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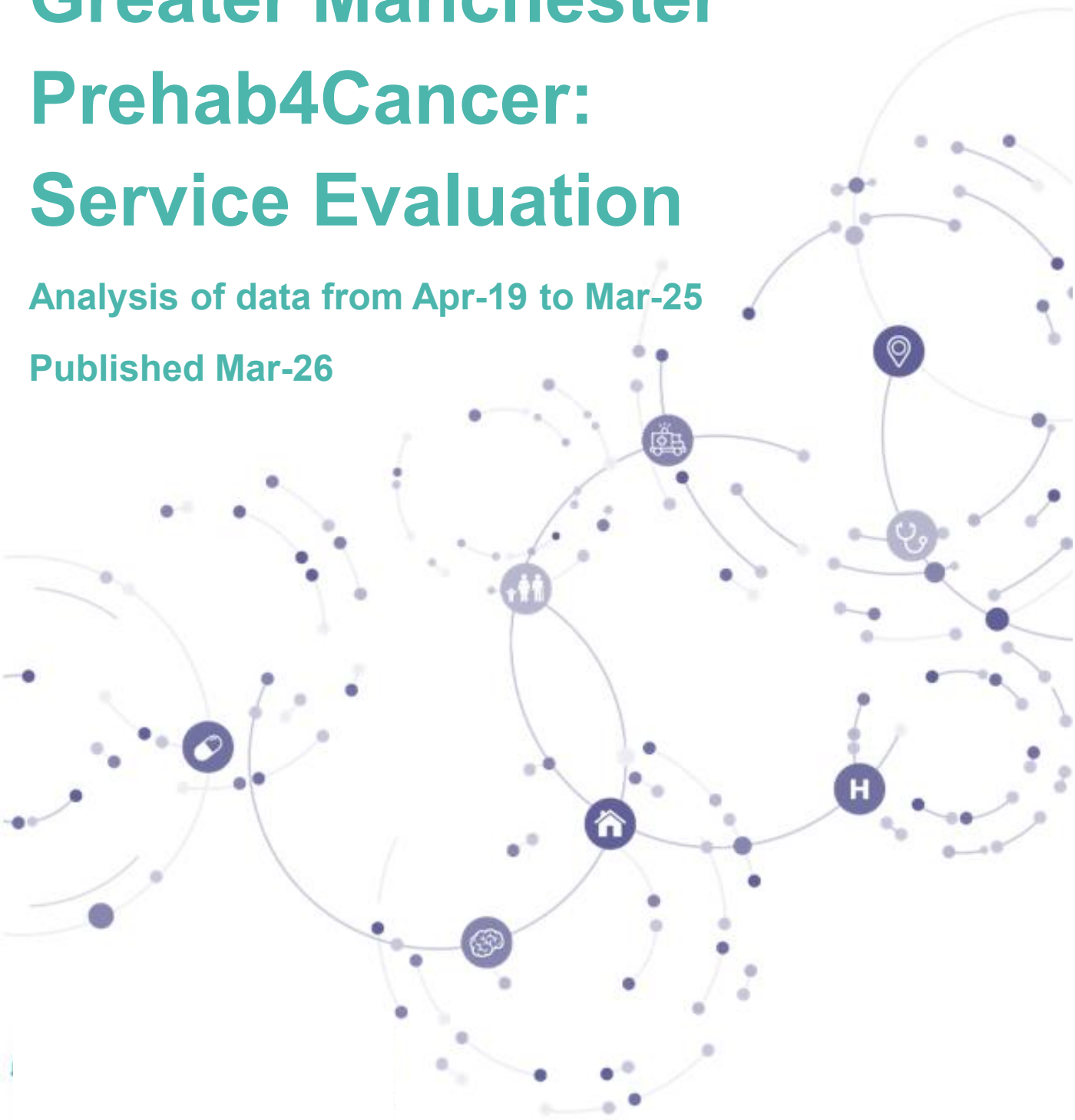
Commissioning Support Unit

Greater Manchester Prehab4Cancer: Service Evaluation

Analysis of data from Apr-19 to Mar-25

Published Mar-26



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Executive Summary

INTRODUCTION

Prehabilitation (prehab) is a needs-based, multi-modal intervention delivered before and during cancer treatment to optimise patients' physical, nutritional, and psychological status. Its aim is to enhance readiness for and tolerance of treatment, improve recovery, and support long-term quality of life.

The Prehab4Cancer (P4C) and Recovery Programme launched in 2019 under the strategic leadership of Greater Manchester (GM) Cancer Alliance and in partnership with GM Active. It was the first large-scale regional prehab programme in the UK. It aligns with both national policy and local strategic priorities, such as the Greater Manchester Live Well agenda and Cancer Plan.

The programme has received national and local recognition and continues to evolve as a core component of cancer care across the region.

ABOUT THE EVALUATION

NHS Arden & GEM (AGEM) Commissioning Support Unit were commissioned by the P4C project team to conduct an independent evaluation of the P4C service, examining patient outcomes and health economics.

Using retrospective analysis comparing pre and post intervention or via comparative cohort methods, the study examined:

- Service delivery metrics including referral volumes, participation rates, and assessment completion.
- Clinical outcomes including physiological measures, nutritional status, and patient-reported outcomes.
- System-level outcomes such as length of stay and wider secondary care usage, survival rates and economic impact.

DATA SOURCES

Data was made available from the P4C referrals database, validated assessment tools, and linked secondary care records, covering lung, colorectal, and oesophago-gastric (OG) cancer cohorts from FY2019/20 to FY2024/25*.

CONSIDERATIONS

- Participation disparities were observed in some cases for patients from deprived areas, particularly in lung cancer cohorts.
- Incomplete ethnicity recording, small sample sizes for some cohorts and reduced follow-up assessments constrain some aspects of analysis.
- Differences in surgical complexity and comorbidities require consideration when interpreting comparative outcomes.
- Evidence suggests a broader economic perspective, indicating potential gains in quality-adjusted life years, however, this could not be fully assessed at this stage.

KEY FINDINGS

Referrals have grown substantially, with strong engagement, over two-thirds of referred patients participate in prehab.

Significant improvements in physical function, nutritional status, and quality of life were observed, with sustained behavioural change at one-year follow-up.

Colorectal patients completing prehab had higher one-year survival rates; early indications suggest similar benefits for lung and OG cohorts.

Whilst not possible to conclude for all cancer types, P4C was found to be cost-saving for colorectal cancer patients, primarily through reduced length of stay.

*Information governance was in place, via NHS GM ICB, to provide AGEM with the necessary access to pseudonymised data.

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1. Introduction

*"Prehabilitation is a needs-based, multi-modal intervention, before and during cancer treatment, to optimise physical, nutritional and psychological status, enhance readiness for and tolerance of treatments and improve recovery and/or quality of life."**

GM Cancer Alliance was the first regional system in the UK to introduce a large scale prehabilitation (prehab) and rehabilitation programme as a standard of care for cancer patients. The **Prehab4Cancer (P4C)** and Recovery programme evolved from an existing enhanced recovery pathway for cancer patients undergoing surgery (ERAS+).

P4C has gained local and national recognition, for example, being voted by patients for the Patient's Choice Award at the Greater Manchester Cancer Awards (2022) and being awarded two HSJ Partnership Awards (2022). At the Live Well with Cancer Showcase (2025) Mayor Andy Burnham celebrated Greater Manchester's progress, publicly supporting the prehabilitation and movement agenda, including Prehab4Cancer, and highlighting its leading role in the region.

LOCALLY RELEVANT

The *Live Well* agenda promotes proactive, community-based support to improve health and wellbeing across Greater Manchester. The Greater Manchester Cancer Plan sets out commitment to personalised care, reducing inequalities, and maximising quality of life. Salford public health strategies target increasing physical activity and reducing health inequalities in deprived populations.

A REQUIREMENT OF NATIONAL PLANNING

Prehab is set out as a key part of cancer care as per the updated Macmillan guidelines, 2025 as well as the recently published National Cancer Plan (pg 48, action 5).

Prehab services are also aligned to the 2025 10-year plan (and the three shifts: community, digital & prevention).

MACMILLAN PREHABILITATION PRINCIPLES

Purpose

- Support people with cancer to prepare for treatment by promoting healthy behaviours.
- Maximise resilience to treatment and improve long-term health and quality of life.
- Reduce vulnerability to side effects by optimising physical and psychological health.

Core components

- Interventions to improve physical health.
- Support for nutrition.
- Psychological support for mental wellbeing.
- Behavioural change strategies to support health improvement.

Recommendations

- Align with other health improvement initiatives such as smoking cessation, management of long-term conditions.
- Embed throughout the entire cancer pathway, forming part of the personalised care plan.
- Include screening (physical, nutritional, psychological) followed with individualised assessment and intervention and ongoing support and evaluation.
- Screening for prehab should start as early and align with Holistic Needs Assessment.

*Macmillan guidelines

2. Programme aims & current evidence

"Best assessment, Best prehab prescription, Best outcomes for patients."

WHY PREHAB?

Level of fitness, wellbeing and nutritional status, when someone is diagnosed with cancer and following cancer treatment, may impact patient and service outcomes such as:

- Rate of perioperative complications, which can lead to morbidity and increased lengths of stay in hospital with resulting negative impact on functional capacity and recovery.
- Quality of life (QoL) and symptoms such as fatigue, anxiety and depression which may be experienced when diagnosed with cancer
- Ability to resume pre-morbid occupations and roles such as employment and resuming independent living.
- Economic implications both for the individual and in terms of service provision that is required (i.e. secondary care, primary care, social care, welfare benefits).
- Emerging evidence, both nationally and internationally, points to prehab being beneficial for people affected by cancer including improved quality of life, physical fitness, reduction in perioperative complications and enhanced functional recovery. The timeline of potential impact for these outcomes is set out in figure 1.

CURRENT EVIDENCE

- The P4C service previous evaluation, reported evidence of the impact of the service on outcomes such as length of stay and quality of life.
- Further published studies of the programme set out the impact on patient wellbeing, the acceptability of the service to its users and impact on physiological and functional assessments over the course of the P4C prehab programme.
- The programme reported a reduction in malnutrition and associated improvement in quality of life and functionality for P4C patients, highlighting the potential to improve recovery trajectories.
- Other comparable prehab services report similar benefits: Active Together, Prehab2Rehab.

P4C aims to build on and consolidate efficacy to improve patient experience, outcomes and service efficiency by delivering a multimodal prescribed exercise, nutritional screening & signposting/advice, and mental wellbeing support, using best practice, evidence base and advice from leading local/national experts.

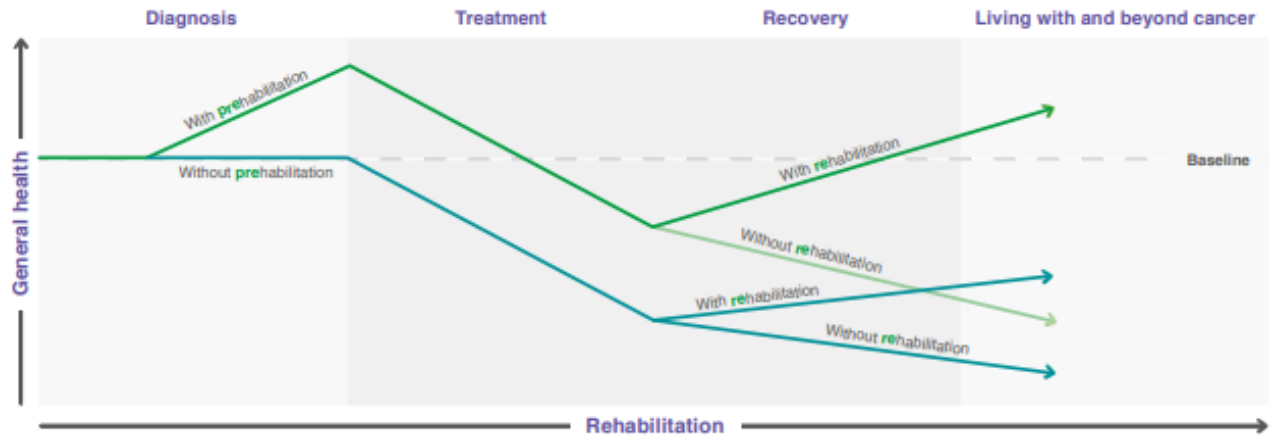


Figure 1: *Illustration of relationship between prehabilitation and rehabilitation and the proposed difference in outcomes [Macmillan guidelines]*

3. Service Design

- The P4C service supports patients with **lung, colorectal, or oesophago-gastric cancer**, referred for surgical or non-surgical treatments.
- The project team are supported by cancer subgroups, intervention specific expert groups and governance via a steering group reporting into the ICB and GM Cancer board.
- The project team includes a secondary care medical clinical lead, an AHP clinical lead (with background in occupational therapy and community rehabilitation) and project support. The team work substantively at Manchester University NHS Foundation Trust.
- The clinical leads are national / international prehab experts and members of the international Macmillan / NIHR / CPOC Prehabilitation guidelines expert steering group, individually chairing expert subgroups.
- The team possess a mixture of qualifications in level 4 in cardiac, pulmonary and cancer rehabilitation as well as falls prevention, obesity, diabetes and musculoskeletal disorders. In addition, some member of the team have also completed exercise physiologist qualifications.

Referrals: Eligible patients are referred to the service via the ReferAll system after MDT review. The referral coordinator contacts the patient within 48 hours to arrange an initial assessment within another 48 hours.

Assessments: Initial assessments take place at local leisure centres or hospital clinics, using validated clinical, functional and psychosocial measures. This informs personalised prehabilitation plans and triage to either a **targeted or universal pathway.** Patients are reassessed pre-surgery, 4–6 weeks post-surgery and at discharge.

Prehab sessions: Patients follow an exercise prescription combining cardiovascular and strength training, aiming for 3 sessions per week before surgery and 2-3 during chemotherapy / radiotherapy / immunotherapy. Nutritional and wellbeing support is provided through local centres, remote options (homebased) and online resources.

Rehabilitation transition: after treatment, patients are invited back for a rehab phase (approx. 12 weeks) to cement behaviour change and community engagement.

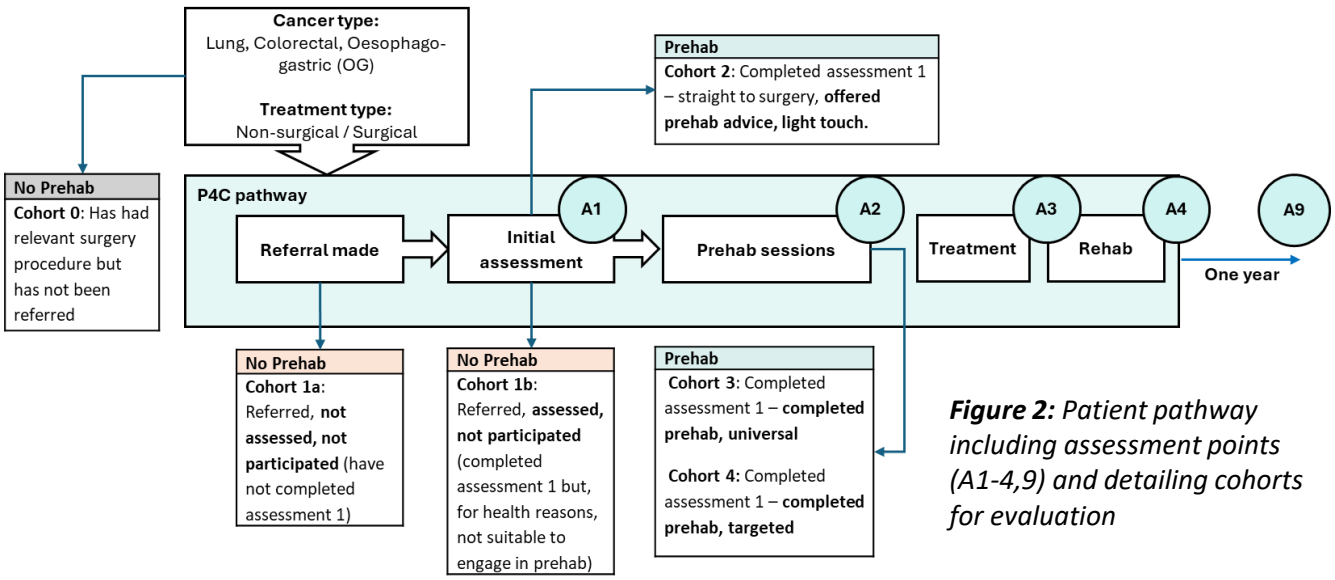


Figure 2: *Patient pathway including assessment points (A1-4,9) and detailing cohorts for evaluation*

4. Evaluation approach

Further details are provided in technical appendices A1 & A2

INTRODUCTION

This evaluation explores the effectiveness and value of the P4C service to patients and potential economic impact based on changes to service use throughout the cancer pathway. The evaluation approach included both:

- A retrospective quantitative analysis of data points pre and post intervention.
- Where possible, a comparative analysis of cohorts who had and hadn't received prehab.

As well as grouping by the participation cohorts described in figure 2, the analysis looked at cancer type (lung, colorectal, oesophago-gastric) and demographic characteristics (age, gender, ethnicity, deprivation quintile). There were challenges to ensuring the different cohorts had similar characteristics, discussed further in the findings section.

DATA SOURCES

Data for patients referred to and participating in the P4C programme, is collected by GM Active using the ReferAll database and in line with the Consensus on Exercise Reporting Template (CERT). Records are initiated at referral from cancer services and updated throughout the prehabilitation pathway, incorporating validated questionnaires to assess health, fitness, behaviour, and wellbeing.

Pseudonymised medical and demographic data were made available for evaluation linked at patient level to Secondary Usage Services (SUS) data providing historical secondary care and mortality data points spanning the last five years.

SERVICE DELIVERY METRICS

To understand service reach, delivery outputs were measured in terms of volumes and rates of referrals and subsequent patient engagement with the service, with reference to figure 2 which sets out different participation cohorts. The following were assessed:

- Number and rate of referrals (comparing with all patients with relevant procedure and diagnosis codes in the SUS database).
- Reasons for leaving the service early.

OUTCOMES

To demonstrate whether the service had an impact on health status and wellbeing, physiological and patient-reported measures were captured at initial and subsequent assessments, with some patients also having a one-year follow-up assessment.

System-level outcomes such as length of stay, readmissions and A&E attendances were compared for those who had and hadn't participated in prehab, controlling where possible for different patient characteristics. Comparative survival rates at one and five years were also assessed.

Key outcome metrics and the domain of care they relate to are summarised in tables 1 and 2 in appendix A1.

ECONOMIC ANALYSIS

A comparison of service costs and economic impact, resulting from measurable differences in outcomes, was also conducted, to assess overall costs and benefits of the service compared to standard care.

5. Key findings

5.1. Engagement – Referrals, Participation & Assessment

HEADLINES

- The service has expanded over the years reported, particularly for lung cancer referrals which have trebled over 6 years (likely as a result of the expansion of lung cancer screening in the GM region).
- Over two thirds of patients referred go on to participate in the prehab service, however, assessment rates taper off as patients progress through the service pathway with the initial assessment being prioritised to ensure appropriate, timely access to the service.

***Figure 3**: Referrals to the P4C service by financial year and cancer type*

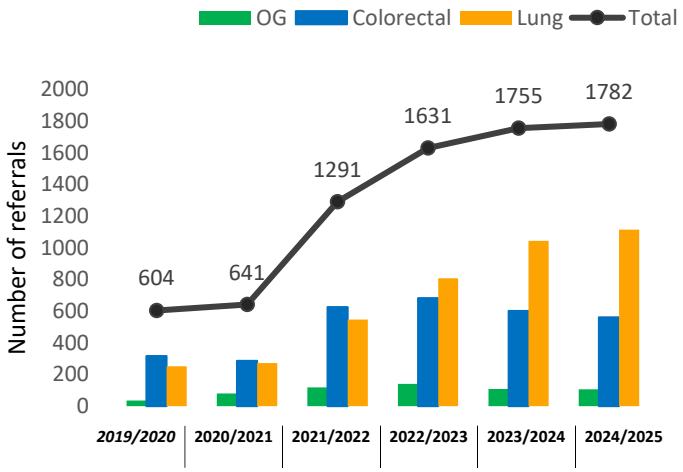
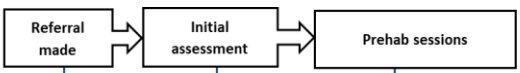


***Figure 4**: Participation in prehab for FY 2024/25 by cohort and cancer type**



Cohort	1a. Non-engagement	1b. Not suitable	2. Prehab: Straight to Surgery	3. Prehab: Universal	4. Prehab: Targeted	Total Prehab
Lung	143(25.4%)	18(3.2%)	78(13.9%)	208(37.0%)	115(20.5%)	**401**
Colorectal	329(29.5%)	71(6.4%)	70(6.3%)	332(29.8%)	312(28.0%)	**714**
OG	11(10.4%)	2(1.9%)	4(3.8%)	52(49.1%)	37(34.9%)	**93**

PARTICIPATION

For the most recent year of data 27% of patients referred did not progress to prehab (categories 1a and 1b). A further 5% went straight to surgery (cohort 2), however, these patients still received some elements of the intervention as part of the initial assessment appointment.

Reasons for non-engagement at the initial point of referral include patient readiness / choice. Instances where the P4C team were unable to contact those referred or mis-referral.

ASSESSMENTS

100% of patients in cohorts 1b to 4 had an initial assessment. This drops off through further assessment points with between 20-45% having had the post-surgery assessment. As referrals to the service have increased and with limited resources, the initial assessments are prioritised to ensure fair and equal access to the P4C service.

It may also not be possible to carry out later assessments due to changes to surgery date / other medical appointments. In contrast to many services, there is a limited timeframe for providing prehab and prehab is not suitable for management with a waiting list.

**It is noted level of need is here based on initial assessment and this may change throughout the course of treatment*

5. Key findings

5.2. Engagement – Patient Demographics

HEADLINES

- Age, gender and ethnicity do not vary significantly between participation groups, within the different cancer cohorts.
- Equity considerations highlight some disparity in deprivation levels among lung cancer patients not accessing prehab once referred, suggesting a need for targeted outreach and support.

REFERRALS

Age and gender: Within the different cancer groups, differences in average ages and gender split were not found to be statistically different between participation cohorts. For those referred to the service, mean ages ranged between 70 and 63.

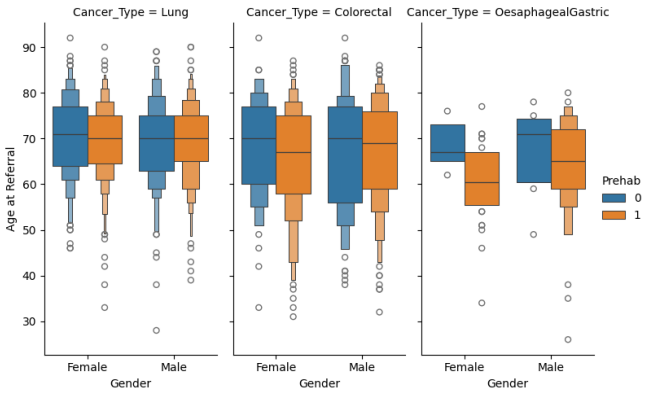


***Figure 5**: Referral age and gender distributions for FY2024/25 by cancer type*

Ethnicity: Recording of ethnicity has improved over the years reported across all cancer groups from c. 80% missing in 19/20 to below 10% missing in 24/25. There were no significant differences in ethnicity between key cohorts based on the available data.

Deprivation: Over both participation groups, lung cancer referrals are more prevalent for lower quintiles (higher deprivation), which aligns to GM Lung Cancer Screening programme. Calculating across all deprivation quintiles, lung cancer patients were more likely not to participate in prehab if from more deprived areas.

REFERRALS

People receiving follow-up assessments did not vary significantly in terms of their demographics compared to those having just the initial assessment.

	Colorectal		Lung		OG	
Cohort	**No Prehab**	**Prehab**	**No Prehab**	**Prehab**	**No Prehab**	**Prehab**
Mean age (years)	67.4 ±12.4 (n=160)	66.5 ±11.6 (n=401)	69.9 ±9.1 (n=395)	69.4 ±8.1 (n=714)	67.8 ±8.4 (n=13)	62.9 ±10.1 (n=93)
Gender count (F / M)	65 / 96	170 / 231	213 / 185	399 / 309	5 / 8	28 / 65
% most deprived quintile	31%	34%	50%	49%	28%	28%

***Table 1**: Referral age, gender and deprivation figures for FY2024/25 by cancer type*

5. Key findings

5.2. Engagement – Secondary Care Activity

HEADLINES

- Cancer surgery activity were identified from the SUS (Secondary Use Service) admitted patient care database and linked to the P4C referral database. This meant relevant surgery admissions could be compared for those who had and hadn't been referred to the P4C service,
- There are differences in procedures that the different groups typically have.
- For colorectal and lung cancer surgery patients, those eligible for but who were not referred to P4C, were younger , had different gender mixes and different levels of deprivation. Understanding such differences are important to interpreting comparative analysis of outcomes.

SURGERY RECORDS

Approximately half of referrals were found to have a relevant surgery in SUS. The majority of referrals without a surgery were patients who had non-surgical cancer treatments or who had surgeries out of area.

Some surgeries were not linked to a referral. For OG and lung cancer, there were equivalent numbers of surgeries with / without referral to P4C. For colorectal cancer, over double the number of patients did not have a referral compared to those that did.

PROCEDURAL COMPLEXITY

The complexity of surgeries was explored by comparing Healthcare Resource Groups (HRGSs) recorded by the hospital. There were differences in typical complexity between participation cohorts particularly for colorectal and OG groups.

PATIENT DEMOGRAPHICS

Age and gender: Typically, those referred to the service were older than those not referred by approx. 5 years. For colorectal cancer, those not referred were statistically more likely to be female (52% women not referred, 40% referred), whereas for lung cancer there were more female patients in the referred group (53% women not referred, 61% referred).

Ethnicity: There were no significant differences in ethnicity between those referred / not-referred based on the available data, however, further review of the higher number of Black and Black British patients in the 'not referred group' for OG cancer was recommended.

Deprivation: Lung cancer patients who were referred were from more deprived areas than those who were not (aligns to GM Lung Cancer Screening programme).

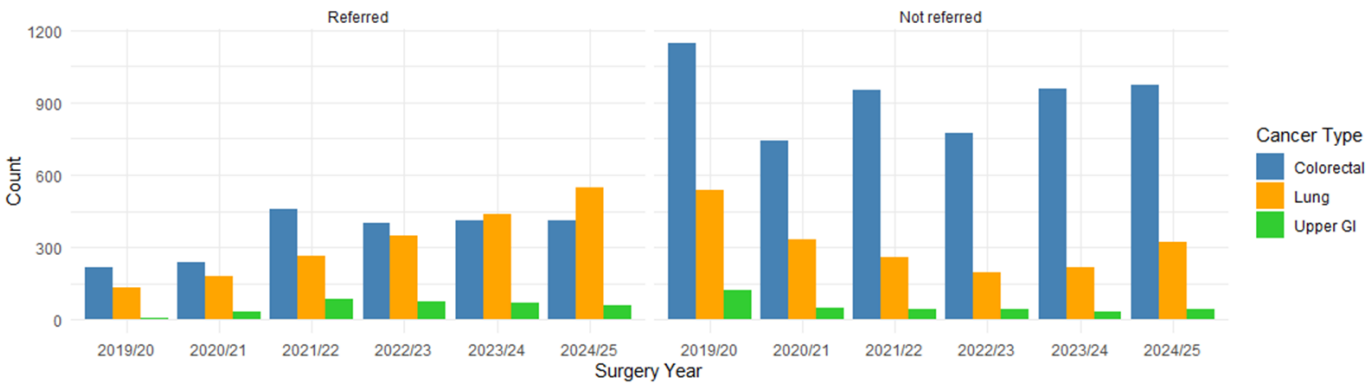


***Figure 6**: Surgery counts by cancer type in GM area, split by those referred / not referred to P4C*

5. Key findings

5.3. Survival & Secondary Care Outcomes

HEADLINES

- **Survival rates improved with prehab comparing with those who declined the service.**
- A positive impact on length of stay was observed for colorectal patients. However, evidence for impact on service outcomes is limited with more insight needed into cohort differences.
- Where there is evidence of statistically significant differences between those who have / haven't participated in prehab are been referred at all, the prehab group has the more favourable outcome, having the combination of shorter length of stay and lower mortality for colorectal patients.

SURVIVAL RATES

The survival rate of those who do vs do not participate in prehab, having been referred, is significantly higher after one year for colorectal patients, based on data for surgeries that took place in FY 2023/24. Those who were not referred at all had a lower survival rate but this was not significantly different.

This difference is still observed after adjusting for key variables such as age, IMD and procedural complexity.

Lung non-surgery patients have statistically higher survival rates, for the last 2 years for prehab vs non-prehab groups.

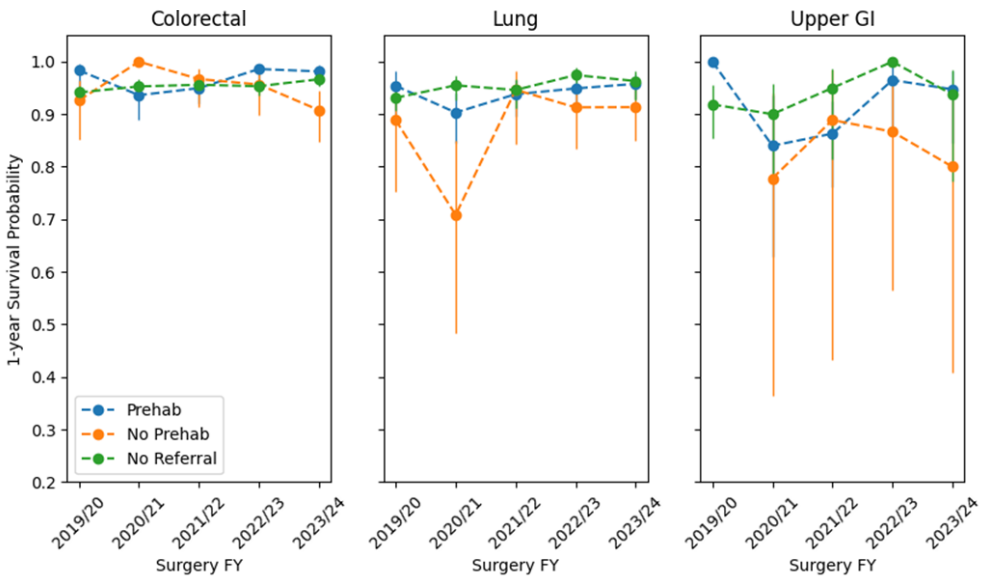
SECONDARY CARE USAGE

Length of stay for colorectal patients is lower in the prehab vs not referred group by **1.2 days** after adjusting for complexity, deprivation and age.

It was not possible to conclude impact for lung and OG groups due to complex case-mix and limited by sample size. Patient prehab cohorts may differ in multiple dimensions (age, comorbidity, procedure complexity, tumour site, frailty etc.). Sensitivity of results for these cohorts suggests that the treatment assignment mechanism is complex and not fully captured by available covariates.

***Figure 7**: 1-year survival rates by time from surgery (surgeries took place in FY 2023/24)*

There were also promising indications for lung and OG surgery cohorts 1-year survival and also 5-year survival rate for lung. However, currently sample size limits the ability to test significance.



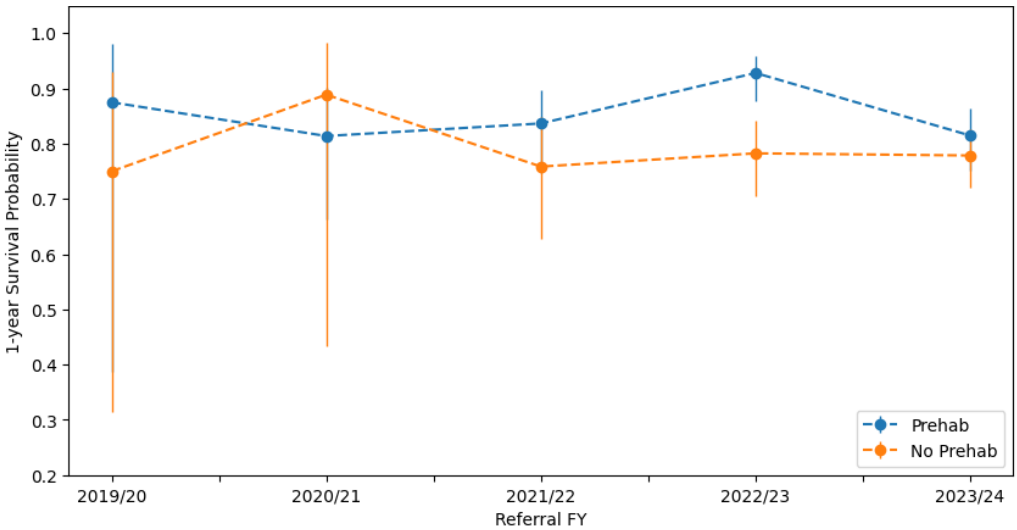
5. Key findings

5.3. Survival data – further findings

NON-SURGERY PATIENTS: 1-YEAR SURVIVAL RATES

- For patients offered prehab for radiotherapy / chemoradiotherapy curative treatment for lung cancer, there was a significant difference in one-year survival FY 2022/23 between those who have and haven't participated in prehab following referral.

***Figure 8**: 1-year survival rates by time from treatment (treatment took place in FY 2023/24)*



Note, in FY 2023/24 the Prehab group had a significantly older average age than the 'No prehab' group. This was not the case in previous years.

SURGERY PATIENTS: 5-YEAR SURVIVAL RATES

- Comparing prehab and no prehab, the difference for lung cancer patients 5-year survival rate is large (14.4% higher for the 'prehab' group compared to 'no' prehab).
- However, only 45 patients are included in the 'no' prehab group and hence this result doesn't test as significant.

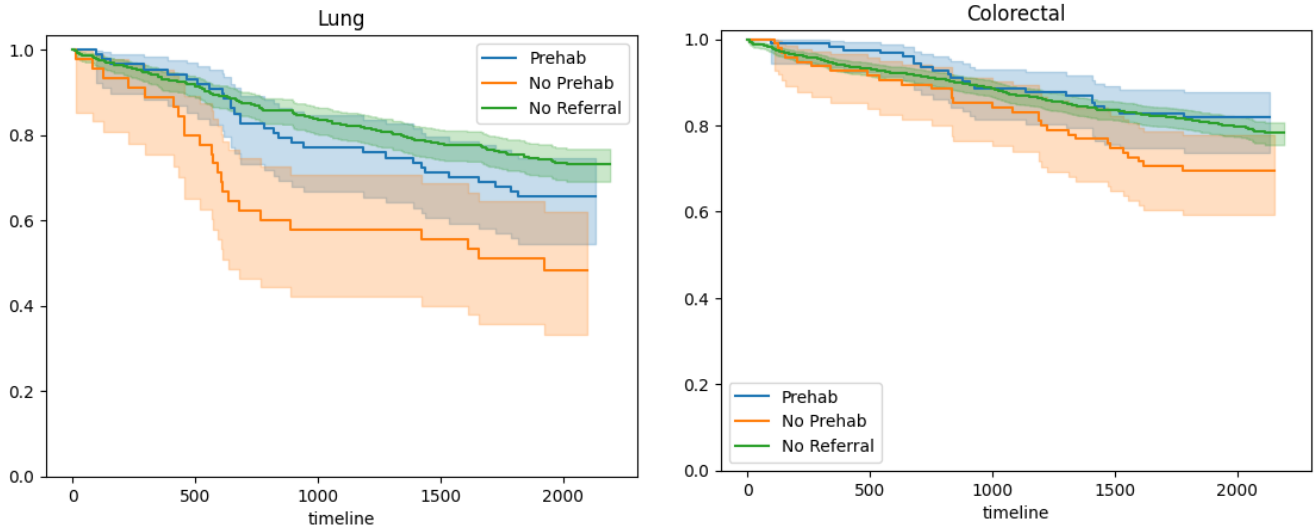


***Figure 9**: 5-year survival rates by time from surgery (surgeries took place in FY 2019/20)*

5. Key findings

5.4. Physiological outcome measures (optimisation for treatment)

HEADLINES

- Statistically significant improvements in physiological outcomes, measured using validated scores, at initial assessment and again pre-operatively, were observed across all cancer cohorts.
- Improvements between initial and post-rehab assessment outcomes were also found to be statistically significant for colorectal and lung cancer cohorts.
- Patients were found to maintain fitness levels comparing initial assessment and assessment immediately after surgery. This is significant as there would be an expectation of reduced fitness levels for patients undergoing treatment, compared to their baseline ordinarily.

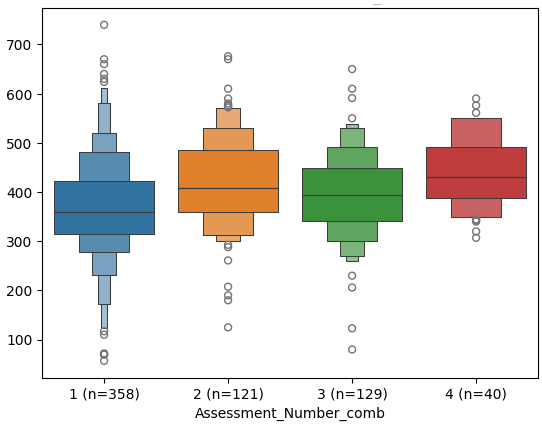
SIX MINUTE WALK TEST (6MWT)

The 6MWT is a physiological measure used to assess aerobic capacity and endurance by measuring the total distance covered by the patient in the 6-minute period.

Differences between initial / pre-op assessment outcomes were found to be statistically significant across all cancer cohorts as were differences between initial / post-rehab assessments for colorectal and lung cancer cohorts. The number of OG patient post-rehab assessment was too small to test significance.

No statistically significant differences were found comparing initial and post-op assessments, indicating that physical abilities have been maintained post-op at levels similar to before beginning prehab.

***Figure 10**: 6MWT distance (m) at assessment for FY2024/25 colorectal patients*

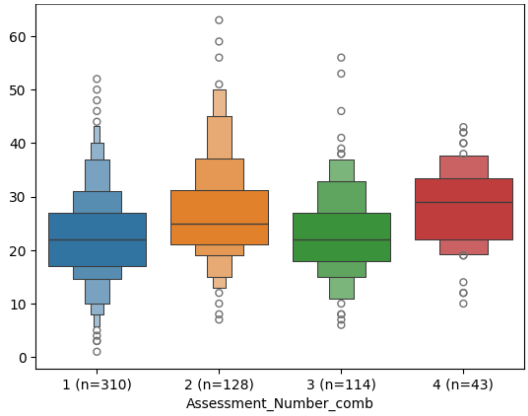


SIT TO STAND TEST (STS)

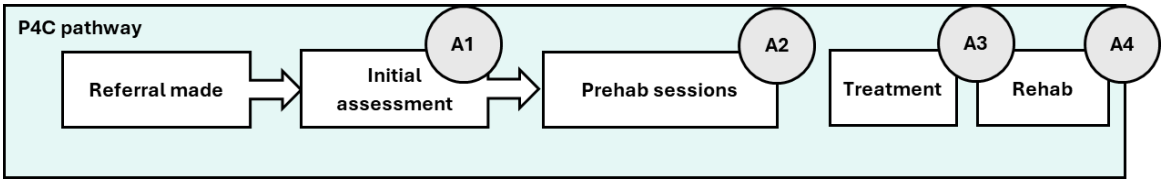
The STS is an assessment that measures the number of repetitions patients manage to stand up from a chair and sit back down unaided within the span of 60 seconds.

Similar trends were observed for the STS and 6MWT.

***Figure 11**: STS repetitions at assessment for FY2024/25 colorectal patients*



Assessment Key



5. Key findings

5.5. Change in nutritional status

HEADLINES

- For the PG-SGA, statistically, people in the lowest risk category at initial assessment maintained this level at pre-op and post-op assessments.
- There was typically a statistically significant improvement for people initially in the higher risk categories when assessed again at both pre-op and post-op assessments.
- Hand grip strength was maintained other than immediately post-operatively.

PG-SGA

The PG-SGA (Patient-Generated Subjective Global Assessment) is used to assess a patient's nutritional status using information such as weight changes and dietary intake. A higher score indicates higher risk of malnutrition and requirement for intervention.

For those initially in lower risk categories there was no significant change indicating scores are maintained across the pathway. For those initially in higher risk categories there was significant improvement at both pre-op and post-rehab assessments. The number of OG patient post-rehab assessment was too small to test for significance.

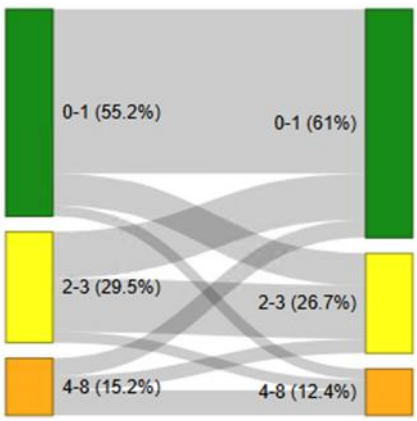
HAND GRIP STRENGTH

Measuring hand grip strength is an indicator of potential malnutrition and was assessed over the course of their cancer treatment pathway, typically taking three measurements for each hand at each assessment point.

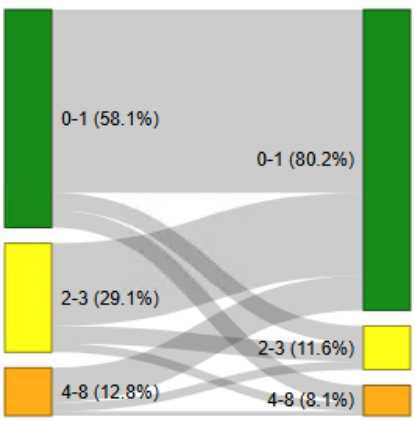
Most of the differences observed were not found to be statistically significant. No change in hand grip strength can be associated with the maintenance of a patient's nutritional status.

***Figure 12**: Sankey visualisation of PG-SGA score distributions between assessment points for FY2024/25 lung patients*

Initial vs Pre-Op



Initial vs Pre-Rehab



5. Key findings

5.6. Patient reported outcomes (longer term functional measures)

HEADLINES

- At the pre-operative assessment point, on average patients who initially reported low / no physical difficulties, maintained this level. Additionally, there was a significant improvement for those initially reporting difficulties for all cancer cohorts.
- IPAQ (physical activity behaviour) scores improved significantly at all points considered including at the one-year follow up point indicating lasting behaviour change in attitude to exercise.
- EQ5D (quality of life) scores for the majority of domains demonstrated improvements for both pre-op and post-rehab.
- These findings suggest that the prehab programme is supporting recovery and enhancing wellbeing with a long-term impact on patient experience relating to physical function.

WHODAS

The World Health Organisation's Disability Assessment Schedule (WHODAS 2.0) is a self-rated questionnaire which assesses difficulties related to health conditions that impact on ability to undertake daily activities.

A lower overall WHODAS score indicates greater function and lower disability, the aim of the prehab service is to support as many people as possible to a 0 score.

Whilst improvement was marginal pre-operatively, by the post-operative assessment patients who initially had a 0 WHODAS score typically maintained this level. Additionally, there was a significant improvement for those with initial score >0 for all cancer cohorts.

EQ-5D

The EQ-5D-5L is a tool used to measure a person's health-related quality of life. It looks at five key areas: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.

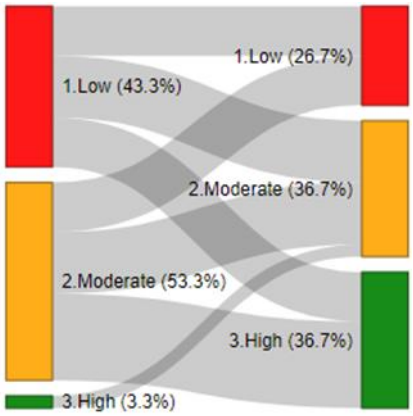
Improvements were demonstrated for the majority of domains both pre-op and post-rehab.

IPAQ

IPAQ (short-form) is an instrument designed for population surveillance to obtain comparable estimates of physical activity. Scores are categorised as Low =1, Moderate =2 and High =3.

An increase in IPAQ score indicates an improved behavioural change with regards to physical activity. Improvements were seen comparing all assessment points, including the one-year follow-up indicating sustained improvement.

***Figure 13**: Sankey visualisation of IPAQ score distributions between Initial vs One Year Follow-Up assessments for FY2023/24 colorectal patients*



5. Key findings

5.7. Economic Impact

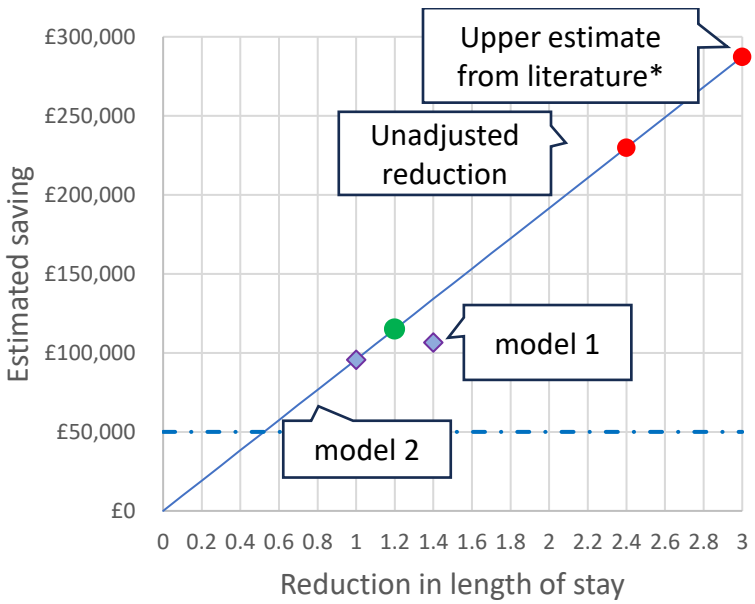
HEADLINES

- A comparison was completed of service costs and economic impact resulting from reduced length of stay (LoS), to assess costs and benefits of the service compared to standard care.
- The assessment looks at colorectal cases only as service outcomes analysis was inconclusive for lung and OG cohorts due to case-mix differences.
- The prehab group are modelled as having received an average benefit. Those who were referred but didn't participate, are included in the costs.
- We've used costs of providing colorectal prehab service, excluding the cost of rehab as rehab won't have impacted on length of stay outcome. A breakdown of costs is provided in appendix A3.
- **For colorectal patients, the delivery of prehab is concluded to be cost saving.**

Outcomes	Proxy per-patient saving	Cohort size (those receiving prehab)	Estimated saving for cohort
1.2 bed days per patient released, reduction in surgery LoS	£328* x 1.2 = £393	292	£114,931.20

- Bed-day cost estimated as the average excess bed days national price for colorectal procedures £328 (based on procedures recorded in analysis data set for FY 24/25)
- Cost of delivering the service to all those referred (413 patients) was estimated using the unit costs presented in appendix A3, as **£49,990**.
- Comparing estimated costs and savings gives a return on investment of **£2.30 : £1**.
- Figure 14 demonstrates sensitivity of results to assumptions made as part of the economic model.

***Figure 14**: Sensitivity analysis, length of stay reduction*



Model variation 1: Patients who initiated prehab but went straight to surgery are included as part of the 'No prehab' group

Model variation 2: Prehab group length of stay is compared to the average of those who have been referred but not participated, and those who have not been referred

* Public Health Wales Prehab2Rehab programme reported upper estimate of 3 days reduction LoS for prehab vs no prehab for Cardiff and Value. This depended on cohort e.g. relating to age.

6. Conclusions & Recommendations

SERVICE ENGAGEMENT

- The Prehab4Cancer (P4C) service has expanded significantly since inception, with lung cancer referrals tripling over six years.
- Over two-thirds of referred patients engage with prehab, demonstrating strong uptake.
- While initial assessments are consistently completed, later-stage assessments decline due to resource constraints and clinical scheduling. This reflects prioritisation of early intervention within limited timeframes.
- Participation disparities are observed in some cases, lung cancer patients from more deprived areas being less likely to participate once referred.

EFFECTIVENESS

- Statistically significant improvements were observed for prehab patients in physical fitness and nutritional status, comparing before and after intervention.
- Function and wellbeing were maintained or improved.
- Rehabilitation appears to support post-operatively, with patients recovering well and reporting fewer problems across key domains such as pain, anxiety, and mobility.
- Whilst assessment measures were not compared with a control group, findings align with an emerging evidence base.
- Colorectal patients who completed prehab had higher one-year survival rates and shorter hospital stays (by 1.2 days) compared to non-participants. Evidence for lung and OG cohort analysis was limited by sample case-mix / size.
- For colorectal cancer, prehab delivery is cost-saving, driven by reduced length of stay. Economic benefits for other cohorts remain inconclusive due to data limitations.
- The evidence that the service may enhance survival rates and physical and mental health, implies gains in quality-adjusted life years.

LIMITATIONS

- Ethnicity recording and long-term follow-up completeness limits equity analysis and modelling of longer-term benefit which may have significant economic impact.
- Case-mix differences between participation cohorts restricted the statistical power of the available sample size when comparing outcomes.
- There were indications that information which may impact outcomes was not always captured in the available data (such as cancer stage, smoking status), limiting meaning it wasn't possible to control for these aspects when comparing outcomes.
- This evaluation only includes service outcomes for those who've had surgery.

KEY RECOMMENDATIONS

1. Strengthen ethnicity data recording to support targeted outreach for underserved populations and monitor engagement by socio-economic status.
2. Comparative cohort analysis would also benefit from improved ethnicity recording and from linking to other data sources such as cancer registry data.
3. Whilst recognising resource limitations for completing assessments, further linking assessment scores and level of engagement (e.g. session attendance) with service and survival outcomes would offer valuable insight.
4. Explore approaches to broadening economic perspective including measuring quality-adjusted life year gains to ascribe economic value.
5. Expand evaluation to non-surgery patients.

Technical Appendix

A1. Evaluation Metrics

Table 1: *Key assessments considered from the ReferAll assessment data set*

Domain	Approach
Change in functional capacity / Physiological measures	• 6MWT (6-Minute Walk Test), measures total distance walked by the patient in 6-minute period • 60 second Sit to Stand test, measures how many repetitions of sit to stand exercise completed
Change in nutritional status / Physiological and patient reported measure	• PG-SGA© | Pt-Global (Patient-Generated Subjective Global Assessment short-form), a higher score indicates higher risk from malnutrition • Hand grip dynamometry (HGD), measures grip strength, a potential indicator of malnutrition
Change in functional capability and QoL – patient reported measure	• WHO Disability Assessment Schedule (WHODAS 2.0) overall score, a lower score indicates higher functionality • EQ-5D-5L - EuroQol (5 Dimensions) standardised questionnaire for measuring health-related quality of life
Behavioural change relating to physical activity – patient reported measure	• IPAQ – Score (International Physical Activity Questionnaire – Short form) total score, a higher score indicates higher activity levels

Table 2: *Secondary care and survival metrics*

Measure	Data source	Approach
Survival rate	GM ICB Master Patient Index	• Date of death records linked at patient level to the ReferAll cohorts • Survival rate after surgery for 1 and 5 years (where applicable)
Length of stay, cancer surgery	SUS Admitted Patient Care	• Identified through procedure codes within elective/ daycase admitted patient care spells within a 6-month time frame of referral record
Critical care admission during cancer surgery	SUS Critical Care	• Identified critical care record under identified surgery admission • Measured as bed-days within critical care
Readmissions following cancer surgery	SUS Admitted Patient Care	• Measured as cumulative length of stay over 30- and 90-days following surgery • Only subsequent non-elective admissions are included if identified as readmissions related to initial admission as per national readmission rules.
A&E attendances following cancer surgery	SUS Accident & Emergency	• Counts of attendances within the 30- and 90-days following surgery

Technical Appendix

A2. Analytical methods

ANALYTICAL METHODOLOGY

- Statistical significance of differences over time periods and between cohorts has been tested.
- Statistical tests to compare differences in assessment outcomes were chosen depending on the underlying data type (e.g. numerical vs. ordinal or categorical values). Table 3 below lists the statistical approaches chosen.
- Where differences were observed between demographic or confounding variables (such as surgery complexity), the use of matching approaches and regression models were considered.
- Sensitivity analyses indicated that results varied by matching approach, suggesting a high level of heterogeneity within the prehab cohort that could not be fully controlled.
- Therefore, regression models were used to test these dependencies and adjust outcomes to account for differences.

Table 3: *Analytical approach for each metric*

Assessment Metric	Methodology for comparison across assessment cohorts
6 Minute Walking Test (distance walked in metres)	Paired t-test (parametric repeated measures)
60 second Sit to Stand test (number of repetitions completed)	
Hand Grip Strength (grip strength in kg)	
WHODAS overall score (calculated as a sum across sub-scores)	Wilcoxon signed rank test (non-parametric repeated measures)
PGSGA Overall Score	
IPAQ Score (categorical measure Low/Moderate/High)	Bowker's test of symmetry (appropriate for paired nominal or ordinal data with three or more categories)
Length of stay (days), critical care (days), 30- and 90- day readmissions (days), A&E attendances	Different tests were considered based on the underlying distributions of the data, typically an independent t-test was found to be suitable
Survival rates	Log-rank test (non-parametric comparison of survival curves)

Analysis has been performed in:

- python (version 3.12) using packages pandas, numpy, and scipy
- r (version 4.2.1) using base stats and coin package's symmetry_test() function with the "quad" test statistic

Technical Appendix

A3. Detailed costs used financial analysis

Table 4: Unit costs (provided by the P4C programme team) alongside patient counts for colorectal patients

Cancer type	Cohort	Patient Count	Unit cost	Description	Total cost
Colorectal	1a - Not assessed & didn't participate	109	£10	Referral initiation admin cost only	£1,090
Colorectal	1b - Assessed but didn't participate	12	£50	Referral initiation admin cost and initial assessment cost	£600
Colorectal	2 - Straight to Surgery	69	£50	Referral initiation admin cost and initial assessment cost	£3,450
Colorectal	3 - Universal	147	£150	All costs for admin, assessment, prehab	£22,050
Colorectal	4 - Targeted	76	£300	All costs for admin, assessment, prehab	£22,800

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