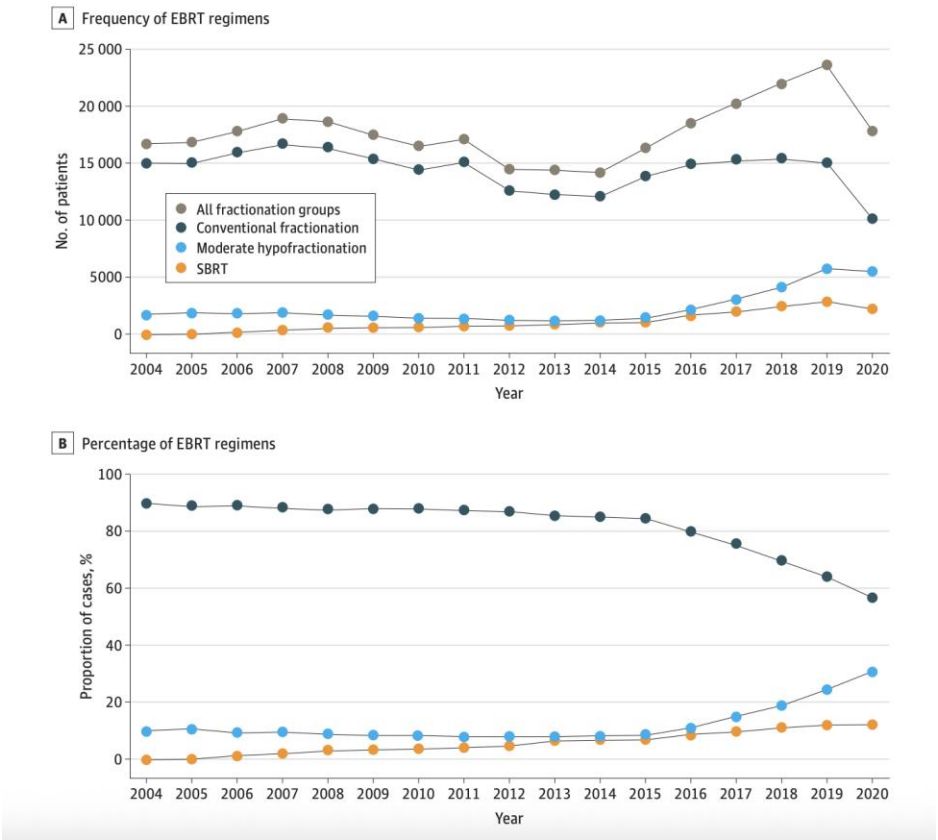
Yu et al, JAMA Oncol 2023

JAMA Network | Open™

Original Investigation | Oncology

# Differential Use of Radiotherapy Fractionation Regimens in Prostate Cancer

Sarah A. Qureshy, BS; Marshall A. Diven, MD; Xiaoyue Ma, MS; Ariel E. Marciscano, MD; Jim C. Hu, MD; Tim D. McClure, MD; Christopher Barbieri, MD, PhD; Himanshu Nagar, MD




302035 patients
treated 2004- 2020
NCDB database

Qureshy et al, JAMA Open 2023

# SBRT vs conventional fractionation

| | | |
|---|---|---|
| Facility type | | |
| Academic or research program | 1 [Reference] | NA |
| Community cancer program | 0.21 (0.19-0.24) | <.001 |
| Comprehensive community cancer program | 0.52 (0.50-0.54) | <.001 |
| Integrated network cancer program | 0.75 (0.72-0.79) | <.001 |
| Median annual income, $ | | |
| >62 999 | 1 [Reference] | NA |
| 48 000-62 999 | 0.58 (0.56-0.61) | <.001 |
| 38 000-47 999 | 0.44 (0.41-0.46) | <.001 |
| <38 000 | 0.40 (0.37-0.43) | <.001 |
| Race and ethnicity | | |
| White | 1 [Reference] | NA |
| Black | 0.84 (0.80-0.89) | <.001 |
| Other[c] | 0.89 (0.82-0.96) | .004 |
| Primary payer | | |
| Private | 1 [Reference] | NA |
| Medicaid, Medicare, and other government insurance | 0.94 (0.91-0.98) | .004 |
| Uninsured | 0.76 (0.63-0.90) | .002 |
| Unknown | 1.71 (1.53-1.91) | <.001 |

Less likely to receive SBRT in non-academic setting

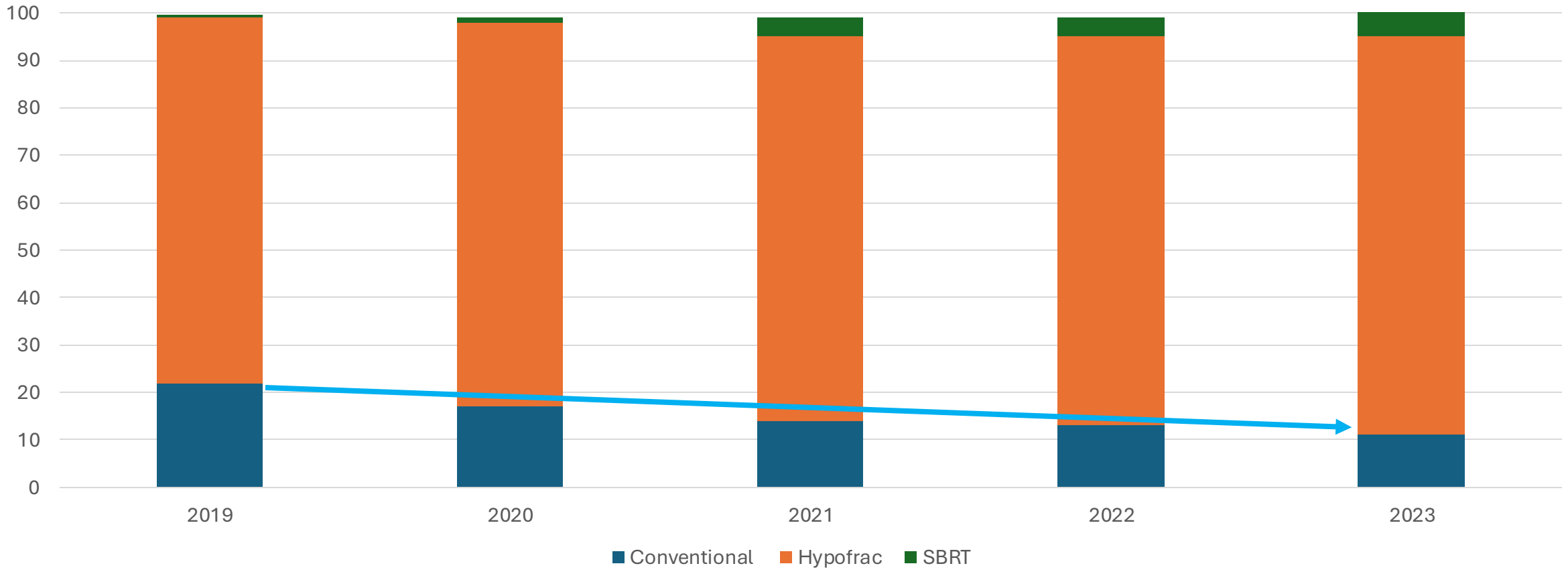
Less likely to receive SBRT if lower income

Less likely to receive SBRT if non-white

Less likely to receive SBRT if Medicare/aid or uninsured

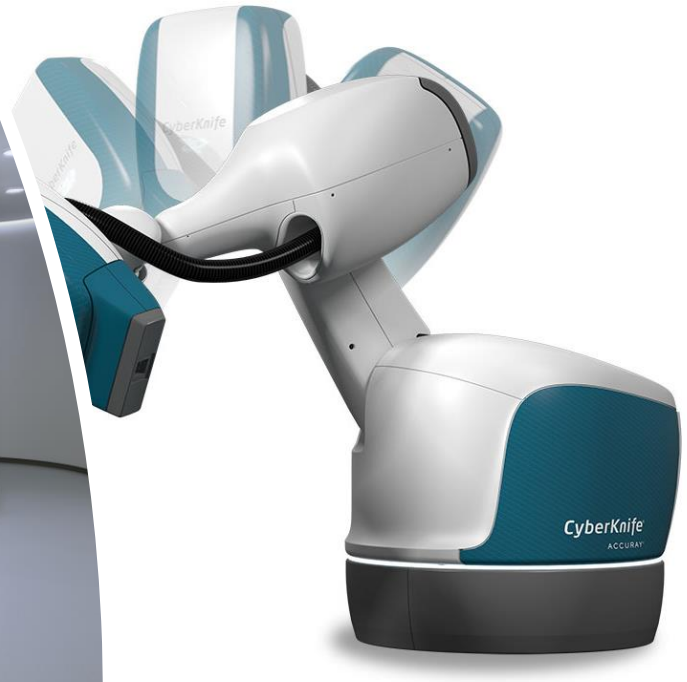
Qureshy et al, JAMA Open 2023

# UK - still room for improvement




Source: National Prostate Cancer Audit (NPCA) – data available at https://www.npca.org.uk/

# What’s new in treatment delivery?

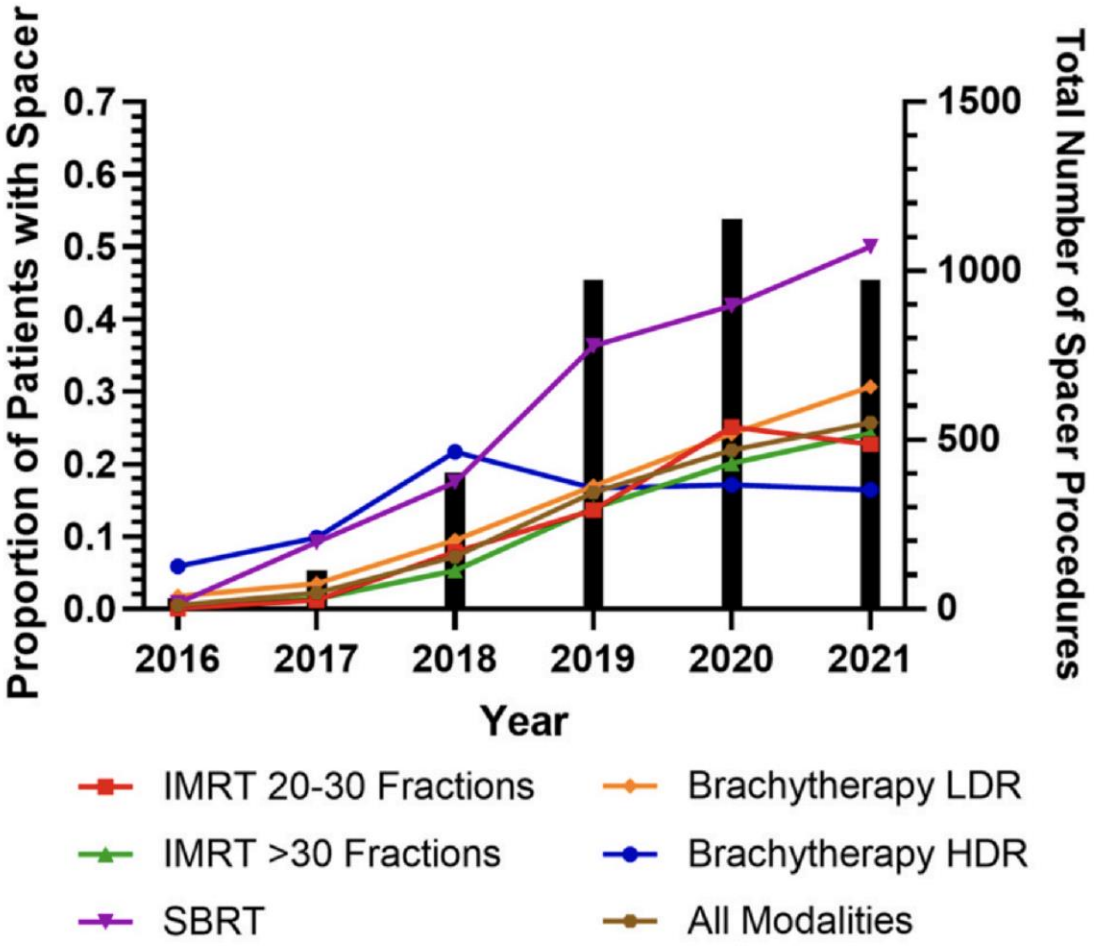




Oncology

# Utilization, Acute Complications, and Delays in Treatment Associated With Rectal Spacers for Prostate Cancer Radiotherapy

Jack C. Millot, Adithya Balasubramanian, Lauren Chew, Gal Wald, Camilo Arenas-Gallo, Edward Zhang, Jacob McCann, Leo D. Dreyfuss, Stephen Rhodes, Patrick Lewicki, Angela Y. Jia, Nicholas G. Zaorsky, and Jonathan E. Shoag

# Spacers




Merative MarketScan and
Medicare Claims and Encounters
Databases
Patients receiving RT +/- spacer
2016-2021
3732 rectal spacer
28787 no spacer

2016 0.5% had a spacer

2021 25.7% had a spacer

Oncology

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**Figure 2.** Annual rectal spacer utilization across all radiation therapy types from 2017 to 2021.

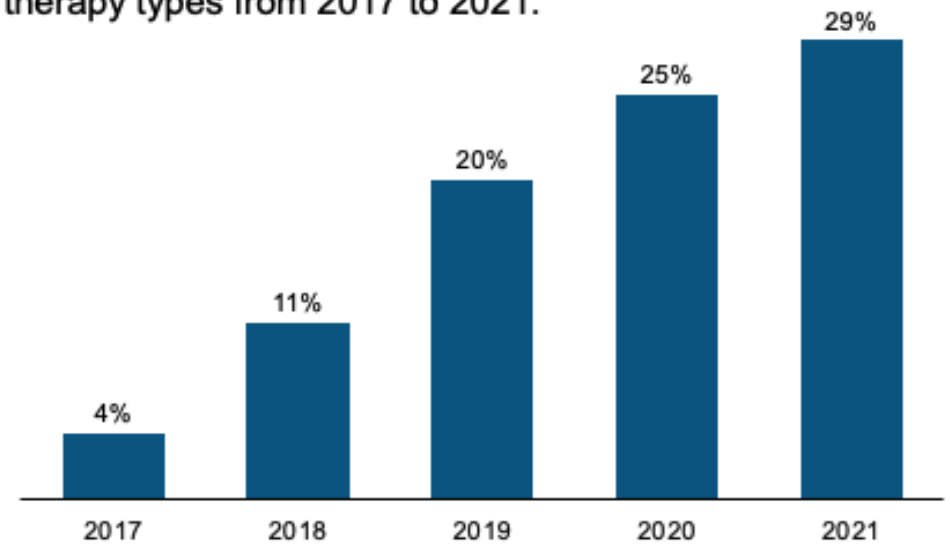
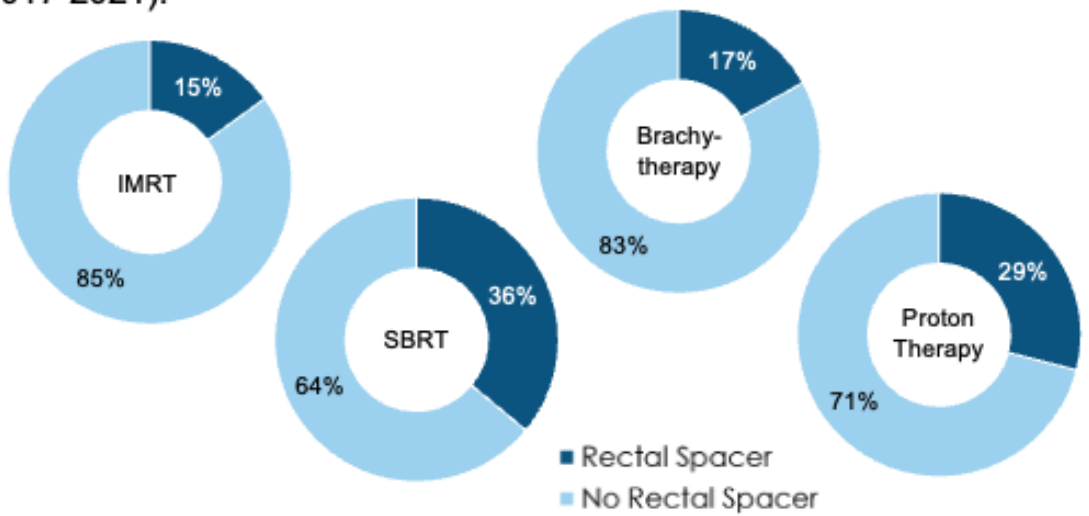



**Figure 1.** Rectal spacer utilization by radiation therapy type (combined 2017-2021).




Hankins et al, ASTRO abstract 2024, images courtesy of Dr Sean Collins

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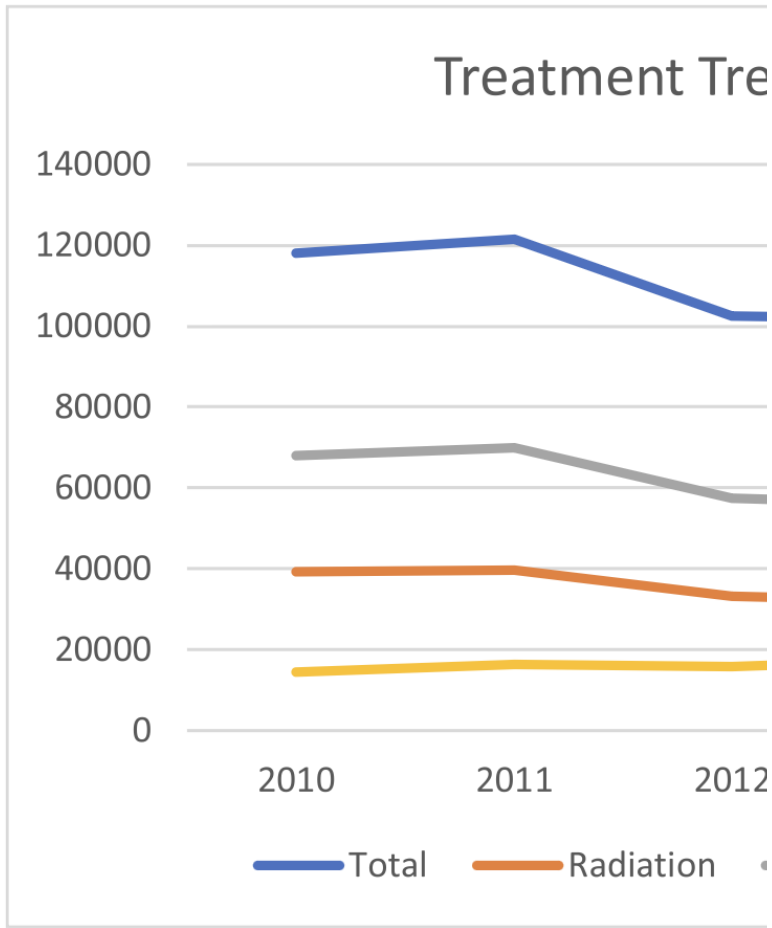
Brachytherapy 21 (2022) 6–11

BRACHYTHERAPY



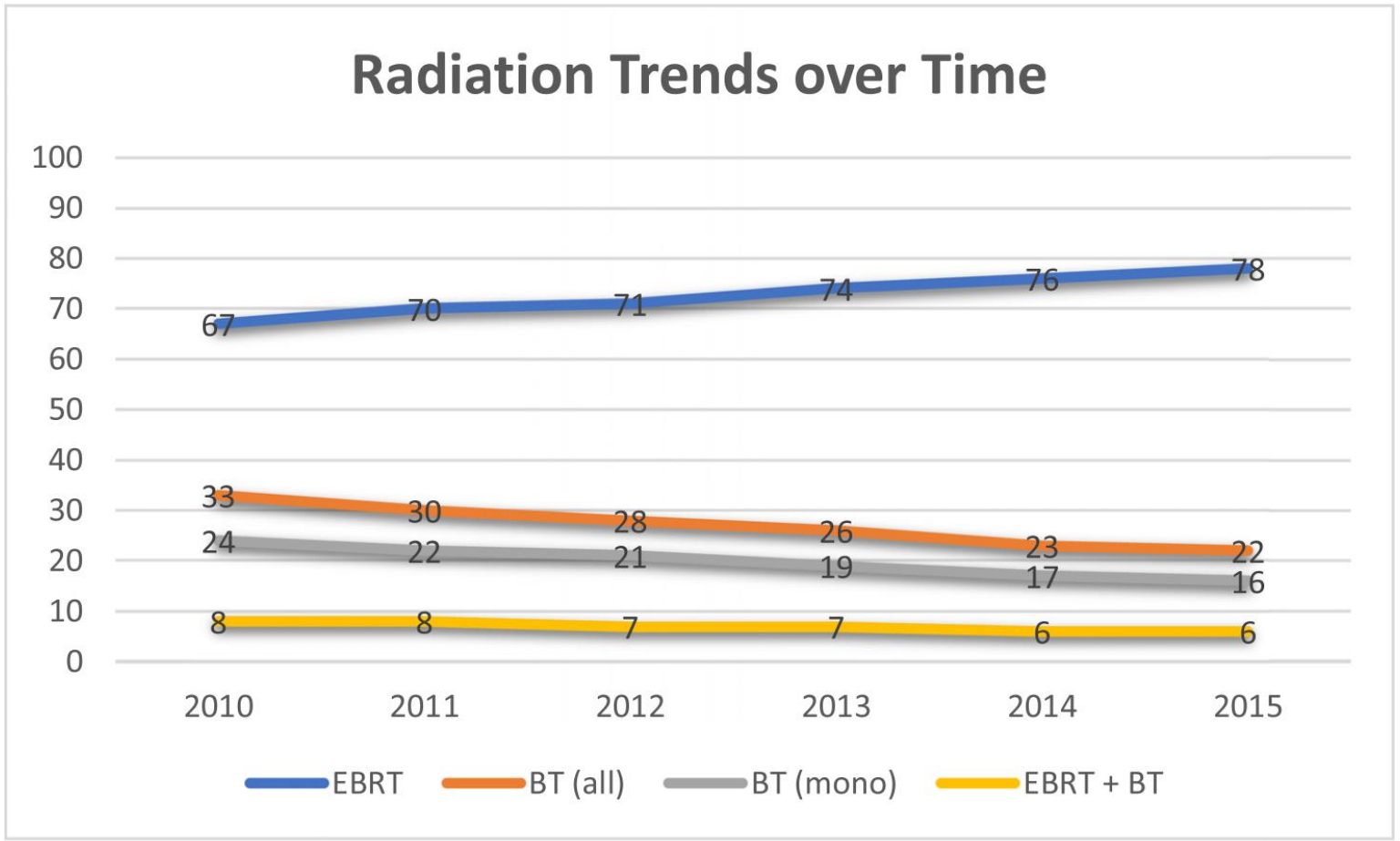




Fig. 1. Treatment modality utilization over time.

Andring et al, Brachytherapy 2022

# Other trends

- Margins?
- IGRT strategy? Reducing fiducial use in UK
- Daily online adaptation?
- Urethral sparing techniques

- Does technique matter? Probably yes, but centre experience probably matters more

# Conclusions

- Cancer incidence and mortality is rising globally
- Prostate cancer incidence is going to double 2020-2040
- Hypofractionation is key to maintaining capacity
- SBRT increasingly attractive option for prostate cancer
- Multiple safe ways of delivering prostate SBRT