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Modelling the outcomes of prostate cancer screening

Key information

Key terms and definitions:

- **PSA test:** A test that measures the amount of prostate specific antigen (PSA) in the blood. PSA is a protein made by both normal and cancerous prostate cells.
- **A positive PSA test:** defined in this infographic as ≥ 3ng/mL (nanograms/millilitre) of PSA in the blood for men without symptoms. The threshold for a positive test varies for men of different ages - see the webpage as signposted below for further information.
- **MRI:** a Magnetic Resonance Imaging scan, typically used after a PSA test to help determine whether a patient needs a biopsy.
- **Biopsy:** the removal of a small sample of tissue for examination under a microscope. It is the only way to provide a certain diagnosis of cancer.
- **Active surveillance:** a way of monitoring prostate cancer that doctors suspect does not currently need treatment.
- **Overdiagnosis:** the diagnosis of a cancer that wouldn't have gone on to cause harm in a person's lifetime. Detecting these cancers can lead to unnecessary treatments, anxiety, and side effects without any real health benefit.
- **Overtreatment:** the treatment of a cancer that wouldn't have gone on to cause harm in a person's lifetime. Treatment has associated physical harms as outlined in the infographic, but also can have psychological, social and economic impacts on patients.

Prostate cancer mostly affects men but can also affect trans women and non-binary people who are born male (assigned male at birth). For more information on prostate cancer, including the PSA test, prostate cancer treatments and associated harms visit **cruk.org/prostate**

Explanation of the modelling:

- The model has been developed collaboratively, with figures calculated by UK National Screening Committee (UK NSC) and design of the infographic led by Cancer Research UK.
- The majority of the modelling for men screened for prostate cancer up to diagnosis is based on the GOTEBORG-2 screening trial [1]. This is based on men aged 50-60 undergoing four rounds of screening. The harms are based primarily on the ProtecT trial [2, 3] and the benefits on the CAP [4] and ERSPC trials [5].

Working through the infographic, we've applied the following trial data, clinical expertise, and assumptions:

- Men with a PSA level ≥ 3 ng/ml will undergo an MRI-targeted biopsy [1].
- PSA positivity rate is 10.4% and is based on multiple screening rounds [1].
- 33% of men with a positive PSA test will have a positive MRI scan [1].
- 2.8% of men who have a PSA test will have cancer [1].
- 37% of cancers are Grade Group 1 and are likely to be offered active surveillance [1].
- 47% of prostate cancers will be Grade Group 2 and are likely to be offered surgery, radiotherapy, or active surveillance [1]. Clinical experts suggest many of those diagnosed with Grade Group 2 disease are likely to be over detected and overtreated.

- 12% of prostate cancers will be Grade Group 3-4 [1]. These are likely to be clinically significant and benefit from treatment.
- 4% of prostate cancers will be Grade Group 5 or advanced [1]. These are likely to be treated with multimodal treatment including hormonal or other therapies.
- 61% of men with Grade Group 1 disease will switch from active surveillance to radiotherapy or surgery within 15 years [3].
- Modelling for lives saved is based on 0.9 deaths prevented per 1000 invited to screening in CAP screening trial – 15 yr follow up [4], and 1 death prevented per 456 invited to screening in the ERSPC screening trial – 23 yr follow up [5].
- The estimates of people overdiagnosed and overtreated are based on a mixture of clinical expertise and the ProtecT trial [3].
- Estimates for treatment harms after 5 years are from the ProtecT trial which uses the Expanded Prostate Cancer Index Composite (EPIC) tool to look at patient quality of life and harms after prostate cancer treatment [2].
    - "One or more pad per day in the past 4 weeks" is used as a proxy for urine leakage (table S1A) [2].
    - "Moderate to severe problem with erectile dysfunction" is used as a proxy for erection problems (table S1B) [2].
    - "Moderate to severe effect of bowel habits on quality of life" is used as a proxy for bowel problems (table S1C) [2].
    - These measures also assess the declines in sexual, bowel, and urinary function that occur naturally with age in patients who remain on active surveillance [2]. Harms are taken from the ProtecT trial, including men's experiences while on active surveillance [6].

References:

1. Hugosson J, Godtman RA, Wallstrom J, Axcrona U, Bergh A, Egevad L, et al. **Results after Four Years of Screening for Prostate Cancer with PSA and MRI. New England Journal of Medicine.** 2024 Sept 25;391(12):1083–95.
2. Donovan JL, Hamdy FC, Lane JA, Young GJ, Metcalfe C, Walsh EI, et al. **Patient-Reported Outcomes 12 Years after Localized Prostate Cancer Treatment.** NEJM Evidence. 2023 Mar 28;2(4):EVIDoa2300018.
3. Hamdy FC, Donovan JL, Lane JA, Metcalfe C, Davis M, Turner EL, et al. **Fifteen-Year Outcomes after Monitoring, Surgery, or Radiotherapy for Prostate Cancer.** N Engl J Med. 2023 Apr 27;388(17):1547–58.
4. Martin RM, Turner EL, Young GJ, Metcalfe C, Walsh EI, Lane JA, et al. **Prostate-Specific Antigen Screening and 15-Year Prostate Cancer Mortality: A Secondary Analysis of the CAP Randomized Clinical Trial.** JAMA. 2024 May 7;331(17):1460–70.
5. Roobol MJ, Vos II de, Månsson M, Godtman RA, Talala KM, Hond E den, et al. **European Study of Prostate Cancer Screening — 23-Year Follow-up.** New England Journal of Medicine. 2025 Oct 29;393(17):1669–80.
6. Wade J, Donovan JL., Lane JA, et al. **Strategies adopted by men to deal with uncertainty and anxiety when following an active surveillance/monitoring protocol for localised prostate cancer in the ProtecT trial**. BMJ Open. 2020;10(9):e036024.

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This infographic has been designed by Cancer Research UK with figures calculated by UK National Screening Committee.

1,000 men aged 50-60 are screened with a PSA test

↓

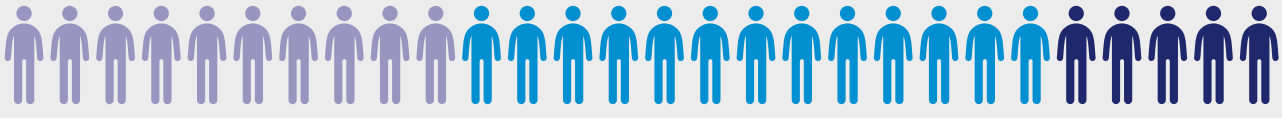
Around **100** have a positive PSA test

↓

34 have a positive MRI and receive a biopsy

↓

28 are diagnosed with prostate cancer



10 likely offered active surveillance

↓

Around **6** switch to radiotherapy/surgery within 15 years

↓

Up to **20** likely overdiagnosed* including **12** likely overtreated**

13 likely offered surgery, radiotherapy or active surveillance

4 likely need surgery or radiotherapy, **1** may need other treatment

Up to **2 lives** will be saved by inviting men to screening†

Treatment harms after 5 years

These statistics apply to all men who received treatment, whether they needed it or not:

- **For men who had surgery**, almost 20% experience leaking urine and 50% experience erectile problems
- **For men who had radiotherapy**, almost 40% experience erectile problems and around 5% experience bowel problems
- **For men who had active surveillance**, harms may occur from anxiety at the diagnosis and follow-up testing, and if they switch to a radical treatment unnecessarily, or if they do not receive treatment when they need it.

*The number of men likely overdiagnosed includes consideration of the over-detection of prostate cancer that will not cause harm in the patient's lifetime, and over-definition of the seriousness of the disease.
**The number of men likely overtreated assumes that some men who switch from active surveillance to radiotherapy/surgery within 15 years did so unnecessarily. And some men who were offered surgery, radiotherapy or active surveillance chose surgery or radiotherapy when active surveillance could have been sufficient.

†Assumes all invited men accept a PSA test.
The information in this infographic is based on the Göteborg II screening study using PSA and MRI over 4 years in men aged 50-60 (Hugosson et al, NEJM 2024), deaths prevented in men aged 50-69 from the CAP screening trial (Martin et al, JAMA 2024) and in men aged 55-69 from the ERSPC screening trial (Roobol et al, NEJM 2025) , harms in men aged 50-69 from ProtecT (Hamdy et al 2023, Donovan et al 2023).

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