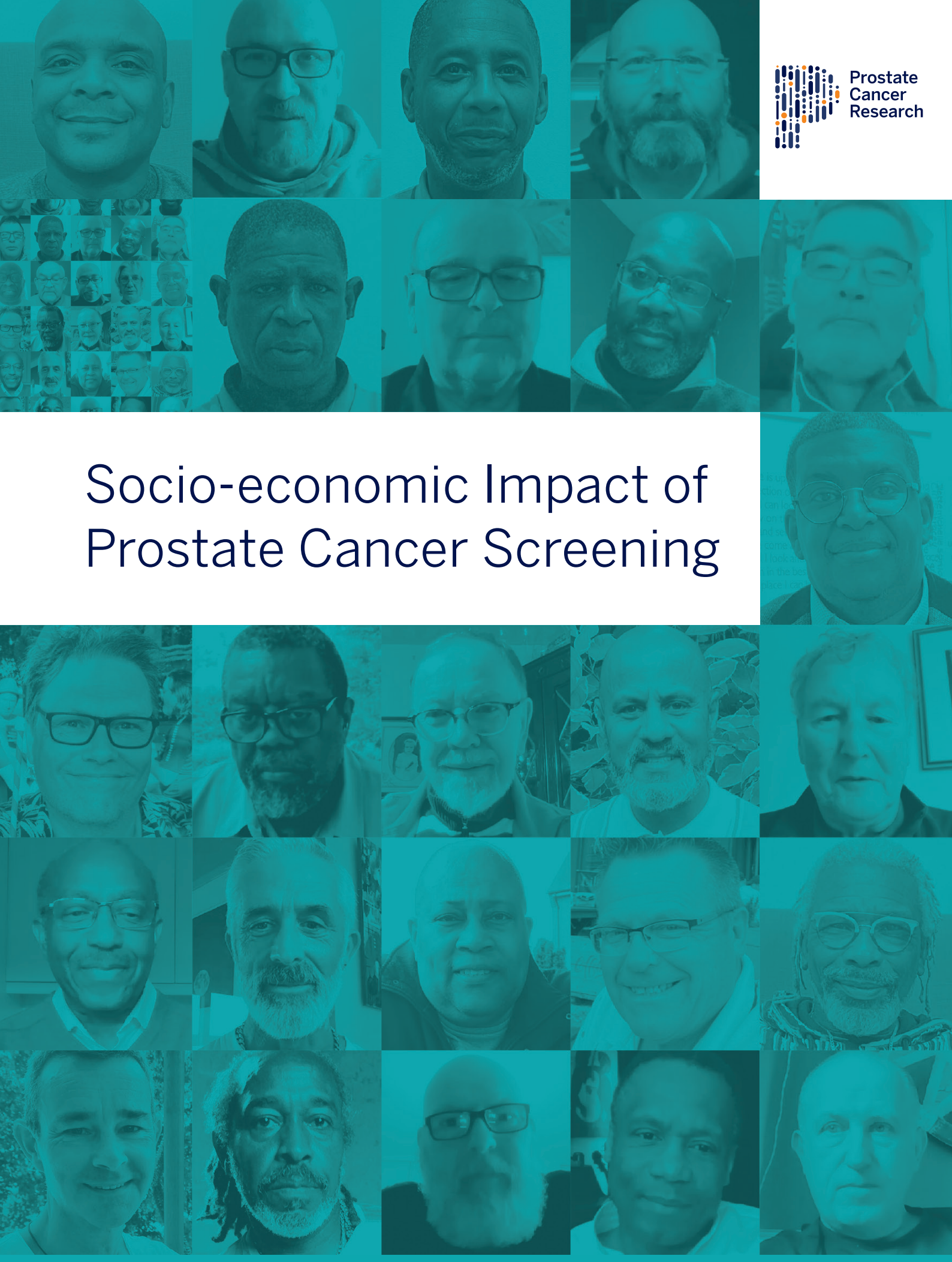
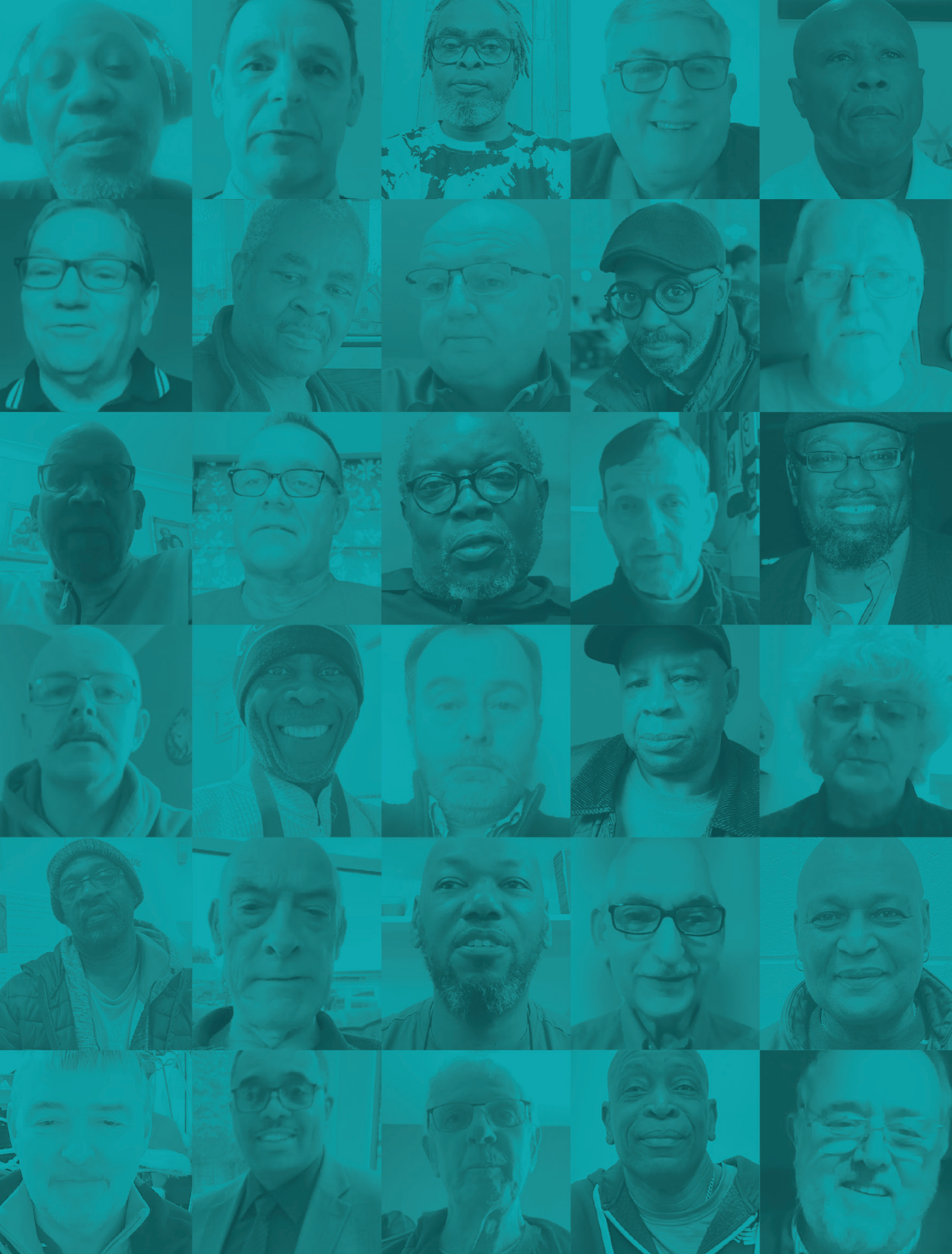


Prostate Cancer Research

Socio-economic Impact of Prostate Cancer Screening

November 2024



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Contents

This report has been commissioned and approved by Prostate Cancer Research (PCR). Deloitte has conducted the analysis and modelling included in the report, working to the scope as agreed with PCR. Deloitte's analysis and modelling has been supported by secondary data from a range of sources as well as primary data/views from consultations with PCR, subject matter experts and wider sector stakeholders.

PCR's cost-benefit analysis report on prostate cancer screening has been part-funded from general contributions (74%) and part-funded by educational grants from pharmaceutical companies (26%). These companies are: AstraZeneca, Ipsen, Janssen (now Johnson & Johnson Innovative Medicine) and Pfizer Inc. The companies providing grants had no control or influence over the content included in this report.

01 Foreword

Prostate cancer affects thousands of lives across the UK, leaving a deep impact not only on patients and their families but also on the healthcare system and the economy. Prostate cancer is the second-most-deadly cancer among men. High-risk groups, particularly Black men, are twice as likely to die from this disease. Men living in deprived areas also face a 14% higher mortality rate. The existing 'informed choice' system, which requires men to actively request testing, is failing. As a direct result, too many men are being diagnosed late, which drastically reduces their chance of survival.

This report stems from our dedication at Prostate Cancer Research (PCR) to tackle one of the most pressing issues in men's health from a fresh and comprehensive perspective. The socio-economic impact modelling presented in this document has been informed by valuable insights from patients, clinicians, and a broad group of stakeholders who, like us, are deeply invested in bettering outcomes for everyone affected by prostate cancer. This collaboration has highlighted the urgent need to address gaps in prostate cancer care, particularly the lack of a universal screening programme and the barriers that health inequalities impose on at-risk groups.

Our report concludes that early diagnosis of prostate cancer using new testing technologies could potentially yield a positive socio-economic benefit of over £200 million, driven by improved patient outcomes. This could also ease the burden on the healthcare system through avoiding late-stage diagnoses and the associated treatments.

The evolving landscape of prostate cancer, which is shaped by new trials and rapid advancements in technology, signals that now is the opportune time to reassess the potential benefits of a screening programme. We are encouraged that the Government and our friends at Prostate Cancer UK have recently made a major commitment to the TRANSFORM trial. At the same time, we also think it vital that the Government acts now based on the information already available, including the contents of this report, to help so many men being diagnosed too late.

The future of prostate cancer screening lies in the integration of those diagnostic technologies that promise the most significant long-term gains. To make this a reality, we must look ahead and start planning now. We need to build a health system equipped to adopt innovations, push promising biomarker tests into real-world evaluation, and address health disparities through targeted education and engagement. The most successful programme will be one that reflects the needs of all patients, especially those at highest risk, in every aspect. This report finds that we could save over 19,000 years of life from a five-year screening programme if technology that already exists were to be approved and adopted. I find it hard to imagine so many years of life, but what I can imagine is a stadium full of grandfathers or fathers being with their families for a year longer. Wouldn't it be a great thing if someone made that happen?

There is much work ahead, but through thoughtful planning, patient-centred approaches, and a commitment to innovation, we can set a new standard for prostate cancer screening – one that brings real hope to all those affected.

Oliver Kemp
Chief Executive Officer
Prostate Cancer Research

02 Executive summary

Targeting prostate cancer screening at high-risk groups using current testing technology would offer positive socio-economic benefits and warrants careful consideration. Integrating new technologies will be crucial for improving outcomes and extending additional socio-economic benefits to all men in the future.

Our findings suggest:

Introducing a five-year screening programme for **high-risk groups** aged 45-69, using the current clinical pathway results in a positive socio-economic impact of

c.£54m*

In the future, applying new screening tests and extending to the **wider general population** aged 50-69 the impact of a programme could increase to

c.£204m*

Prostate cancer in the UK

Prostate cancer is the most common cancer in men in the UK, with approximately 55,000 new cases reported annually, yet there is currently no screening programme for early detection.[1] The UK National Screening Committee's most recent evidence review in 2020 concluded that screening for prostate cancer should not be introduced in the UK. This decision was based on several factors, including unreliability of PSA testing leading to unnecessary biopsies (which can cause physical and emotional stress), treatment effectiveness, and risk of overdiagnosis and overtreatment of clinically insignificant cancers that do not need treating.

(*) Full appraisal period impact (not annual).

Health equity in prostate cancer

There are widespread health inequalities in prostate cancer that we need to address. Health inequalities are prevalent across the prostate cancer pathway and compound the challenges. Socio-economic, ethnic and geographical factors contribute to disparities in diagnosis, available treatment options, patient experience and outcomes. Risk factors including increasing age, being of Black ethnicity, higher socio-economic deprivation, and genetic factors including family history and homologous high-risk genetic mutations (e.g. BRCA 1/2 mutations as being the most prevalent and carrying the greatest risk) are all associated with an increased risk of developing prostate cancer.[a] [b]

These risk factors indicate that there may be a case for a risk-stratified screening approach to effectively target specific cohorts of individuals who are at increased risk of prostate cancer and may see increased benefit from early detection. Currently, reliance is often on the individual to be proactive about requesting a PSA test from their GP.

[a] NHS UK, Prostate cancer causes | NHS UK, Accessed August 2024

[b] J Urology, Systematic Literature Review of the Epidemiology of Advanced Prostate Cancer | NIH, Accessed August 2024

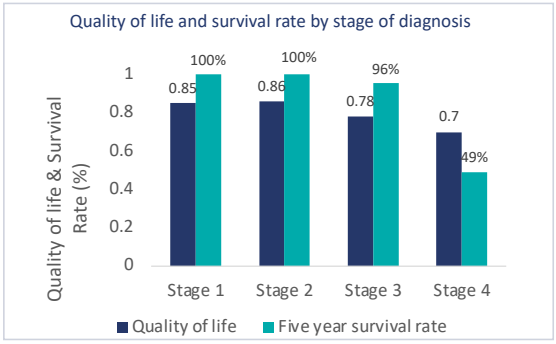
Early diagnosis is crucial

The impacts of prostate cancer for patients and carers become increasingly severe when the disease is diagnosed at later stages, and more costly for the NHS.

Figure 1: Impacts of prostate cancer across disease stages

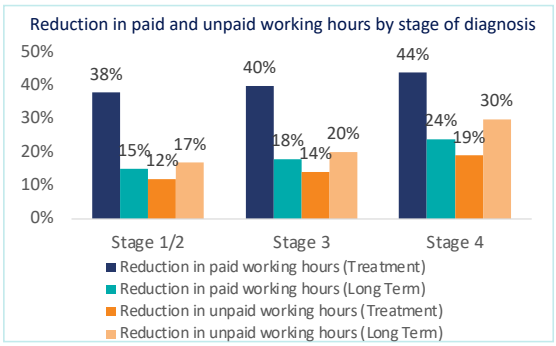
Survival and quality of life

- Average five year survival rate drop by 51% for stage 4 diagnoses compared to stages 1 and 2.[i]
- Reported quality of life (QoL) scores decline to 0.7 at 18 months post diagnosis, compared to general population levels of 0.9. Impacts to QoL include social impacts, physical impacts (e.g. fatigue, nausea and vomiting, difficulty sleeping) and emotional impacts.
- This highlights the significant toll late-stage prostate cancer takes on overall physical health and wellbeing.[ii]



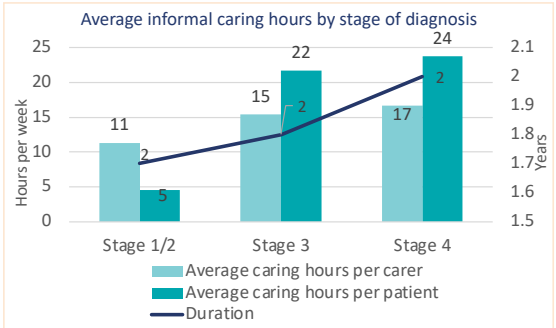
Ability to work

- During treatment, individuals diagnosed with stage 4 prostate cancer experience a 44% reduction in paid working hours, compared to a 38% reduction for those diagnosed at stage 1.[iii]
- Even after treatment ends, long-term effects persist, with a 24% sustained reduction in paid working hours for stage 4 patients versus 15% at stage 1 and 2.[iii]
- Impact on unpaid working hours, including caregiving, volunteering and household duties, is also more pronounced in the long-term than during treatment.



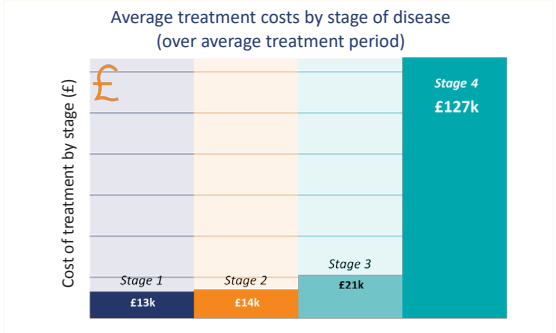
Impact on carers

- A prostate cancer diagnosis can lead to significant emotional distress and caregiving responsibilities for families and caregivers.
- The average time spent caring for someone diagnosed with stage 4 prostate cancer more than doubles compared to caring for someone in stage 1, with 23.8 hours per week compared to just 4.5 hours.[iii]
- This not only affects the caregiver's employment, leading to a reduction in workforce participation, but also results in a loss of productivity for society.



Cost of treatment

- A late-stage diagnosis is not only costly for individuals and carers, with significantly worse outcomes, but is also costly for the health system - the average cost of treatment over the average treatment period is nearly 10 times higher for stage 4 compared to stage 1.
- While novel hormonal therapies offer promising benefits for metastatic prostate cancer, these therapies can cost over £4,000 per month. This drives the high costs of treatment in stage 4 disease.[iv]

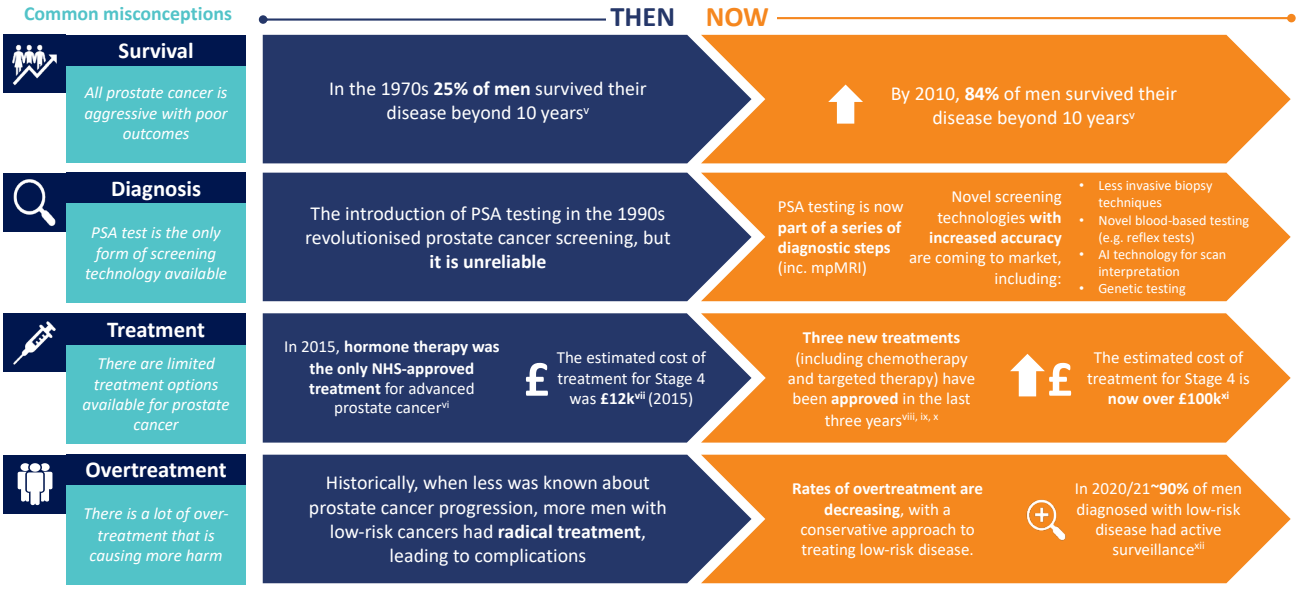


Source: i – ONS[2], ii – NHS[3], iii - PCR[4], iv – Estimation based on clinician survey (2024) BNF[5]

Why now?

With the evolving focus on prevention for cancer, and the emergence of promising diagnostic technologies including reflex tests, AI technology and blood-based biomarkers, now is an opportune time to re-evaluate the benefits of prostate cancer screening.

Figure 2: Prostate cancer: then vs now



Source: v – CRUK (2024)[6], vi – Prostate Cancer UK[7], vii – Deloitte analysis, viii – NHS England[8] , ix – Prostate Cancer UK[9], x – NHS England[10], xi – Estimation based on clinician survey (2024), BNF[11], xii – NPCA (2024)[12]

A need to consider the wider impacts

Prostate cancer imposes significant economic burdens that extend beyond direct healthcare costs. The disease impacts a wide range of stakeholder groups, and a comprehensive evaluation of a screening programme needs to consider both direct and indirect economic implications. The framework that defines the scope of the socio-economic impact assessment considers three stakeholder groups: individuals, the health and social care system, and wider society.

Scenarios considered in this report

This report considers the impact to these three stakeholder groups under two screening scenarios:

1. The current screening pathway – using a PSA test, followed by an mpMRI then a biopsy as point of diagnosis.

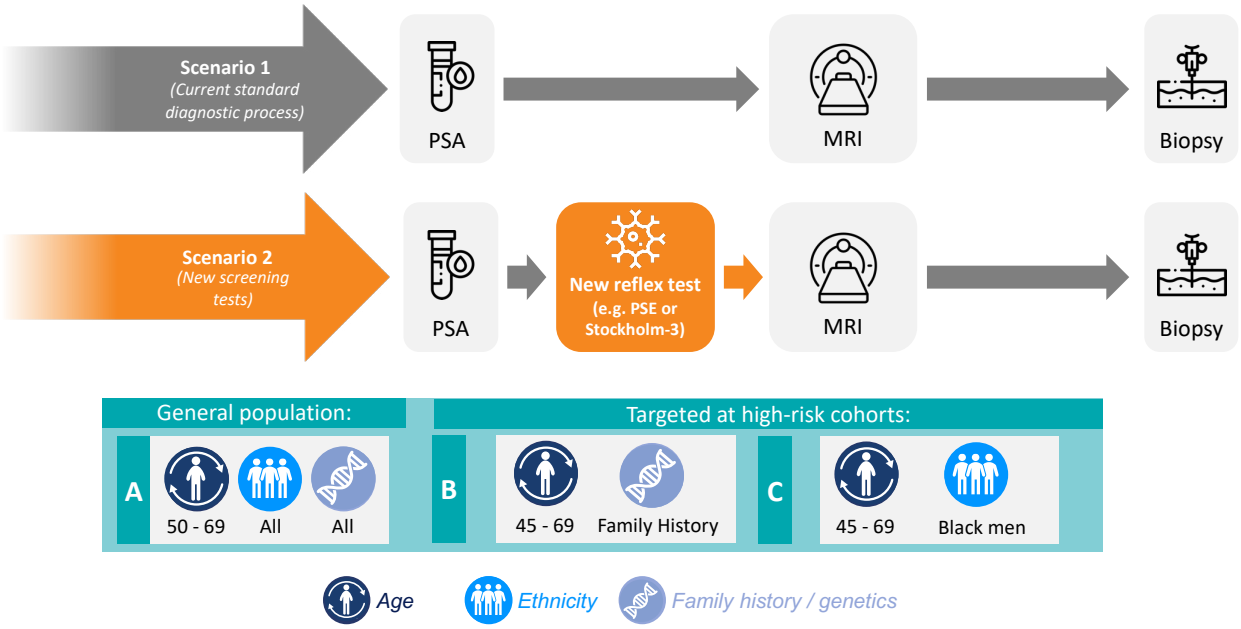
2. New screening pathway – adding reflex test into the current pathway, following an initial PSA test. This would result in a more targeted flow of individuals to further diagnostic tests.The 'new screening pathway' is a hypothetical scenario that is intended to capture introducing a new reflex test into the screening pathway. While this does not reflect a single particular test, it is intended to reflect a scenario where evidence is currently being collected and reviewed in the UK and the potential accuracy and cost of a new reflex test in future. In reality, a future screening pathway may differ from this example.

- A prostate cancer screening programme could be targeted at the general male population, or specific age groups or high-risk groups, such as Black men or those with a family history of prostate cancer. This report considers three cohorts:

A: General population	B: Men with a family history	C: Black men
The general population, aged 50–69 c. 8,000,000 cohort size in 2025	Men with a family history, aged 45–69. Includes BRCA 1/2 carriers c. 1,000,000 cohort size in 2025	Black men, aged 45–69 c. 373,000 cohort size in 2025

- The impacts of a five-year screening programme are estimated, with 20% of an eligible cohort invited to participate in the screening programme each year.

Figure 3: Screening scenarios considered in this report



Outputs from this analysis

The outputs are presented as an incremental impact between the scenario and the base case. The socio-economic impacts are based on introducing a five year screening programme and tracking impacts over a 30-year period. These are presented in net present value (NPV) terms. Therefore, positive values represent cost savings resulting from the screening scenario, whereas negative values represent additional cost resulting from the screening scenario. Key observations include:

- The NPV in any given scenario is driven by the scale of the cohort invited and its underlying prevalence.
- There is a net economic cost to undertaking general population screening under the current pathway, however there is a positive impact on screening for high-risk groups. As more effective tests become available, there could be a net positive socio-economic impact for general population screening as well as high-risk groups.
- This positive socio-economic impact is driven by improved patient outcomes and survival outcomes for those detected earlier who would have progressed to later stage disease. To enable this benefit, there are costs of detection through a screening programme and making adjustments to an individual's lifestyle earlier which could reduce their available productive hours.

NPV (£m)	Scenario 1: Current pathway			Scenario 2: New screening scenario		
	1A. General Population (50–69)	1B. Family history (45–69)	1C. Black men (45–69)	2A. General Population (50-69)	2B. Family history (45-69)	2C. Black men (45-69)
Total (£m)	- £271	£47	£7	£204	£96	£27
NPV per diagnosis (£000s)	*c. -£19*	*c. £14*	*c. £8*	*c. £15*	*c. £33*	*c. £36*
Non-financial metrics						
Number of screening diagnoses over 5-year screening programme	14,244	3,233	828	12,819	2,910	745
Years of life saved	21,341	4,896	1,376	19,207	4,407	1,238
Reduction in stage 4 diagnoses	5,119	1,162	297	4,607	1,046	268

Source: Model outputs

PCR's key recommendations

- The results of this work indicate that there is an opportunity to optimise PSA testing within the current pathway by targeting high-risk groups while planning for a long-term solution that offers improved diagnostic accuracy for the wider population.

- We must also start planning for the future, focusing on how to fully leverage emerging technologies without delay. While more targeted PSA testing can yield socio-economic benefits, it is the future integration of advanced technologies with higher accuracy, and being able to distinguish aggressive from non-aggressive cancer that will deliver the most significant long-term impact to improve outcomes in prostate cancer for everyone. This approach allows us to maximise immediate benefits while laying the groundwork for more accurate and inclusive screening, and prostate cancer outcomes for all men.

Right now, we need to optimise screening using a PSA test, focusing on high-risk groups – Black men, those with a family history, and those with BRCA 1/2 mutations. This risk-stratified approach, prioritising those at highest risk of prostate cancer, has shown to provide economic benefits while requiring the lowest level of health system change.

Alongside more targeted PSA testing, we need to focus on getting new diagnostic technologies into pilots (e.g. reflex tests), to gather real-world evidence and understand efficacy in diverse populations. Once clinical utility has been demonstrated, we should expand the screening programme to cover the general population utilising a test with greater accuracy, as this will realise the greatest economic benefits.

To further enhance patient outcomes and the economic benefits of earlier detection, we need to integrate AI technology into the NHS. We need to leverage its potential to improve the accuracy and reliability of screening, avoiding the need for unnecessary biopsies, while also boosting operational efficiencies. By adopting AI-driven technologies in imaging, we can streamline processes, reduce diagnostic errors and ensure resources are allocated more effectively.

03 Model approach

Approach to this analysis

Understanding the economic costs and benefits associated with prostate cancer screening.

PURPOSE

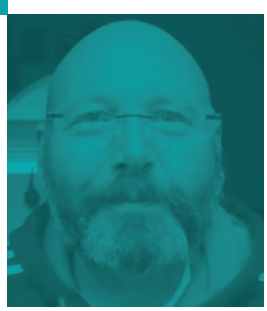
- This study aims to contribute to the wider discussion on prostate cancer screening through a focus on **socio-economic impact.**
- It assesses the **relative costs and benefits of introducing screening** to support earlier detection, under a range of scenarios (including for high-risk cohorts).
- The **recommendations from this study should be considered alongside wider evidence** and ongoing discussion around the future of prostate cancer screening.

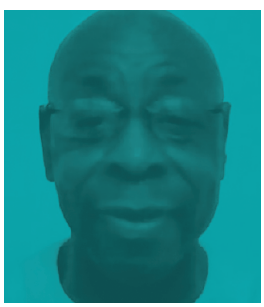
FOCUS

- Prostate cancer imposes **significant economic burdens** that extend beyond direct healthcare costs. The disease impacts a **wide range of stakeholder groups**, and a comprehensive evaluation of a screening programme needs to **consider both direct and indirect economic implications**.
- The stakeholder groups are defined as **individuals**, the **health and social care system**, and **wider society**.
- A range of impacts are considered, including **quality and years of life**, health and social care system **costs of screening and treatment**, **paid and unpaid productivity,** as well as **wider socio-economic impacts** such as wellbeing.

APPROACH

- The approach follows HMT Green Book appraisal guidance. The **scope of impacts is broader than the traditional focus of cost-effectiveness reviews.** It is not intended to provide an in-depth clinical evidence review nor a cost-effectiveness analysis study to assess the case for introducing prostate cancer screening.
- To estimate these impacts under a range of scenarios, the **modelling approach is based on a simplified and representative diagnosis and treatment pathway**.
- **A wide-range of data and evidence has been collected** to inform the outputs of this review. To address gaps in publicly available data, information has been collected through **SME consultation, surveys** (clinical- and patient-focused) and available **literature**.



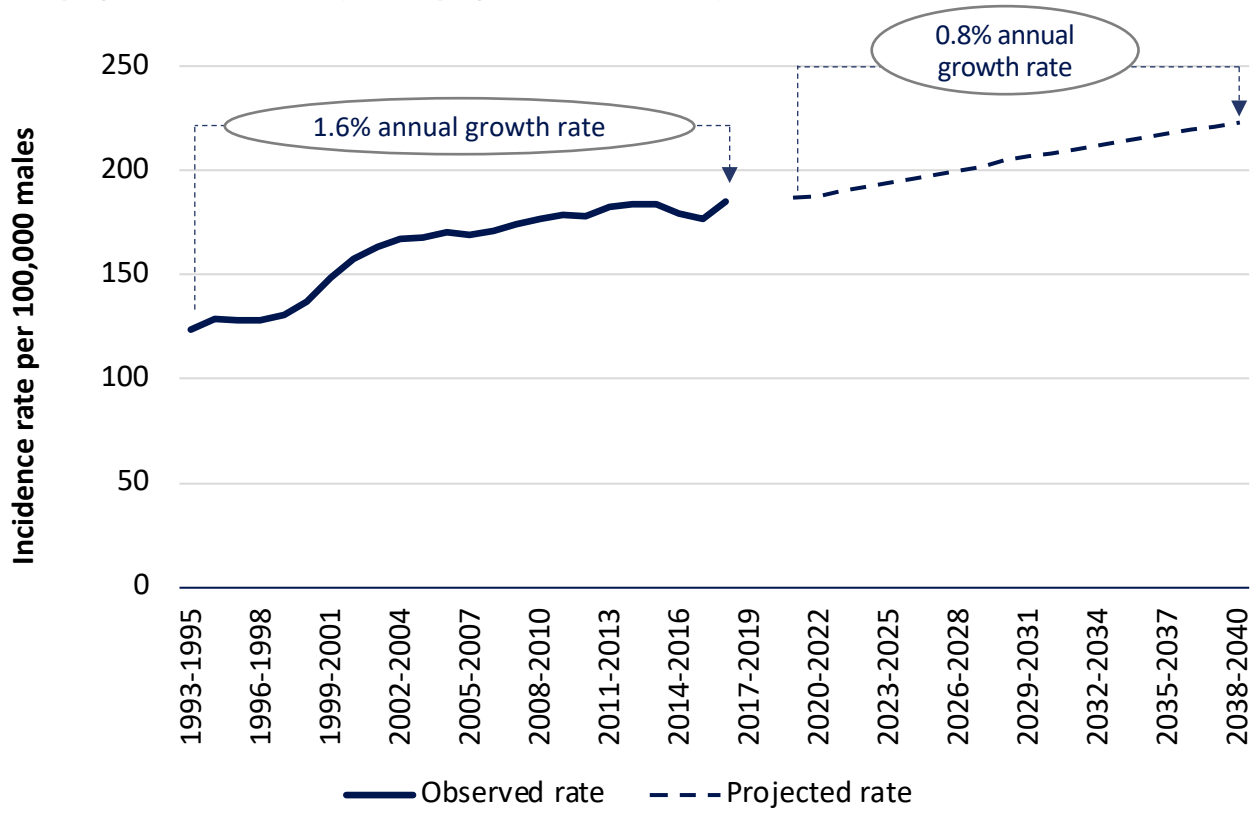


04 Prostate cancer trends and diagnosis in the UK

Prostate cancer is the most common cancer in men in the UK, yet there is currently no screening programme for early detection.

Prostate cancer is a significant health challenge, impacting an increasing number of men due to population growth, an ageing population and advances in screening and diagnostics. In the UK, it is the most common cancer diagnosed in men, with approximately 55,000 new cases reported annually from 2017–19.[13] This represents 28% of all cancers in men and 14% of all new cancer cases in men and women.[14] Prostate cancer is the second most common cause of cancer-related deaths in men (second to lung cancer)[15] and prostate cancer incidence rates are projected to increase by 15% in the UK in 2023–2025 and 2038–2040 (Figure 1). This concerning trend suggests that the number of new cases could reach 85,000 per year by 2038–2040, placing further strain on an already stretched healthcare system.[16]

Figure 1: Observed and projected age-standardised prostate cancer incidence rates (UK, 1990–2040: CRUK projections from 2020) CRUK projections from 2020)

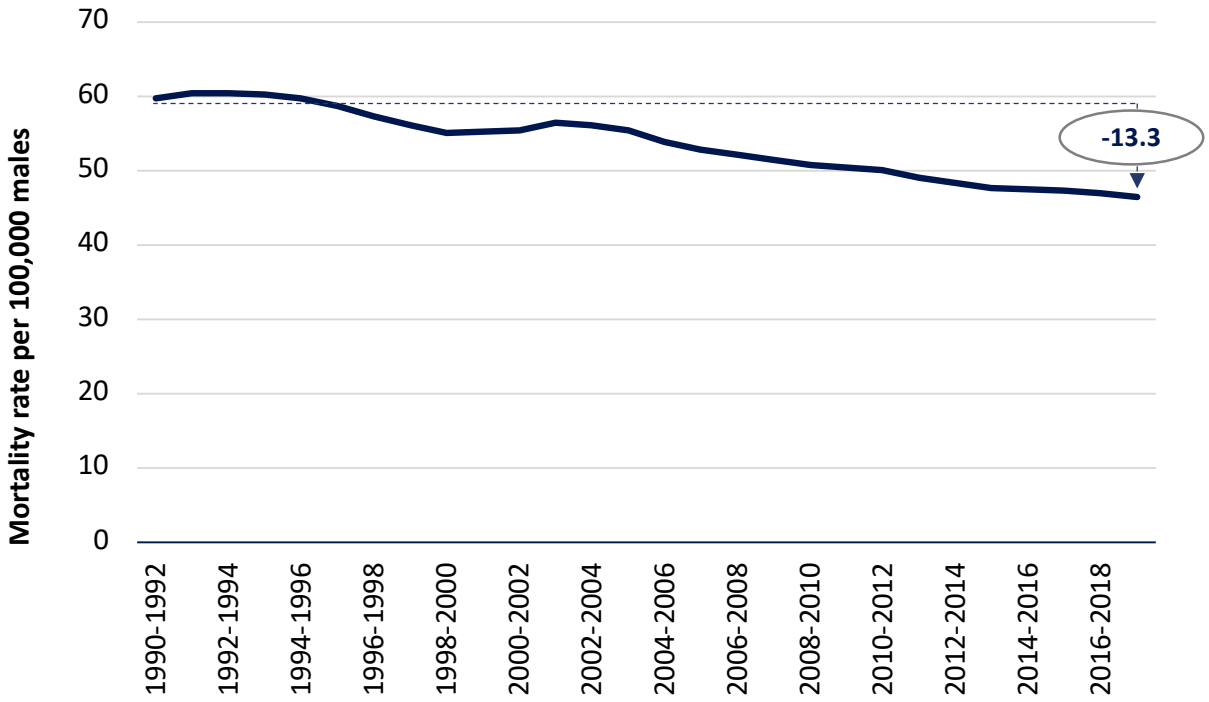


Source: CRUK statistics – Prostate Cancer incidence trends over time[17]

While prostate cancer is a significant health concern, the UK lacks a screening programme due to the ongoing debate around the accuracy of PSA testing and the balance between early detection and potential overdiagnosis. Screening could lead to earlier detection and improved outcomes for some men, but to ensure that a population-wide prostate cancer screening programme provides net benefits, screening technologies are needed that are both sensitive and specific (i.e. capable of detecting aggressive cancers while avoiding overdiagnosis). Men of Black ethnicity, those with genetic predispositions (family history and BRCA 1/2 mutations), older men, and those experiencing socio-economic deprivation are at increased risk for prostate cancer. These groups present an opportunity for targeted screening initiatives, particularly in the interim while we await results from trials and real-world evidence on emerging technologies.

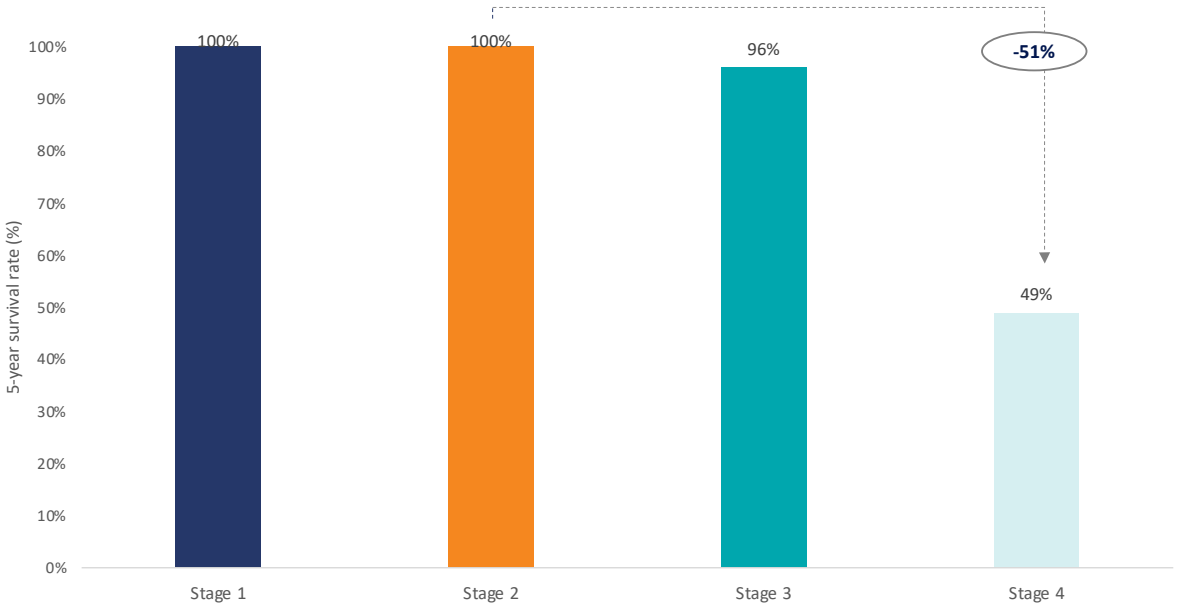
Despite the complexities surrounding prostate cancer screening, there have been positive developments in the treatment landscape. Advances in research, technology and treatments have contributed to a decline in mortality rates since the late 1990s (Figure 2). However, in the UK, approximately 12,000 men die as a result of prostate cancer each year.[18] The stage of diagnosis remains a crucial factor in determining overall survival and early detection at early disease stages leads to more positive patient outcomes. Outcomes worsen significantly from diagnosis at stage 1 compared to stage 4, with five-year survival rates decreasing by 51%, from 100% to 49% across these stages (Figure 3).[19]

Figure 2: Three year moving average observed age-standardised prostate cancer mortality rates (UK, 1990–2019)



Source: CRUK statistics[20]

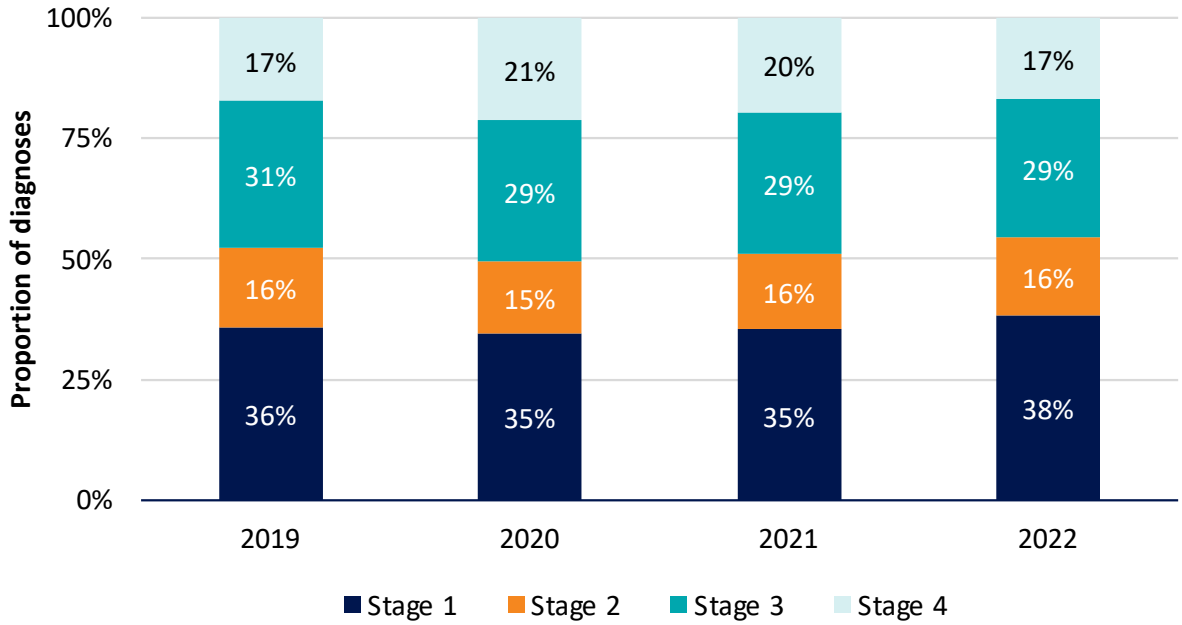
Figure 3: Five year survival rate by stage of diagnosis



Source: ONS cancer survival (2019)[21]

Following the pandemic, there has been a slight increase in the proportion of men diagnosed at early stages 1 and 2, but many men are still diagnosed with late-stage disease, which is too advanced for curative treatment. In England in 2022, nearly 50% of men were diagnosed with either stage 3 or stage 4 disease (Figure 4). To align with the NHS's ambition of diagnosing 75% of cancers at stage 1 or 2 by 2028, a significant increase of around 25% in early-stage prostate cancer diagnoses is needed over the next few years to meet this goal.[22]

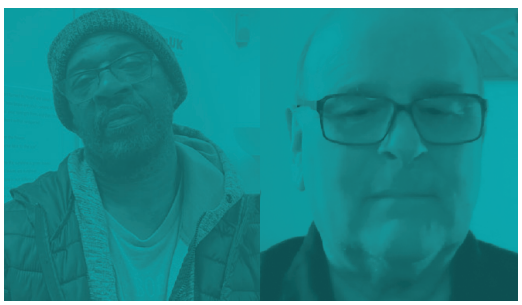
Figure 4: Distribution of prostate cancer diagnoses by stage (England, 2019–2022)



Note: Where stage of diagnosis is unknown it has been excluded from this figure

Source: NPCA 2024[23]

A prostate cancer diagnosis can have a profound impact on an individual's physical, emotional, financial, and social wellbeing (Figure 5). The physical challenges associated with treatment, the emotional toll of uncertainty, the financial strain from impact on ability to work, and the social implications of the diagnosis can significantly disrupt a person's life. As part of this work, a survey was conducted of over 2,600 prostate cancer patients and caregivers which found that the top physical impacts include loss of libido (58%) and fatigue (51%), with the most reported psychological impacts being anxiety/worrying (51%) and stress (45%). Survey respondents also reported changes to lifestyle, with 33% citing an impact to their work or leisure activities. Financial constraints also impact patients and their families, with lost earnings from reduced work and out-of-pocket (OOP) costs that are largely driven by reduced income and money spent attending appointments.[24]



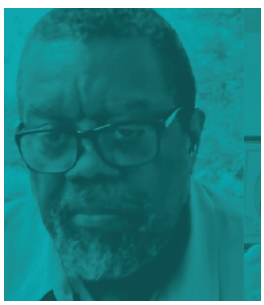
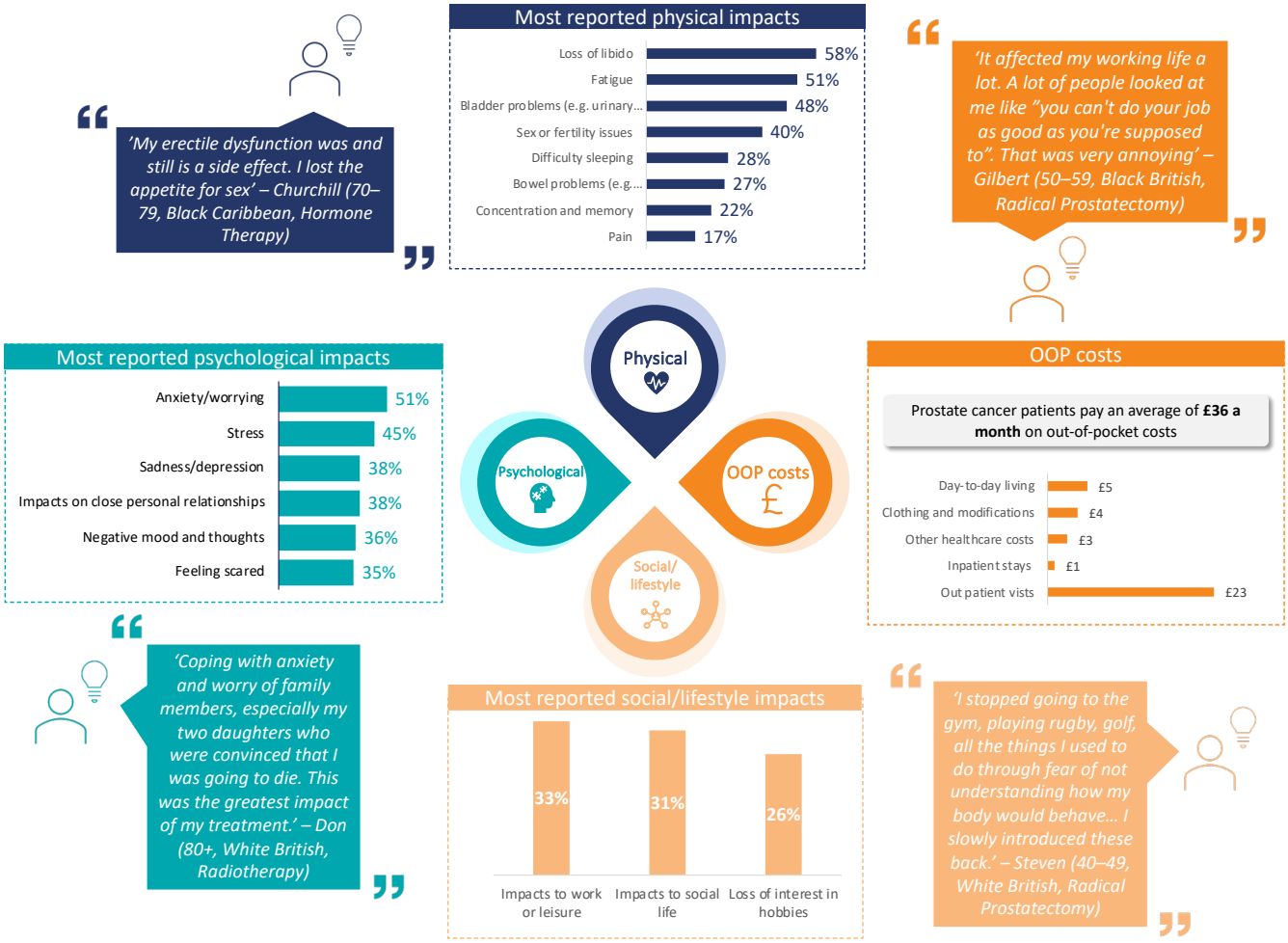
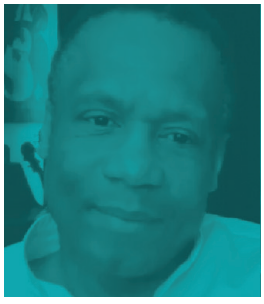


Figure 5: Classification of impacts to patients



Source: Prostate Cancer Research Patient and Carer Survey (2024)[25]*, PCR's educational website – the infopool*[26]*, Financial impacts of Cancer*[27]

The impacts of a prostate cancer diagnosis to patients are profound. However, to comprehensively assess the benefits of a prostate cancer screening programme, we need to understand the multifaceted impacts on individuals, as well as on their family, caregivers, the health and social care system, and society as a whole.

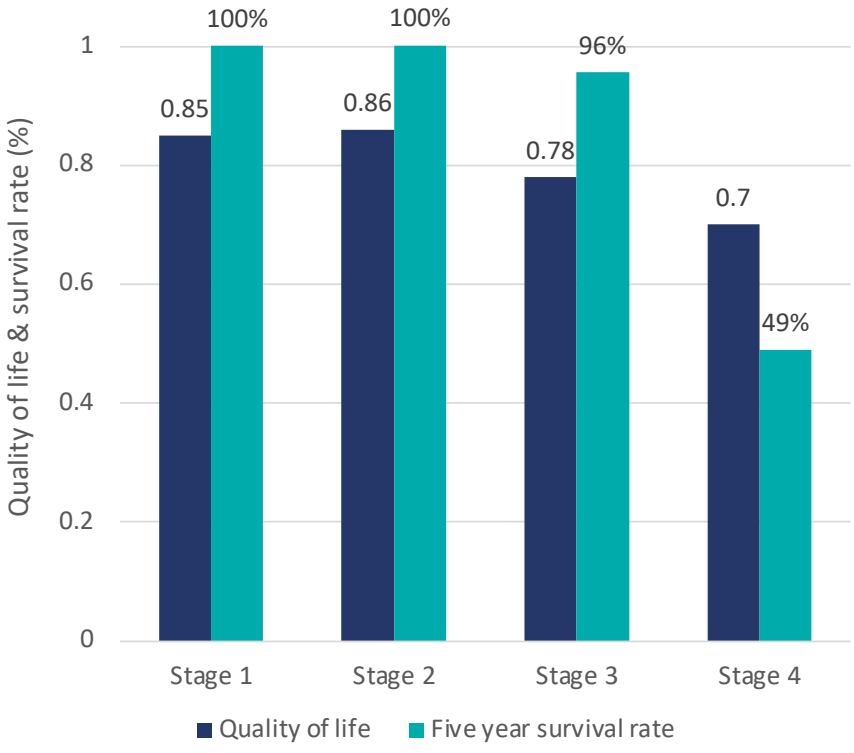


The impacts of prostate cancer for patients and carers become increasingly severe as the disease is diagnosed at later stages. The average five year survival rate drops by 51% for stage 4 diagnoses compared to stages 1 and 2, where the survival rate is 100%, while reported quality of life (QoL) scores decline to 0.7 at 18-months post-diagnosis, compared to general population levels of 0.9,[c] highlighting the significant toll late-stage prostate cancer takes on overall physical health and wellbeing (Figure 6).

Physical and emotional deterioration, particularly during advanced stages, also has a marked effect on a person's ability to work. Survey respondents report that during treatment, men diagnosed with stage 4 prostate cancer experience a 44% reduction in paid working hours, compared to a 38% reduction for those diagnosed at stage 1 (Figure 7). Even after treatment ends, long-term effects persist, with a 24% sustained reduction in paid working hours for stage 4 patients versus 15% at stage 1 and 2. The impact on unpaid working hours – including caregiving, volunteering and household duties – is more pronounced in the long-term than during treatment. This is particularly true for older men, some of whom may not return to the workforce, thereby also reducing their contribution to paid work. Caregivers also bear a significant burden. The average time spent caring for someone diagnosed with stage 4 prostate cancer more than doubles compared to caring for someone in stage 1, with 23.8 hours per week compared to just 4.5 hours (Figure 8). This not only affects the caregiver's employment, leading to a reduction in workforce participation, but also results in a broader loss of productivity for society.

Advanced-stage diagnosis is also a significant economic burden on the healthcare system due to high cost of advanced-stage treatments. Cost of treatment over the average treatment period is nearly 10 times higher at stage 4 compared to stage 1 (£13k vs £127k). Recent advances in hormonal therapies have transformed the management of metastatic prostate cancer. These therapies are generally well-tolerated when compared with chemotherapy and can significantly improve quality of life for many patients who were previously faced with limited options. While novel hormonal therapies offer promising benefits for metastatic prostate cancer, their high cost presents a financial challenge for the NHS. These therapies can cost over £4,000 per month, and – with an average treatment duration of approximately 4.5 years for hormone-sensitive metastatic disease – drive the high costs of treatment in stage 4 disease (Figure 9).[28]

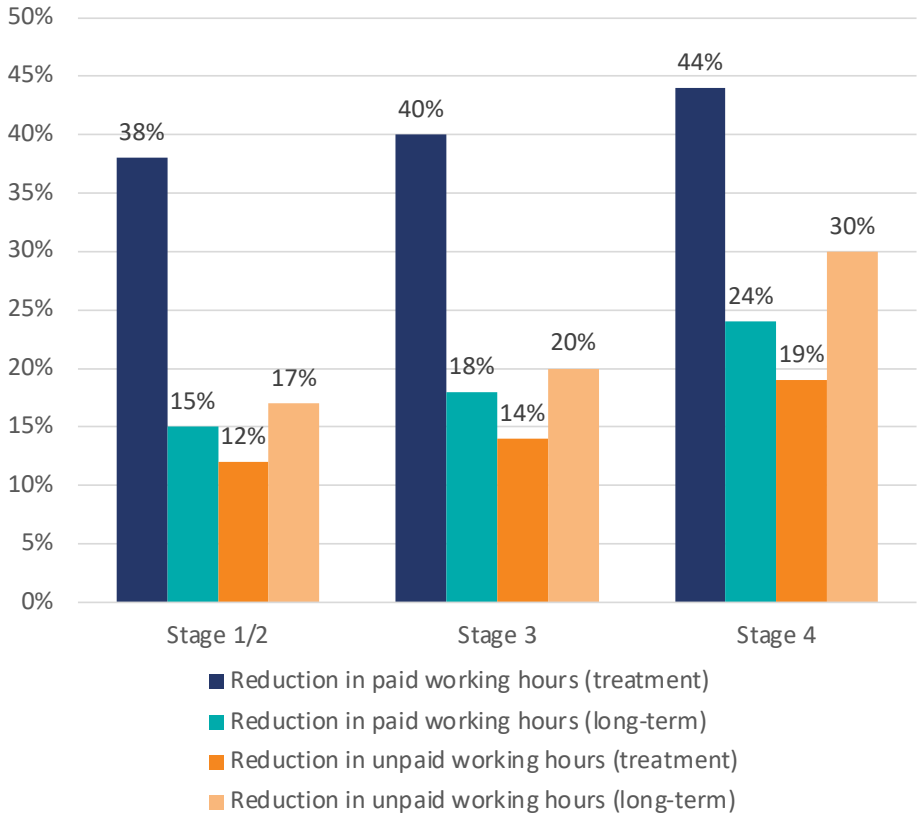
Figure 6: Quality of life and survival rate by stage of diagnosis



Source: NHS QoL Survey (2024)[29], ONS cancer survival (2019)[30]

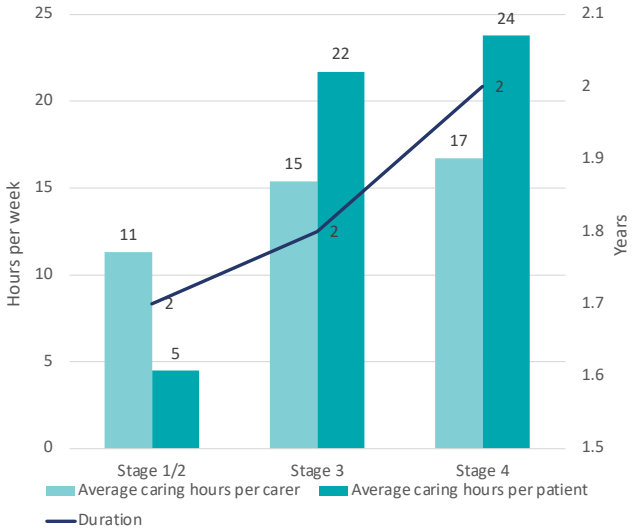
[c] Quality of life is measured through EQ-5D score which ranges from 0–1, with 0 being equivalent to death and 1 being equivalent to full health

Figure 7: Reduction in paid and unpaid working hours by stage of diagnosis



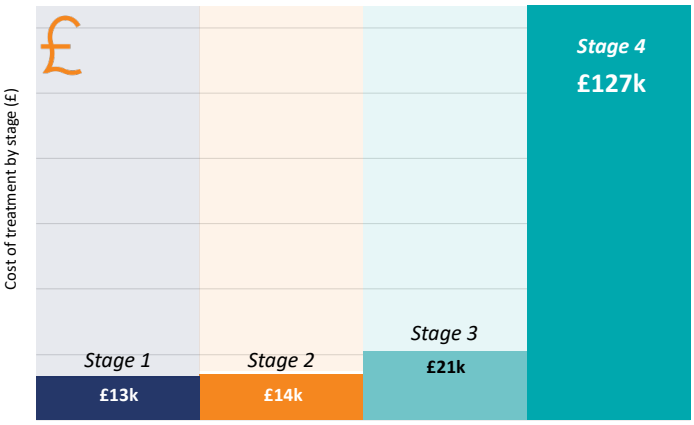
Source: Prostate Cancer Research Patient and Carer Survey (2024)[31]

Figure 8: Average informal caring hours by stage of diagnosis



Source: Prostate Cancer Research Patient and Carer Survey (2024)[32]

Figure 9: Average treatment cost by disease stage (over average treatment period)



Source: Estimation based on clinical survey, BNF[33]

Why is there no screening programme for prostate cancer?

Despite the impacts to patients of a prostate cancer diagnosis and healthcare system costs associated with late-stage prostate cancer diagnoses, the UK's National Screening Committee's most recent evidence review in 2020 concluded that screening for prostate cancer should not be introduced in the UK. This decision is based on several factors, including unreliability of PSA testing, treatment effectiveness, as there are some cancers that do not need treating.

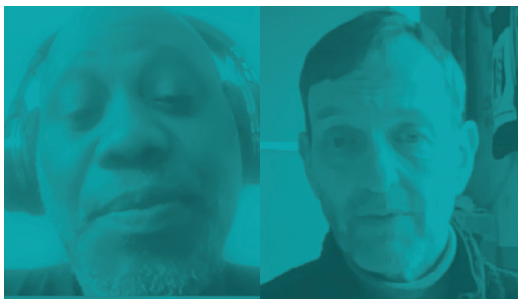
Prostate cancer is different from some other cancers in that it often has no or limited symptoms making it difficult to be detected early. Additionally, non-aggressive cancers often do not require treatment, making overdiagnosis a key concern of prostate cancer screening and in some circumstances it is difficult to give a prognosis and distinguish a clinically insignificant cancer from an aggressive one. The prostate cancer pathway – from initial healthcare access to diagnosis, treatment, and follow-up – is complex and can present significant challenges for both patients and HCPs. These challenges arise from a combination of factors, including:

- **Challenges of PSA testing:** The National Screening Committee's rejection of the case for implementing a national screening programme for prostate cancer was primarily due to unreliability of the PSA test as a stand-alone test and its unclear impact on mortality in comparison with no screening. Inaccuracy of the PSA test when used alone can lead to unnecessary biopsies for patients and subsequent side effects, or false reassurance that there is no cancer. These factors lead to uncertainty from GPs as to its use in prostate cancer diagnosis. Adding to the challenge, there is wide variation in published estimates of the specificity and sensitivity of the PSA test:

    - **Insufficient specificity:** Specificity of the PSA test is its ability to detect a negative diagnosis and avoid false positives. Three in four men with a raised PSA level do not have prostate cancer (false positive) (Figure 10). As a result, many men with a false-positive PSA result are subject to the emotional stress of a cancer scare and an unnecessary prostate biopsy. A study in the *British Cancer Journal*, looking at 330 participants who had false positive PSAs, found that there was a significant increase in distress and anxiety after a PSA test at subsequent time-points – during the biopsy, immediately after the negative biopsy result and 12 weeks later.[34] Additionally, a prostate biopsy can have painful side effects and, in rare circumstances, serious complications including sepsis.

    - **Insufficient sensitivity:** Sensitivity of a test is its ability to detect a true positive diagnosis and avoid detection of false negatives. One in seven men with a normal PSA result have the disease (false negative). A false-negative result can falsely reassure patients that there is no risk of cancer. This may lead them to ignore symptoms of prostate cancer in the future and result in diagnosis at a later stage with poorer outcomes.

    - **Clinician reluctance:** Many clinicians express uncertainty regarding the reliability of the PSA test for diagnosing prostate cancer, leading to a reluctance to utilise it.



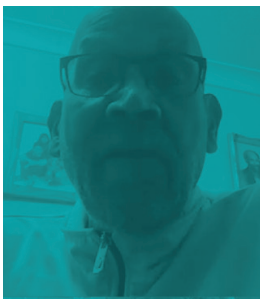
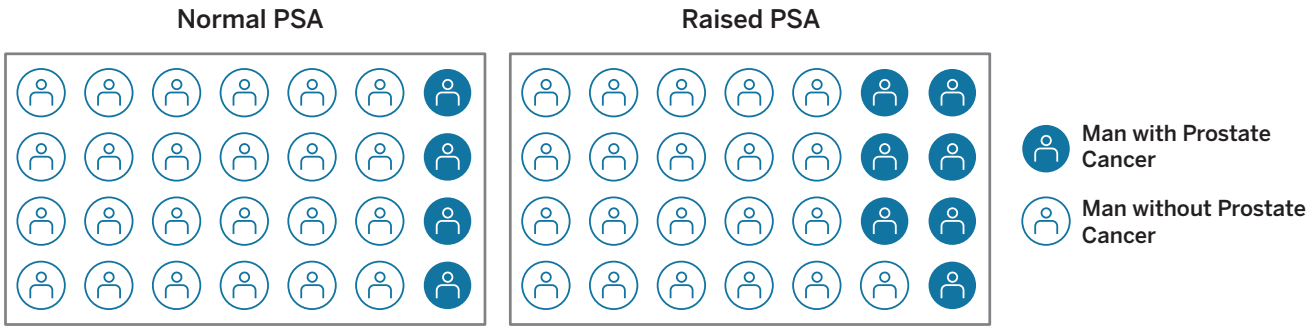


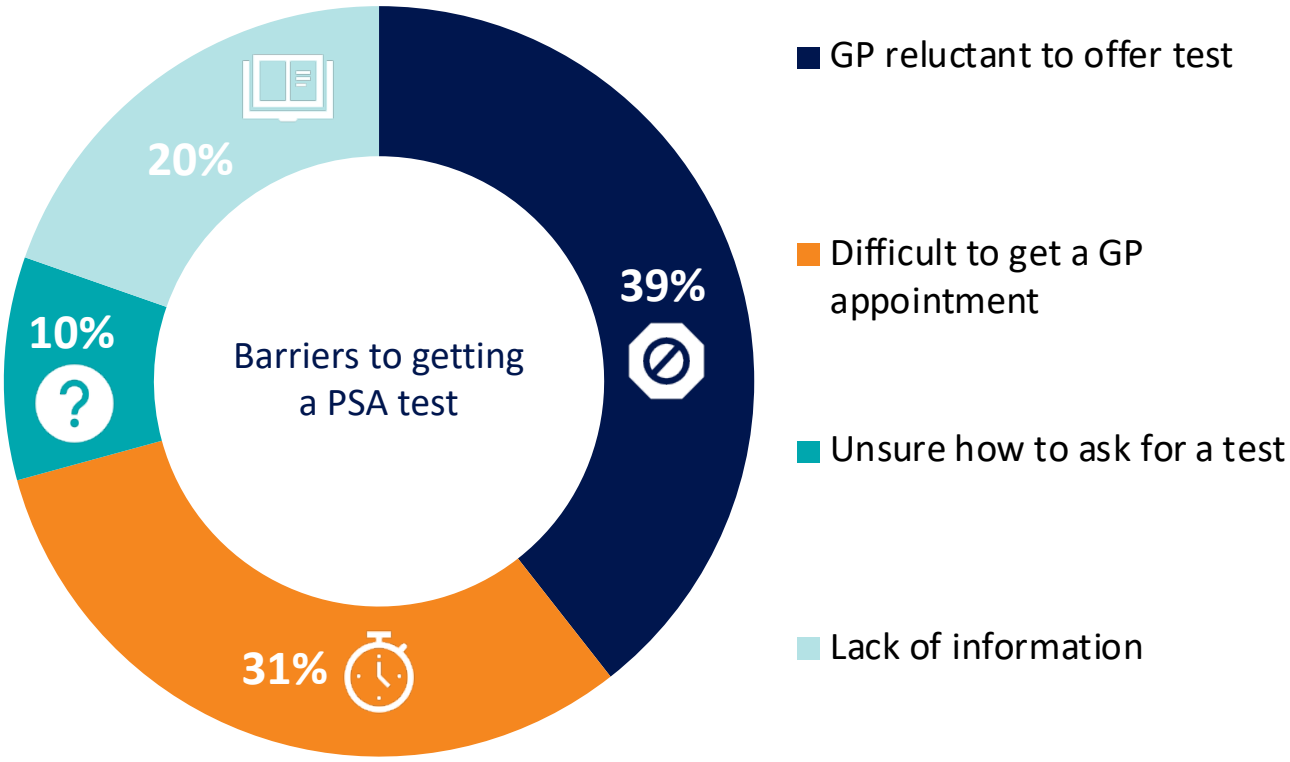
Figure 10: Comparison of 28 men with and without elevated PSA



Source: NICE[35]

- A lack of awareness and confidence amongst patients in the prostate cancer screening process, including the availability of the prostate cancer risk-management programme, adds to the challenges accessing testing and contributes to diagnostic delays today. Our survey found that over half of men faced challenges getting a PSA test, of which 39% said that their GP was reluctant to offer it, 31% had challenges accessing a GP appointment and 30% said they were unsure how to ask for a test or lacked information about it (e.g. insufficient information provided by the GP) (Figure 11).

Figure 11: Key challenges faced by survey respondents who expressed difficulty accessing a PSA test



Source: Prostate Cancer Research Patient and Carer Survey (2024)[36]

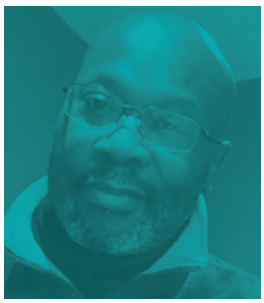
- **The diverse nature of prostate cancer adds to the complexity of treatment decisions.** A prostate cancer diagnosis does not always require treatment; many prostate cancers are low-risk and many men will live healthy lives without radical treatment. The UK NSC evidence review concluded that of treatments recommended by NICE for early-stage prostate cancer, no single intervention could be identified as conclusively superior. Slower disease progression after radical treatment (prostatectomy or radiotherapy) versus no treatment (active surveillance) must be balanced against increased adverse events, particularly in men who may not develop clinically significant disease.[37] The decision to start radical treatment requires accurate staging and grading, along with careful consideration of individual factors to assess the risk-benefit ratio of treatment. Consequently, many men with prostate cancer may choose monitoring protocols (i.e. active surveillance or watchful waiting), avoiding active treatment and the process of waiting for test results can be emotionally taxing for patients.

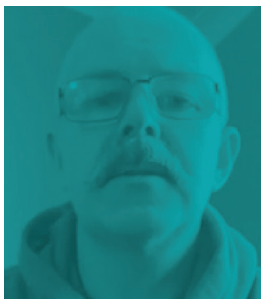
"I was under active observation for about 7 years, my PSA blood test results fluctuated between 5 to 9, at the times of higher levels I became more anxious, I would have preferred to be given MRI scans at these times, rather than to be told to wait to see what my next PSA result would be, this could be six months later, which put me personally under a lot of stress and anxiety." – Stephen (60-69, White British, Active Surveillance)

Source: PCR's educational website, the infopool[38]

- **The evolving landscape of medical research and guidelines leading to new discoveries about prostate cancer and treatment options.** The rapid pace of medical research has led to significant advances in treatment options and outcomes for many patients. However, this can create challenges for healthcare professionals in staying informed of the latest research findings and guidelines. Conflicting evidence regarding the most appropriate treatment approaches at different stages, and often unclear guidelines contribute to the challenges faced by healthcare professionals and patients when deciding on the most appropriate treatment. The dynamic landscape necessitates ongoing training for healthcare professionals on best practice, and education for patients to feel empowered to self-advocate and manage their own health.

While the benefits of early detection for many cancers are well established, prostate cancer is complex and has its own challenges. PSA testing has limitations, including the risk of overdiagnosis and false positives and the potential harms of screening – such as unnecessary biopsies and treatments – must be carefully weighed against the benefits of early detection. However, targeted screening strategies for the most vulnerable groups, combined with ongoing research into improved diagnostic technologies, may offer promising solutions for improving outcomes in prostate cancer.





05 Inequalities in prostate cancer

The prostate cancer pathway is complex and nuanced, characterised by significant health equity challenges for patients.

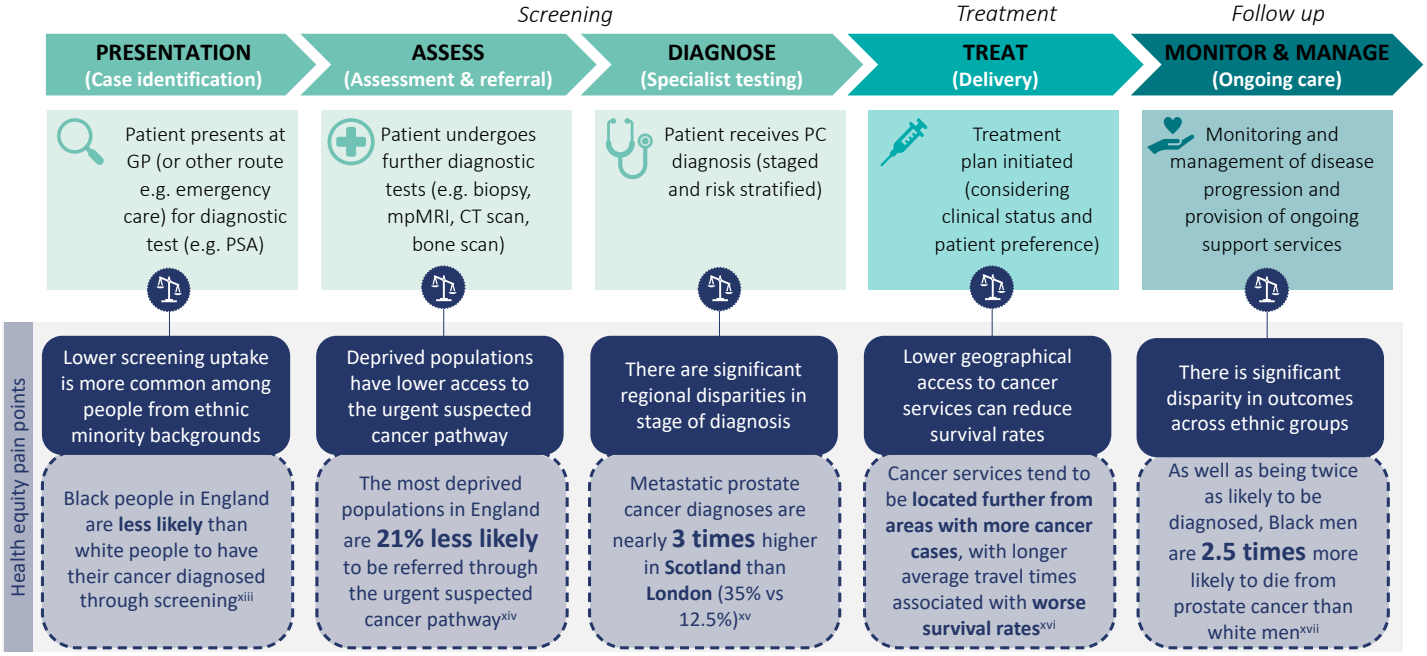
Health inequalities are prevalent across the prostate cancer pathway and compound the challenges. Socio-economic, ethnic and geographical factors contribute to disparities in diagnosis, available treatment options, patient experience and outcomes (Figure 12).

People from minority ethnic backgrounds are less likely to get their cancer diagnosed through screening[14], highlighting the challenges surrounding access and awareness of preventative healthcare and the need to improve access for these groups when considering any screening programme. People from the most deprived populations in the UK are 21% less likely to be referred through the urgent suspected cancer pathway, due to dismissal of symptoms and challenges accessing healthcare in the first instance.[15]

Older men and those experiencing greater social deprivation are more likely to present with metastatic disease at diagnosis. There is also significant geographic variation. In the UK, the percentage of men diagnosed with prostate cancer at a stage too late for curative treatment is nearly three times higher in Scotland compared to London (35% vs 12.5%)[39] (Figure 13), and men living in parts of the North East are almost six times more likely to be diagnosed after their cancer has spread than in the country's top performing trusts.[40] Additionally, men who must travel further for cancer treatment have worse outcomes. In England, 24% more men are living with a prostate cancer diagnosis in affluent areas compared to deprived areas, which is the opposite to many other cancers.[41] This is due to a complex interplay of factors including lower awareness and reduced access to healthcare resulting in underdiagnosis, and as a result, approximately 3,100 cases per year are linked to deprivation.[42] These disparities underscore the urgent need for targeted interventions to address health inequalities and improve access to early diagnosis and treatment for prostate cancer in seldom-heard populations.

As well as being twice as likely to be diagnosed with prostate cancer, Black men are 2.5 times more likely to die from prostate cancer than white men, highlighting significant inequalities between ethnicities in accessing the right treatment and care.[43]

Figure 12: Health equity pain points and examples



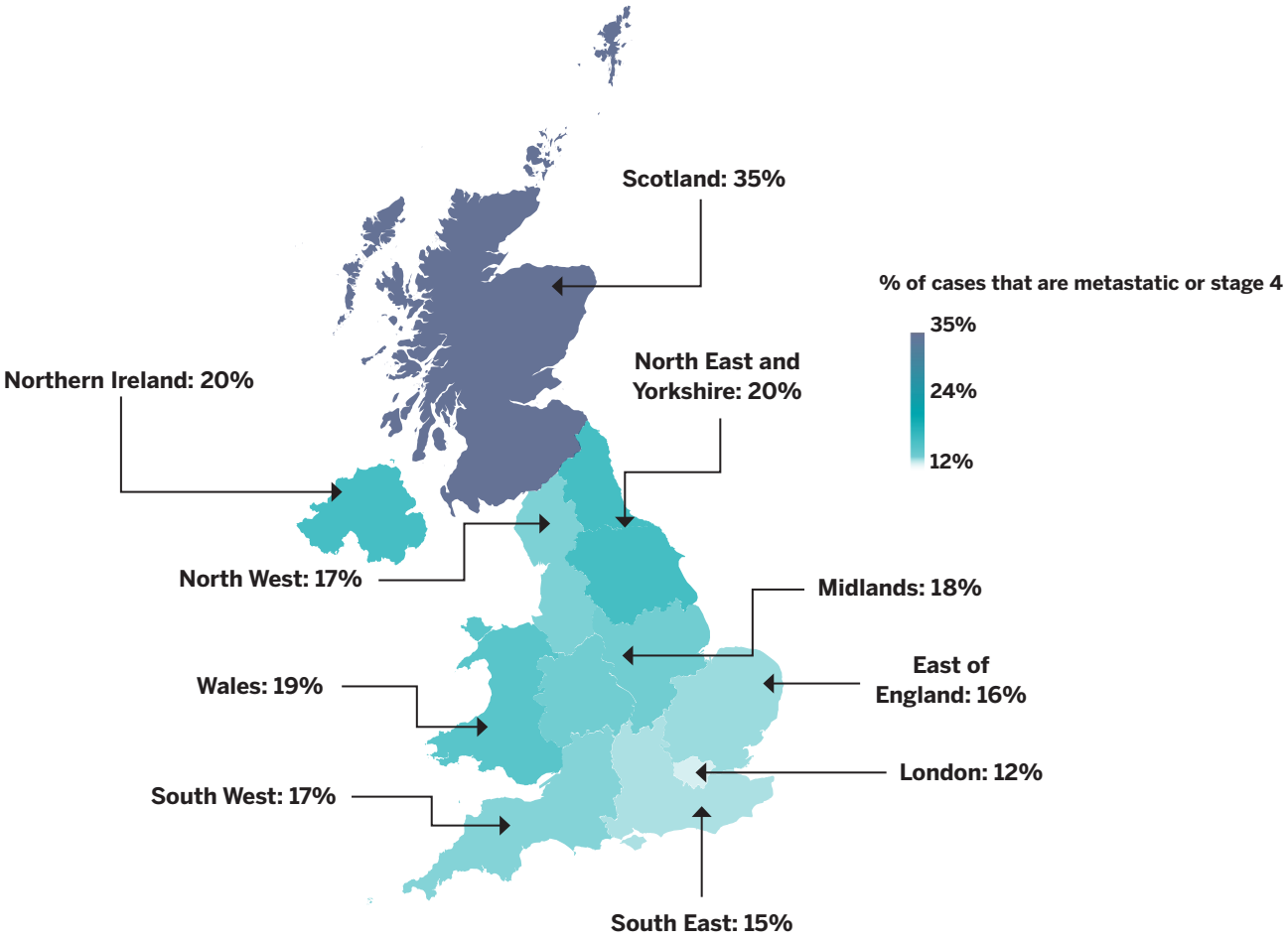
Source: xiii – BMJ (2022)[44], xiv – Nuffield Trust[45], xv – NPCA (2022)[46], xvi – Health & place (2016)[47], xvii – Prostate Cancer Research[48]

> *"Talk to someone, a problem shared is a problem halved, especially as Black men and the stereotypes surrounding this." – Maurice (40-49, Black British, Watchful Waiting)*

> *"As a Black man, sometimes you take your health for granted and so that [prostate cancer diagnosis] definitely caused us to look at life differently." (Jacqui, 50-59, Black Caribbean, wife of Tim who is on Watchful Waiting)*

Source: PCR's educational website – the infopool[49]

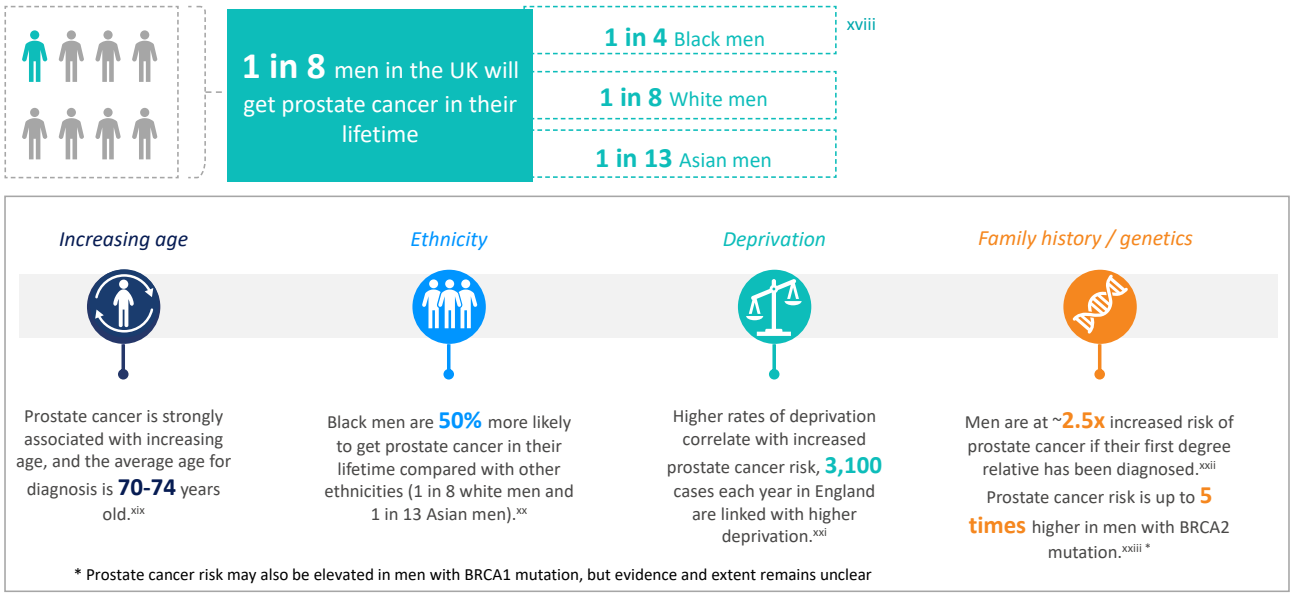
Figure 13: Proportion of prostate cancer cases that are metastatic / stage 4 at diagnosis



Source: Prostate Cancer UK 2024[50]

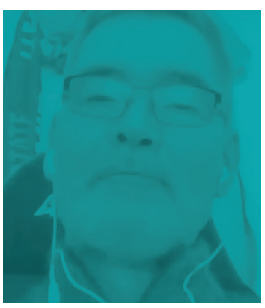
Unlike many diseases, prostate cancer is not thought to be linked to any preventable risk factors beyond maintaining a healthy diet and avoiding smoking and obesity. Unavoidable risk factors including increasing age, being of Black ethnicity, higher socio-economic deprivation, and genetic factors including family history and homologous high-risk genetic mutations (i.e. BRCA 1/2 mutations being the most prevalent and carrying the greatest risk) are all associated with an increased risk of developing prostate cancer (Figure 14).[51 52] Some risk factors are interlinked and may overlap. For example, 13.5% of non-Black respondents report a relevant family history in Prostate Cancer UK's online risk checking tool compared to Black men, for whom the prevalence jumps to 20.4%. Black men are also more likely to experience other health conditions and have sociodemographic characteristics all contributing to poorer prostate cancer outcomes.[53 54 55]

Figure 14: Key risk factors for prostate cancer



Source: xviii – Prostate Cancer UK[56], xix – NPCA[57], xx – Prostate Cancer UK[58], xxi – CRUK[59], xxii – International Journal of Cancer[60], xxiii – Breast Cancer Linkage Consortium[61], and Nature Reviews Urology[62]

These risk factors indicate that there may be a case for a risk-stratified screening approach to effectively target specific cohorts of individuals who are at increased risk of prostate cancer and may see increased benefit from early detection. Currently, reliance is on the individual to be proactive about requesting a PSA test from their GP. A recent study by the *British Journal of General Practice* concluded that there may be an opportunity for 'proactive approaches' whereby GP's initiate proactive rather than reactive conversations about the PSA test with men who are at higher-than-average risk of developing prostate cancer.[63] While there may be good-use cases for 'proactive approaches' in some situations and this can be seen as a step in the right direction, this does not fully address the widespread inequities in healthcare access. Individuals who are disengaged from the healthcare system, less likely to visit their GP and lack trust in the system stand to benefit most from screening but may be overlooked by 'proactive approaches'.



Targeted risk-based screening initiatives, including formal invitations and tailored education, can optimise the use of current diagnostic technologies within existing healthcare capacity. These initiatives can also be influential in engaging individuals with lower health literacy and those from lower socio-economic backgrounds in screening programmes. By varying the target cohort, frequency and type of test offered based on an individual's risk level, risk-stratified screening for cancer offers a more targeted approach to population-based screening and may be easier to implement within current healthcare capacity constraints. This approach is being taken in lung cancer, breast cancer and colorectal screening for targeted age ranges and genetic conditions in the UK (Figure 15).

Figure 15: Targeted screening examples

Lung cancer screening

- A risk-based approach has demonstrated success in the UK under the NHS Targeted Lung Cancer screening programme.
- People aged 55 to 74 with a GP record including a history of smoking are assessed and invited for screening, with screening taking place in mobile units parked in convenient places such as supermarket car parks to ensure easy access for people in deprived regions.
- In the pilot phase, more than 2,000 people were diagnosed with cancer, and 76% of these diagnoses were at an earlier stage compared to 29% outside of the programme in 2019.[xxiv]

Breast cancer screening

- The NHS Breast Screening Programme has adapted its approach based on risk, targeting certain age groups in the UK.
- All women between the ages of 50-70 years old are invited for three-yearly screening, and those who have an increased risk below the age of 50 on account of family history or because of genetic testing are invited earlier.[xxv]
- The Breast Screening Programme has led to cancers being detected in 18,942 women across England in 2022-23, which otherwise may not have been diagnosed and treated until a later stage.[xxvi]

Colorectal cancer screening

- In June 2024, a new NHS testing programme for bowel cancer was launched for people with Lynch Syndrome, following an initiative to increase genomic testing for the disease.
- The programme forms part of the wider NHS Bowel Cancer Screening Programme and specifically targets younger age ranges with Lynch syndrome, who are eligible to join the programme from age 25 or 35 depending on the gene variant they possess. Relatives of those who test positive are then also invited to be tested.[xxvii]

Source: xxiv – GOV.UK[64], xxv – GOV.UK[65], xxvi – NHS England[66], xxvii – Genomics Education Programme[67]

Progress is being made to help address inequity in the prostate cancer pathway, but there is still a long way to go to diagnose men sooner.

Men with prostate cancer may struggle to interpret complex medical information, particularly those who have lower health literacy at a time when they are experiencing high emotional stress. To help address this, in April 2023, Prostate Cancer Research launched the infopool. The infopool is an accessible website that bridges the information gap for men affected by prostate cancer and empowers men living with prostate cancer to manage their disease and, with their clinicians, make the choices they want for a better quality of life.[68]

The site provides prostate cancer patients with clear and valuable information on testing and diagnosis, treatment options, living with side effects, and finding suitable clinical trials. PCR has co-designed content and materials with patients that are representative and appropriate, using images, animations, infographics, videos and interactive tools. At its heart are stories from men from across the community – stories that talk to the diversity of people's experiences and culture offering insight into the options available. Through the infopool, patients can filter these stories by ethnicity, age, sexuality, work status and treatment type so that they can learn from those with similar lived experiences to them and know that they are not alone on their journey.

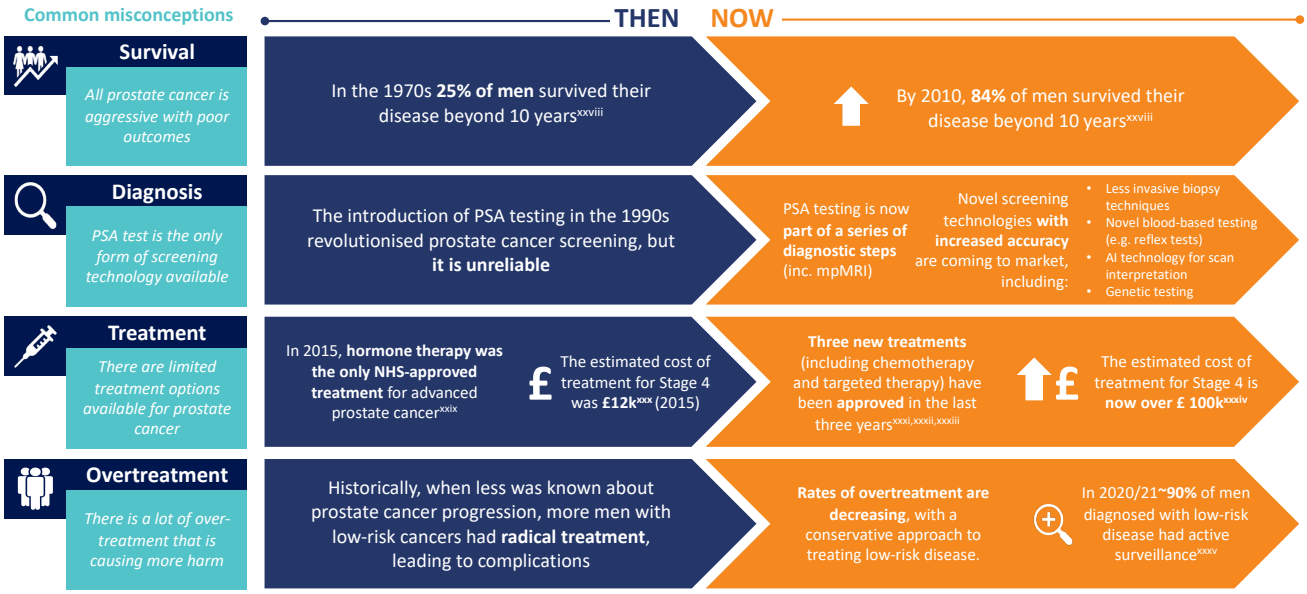
The website has been accredited by the Patient Information Forum (PIF) TICK, evidencing that the information is produced to the highest in-patient standards, and it is endorsed by the British Association of Urological Nurses. Since its launch, over 190,000 people have visited the infopool and 93% are likely or extremely likely to recommend it to a friend or colleague.[69] The tool is an example of what can be done to advance health equity in prostate cancer, helping to bridge healthcare literacy gaps and ensuring that everyone has access to the resources they need to navigate complex medical journeys.

06 Re-evaluating the benefits of screening

With the evolving focus on prevention for cancer, and the emergence of promising diagnostic technologies, now is an opportune time to re-evaluate the benefits of prostate cancer screening.

Research in recent years has altered the perception and management of prostate cancer. A diagnosis no longer necessarily equates to a life-limiting condition, survival rates have significantly improved, a broader range of diagnostic tests and treatment options are available, and there is compelling evidence supporting the benefits of active surveillance for low-grade prostate cancers, offering a less invasive alternative to radical treatment that limits concerns of overtreatment (Figure 16).

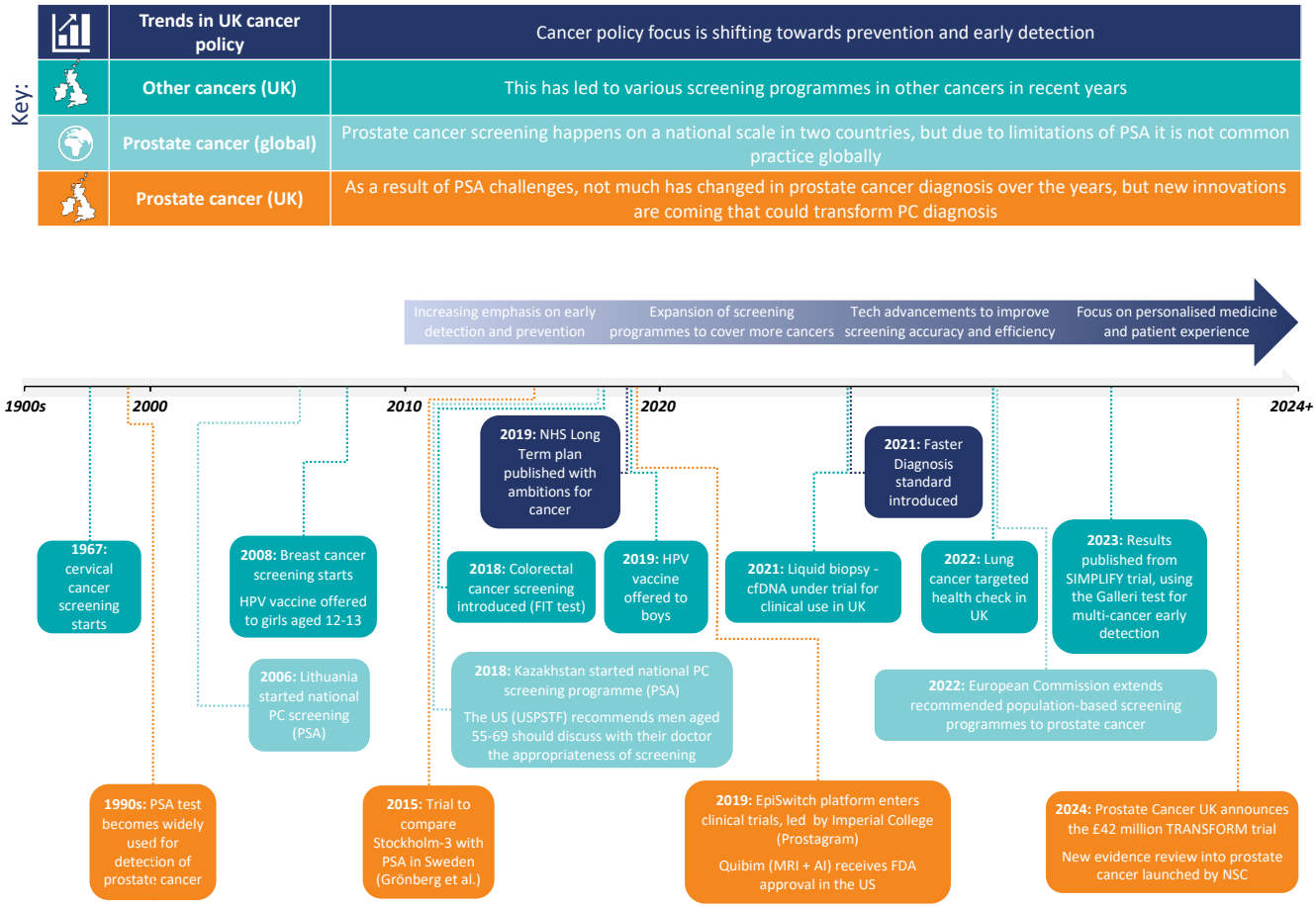
Figure 16: Prostate cancer: then vs now



Source: xxviii – CRUK (2024)[70], xxix – Prostate Cancer UK[71], xxx – Deloitte analysis, xxxi – NHS England[72], xxxii – Prostate Cancer UK[73], xxxiii – NHS England[74], xxxiv – Estimation based on clinician survey (2024), BNF[75], xxxv– NPCA (2024)[76]

Supporting this, cancer policy focus is shifting towards prevention and early detection, and this has led to various national cancer screening programmes in the UK in recent years, including breast, cervical, colorectal and lung screening. European guidelines state that prostate cancer could be a suitable candidate for a national screening programme, following a proposal by the European Commission in 2022 [77] [78] and two countries (Lithuania and Kazakhstan) have implemented such programmes using PSA testing. Since the last review of the National Screening Council in 2020, there have been several promising developments in alternative screening methods to using the PSA test alone, including reflex tests (e.g., Stockholm-3 and PSE used alongside PSA). The use of AI technology in MRI scanning and testing for cancer biomarkers also offer promising new or additive methods for more reliable and effective screening methods with reduced risk of overdiagnosis and overtreatment of insignificant cancers (Figure 17).

Figure 17: Illustrative timeline of changes in cancer policy and screening landscape



Source: Summary from desktop review

With significant advances in prostate cancer research and ongoing reviews, the timing is ideal to explore innovative screening strategies and consider their benefits to patients, their loved ones and society as a whole. In 2024, the UK government and Prostate Cancer UK announced the TRANSFORM trial, which will evaluate the effectiveness of different screening methods on a diverse population, with an aim to inform future national screening policies. Additionally, the UK NSC is due to review its recommendation for prostate cancer screening and will consider new evidence published since the last review.

Figure 18: Transform trial

TRANSFORM – the largest prostate cancer screening trial in decades

The UK government and Prostate Cancer UK have announced a £42m trial to find ways to detect the disease earlier. The trial, which is due to start in spring 2025, will invite hundreds of thousands of men to receive a screening. Men at higher risk will be recruited through their GP surgery, with 1 in 10 participants set to be Black men. The trial will consider alternative screening pathways to the PSA test, including the use of an MRI scan to screen for the disease.

Source: GOV.UK[79]

Examples of new screening methods

Reflex tests:

- More trials and evaluations of the Stockholm3 test have been performed with positive outcomes across ethnically diverse populations.[80] The Stockholm3 test predicts likelihood of prostate cancer using a range of plasma protein biomarkers, genetic markers and clinical data. Stockholm3 is more effective than PSA alone at detecting clinically relevant cancer, but it is expensive, with a list price almost 12 times the cost to the NHS of a PSA test. Despite the high upfront cost, a 2020 study in Sweden evaluating Stockholm3 against PSA found a reduction in costs of 23–28%, because of the reduced number of unnecessary MRIs, biopsies and biopsy complications including sepsis. There are also quality-of-life improvements for men who do not experience the stress and side effects of an unnecessary suspected cancer pathway.[81]

- In 2023, the PSE (Prostate Screening Episwitch) test was evaluated. This test combines the PSA test with a DNA test, resulting in substantially improved accuracy. Additionally, the test is minimally invasive and if successful in larger trials across diverse patient populations, it has the potential to reduce or eliminate the downsides of the PSA test, such as the high rate of false positives.[82]

MRI (+/- AI):

- In 2023, a formal screening study trialled the use of MRI as a screening tool alongside the PSA test, which concluded that the addition of MRI allowed the detection of cancers that would have been missed by the PSA test alone. Importantly, the MRI can pick up significant lesions before the PSA has started to rise, offering an opportunity for early detection. The study also highlighted some of the deficiencies of the PSA test; two in three men with a positive MRI screening and half of men with clinically relevant prostate cancer had a low PSA level.[83]

- The addition of AI diagnostic software in prostate cancer MRI scanning has been evaluated and a recent study in the *European Journal of Radiology* concluded its high diagnostic performance in identifying and grading prostate legions while accurately ruling out prostate cancer in low-risk lesions.[84] Utilising AI as a supplementary tool in the prostate cancer diagnostic pathway can standardise MRI readings, minimise variability and alleviate clinical workload to optimise operational efficiencies.

Biomarkers:

- In October 2024, a new study was launched by the Institute of Cancer Research for the use of the PRODICT spit test in diagnosing prostate cancer. The £2 million study, funded by the National Institute for Health and Care Research (NIHR) Invention for Innovation (i4i) Early Cancer Diagnosis Clinical Validation and Evaluation programme, aims to pick up more men with prostate cancer at an earlier stage. PRODICT identifies more than 400 genetic cancer variants, and the three year study will comprise 1,000 men with prostate glands from varying ethnic backgrounds, aged 40–55.[85]

While promising diagnostic technologies for prostate cancer are emerging, there are also important costs that need to be considered when deciding whether to introduce a screening programme in the UK. These include costs to individuals, such as the emotional impacts of undergoing testing, costs to society, such as reduced working hours, and costs to the health system, such as those associated with screening and increased diagnosis and treatment. Therefore, a balanced approach needs to be taken to ensure that positive and negative factors are considered before implementing a screening programme.

The widespread adoption of new technologies within the NHS may be hindered by several challenges. Capacity constraints, including limited resources and infrastructure, and the associated costs can impede implementation. To overcome these barriers, strategic planning, collaborative efforts and investment in healthcare infrastructure are essential. Identifying the right screening tests that have gone through robust clinical evaluation, and the right implementation methods that limit disruption to clinical pathways needs to be carefully considered to optimise patient outcomes. While we await trial results (i.e. from TRANSFORM) and real-world evidence on new technologies and strategic planning of NHS resources to adopt innovation, optimising the use of the PSA test within current healthcare capacity could be an option for improving early diagnosis for high-risk groups in the near-term. In the next section of this report we explore three scenarios for consideration in a future screening programme for prostate cancer.

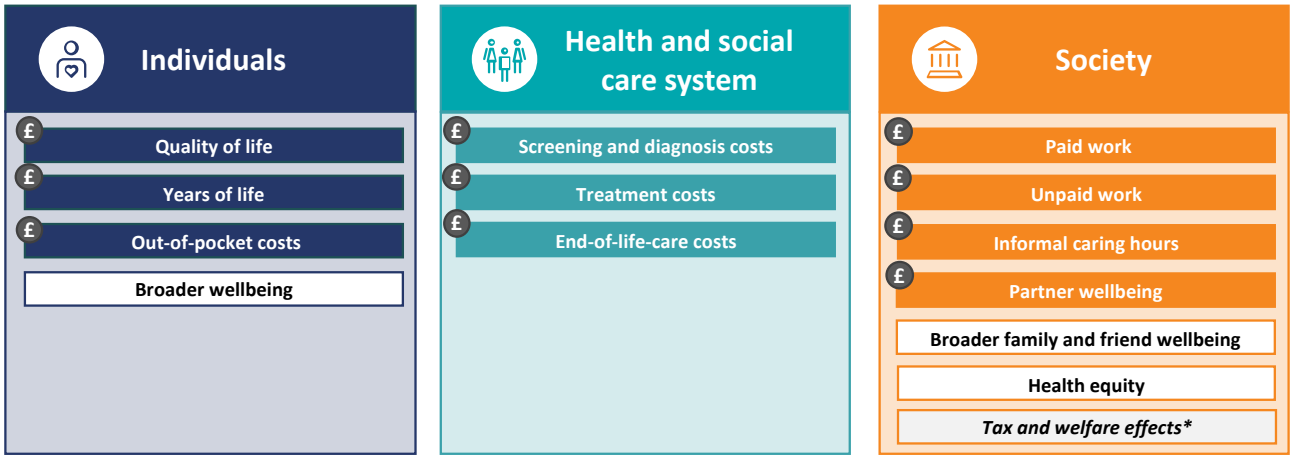
07 A need to consider the wider impacts

Prostate cancer imposes significant economic burdens that extend beyond direct healthcare costs. The disease impacts a wide range of stakeholder groups, and a comprehensive evaluation of a screening programme needs to consider both direct and indirect economic implications.

This report seeks to highlight the socio-economic impact of introducing a prostate cancer screening programme and the approach follows HMT Green Book appraisal guidance. The scope of impacts is broader than the traditional focus of cost-effectiveness reviews used within other contexts in healthcare. The National Screening Committee's review of the merits of introducing a screening programme considers medical and NHS-level impacts (in line with principles around fairness and equity in appraisal) but does not consider the broader economic impacts. By considering both direct costs and indirect impacts (such as value to changes in quality of life or paid and unpaid productivity), we aim to contribute to the ongoing debate regarding screening for prostate cancer.

The framework that defines the scope of the socio-economic impact assessment considers three stakeholder groups: individuals, the health and social care system, and wider society. This is not an exhaustive set of costs relating to prostate cancer and therefore represents an estimate of the socio-economic impact of screening. The scope of impacts by stakeholder group is summarised in the figure below.

Figure 19: Overview of Socio-economic Impact Assessment Framework



Key:

(*) Note that tax and welfare payments are not included in the analysis as these are transfers and therefore do not impact economic value, in line with HMT best practice. A transfer is where the benefit to one recipient is a cost to another – these therefore do not make society better or worse off, as the impact is neutral.

£ = impact quantified

Dimensions considered:

Age | Ethnicity | Stage of cancer

Individuals

Prostate cancer can have a profound impact on patients, with physical, psychological, financial and social consequences. Prostate cancer can affect an individual's quality of life during diagnosis and treatment. There are also longer-term implications post-treatment, as well as the impact it has on an individual's life expectancy due to worsening survival outcomes. There are also impacts for individuals who are suspected of having prostate cancer but are not diagnosed, either from a psychological and wellbeing perspective or from undergoing unnecessary and invasive procedures. Our framework monetises the following impacts:

- **Quality of life (morbidity).** Changes in Quality-Adjusted Life Years (QALYs) are used to measure the impact on an individual resulting from a cancer diagnosis and undergoing treatment by stage of cancer. In addition, we calculate the short-term QALY loss for individuals who are estimated to undergo an unnecessary invasive biopsy and we also capture additional QALY losses at the end of an individual's life.

- **Quality of life (mortality).** QALYs are also used to value years of life lost due to mortality, using quality-adjusted expected years of life lost at different age bands.

- **Out-of-pocket costs.** Individuals may also incur additional out-of-pocket costs resulting from their prostate cancer diagnosis, for a range of day-to-day costs.

The approach taken to monetising the changes in QALYs for the socio-economic impact assessment is in line with the HMT Green Book guidance. It is recognised that health cost-effectiveness reviews take a different approach to QALY valuation and consider a different scope of impacts. The estimated health and social care system cost per QALY gained is also included for each scenario, and further detail can be found in the Technical Annex.

Other costs that individuals may incur as a result of prostate cancer are not estimated in this model. For example, we do not quantify the broader wellbeing impacts relating to individuals as part of the testing pathway, such as emotional impacts of false positive diagnoses due to a lack of robust evidence.

Health and social care system

Identifying and treating prostate cancer leads to a number of costs to the health and social care system. The approach captures three main costs:

- **Screening and diagnosis costs** are estimated based on different screening pathways and unit costs of diagnostic tests.

- **Treatment costs** are estimated based on a survey of over 20 clinicians using a representative pathway of the typical treatments that are administered at different stages of disease (as per NICE guidelines). These are supplemented by health care costing data to estimate the average cost of treatment per stage of disease, profiled over time according to estimated average treatment durations. Ongoing social care costs are estimated based on literature.

- **End-of-life-care costs.** Additional end-of-life-care costs from literature are applied to individuals who die from prostate cancer in the model. This captures additional hospital, GP and social care (home care, residential care, day care) as well as from the charity sector (e.g. hospice).

Additional costs relating to implementing a new screening programme are not included – for example, additional equipment needed to provide additional MRI capacity. Additional health and social care costs associated with extending life expectancy are also out of the scope of this review.

Society

Individuals diagnosed earlier have greater survival prospects and a higher quality of life. Living with a prostate cancer diagnosis and undergoing treatment can impact upon the contribution an individual can make to their family, employer and society more widely. The framework considers the following:

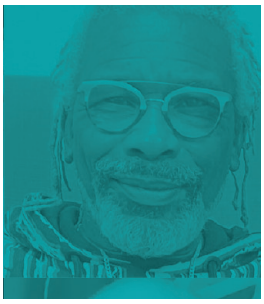
- **Paid working hours** during treatment, and longer-term following a prostate cancer diagnosis can affect productivity in the labour market in the form of lost output. The impact to an individual's paid working hours is estimated based on NHS Quality of Life (QoL) survey data and PCR's Patient and Carer survey. This study utilises the human capital approach to estimating productivity impacts, with each hour of paid work valued using Gross Value Added (GVA). See Technical Annex for further details.

- **Unpaid working hours,** such as volunteering and childcare, can be affected during treatment or longer-term following a prostate cancer diagnosis. The impact to an individual's unpaid working hours is estimated based on NHS QoL survey data and PCR's Patient and Carer survey. Given the age ranges most commonly impacted by prostate cancer, capturing the impacts on unpaid working hours is important; the balance of paid and unpaid working hour contribution changes by age band.

- **Informal caring hours.** Family and friends can carry a significant caring burden supporting individuals during their treatment or longer-term with their daily needs. Many carers suffer quality-of-life impacts and emotional impacts when their loved one or friend suffers from prostate cancer and treatment. This is particularly prominent in advanced stages of cancer and in end-of-life care. The impact on informal caring hours as a result of prostate cancer is estimated based on PCR's Patient and Carer survey.

- **Partner wellbeing.** WELLBYs are used to monetise the wellbeing impact to partners from deaths relating to prostate cancer.

There are wider impacts on society that are not captured in this framework. For example, reduced productivity at work (presenteeism) or wellbeing impacts on friends and broader family members. Tax and welfare payments are not included in the analysis as these are transfers and therefore do not impact economic value, in line with HMT best practice.



Overview of approach to applying the socio-economic impact assessment framework

To apply the impact framework, the modelling approach considers the impacts along the patient pathway – from diagnosis through treatment and beyond. This approach is summarised in the figure below.

Figure 20: Overview of socio-economic impact modelling approach

Approach	1. Population	2. Diagnostic pathway	3. Treatment pathway	4. Outcomes	5. Economic impacts

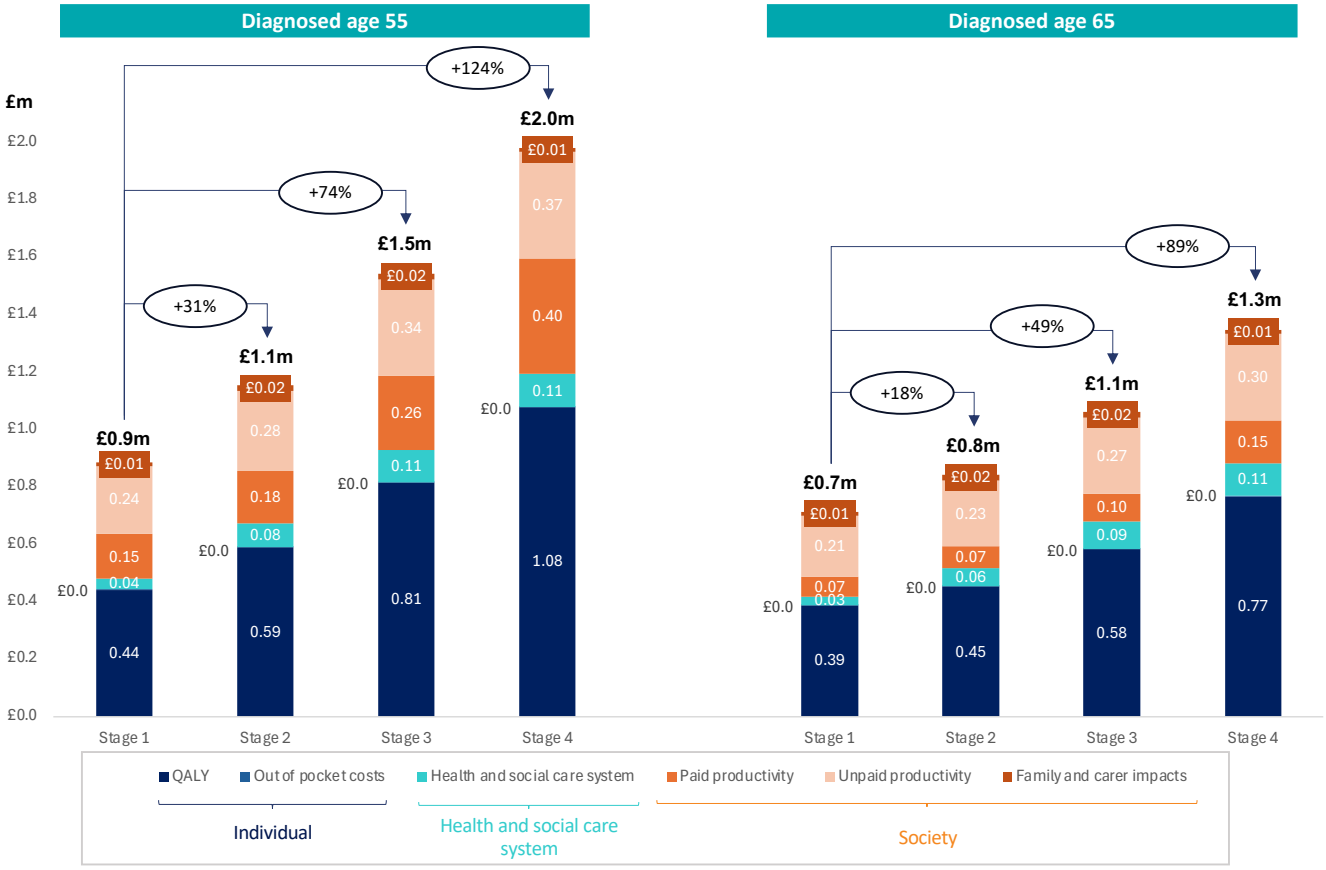
	• Develop stock and flow model of expected prostate cancer prevalence over 30 years, by stage of cancer, age and ethnicity.
	• Key data and assumptions include incidence, mortality rates and disease progression across different cohorts.
		• Define a diagnostic pathway to reflect (i) base case (current PSA pathway) and (ii) screening introducing new screening programmes.
		• Key data and assumptions include testing efficacy rates, cohort prevalence of prostate cancer and screening programme parameters (such as uptake and duration).
			• Define a simplified and representative treatment pathway for each stage of disease (based on the clinician survey).
			• Estimate average treatment costs for each stage of disease.
			• Key data and assumptions by stage include treatment options and usage, unit costs, duration and disease stage progression.
				• Quantify impacts associated with prostate cancer diagnoses across the full patient pathway to enable estimation of economic impacts.
				• This includes:
				  • Years of life lost
				  • Quality of life
				  • Ability to work
				  • Caring burden
				  • Partner wellbeing
					• In line with the socio-economic impact framework, estimate the net present value over 30 years of the incremental impacts of the scenario, relative to the base case.

A more detailed approach and key considerations around the data uncertainty is included in the Technical Annex.

Total costs of prostate cancer by stage at diagnosis over the appraisal period

Figure 21 illustrates the estimated total costs of prostate cancer over the appraisal period by category, for two different individuals: one diagnosed aged 55 and another diagnosed aged 65 in Year 1 (2025) by stage of cancer. This demonstrates how the cost of cancer is estimated to differ according to age and stage of diagnosis.

Figure 21: Estimated undiscounted lifetime impacts by stage of diagnosis (for a 55–year old and a 65–year old diagnosed in 2025)[d]



Source: Model outputs

These are costs over the full 30-year appraisal period and take into account:

- **Age progression.** How people use their time changes with age, with younger people spending more time undertaking paid work and a greater proportion of older people shifting toward unpaid work. Further, mortality rates to both prostate cancer and general background mortality increase with age.

- **Disease progression.** An individual diagnosed at earlier-stage cancer may progress to a later stage or stages of cancer where they undergo additional treatment. These additional treatment costs are included in the cost totals for the next stage of disease. Disease progression by stage of prostate cancer is estimated based on data from a survey of over 20 clinicians.[e]

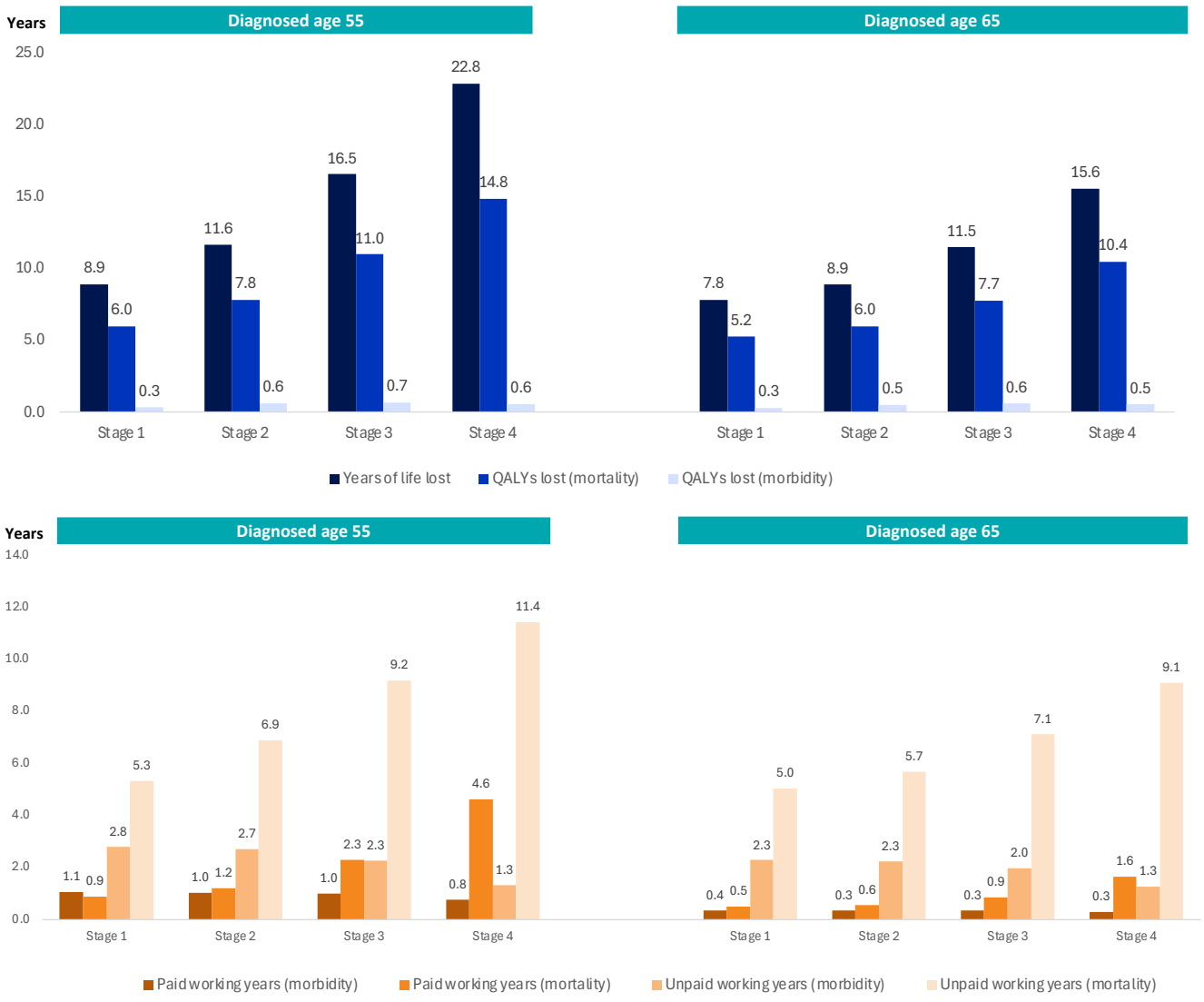
Lifetime costs of cancer by stage differ according to age at diagnosis as well as ethnicity. The costs of prostate cancer are estimated to increase significantly when diagnosed at a later stage. The cost of cancer is also greater for younger-age cohorts.

[d] Lifetime impacts are estimated over the 30-year modelling appraisal period (2025–2054). Younger men, particularly with stage 1 and 2 prostate cancer, may live beyond the 30-year appraisal period, meaning that these figures may underestimate a full lifetime cost.

[e] Disease progression is based on current existing treatment. New treatments in the future may slow this progression.

The key drivers of these impacts are the impact on an individual's quality of life and life expectancy, as well as their ability to undertake paid and unpaid work. The changes in these metrics are summarised in the figure below.

Figure 22: Estimated impact on years of life lost, QALYs, paid work and unpaid work (to both morbidity and mortality) for someone diagnosed aged 55 and 65, by stage of diagnosis over the 30-year appraisal period



Source: Model outputs

At younger ages, individuals have longer life expectancies and the proportion of time in paid work is greater. As prostate cancer is largely asymptomatic in stages 1, 2 and 3, a diagnosis at a younger age may bring forward treatment cycles that can improve longer-term survival outcomes, but may make changes to an individual's life sooner. These changes include emotional and physical effects of prostate cancer treatment and its potential side-effects, as well as the impact on an individual's participation in paid and unpaid work – both during treatment and longer-term.

The impact of earlier detection of prostate cancer through screening is a complex topic that will depend on a number of different factors. These include:

Figure 23: Factors influencing earlier detection of prostate cancer

Cost of detection	The cost of detecting positive cases of prostate cancer depend upon **the approach to screening**, including the testing pathway, the efficacy rates of tests, and the unit costs of tests, as well as the **underlying prevalence of the cohort** invited to screening.
Ability to detect earlier	There is not reliable data on the undetected prevalence of prostate cancer. Given the nature of prostate cancer, with it being largely asymptomatic in Stages 1-3 and associated with relatively good survival outcomes before Stage 4, it is assumed that those detected through a screening programme will have presented in the future. A screening programme therefore enables earlier detection, entering the treatment pathway earlier which could slow down disease progression.
Improvement in outcomes	Earlier detection and diagnosis of prostate cancer should improve survival outcomes and reduce years of life lost through increasing the diagnosis of prostate cancer at earlier stages.
Impact post diagnosis	Earlier detection makes an individual aware of their prostate cancer earlier and they would start treatment earlier than they would have done before. How this impacts upon someone's life is a complex question that depends on individual circumstances. The Prostate Cancer Research Patient and Carer Survey is used to understand how people changed their lifestyle post diagnosis.

Depending on the cohort targeted for screening, there could be a trade-off between enabling better outcomes for individuals against the cost of detection and impact on how their diagnosis and treatment may affect working patterns and ability to participate in activities that benefit society. There may be the potential for overtreatment, in which patients are diagnosed and treated for prostate cancer even though the cancer may never have caused significant issues and the patient may have gone on to die of other causes.

08 Estimating the impact of prostate cancer screening

Economic modelling suggests that there is a positive socio-economic impact of screening for high-risk groups using the current clinical pathway (consisting of a PSA test, followed by an mpMRI and a guided biopsy). This benefit could increase further in the future as new tests become available and may generate a positive impact for general population testing.

In this report, the socio-economic impact of a screening programme is estimated by comparing the total costs under a screening scenario to a base case (cost as is today, without a screening intervention). The socio-economic impact of screening for prostate cancer depends on a number of key features including the cohorts being invited to screen and the tests that will be used to screen the individuals, which will be flexed in scenarios: 1A, 1B, 1C, 2A, 2B and 2C.

Defining a screening scenario

This report considers the impact to these three stakeholder groups under two screening scenarios. When defining these scenarios, there are several parameters to consider, which will impact on the relative costs and benefits of the scenarios.

- **What screening method should be applied?** Two screening scenarios are considered in this report:

1. Current screening pathway	Using a PSA test as the first-line test, followed by an mpMRI then a biopsy as the point of diagnosis
2. New screening pathway	This hypothetical screening pathway is based on adding a reflex test into the current pathway, following an initial PSA. This would result in a more targeted flow of individuals to further diagnostic tests (MRI followed by a biopsy). The impact of AI as part of the MRI process is also considered

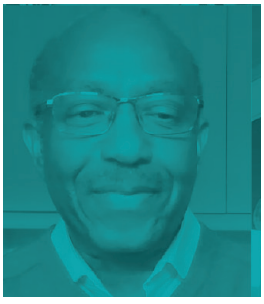
  - The 'new screening pathway' is a hypothetical scenario that is intended to capture introducing a new reflex test into the screening pathway. While this does not reflect a single particular test, it is intended to reflect a scenario where evidence is currently being collected and reviewed in the UK and the potential accuracy and cost of a new reflex test in future. In reality, a future screening pathway may differ from this example. The feasibility and optimal approach for implementing a new approach to screening is not within the scope of this review.

- **Which population cohort(s) should be targeted?** A prostate cancer screening programme could be targeted at the general male population, or specific age groups or high-risk groups, such as Black men, those with a family history of prostate cancer or BRCA 1/2 mutations. Three cohorts are considered in this report:

A: General population	B: Men with a family history	C: Black men
The general population, aged 50–69	Men with a family history, aged 45–69. Includes BRCA 1/2 carriers	Black men, aged 45–69

  - The high-risk groups considered in this analysis are Black men as well as all men with an estimated family history of prostate cancer.[f] Those with BRCA 1/2 gene mutation are considered to be a subset of the family history cohort. This is different to current practice as it proactively targets men who are asymptomatic.

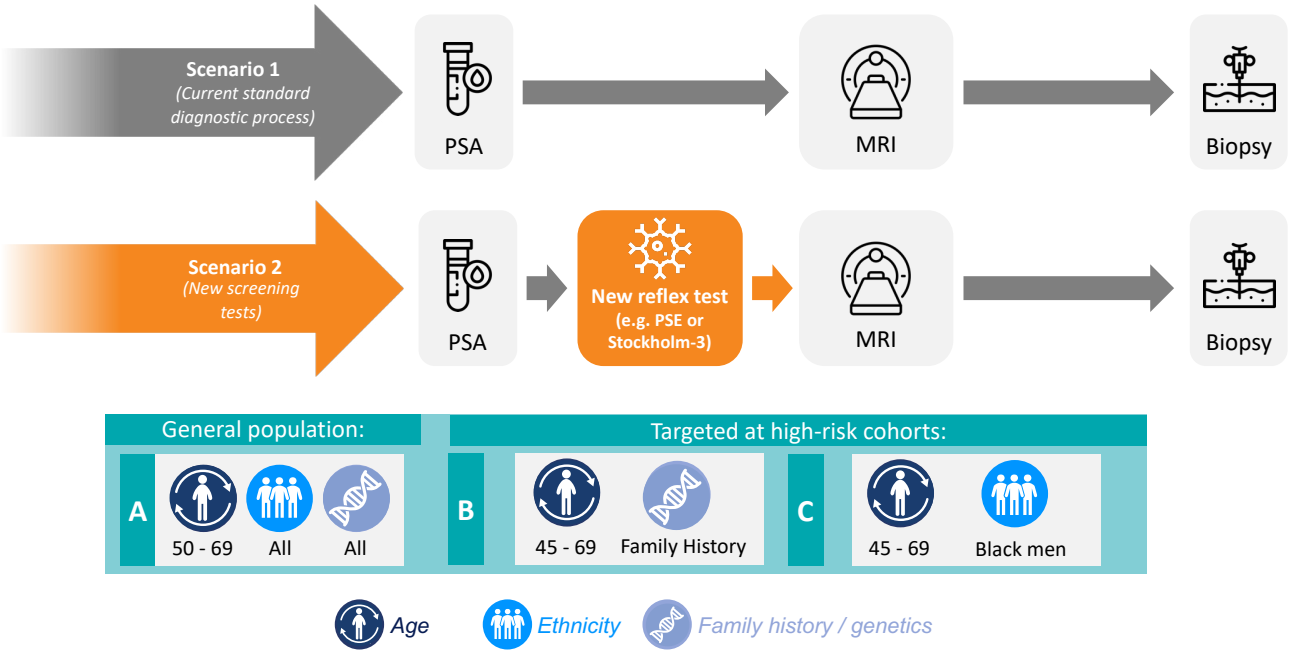
How should the screening programme be implemented? The impacts of a five-year screening programme are estimated, with 20% of an eligible cohort invited to participate in the screening programme each year. Of those participating, 72% are assumed to take-up the first line screening test (PSA test).



[f] Individuals are considered to have a family history if their father or brother has been diagnosed with prostate cancer

The figure below summarises the scenarios that are considered.

Figure 24: Socio-economic impact assessment scenarios



The underlying estimated prevalence of prostate cancer[g] in these cohorts as well as the testing efficacy rates determine the number of positive diagnosis and volume of tests at each stage of the pathway. The table below summarises the two population cohorts targeted for screening.

Table 1: Overview of cohorts invited to screening within each scenario

Parameter	Cohort		
	A. General population	B. Men with a family history	C. Black men
Age at initial screening[h]	50–69	45–69	45–69
Ethnicity called to screening	All	All	Black men
Risk-factor uplift (increase in likelihood to be detected with prostate cancer)	n/a	125%	n/a
Estimated population size (2025)	c. 8.0m	c. 1.0m	c. 373k
Estimated prevalence (%) of prostate cancer (based on forecast incidence up to 12 years in the future)	c. 2.2%	c. 4.0%	c. 2.8%
Estimated number of positive cases in the population cohort called to screening*	c. 179k	c. 41k	c. 10k

(*) Estimated number of true positive diagnoses over a five-year screening programme, assuming that 20% of the cohort are invited each year with a 72% initial screening uptake rate.

The effectiveness of a screening programme is also a product of the sensitivity and specificity of the tests used. A range of studies estimate the sensitivity and specificity of tests in different cohorts, countries and pathways.

[g] We have not found robust evidence on the prevalence of undiagnosed prostate cancer in the literature. As such, diagnoses made through a screening programme are assumed to represent earlier detection of cases that would have presented in future (as part of future incidence).
[h] Currently in the UK men aged 50 and over can request a PSA test from their GP. Further, most research into PSA testing has been among men aged between 50 and 69. For high-risk groups, recent evidence suggests a lower age threshold of 45. Source: GOV UK, PSA testing and prostate cancer, Accessed Oct 2024

The table below sets out the data used to inform the outputs of this review.

Table 2: Overview of screening and diagnostic test sensitivity and specificities used

Test	Testing efficacy	
	Sensitivity (ability to detect a true positive)	**Specificity** (ability to detect a true negative)
PSA test (at 3ng/ml)*	32%	85%
mpMRI	93%	41%
Biopsy	48%	96%
New reflex test**	90%**	90%**
mpMRI + AI	94%	52%

(*) The PSA testing efficacy rates are held constant between the current pathway (which has a threshold of 3ng/ml) and the scenario. It is recognised that a new reflex test may be used with a lower PSA threshold. However, robust data on PSA testing sensitivity and specificity at lower thresholds was not identified.

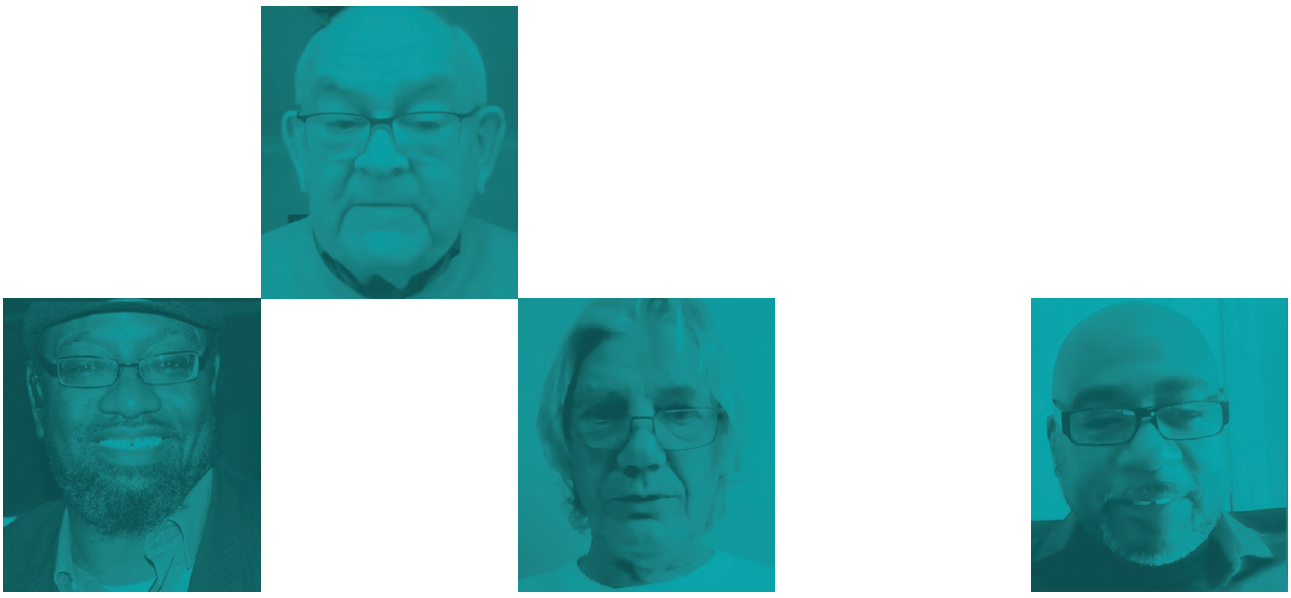
(**) The new reflex test reflects an illustrative and hypothetical scenario to estimate the impact if a new reflex test had a 90% sensitivity and 90% specificity. While this does not reflect a single particular test, it is intended to model the potential accuracy and cost of a new reflex test in future.

Further detail on this is set out in the Technical Annex.

Overview of outputs

The outputs are presented as an incremental impact between the scenario and the base case from introducing a five-year screening programme. The socio-economic impacts are over a 30-year period and are in present value terms. Therefore, positive values represent cost savings resulting from the screening scenario, whereas negative values represent additional cost resulting from the screening scenario.

The net present value in any given scenario is driven by the scale of the cohort invited. For example, a general population scenario will have a larger NPV magnitude than a more targeted screening intervention where fewer men are screened. The NPV per diagnosis represents the NPV per positive diagnosis made through the screening scenario and is a comparable metric to compare across scenarios.



The outputs of the socio-economic impact assessment demonstrate that there is a net economic cost to undertaking general population screening under the current pathway as things stand today. However, there is a positive impact on screening for high-risk groups. As newer and more accurate tests become available, there could be a net positive socio-economic impact for general population screening as well as high-risk groups. The outputs of the scenario modelling are set out in Table 3 below.

Table 3: Overview of outputs for scenarios considered: 2024 prices, five-year screening programme with impacts captured over a 30-year appraisal period

NPV (£m)	Scenario 1: Current pathway			Scenario 2: New screening scenario		
	1A. General Population (50-69)	1B. Family history (45-69)	1C. Black men (45-69)	2A. General Population (50-69)	2B. Family history (45-69)	2C. Black men (45-69)
Individuals (£m)	£727	£188	£52	£813	£188	£54
Health and social care system (£m)	-£749	-£85	-£34	-£384	-£42	-£17
Society (£m)	-£250	-£56	-£11	-£225	-£50	-£10
Total (£m)	**-£271**	**£47**	**£7**	**£204**	**£96**	**£27**
NPV per diagnosis (£000s)	*c. -£19*	*c. £14*	*c. £8*	*c. £15*	*c. £33*	*c. £36*
Health and social care system cost per QALY (£000s)	*c. £67*	*c. £30*	*c. £44*	*c. £31*	*c. £15*	*c. £21*
Non-financial metrics						
Cohort population size in 2025	c. 8,000,000	c. 1,000,000	c. 373,000	c. 8,000,000	c. 1,000,000	c. 373,000
Number of screening diagnoses over 5-year screening programme	14,244	3,233	828	12,819	2,910	745
QALYs lost through diagnostic testing	-3,025	-386	-141	-395	-60	-20
Years of life saved	21,341	4,896	1,376	19,207	4,407	1,238
Reduction in stage 4 diagnoses	5,119	1,162	297	4,607	1,046	268
Working years lost	5,124	1,137	261	4,612	1,023	235

Source: Model outputs

These results support some of the following broad findings:

- There is a **trade-off between morbidity and mortality impacts.** Given the nature of prostate cancer with relatively slow disease progression and relatively good survival outcomes when identified at earlier stages, there is a trade-off from the impacts of earlier detection through screening and bringing diagnoses and treatment forward (which can negatively impact an individual) versus the extent to which this is offset by improved survival outcomes (extending an individual's quality and length of life in the longer-term and the ability to return to work or participate in unpaid work). For some men who have slow-growing cancer, earlier detection can bring forward changes to their life such as side-effects from treatment, or a reduction in ability to participate in paid or unpaid work. However, for those men who would have progressed onto metastatic disease, the potential benefits are significant, if not life-saving.

- **There are estimated to be overall positive impacts to individuals, driven predominantly by QALY** impacts of improving survival rates for those positively diagnosed. However, there are also costs to individuals in terms of QALYs lost to morbidity (impact of living with prostate cancer) or additional out-of-pocket costs where earlier detection can lead to additional treatments and side effects in those who progress to later-stage cancer. Further, the use of a biopsy in the screening pathway can lead to losses in QALYs for those tested unnecessarily, as this is an invasive procedure that can lead to side-effects.

- There is an **economic cost to society from earlier detection of prostate cancer, predominantly driven by taking individuals out of paid and unpaid work** at an earlier stage of life and making permanent changes to working habits. These losses are not estimated to be offset by improved survival outcomes, which are realised in later stages of life. The modelling approach does not assume any replacement of paid working hours lost and therefore could represent a conservative estimate of the impact.

- **For the health and social care system, the cost of diagnosis can be significant.** The extent of these costs is driven by the estimated prevalence of prostate cancer in the cohort as well as the effectiveness of testing approaches. However, earlier detection of prostate cancer is estimated to lead to a saving in treatment costs as well as additional health and social care costs incurred at the end of life.

- The estimated health and social care system cost per QALY[i] demonstrates a consistent finding with that of the NPV analysis. The estimated health and social care cost per QALY is lowest for high-risk groups and reduces for all cohorts under the new screening scenario.

- **Screening is estimated to result in fewer stage 4 diagnoses** and to significantly **improve the life expectancy** for patients diagnosed through the screening programme.

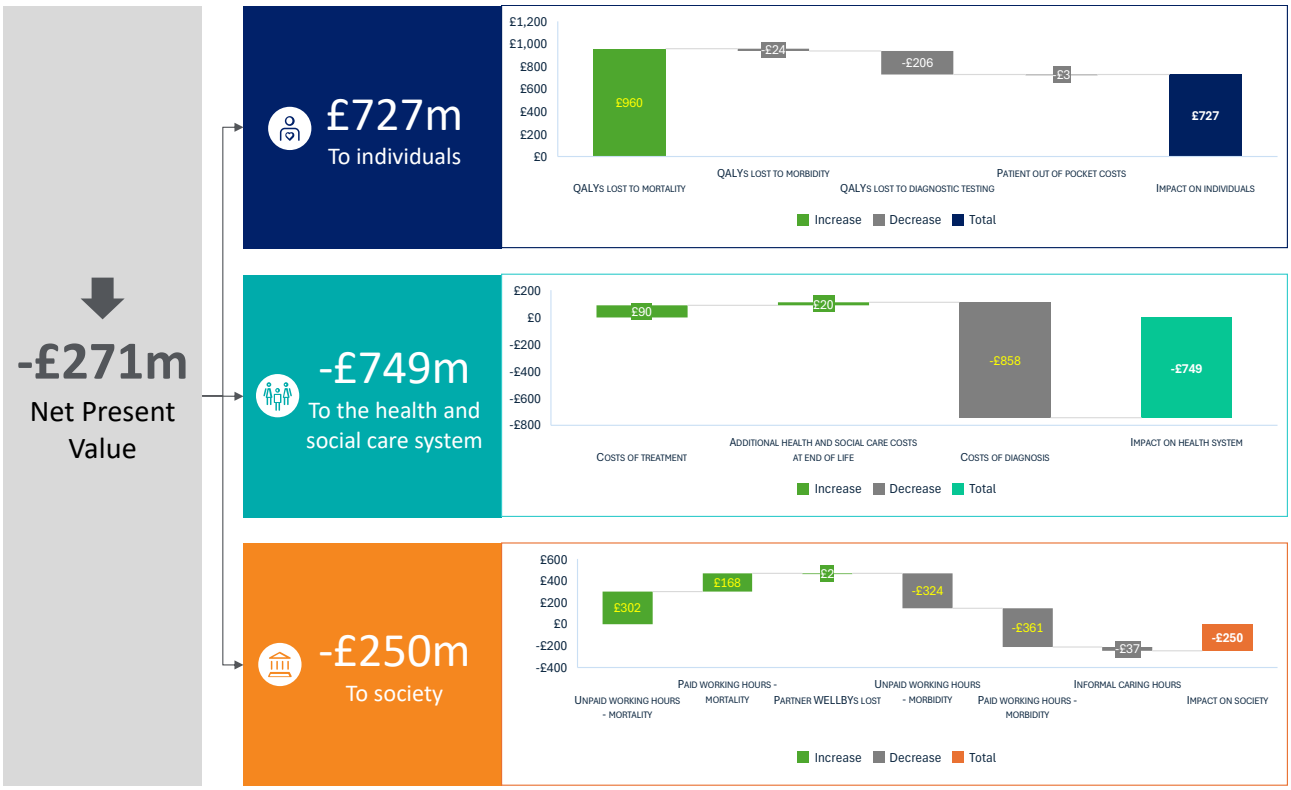
The outputs of the model are sensitive to the underlying data and assumptions. A summary of key areas of uncertainty as well as sensitivities is set out in the Technical Annex.

The next section includes more detailed results for each scenario and population cohort.

[i] The health and social care cost per QALY is based on the estimated costs of screening and diagnosis, plus treatment, as well as end-of-life care costs. Only NHS and social care costs are included.

Current screening pathway

Figure 25: Outputs under Scenario 1A: current pathway, whole population screening for 50–69 year-olds, five-year screening programme with impacts captured over a 30-year appraisal period



These values do not include any capital or fixed costs of introducing a screening programme

Introducing a five-year screening scenario for the general population (50-69) under the current pathway is estimated to result in a net present value of -£271m and an estimated health and social care system cost of £67k per QALY, over the 30-year appraisal period. This is predominantly driven by:

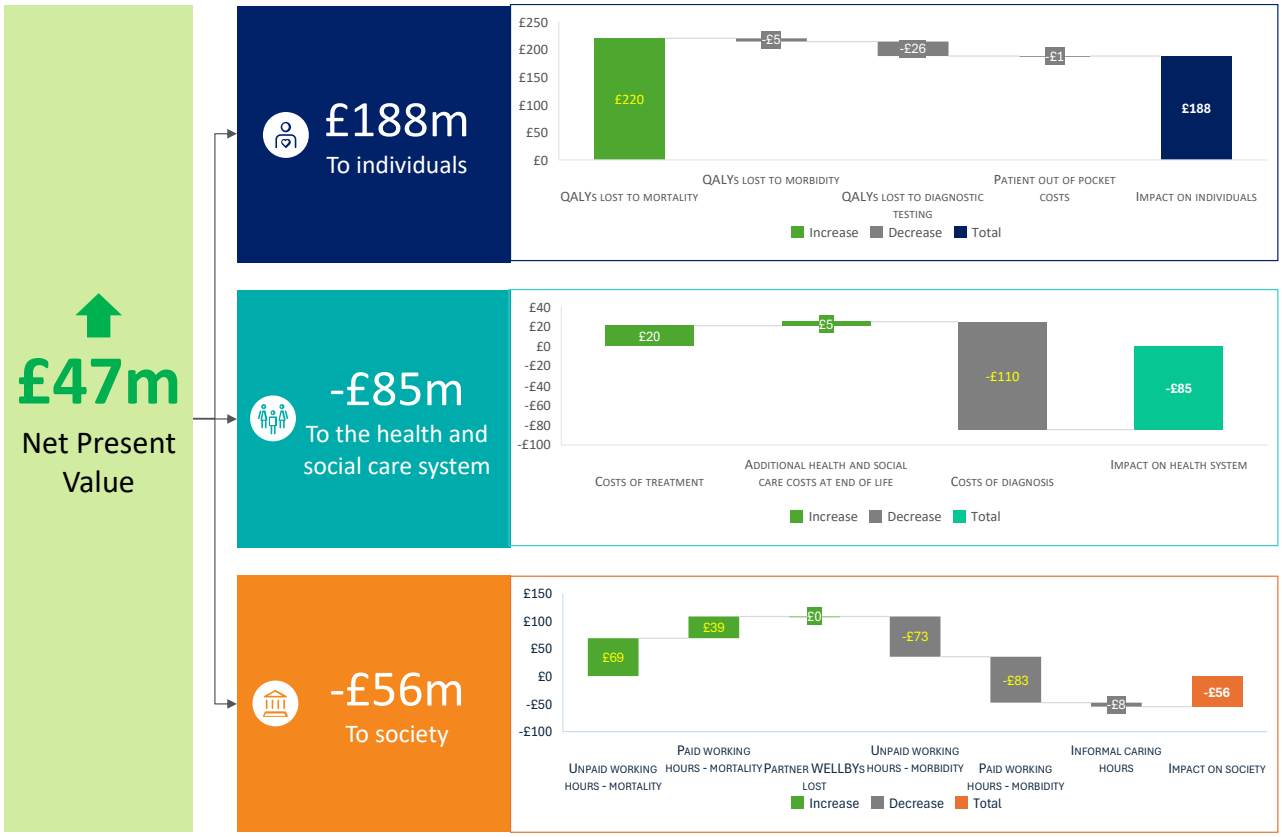
- **Diagnosis costs.** Given the relatively low prevalence of prostate cancer in younger age groups and the challenges with testing efficacy rates with a PSA test, the cost of diagnosis is a significant driver of the overall estimated socio-economic impact, estimated at -£858m (-£60.3k per positive diagnosis).

- **QALYs lost to unnecessary biopsies.** Given the challenges with PSA testing and its ability to identify true positives, a significant number of men are estimated to undergo follow-up diagnostic testing. Biopsies can be invasive and lead to side effects. Under general population screening, there is estimated to be a significant QALY loss (-£206m) for those individuals who received an unnecessary biopsy.

- For individuals positively diagnosed, there is a **significant gain** (£727m) driven by improved survival outcomes (c. £960m). In this scenario, the gains to individuals from improved survival outcomes do not outweigh the costs of detection and impacts of individuals reducing their paid and unpaid work post-diagnosis.

- For individuals diagnosed, there is an **improvement in life expectancy** driven through **fewer stage 4 diagnoses.** In this scenario, there are 5,119 fewer stage 4 diagnoses over the five-year screening programme, saving 21,341 total years of life, over the 30-year appraisal period.

Figure 26: Outputs under Scenario 1B: current pathway, screening for men with a family history aged 45–69, five-year screening programme with impacts captured over a 30-year appraisal period



Introducing a five-year screening scenario for men with a family history under the current pathway is estimated to result in a net present value of £47m and health and social care system cost of £30k per QALY, over the 30-year appraisal period. This is predominantly driven by:

- **A significantly lower cost of diagnosis** (-£110m, or £33.8k per true positive diagnosis). This is due to the increased prevalence of prostate cancer in high-risk groups compared to the general population.
- For individuals positively diagnosed, there is a **significant gain** (£188m) driven by improved survival outcomes (c. £220m). In this scenario, the gains to individuals from improved survival outcomes outweigh the costs of detection and impacts of individuals reducing their paid and unpaid work post-diagnosis.
- For individuals diagnosed, there is an **improvement in life expectancy** driven through **fewer stage 4 diagnoses.** In this scenario, there are 1,162 fewer stage 4 diagnoses over the five-year screening programme, saving 4,896 total years of life, over the 30-year appraisal period.

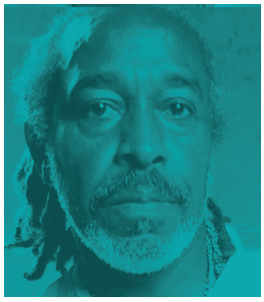
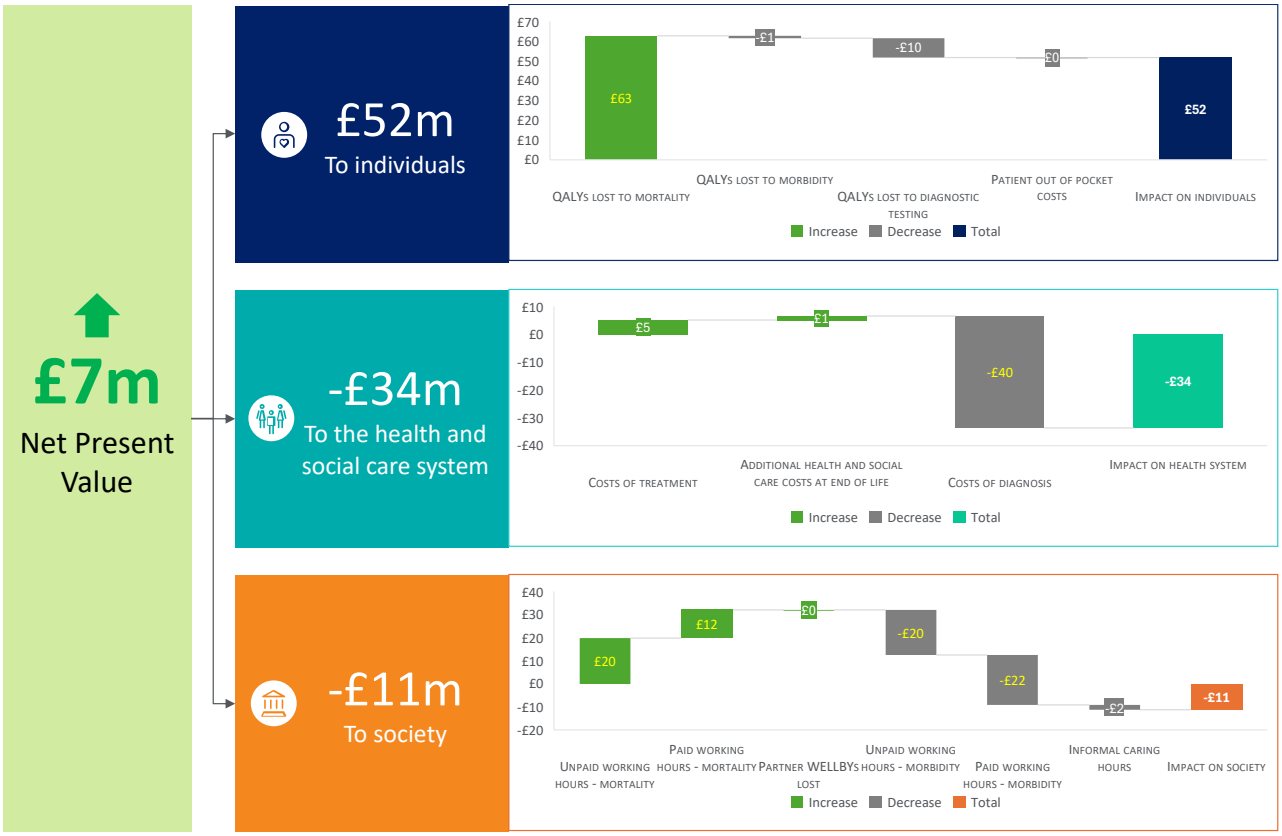


Figure 27: Outputs under Scenario 1C: current pathway, screening for Black men ages 45–69, five-year screening programme with impacts captured over a 30-year appraisal period

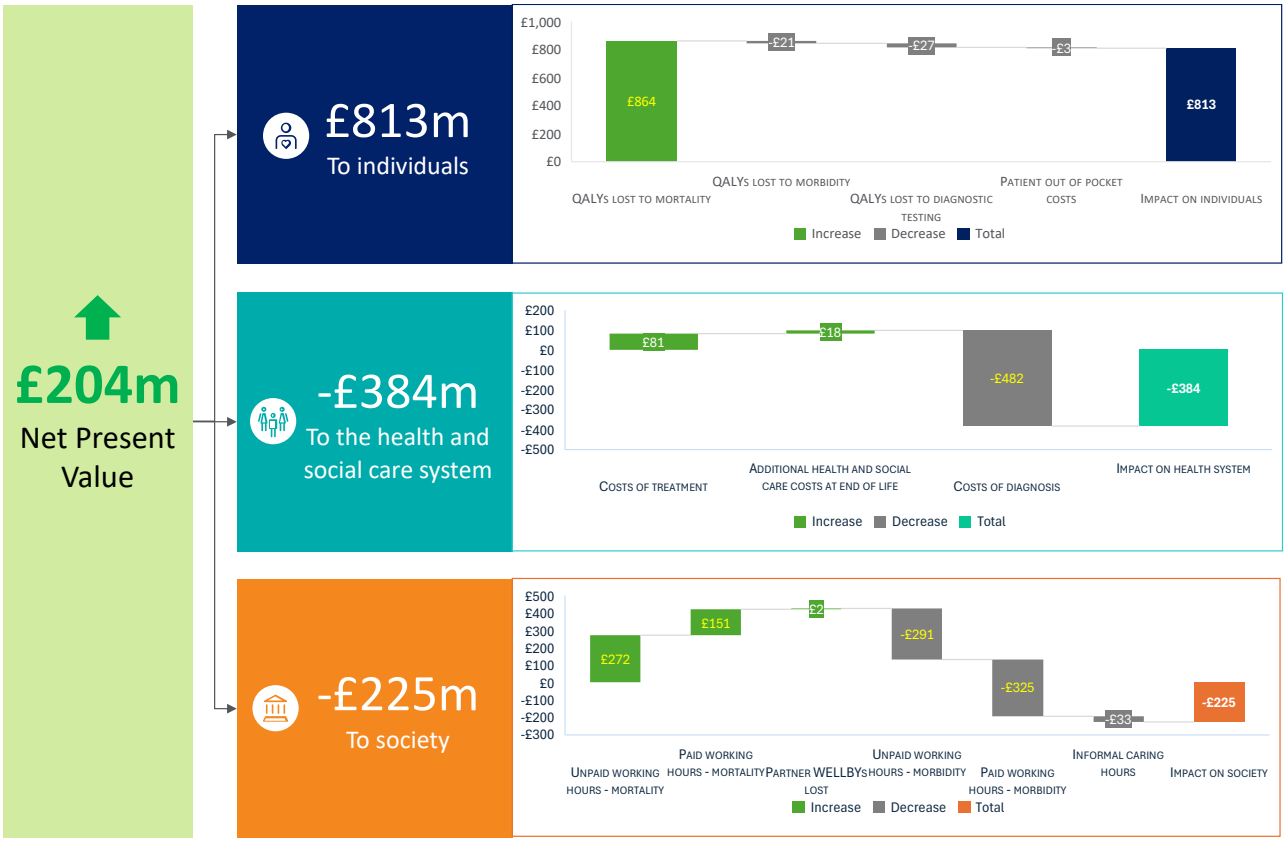


Introducing a five-year screening scenario for Black men under the current pathway is estimated to result in a net present value of £7m and health and social care system cost of £44k per QALY, over the 30-year appraisal period. This is predominantly driven by:

- **A significantly lower cost of diagnosis** (-£40m, or £48.4k per true positive diagnosis). This is due to the increased prevalence of prostate cancer in high-risk groups compared to the general population.
- For individuals positively diagnosed, there is a **significant gain** (£52m) driven by improved survival outcomes (c. £63m). In this scenario, the gains to individuals from improved survival outcomes outweigh the costs of detection and impacts of individuals reducing their paid and unpaid work post diagnosis.
- For individuals diagnosed, there is an **improvement in life expectancy** driven through **fewer stage 4 diagnoses.** In this scenario, there are 297 fewer stage 4 diagnoses over the five-year screening programme, saving 1,376 total years of life, over the 30-year appraisal period.

Future screening scenario

Figure 28: Outputs under Scenario 2A: new screening pathway, whole population screening for 50–69 year-olds, five-year screening programme with impacts captured over a 30-year appraisal period



Including a new test as part of the current pathway between PSA and MRI could lead to a **positive socio-economic impact of £204m and health and social care system cost of £31k per QALY,** over a 30-year appraisal period for a five-year screening programme of the general population (50-69). This is predominantly driven by:

- **Reduced cost of diagnosis** (-£482m compared to -£858m in Scenario 1). The new test acts as a filter between the PSA test and expensive diagnostic tests. The number of unnecessary tests is therefore reduced and the cost per diagnosis is reduced.

- **Reduced loss in QALYs from unnecessary biopsies** (-£27m compared to -£206m in Scenario 1).

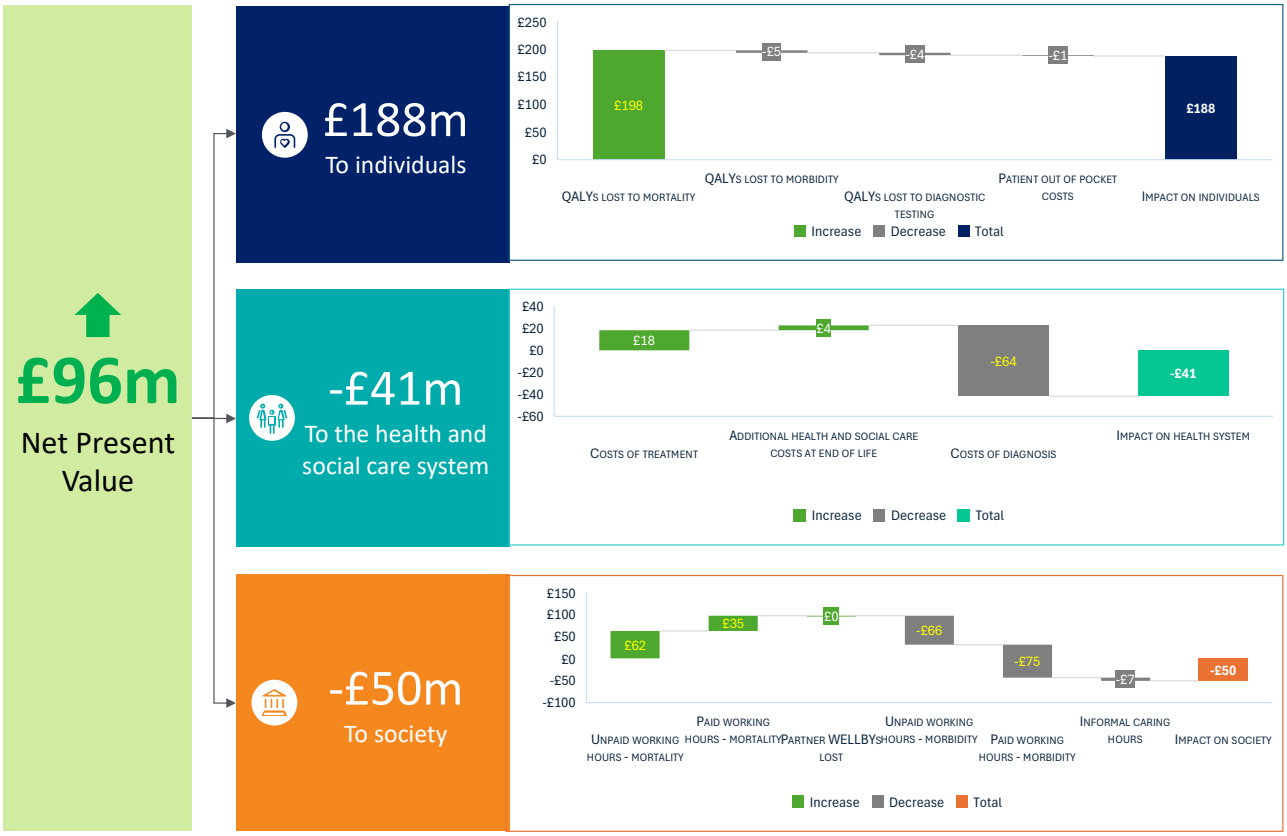
- For each individual positively diagnosed, they experience the same broad outcomes as under the current testing pathway, with differences driven by the volume of true positive diagnoses. The **greatest benefit is estimated to be from improved survival outcomes,** with the value of reduced QALYs lost to mortality estimated to be £864m.

- In this scenario, there are 4,607 fewer stage 4 diagnoses over the five-year screening programme, saving 19,207 total years of life, over the 30-year appraisal period.

Were AI incorporated alongside the mpMRI test, this could further improve the socio-economic impact to c. £223m,[j] driven by reducing the number of patients having an unnecessary biopsy.

[j] This is based on the testing efficacy rates of incorporating MRI+AI as set out in the Technical Annex. No cost for the AI has been included, given the lack of data identified.

Figure 29: Outputs under Scenario 2B: new screening pathway for men with a family history of prostate cancer aged 45–69, five-year screening programme with impacts captured over a 30-year appraisal period



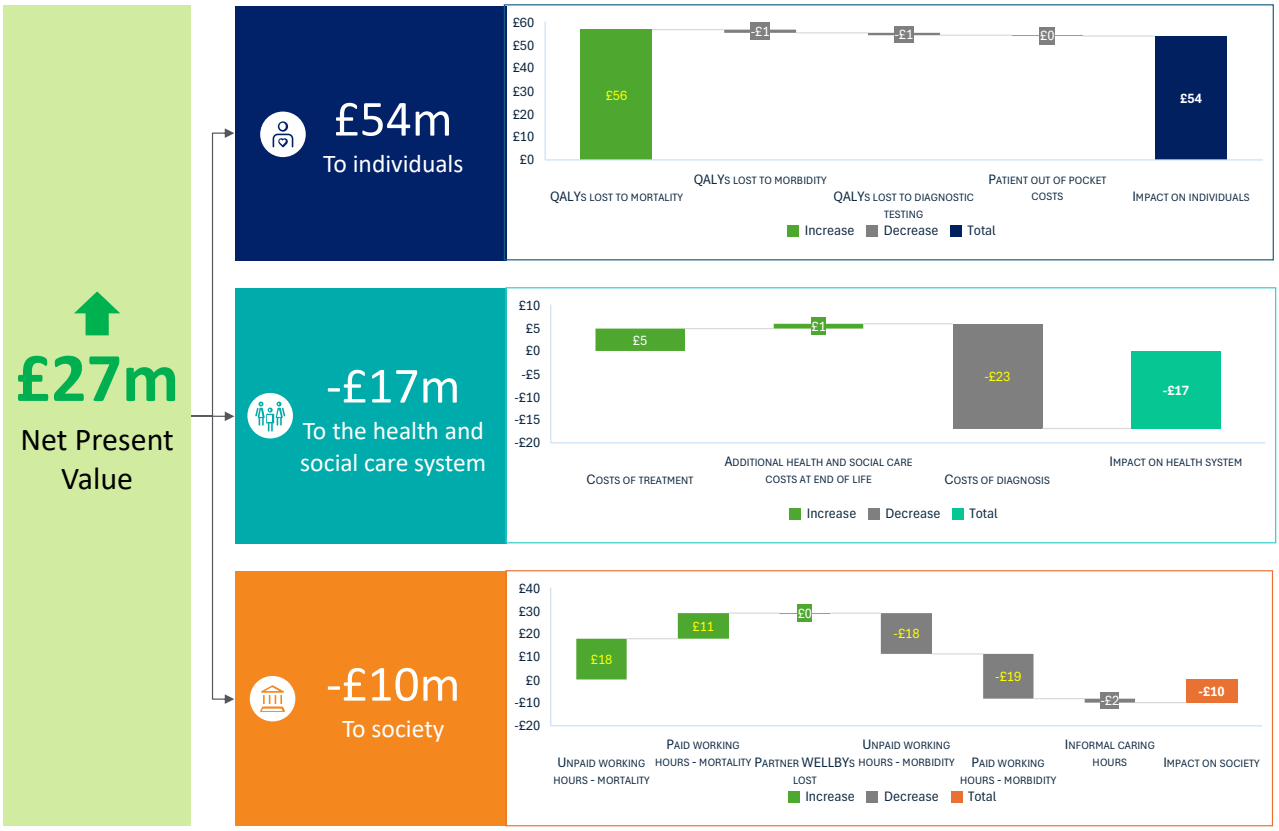
There is estimated to be a **net positive socio-economic impact of £96m from screening men with a family history of prostate cancer and health and social care system cost of £15k per QALY,** over a 30-year appraisal period for a five-year screening programme. This is predominantly driven by:

- **Reduced cost of diagnosis** (-£64m compared to -£110m in Scenario 1). The new tests acts as a filter between the PSA test and expensive diagnostic tests. The number of unnecessary tests is therefore reduced and the cost of diagnosis is more targeted.
- **Reduced loss in QALYs from unnecessary biopsies** (-£4m compared to -£26m in Scenario 1).
- For each individual positively diagnosed, they experience the same broad outcomes as under the current testing pathway, with differences driven by the volume of true positive diagnoses. The **greatest benefit is estimated to be from improved survival outcomes,** with the value of reduced QALYs lost to mortality estimated to be £198m.
- In this scenario there are 1,046 fewer stage 4 diagnoses over the five-year screening programme, saving 4,407 total years of life, over the 30-year appraisal period.

Were AI incorporated alongside the mpMRI test, this could further improve the socio-economic impact to c. £100m,[k] driven by reducing the number of patients having an unnecessary biopsy.

[k] This is based on the testing efficacy rates of incorporating MRI+AI as set out in the Technical Annex. No cost for the AI has been included, given the lack of data identified.

Figure 30: Outputs under Scenario 2C: new screening pathway for Black men aged 45–69, five-year screening programme with impacts captured over a 30-year appraisal period



There is estimated to be a **net positive socio-economic impact of £27m from screening Black men** under the new screening scenario **and health and social care system cost of £21k per QALY,** over a 30-year appraisal period for a five-year screening programme. This is predominantly driven by:

- **Reduced cost of diagnosis** (-£23m compared to -£40m in Scenario 1). The new tests acts as a filter between the PSA test and expensive diagnostic tests. The number of unnecessary tests is therefore reduced and the cost of diagnosis is more targeted.
- **Reduced loss in QALYs from unnecessary biopsies** (-£1m compared to -£10m in Scenario 1).
- For each individual positively diagnosed, they experience the same broad outcomes as under the current testing pathway, with differences driven by the volume of true positive diagnoses. The **greatest benefit is estimated to be from improved survival outcomes,** with the value of reduced QALYs lost to mortality estimated to be £56m.
- In this scenario, there are 268 fewer stage 4 diagnoses over the five-year screening programme, saving 1,238 total years of life, over the 30-year appraisal period.

Were AI incorporated alongside the mpMRI test, this could further improve the socio-economic impact to c. £28m,[I] driven by reducing the number of patients having an unnecessary biopsy.

[I] This is based on the testing efficacy rates of incorporating MRI+AI as set out in the Technical Annex. No cost for the AI has been included, given the lack of data identified.

Summary

This analysis estimates that there is a positive socio-economic impact to screening high-risk groups under the current pathway, driven by the impact on individuals that earlier detection can enable improved survival outcomes. In future, as new tests become available, there is the potential to also generate a positive socio-economic impact in general population screening (ages 50–69).

Earlier detection to unlock these benefits may come at a cost. This is both in terms of the cost of detecting positive cases, but also potentially reducing economic productivity in the short-term as individuals are diagnosed earlier when more likely to be in work.

Screening for prostate cancer is a complex topic given the nature of the condition and there is a lot to consider. The next section of this report includes our recommendations.

09 PCR's key recommendations

There is an opportunity to optimise PSA testing within current healthcare capacity by targeting high-risk groups while planning for a long-term solution that offers improved diagnostic accuracy for the broader population.

The results of this work indicate that there are immediate actions that can be taken now. These actions require limited additional capacity and minimal health system change to support the NHS' ambition of diagnosing 75% of cancers at stage 1 or 2 by 2028.

We must also start planning for the future, focusing on how to fully leverage emerging technologies when they become available. While more targeted PSA testing can yield benefits, it is the future integration of advanced technologies that will deliver the most significant long-term impact to improve outcomes in prostate cancer for **everyone.** This approach allows us to maximise immediate benefits while laying the groundwork for more accurate and inclusive screening, and better prostate cancer outcomes for all.

Key recommendations:

Right now, we need to optimise screening using a PSA test, focusing on high-risk groups – Black men, those with a family history, and those with BRCA 1/2 mutations. This risk-stratified approach, prioritising those at highest risk of prostate cancer, has shown to provide economic benefits while requiring the lowest level of health system change.

Alongside more targeted PSA testing, we need to focus on getting new diagnostic technologies into pilots (e.g. reflex tests), to gather real-world evidence and understand efficacy in diverse populations. Once clinical utility has been demonstrated, we should expand the screening programme to cover the general population utilising a test with greater accuracy, as this will realise the greatest economic benefits.

To further enhance patient outcomes and the economic benefits of earlier detection, we need to integrate AI technology into the NHS. We need to leverage its potential to improve the accuracy and reliability of screening, avoiding the need for unnecessary biopsies, while also boosting operational efficiencies. By adopting AI-driven technologies in imaging, we can streamline processes, reduce diagnostic errors and ensure resources are allocated more effectively.

10 But there is still a lot to consider

While this report highlights the potential economic benefits associated with implementing prostate cancer screening programmes, a sustainable policy decision needs a nuanced understanding of the broader healthcare landscape to deliver an equitable screening programme

Alongside the ongoing work in prostate cancer, including the UK NSC's review and TRANSFORM trial, significant focus is needed on getting promising biomarker tests into pilots, and adopted into clinical practice, to enable gathering of real-world evidence on utilisation across diverse populations. Considerations must extend to the healthcare system's capacity for innovation adoption, the need to change HCP attitudes, and the identification of high-risk groups for a targeted screening solution that would require less health system change. Additionally, altering patient perceptions and behaviours to foster trust and address health inequalities is equally essential to ensure those at the highest risk can access screening.

Continuous evaluation of screening technologies

- Analysis should consider a technology's sensitivity and specificity, as well as unit cost. Prioritising technologies with high accuracy rates (both sensitivity and specificity) is crucial to distinguish between aggressive and non-aggressive cancer, reducing unnecessary anxiety, procedures and risks of overtreatment of clinically insignificant cancers.

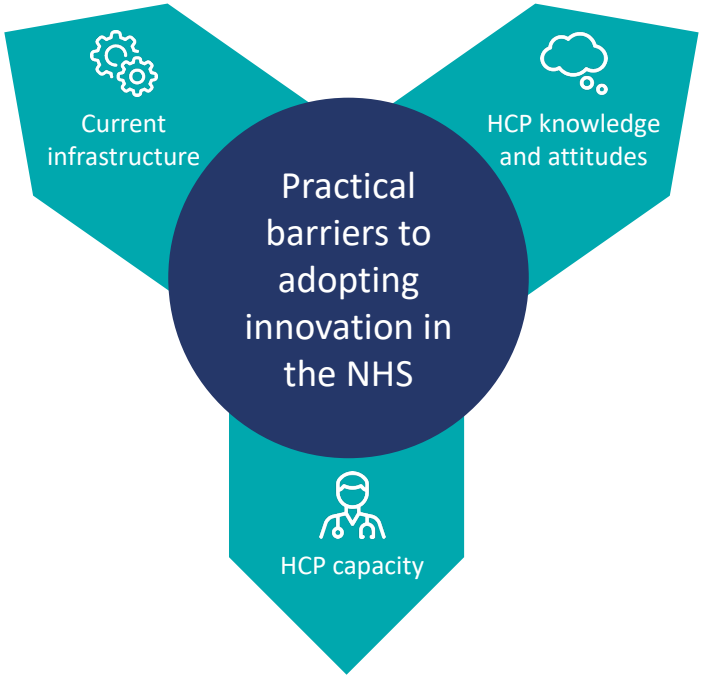
- Identifying the right demonstrator sites for piloting promising technologies needs to be prioritised, to evaluate their potential benefits in clinical practice as quickly as possible and ensuring their widespread use across diverse populations, and accuracy in high-risk cohorts.

- Policymakers should ensure material support is provided for emerging technologies in the prostate cancer space and strategically utilise the NHS to accelerate their adoption into clinical practice. Continuous horizon scanning of promising technologies, including new biomarkers that enhance the ability to distinguish non-aggressive from aggressive cancers is essential to stay ahead of the curve and ensure that the NHS remains at the forefront of innovation and can promptly pilot and adopt promising screening solutions.

Adoption of innovation: building capacity and capability

Beyond evaluating screening technologies, careful consideration is needed of the impact on the health system that a new diagnostic pathway and increased diagnoses will have. Building the capacity and capability required to adopt innovation – including potential disruption to clinical pathways and supporting HCPs to seamlessly integrate innovations into clinical practice, with limited disruption on pathways – is critical (Figure 31).

Figure 31: Challenges adopting innovation



Current infrastructure

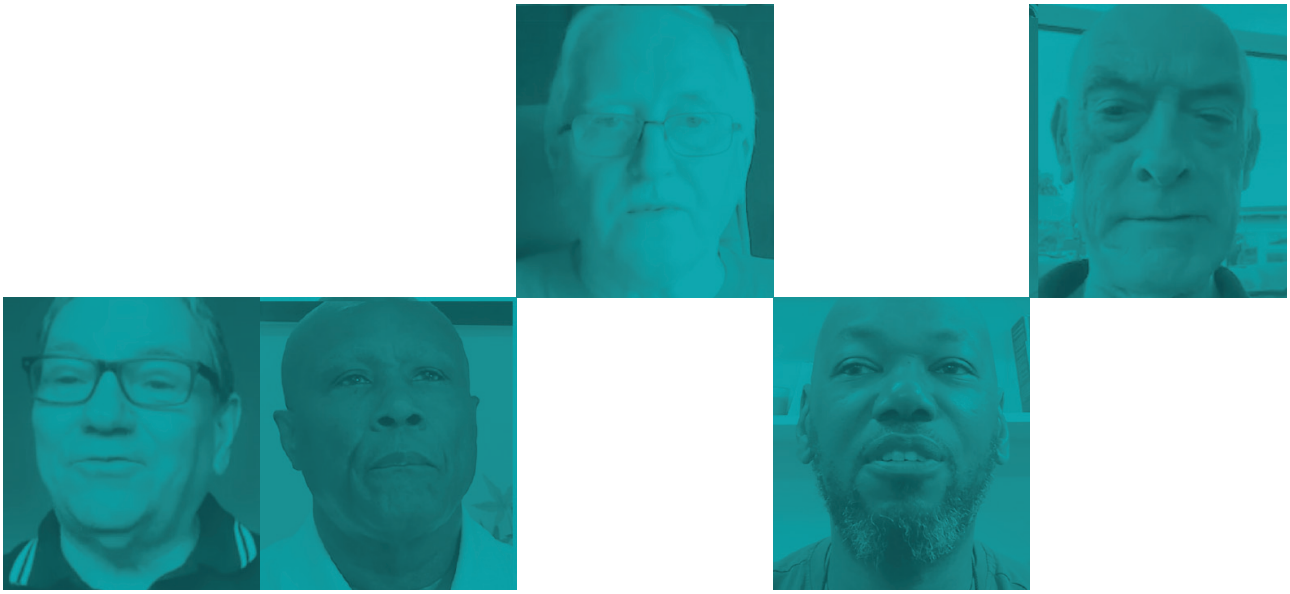
- A thorough assessment of current healthcare capacity and potential bottlenecks is needed, including modelling the anticipated increase in demand for diagnostic tests and treatment from increased diagnoses.
- Policymakers must assess the need for additional diagnostic equipment required – such as laboratory testing, MRI scanners and infrastructure for biopsies – and expand facilities to accommodate increased patient volume.
- Robust, interoperable IT systems need to be in place to manage patient data, track screening results, and facilitate efficient communication between healthcare professionals across different care settings.

HCP capacity

- Infrastructure modifications should be accompanied by robust workforce planning to assess the need for additional healthcare professionals, including urologists, oncologists and nurses, to accommodate the increased workload associated with a screening programme and increased focus on personalised care.
- If cost-effective, policymakers should explore the potential of outsourcing capacity to private providers as a short-term strategy to address the upfront challenges of implementing a new screening programme.

HCP knowledge and attitudes

- Focus is needed on cultural change, supporting HCPs adopt and integrate new innovations, that may require new skills and ways of working.
- HCPs currently lack the capacity to undergo essential training required for upskilling in emerging technologies, including the effective management and interpretation of data and need protected time to learn about new innovations and to complete training to put them into practice safely and effectively.

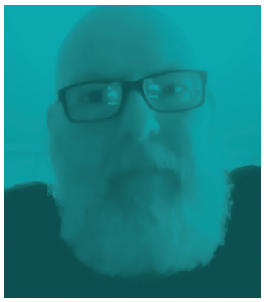


Engaging patients and addressing health inequalities

There are multiple barriers preventing people from ethnic minorities and those living in higher levels of deprivation from accessing cancer screening. A system-wide approach involving multiple stakeholders – including health care providers, policy makers and community organisations – is key to enhancing awareness and building trust in order to optimise the impact of any screening programme (Figure 32).

Figure 32: Barriers to screening

Source: Deloitte research[86]



People living in the most deprived areas of England are much less likely to participate in screening programmes compared to those in the least deprived areas. In bowel cancer screening, individuals in areas with the lowest screening rates are 30% more likely to live in deprived regions than those with the highest screening rates, and breast cancer screening is as low as 10% in some GP catchment areas. [87] [88] This disparity highlights the strong correlation between screening access and socio-economic deprivation and the need to develop tailored patient education channels and accessible routes to ensure good uptake across the population. Key actions include:

Better collection and use of data to enable targeted screening

- To implement a risk-stratified approach in prostate cancer, a better understanding of at-risk groups is needed. For example, there is inconsistent evidence in risk elevation because of BRCA 1/2 mutation, and better data needs to be collected to fully understand the relationship between genetics and prostate cancer.

- Once the right data is collected, it needs to be better utilised. This is needed to support targeting the right individuals, identifying and engaging with those most at risk and encouraging them to participate in screening, leveraging the support of patient advocacy groups and community networks.

Health system collaboration

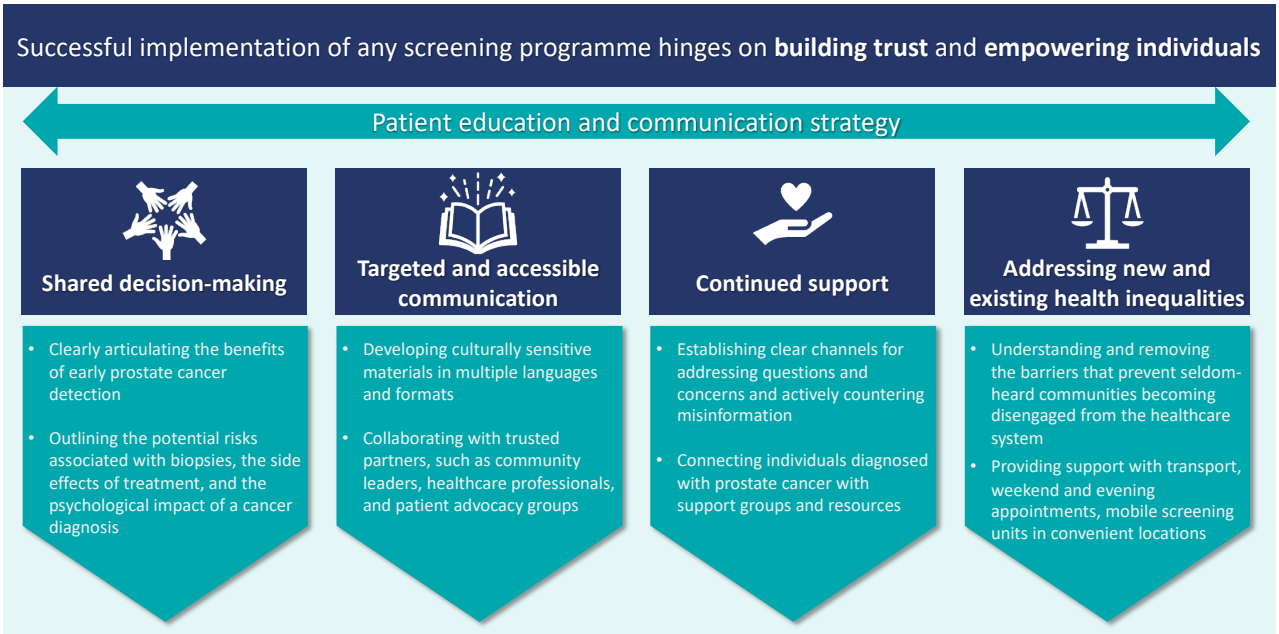
- Joined-up thinking and open collaboration across a diverse range of health-system stakeholders is critical to breaking down silos and driving meaningful progress in expanding access and increasing uptake of screening programmes.

- Better communication is needed between the health system and communities. A community-driven approach, guided by the NHS can help extend outreach into high-risk populations. These partnerships can help facilitate awareness campaigns, education and screening events to bridge the gap between the health system and people most in need of screening.

Addressing trust, empowering patients and removing practical barriers

- Successful implementation of any screening programme hinges on building trust and empowering individuals to make informed decisions about their health as well as ensuring that screening is practically accessible. This requires a patient education and communication strategy that extends beyond raising awareness (Figure 33).

Figure 33: Patient education and communication strategy



- **Shared decision making** – patient education must transparently and comprehensively convey both the potential benefits and limitations of screening, articulating the advantages of early prostate cancer detection while also outlining the potential risks associated with biopsies, the side effects of treatment and the psychological impact of a cancer diagnosis. Transparent communication materials that emphasise shared decision-making – encouraging men to have open communication with their GPs to weigh up the potential benefits and harms based on individual risk factors respecting concerns – can help to build trust and lead to greater engagement.

- **Targeted and accessible communication** – reaching all segments of the population requires targeted and accessible communication. This involves developing culturally sensitive materials, such as education and screening invitations in multiple languages and formats to reach diverse communities, including those traditionally underserved or hesitant to engage with the healthcare system. Collaborating with trusted partners, such as community leaders, HCPs and patient advocacy groups, helps to raise awareness and address concerns and beliefs within different communities. Equipping HCPs with the cultural competency skills and resources to communicate effectively with diverse patient populations and address their needs once they are engaged with the health system is essential to support ongoing trust.

- **Continued support** – effective communication should go further than the initial phases of implementing a screening programme. Establishing clear channels for addressing questions and concerns and actively countering misinformation about prostate cancer and screening is needed for ongoing engagement and reinforcing trust over time. Also, connecting individuals diagnosed with prostate cancer with support groups and resources can provide support as they navigate the emotional, physical and practical challenges of a prostate cancer diagnosis and treatment. By delivering targeted, empathetic and open communication, policymakers can foster trust, empower informed decision-making, and support the high uptake of a screening programme.

- **Addressing health inequalities** – to fully maximise the impact of any screening programme, heavy focus needs to be placed on addressing existing and new health inequalities that will arise. This requires a proactive approach that goes beyond simply offering the same services to all. It requires understanding and removing the barriers that prevent underserved populations who are disengaged from the healthcare system from accessing and benefiting from preventative care. Current healthcare access patterns need to be analysed, identifying communities with lower rates of cancer screening and investigating the underlying reasons for these disparities – including socio-economic, geographic and cultural barriers – and developing of targeted interventions. Many high-risk individuals face practical barriers to accessing screening. Any screening programme needs to account for these challenges and support patients with practical solutions, including, transport, weekend and evening appointments and mobile screening units in convenient locations.

This report highlights the importance of proactively identifying and supporting high-risk groups. Data on risk factors such as age, ethnicity, and family history should be leveraged to identify individuals who may benefit most from screening. Targeted outreach and education should be directed towards these groups, ensuring that they are prioritised and empowered to participate in screening.

In conclusion, while the economic considerations outlined in this report are undeniably important, a holistic approach that considers the broader healthcare context, ethical implications, and patient needs is essential for the development of an equitable and sustainable prostate cancer screening programme in the UK.

11 Technical Annex

This section outlines the assumptions, data and methods used in the modelling.

Modelling the socio-economic impact of a prostate cancer screening programme is complex and is underpinned by key assumptions and data sources. In particular, where there are gaps in publicly available data, information has been collected through SME consultation, surveys (clinician survey and PCR's Patient and Carer Survey) or available literature to inform our approach. As with any modelling approach, simplifying assumptions are applied including in capturing the prostate cancer screening, diagnosis and treatment pathway. The analysis is sensitive to a range of data inputs and assumptions.

The following sections set out the key assumptions that impact the model outputs.

The modelling approaches applied in this study have been cross-checked against the economic literature to align with best practice. Data points and key assumptions have been referenced against the literature or have been verified with leading experts and clinicians.

Overarching model parameters

Appraisal period

The model applies a 30-year appraisal period running from 2025 to 2054. This allows for the impact of screening in the five-year programme to be tracked over time.

As a result of this fixed 30-year appraisal period, the costs and impacts to some individuals are tracked for a shorter period than others. For example, a patient diagnosed in the first year of a screening programme accrues impacts for the full 30-year period. However, someone diagnosed in year five of the screening programme accrues these impacts for 25 years. Tracking patients over their full lifetime may impact the outputs of the modelling. However, a fixed 30-year appraisal period has been chosen in line with Green Book guidance.

The impacts of years of life lost are assumed to all accrue in the year of death. This means that a death in the last year of the appraisal period (2054) accrues all the discounted impacts to mortality in this year, despite many of the years of impact occurring beyond the 30-year appraisal period. This is in line with the approach taken in other cost-of-illness studies.

Discounting

This study uses Green Book guidance to discount costs and impacts to 2024 levels. Financial costs are discounted at 3.5% per annum, whereas non-financial impacts are discounted at 1.5% per annum.

Cost inflation

All unit costs are inflated to 2024 base year prices using annual average historical CPI inflation obtained from the ONS.[89] Beyond 2024, costs are held fixed in 2024 values.

Approach to modelling prostate cancer progression

To assess the impact of a screening programme, an understanding of how diagnoses would have occurred without screening (the base case) is required. Given the lack of data on undiagnosed prevalence, the modelling assumes that diagnoses from screening 'displace' diagnoses that would have been made through existing routes to diagnosis. These displaced diagnoses would have been made at a later year in the model, when patients are at a later age and/or stage of cancer. This could be considered to be a conversative approach around the number of diagnoses made through screening. It is also assumed that a screening programme would only detect individuals with stages 1–3 cancer (as stage 4 cancer is typically symptomatic).

Displacement horizon – how many years earlier can patients be detected through a screening programme?

It is assumed that patients are detected on average six years earlier through a screening programme than they would have been detected without a screening programme. This assumption draws from evidence that PSA screening detects prostate cancer patients on average between 5.4 and 6.9 years earlier than they would have been detected without screening. [90]

Using an average six year displacement period taken from the literature,[91] it is assumed patients are, on average, detected at the midpoint of the maximum displacement horizon, and so patients in the scenario can be detected up to 12 years earlier than in the base case.[92] The modelled prevalence over this maximum displacement horizon for the cohorts selected for screening is divided by the population size of these cohorts. This estimates the prevalence among the undiagnosed cohorts invited for screening.

The undiagnosed prevalence does not change the dynamics of the model or the NPV per diagnosis. However, the undiagnosed prevalence is a volume driver and determines the number of patients that are diagnosed through a screening programme.

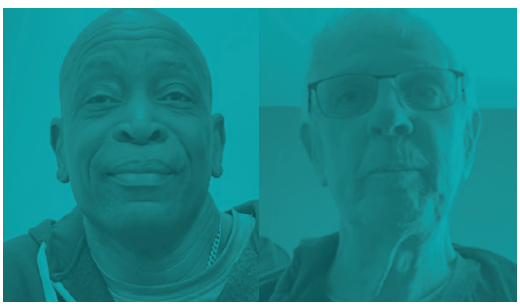
Progression rates

The model considers two different progression rates; one for those diagnosed with cancer and one for those with undiagnosed cancer. Prostate cancer is expected to progress less quickly in those diagnosed, due to the impact of treatment. There is limited data on both the diagnosed and undiagnosed progression rate.

Diagnosed progression rates

Due to a lack of data, the diagnosed progression rate is estimated from a survey of clinicians. The responses from this survey are aggregated and used to estimate an annual progression rate for each stage of cancer. The diagnosed progression rates used in the model are presented in Table 1.

The diagnosed progression rate is a function of the current treatment pathway and is held constant through time. As new and more effective treatments are found, the diagnosed progression rate may slow.



Undiagnosed progression uplift – what stage would patients have been detected at in the absence of a screening programme?

Screening enables earlier cancer diagnosis compared to no screening (the base case). Since screening detects cancers that would otherwise have been diagnosed later, a progression rate uplift is applied. This accounts for the faster progression of undetected cancers in the base case, as earlier treatment is assumed to slow disease progression. There is little evidence on how quickly prostate cancer may progress if undiagnosed and left untreated.

To estimate how much quicker prostate cancer progresses in undiagnosed patients compared to patients receiving treatment, data from the ProtecT study is used to inform this assumption. The 15-year progression outcomes for patients receiving active surveillance, prostatectomy and radiotherapy (a subset of the treatment captured in the model) are taken, weighted by the proportion of patients receiving each treatment at each stage of cancer, to estimate stage-adjusted progression rates. These stage-adjusted progression rates are compared to progression under active surveillance (which we are using as a proxy for the undiagnosed progression rate) to estimate the undiagnosed progression uplift by stage. This approach has several limitations and uncertainties. For example, some patients receive treatments other than a prostatectomy and radiotherapy, and these other treatments may be expected to impact the rate of progression. Moreover, the ProtecT study only includes patients with low-risk prostate cancer. Therefore it may be expected that prostate cancer would progress at a slower rate in these patients.

The progression rates used for diagnosed and undiagnosed patients are presented in Table 1.

Table 1: Annual progression rates applied in the model

Stage	Diagnosed annual progression rate (%)[93]	Estimated progression uplift (%)[94]	Undiagnosed annual progression rate (%)
Stage 1	1.7%	61%	2.8%
Stage 2	7.0%	132%	16.2%
Stage 3	9.2%	131%	21.3%

The model outputs are sensitive to the undiagnosed progression and should be noted with uncertainty given the lack of robust evidence around undiagnosed prostate cancer progression. Given the lack of data in this area, this provides an approximation to inform the modelling and a sensitivity on these rates is set out in Table 6.

Prostate cancer incidence

Prostate cancer incidence to 2054 is based on projections from Cancer Research UK.[95]

Approach to modelling socio-economic impacts

Impacts to individuals

Quality-adjusted life years (QALYs)

QALYs capture many of the side effects and wellbeing impacts of a prostate cancer diagnosis, treatment and the burden of living with prostate cancer. QALYs combine both longevity and quality of life in a single measure and are widely used in health-economic evaluations. QALYs for both morbidity (living with cancer) and mortality (impact on life expectancy) are estimated.

Data from the NHS Quality of Life Survey (at 18 months post diagnosis) is used to estimate the quality of life at different stages of cancer compared to the general population. EQ-5D scores (which are a measure of quality of life on a scale of 0–1, with zero being equivalent to death and one equivalent to perfect heath) by stage of cancer are compared to the general population levels to estimate the percentage reduction in quality of life according to stage of cancer. This percentage reduction is then applied to the quality of life a patient at any given age can expect to live if they don't have cancer.

The NHS Quality of Life Survey gives a snapshot of quality of life 18 months post diagnosis.[96] It is not known how quality of life may change beyond 18 months. Some patients' quality of life may return to that of the general population, while other patients may see a deterioration over an extended period. There is some research to suggest quality of life returns to the general population average between 18 and 42 months post-treatment.[97] For this reason, and in-line with similar studies, quality-of-life reductions from morbidity are applied for two years after entering a new stage of disease (through diagnosis or progression) only.

This could be an underestimate of the impacts on quality of life if they persist for longer than two years post diagnosis.

QALYs lost to mortality are a combination of the years of life lost and the quality-of-life a patient would have lived during those years. Years of life lost and quality-adjusted years of life lost are by age of death are obtained from McNamara *et al*. (2023). [98]

The estimated years of life lost and QALYs lost to mortality by age of death are presented in Table 2.

Table 2: Years of life lost and QALYs lost by age at death

Age at death	Expected years of life lost	Expected quality adjusted years of life lost
Under 50	34.4 years	27.4 QALYs
50-59	27.7 years	21.9 QALYs
60-69	19.4 years	15.0 QALYs
70-79	12.0 years	9.1 QALYs
80-89	6.3 years	4.5 QALYs
90+	3.0 years	1.8 QALYs

QALYs lost to morbidity and mortality are valued at £70,000, in line with Green Book guidance.[99]

Out-of-pocket costs

Individuals diagnosed with prostate cancer and who undergo treatment may have certain out-of-pocket costs following their cancer diagnosis. These costs could include travelling to treatment, adjusting their home or buying personal items.

To calculate these costs, estimated monthly out-of-pocket cost of £52 from Macmillan,[100] which are adjusted to remove costs associated with loss of income to avoid double counting with paid working hours. The cost is then inflated using historical annual average CPI to 2024 prices. The monthly out-of-pocket cost used in the modelling is £36. This monthly cost is applied for the periods of time a patient receives treatment. This could be following their diagnosis or due to progression to a later stage of cancer for which the patient receives further treatment.

Societal impacts

To estimate the impacts that prostate cancer has on an individual's paid and unpaid working hours, questions were included in the PCR Patient and Carer Survey around two specific impacts:

1. **Impacts during treatment** (with a focus on the first year of each treatment stage).

2. **Longer-term impacts,** which reflect prolonged lifestyle changes after treatment (applied on an ongoing basis for the remainder of the modelling period).

Paid working hours

On average, each year a working-age individual lives with prostate cancer, they will lose some working hours to attending appointments or having to take days off due to the side effects of treatment. Some individuals may leave the workforce entirely or choose to reduce their working hours.

Data from the NHS Quality of Life Survey (at 18 months post-diagnosis) is combined with outputs from PCR's Patient and Carer Survey to estimate the percentage reduction in paid working hours by stage of cancer.

This reduction in paid working hours is applied to ONS Time Use data, which accounts for differing working patterns by age group. The paid-working-hour impact is modelled using the human capital approach, where the reduction in working hours is assumed to apply on an ongoing basis while an individual is in a given stage and age band. The impact of using a friction cost approach is considered as a sensitivity (see approach considerations and sensitivities). Each hour of paid work is valued using GVA (£44.90, ONS),[101] rather than wages, to estimate the total productivity impact on society rather than simply the lost income of an individual.

Unpaid working hours

Each year an individual lives with prostate cancer, they may be less able to carry out unpaid work, such as childcare, volunteering or household jobs. This may be due to attending medical appointments, or the side effects of treatment.

Data from the NHS Quality of Life Survey (at 18 months post-diagnosis) is combined with outputs from PCR's Patient and Carer Survey to estimate a reduction in unpaid working hours by stage of cancer.

This reduction is combined with the ONS Time Use data, which accounts for differing working patterns by age group. The reduction in working hours is assumed to apply to individuals on an ongoing basis while they are that stage and age band. The value per hour of unpaid work is based on shadow wage rates from the ONS (£16.03, inflated to 2024 prices).[102]

Informal caring hours

Informal caring hours capture the average time spent by friends and family supporting individuals living with prostate cancer with their daily needs.

To estimate the number of informal working hours provided to prostate cancer patients by stage, results from PCR's Patient and Carer Survey is used. These results give the number of informal caring hours each patient receives and the average duration of the caring responsibilities. The value of each hour of informal care is based on data from the ONS (£13.62, inflated to 2024 prices).[103]

Partner wellbeing (WELLBYs)

The modelling estimates the wellbeing impact on partners when their spouse passes away from prostate cancer. Estimates for the severity and duration of the wellbeing impact are taken from Max Planck Institute.[104] The severity and duration of the wellbeing impact are converted into a WELLBY which is valued at £13,000 as per the Green Book.

Impacts on the health and social care system

Diagnosis costs

The current diagnostic pathway has been modelled based on the NICE recommendation. Testing efficacy rates from the literature are used to estimate flows of patients through the pathway, which are multiplied by a unit cost for each test to estimate a total cost of diagnosis. There are a range of studies that estimate the sensitivity and specificity of tests in different cohorts, countries and pathways. The efficacy rates and unit cost used in the model are presented in Table 3.

Table 3: Efficacy rates and unit costs for each diagnostic test

Test	Testing efficacy			Unit costs	
	Sensitivity	Specificity	Source	Unit cost (2024 prices)	Source
PSA (>3ng/ml)	32%	85%	UK NSC evidence review	£33	NICE
mpMRI	93%	41%	PROMIS (2017)	£287	NHS National Schedule of Costs
Biopsy	48%	98%	PROMIS (2017)	£886	NHS National Schedule of Costs
MRI (+AI)	94%	52%	The European Standalone Study	£287	NHS National Schedule of Costs (not including fixed cost to use the AI algorithm)

PSA testing efficacy rates are held constant between the current pathway (which has a threshold of 3ng/ml) and the scenario. It is recognised that a new reflex test may be used with a lower PSA threshold (e.g., 1.5ng/ml). However, robust data on PSA testing sensitivity and specificity at lower thresholds was not identified. Using a lower PSA threshold in combination with a reflex test is likely to increase the total cost of diagnosis. However, this approach would likely diagnose more positive cases due to the PSA test incorrectly filtering out fewer true positive cases.

The new reflex test reflects an illustrative and hypothetical scenario to estimate the impact if a new reflex test had a 90% sensitivity and 90% specificity. While this does not reflect a particular test, it is intended to model the potential accuracy and cost of a new reflex test in future.

Treatment costs

There is limited published and recent data on the costs of prostate cancer treatment at different stages of disease. As such, treatment costs by stage of prostate cancer are estimated based on the following factors:

- Clinical survey outputs on the treatments used according to stage of cancer, based on a simplified and representative treatment pathway at the UK level.
- Clinical SME input on average treatment durations and doses by treatment type and stage of cancer.
- Unit costs include costs of treatment and estimates of adverse events costs.
- The treatment durations inform the profile of the total treatment cost across years in the model. Not all individuals undergoing treatment will incur 100% of the treatment costs – those who exit a cohort will incur only the years of treatment cost when they were in that stage of treatment.
- These treatment costs do not capture potential additional costs associated with more complex patients with co-morbidities or complications during treatment. In addition, there could be future health system costs associated with improved life expectancy. These are not captured as part of the modelling.

Additional health and social care costs

In addition to the costs of screening and diagnosis and treatment costs, additional costs to the health and social care system are captured using available literature related to prostate cancer treatment. These are set out in the table below.

Table 4: Additional health and social care costs

Cost category	Description	Source	Unit cost (2024 prices)
Additional social care post-diagnosis	Average additional social care costs in the 15 months following a prostate cancer diagnosis. Applied as a one-off cost for those entering the treatment pathway.	Use of health and social care by people with cancer, Nuffield Trust, May 2014. Uplifted to be in 2024 values.	**c. £500**
End-of-life care – health	Average costs of care related to end-of-life (defined as once an individual begins the use of strong opioids). This includes hospital care (inpatient, outpatient, A&E and GP costs).	Round J, Jones L, Morris S. Estimating the cost of caring for people with cancer at the end of life: A modelling study. Palliat Med. 2015 Dec;29(10):899-907. doi: 10.1177/0269216315595203. Epub 2015 Jul 21. PMID: 26199134; PMCID: PMC4669033. Uplifted to be in 2024 values.	**c. £9,000**
End-of-life care – social care	Average costs of care related to end-of-life (defined as once an individual begins the use of strong opioids). This includes home care, nursing and residential home care and day care.		**c. £3,700**
End-of-life care – charity	Average costs of care related to end-of-life (defined as once an individual begins the use of strong opioids). This includes hospice inpatient and outpatient costs.		**c. £600**

Risk factor modelling

To model the impact of screening at risk cohorts (e.g., those with a family history), the modelling needs to assess the increased likelihood of the cohort having prostate cancer (risk factor uplift) over the general population and the number of men with the risk factor in the population.

The risk factor uplift allows for the impact of factors, such as family history or the BRCA gene, to be reflected in the model – e.g., through the increased likelihood of a prostate cancer diagnosis when compared to the same cohort in the general population. There is a range of literature around the likelihood of those with a family history having prostate cancer; studies generally range from two to seven times more likely than the general population. This study uses a risk uplift of 125%, or 2.25 times.

There is limited evidence on the number of men in the general population with a family history of prostate cancer. Some evidence from CRUK's risk-checking tool points to c.13% of the population having a family history. However, this may be influenced by selection bias and individuals repeat-checking the tool. For this study it is assumed 10% of the population have a family history of prostate cancer, although there is a significant amount of uncertainty around this data point.

Fixed parameters though time

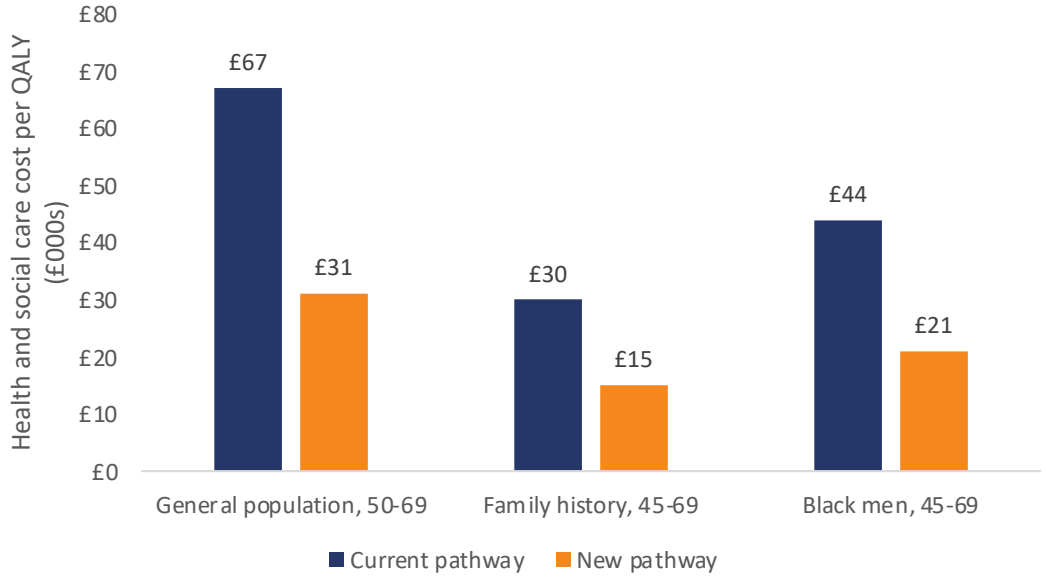
Certain parameters are fixed through time in the modelling. This may not be representative of the future. However, there is uncertainty around changes such as technological developments and health system policy, as well as population health trends.

Health and social care cost per QALY

The approach taken to monetising the changes in QALYs for the socio-economic impact assessment is in line with the HMT Green Book guidance. It is recognised that health cost-effectiveness reviews take a different approach to QALY valuation and consider a different scope of impacts.

The health and social care cost per QALY is based on the estimated costs of screening and diagnosis plus treatment, as well as end-of-life-care costs. Only NHS and social care costs are included. The estimated health and social care cost per QALY for each scenario is included in the figure below:

Figure 1: Health and social care cost per QALY by scenario, for a five-year screening programme with impacts tracked over a 30-year appraisal period



The estimated health and social care system cost per QALY demonstrates a finding consistent with that of the NPV analysis. The estimated health and social care cost per QALY is lowest for high-risk groups and reduces for all cohorts under the new screening scenario.

Sensitivities

Approach to modelling paid productivity

In the economic literature, there are two main approaches to modelling paid productivity losses: the human capital approach and the friction cost approach.

- Human capital approach. This applies productivity losses on an on-going basis and is the most common approach used in cost of illness studies.
- Friction cost approach. This approach assumes that workers are replaced when they leave the workforce. Therefore, there is only a short period of productivity loss rather than an on-going loss.

Given that the friction cost methodology assumes workers are replaced, this approach typically leads to lower productivity impacts than the human capital approach.

Each hour of paid work is valued using GVA, rather than wages, to estimate the total productivity impact on society rather than simply the lost income of an individual.

The impact of using the friction cost approach on the model outputs is considered as a sensitivity. It is assumed it takes two years to replace a worker, which accounts for the time and cost associated with advertising, interviewing and onboarding. The impact on the model outputs is presented in Table 5.

Table 5: Sensitivity of the NPV to the productivity modelling approach

Cohort	1. Current PSA testing pathway		2. New screening scenario	
	Human capital	Friction cost	Human capital	Friction cost
50 – 69 All ethnicities	- £271m	- £180m	£204m	£286m
45 – 69 Family history	£47m	£67m	£96m	£115m
45 – 69 Black men	£7m	£11m	£27m	£30m

The friction cost sensitivity reduces the magnitude of the paid productivity impact but does not change the sign of paid productivity impacts or the overall NPV. In either approach, the impact of screening on paid productivity is negative due to diagnosing individuals when they are younger and more likely to be in paid work. Negative productivity impacts of screening have been noted in some prostate cancer and lung cancer cost-effectiveness studies.[105,106,107]

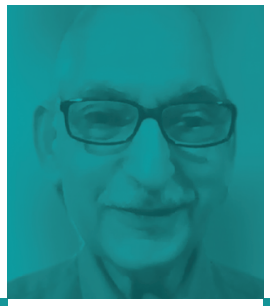
Undiagnosed progression rate uplift sensitivity

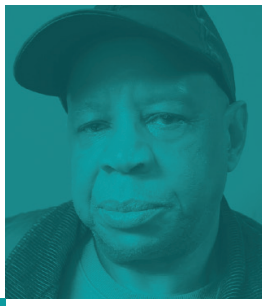
In the absence of robust evidence on the progression of undiagnosed prostate cancer, the undiagnosed progression rate has been estimated using data from the ProtecT trial (see Technical Annex). This approach has several limitations and uncertainties and so a sensitivity analysis is considered.

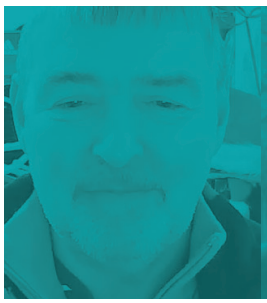
The sensitivity analysis shows the impact on the NPV of a +-20 percentage point movement in the undiagnosed progression uplift. See Table 6.

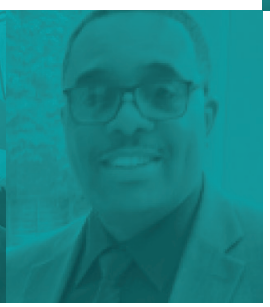
Table 6: Sensitivity of the NPV to the undiagnosed progression rate uplift

Cohort	1. Current PSA testing pathway			2. New screening scenario		
	Modelled estimate	-20 percentage points	+20 percentage points	Modelled estimate	-20 percentage points	+20 percentage points
50 – 69 All ethnicities	- £271m	- £411m	-£138m	£204m	£79m	£324m
45 – 69 Family history	£47m	£15m	£77m	£96m	£67m	£124m
45 – 69 Black men	£7m	-£2m	£16m	£27m	£19m	£35m









12 Glossary

PC	Prostate cancer
PSA test	Prostate Specific Antigen test
Sensitivity	Ability of a test to detect a true positive case of disease
Specificity	Ability of a test to detect a true negative
HCP	Healthcare Professional
NSC	National Screening Committee
NICE	National Institute of Healthcare Excellence
Socio-economic deprivation	The extent of relative disadvantage or lack of resources that contribute to standards of living
Metastatic disease	Cancer that has spread from its original site (primary tumour) to other parts of the body, forming new (secondary) tumours
Overtreatment	Unnecessary treatment for clinically insignificant cancer
Active surveillance	Closely monitoring disease until changes in test results are identified and radical treatment begins
Watchful waiting	Monitoring disease until changes in test results are identified, treatment will usually aim to control the cancer and manage symptoms rather than cure it
Radical treatment	Treatment with curative intent
Reflex test	An additional test that is automatically performed based on the results of an initial test
Biomarker	Measurable biological indicator of a condition or disease
Biopsy	Removal of cells or tissues from the body for laboratory testing
mpMRI	Multi-parametric magnetic resonance imaging is a special type of MRI scan that produces a more detailed picture of the prostate gland than a standard MRI scan
QALY	One quality-adjusted life year (QALY) is equal to one year of life in perfect health. QALYs are calculated by estimating the years of life remaining for a patient following a particular treatment or intervention and weighting each year with a quality-of-life score (on a 0–1 scale)
WELLBY	A WELLBY (wellbeing year) is defined as one point of self-reported life satisfaction measured on a 0-to-10 Likert scale for one individual for one year
GVA	Gross Value Added (GVA) is a measure of the value of goods and services produced

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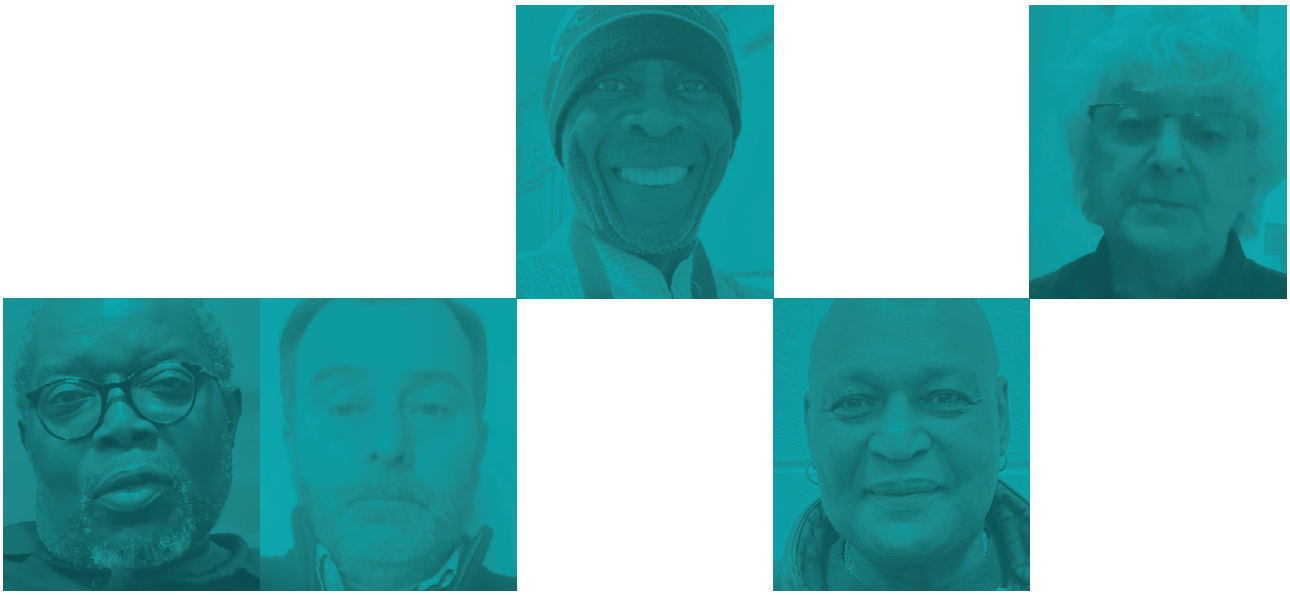

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