Lung Health Check Operational Pilot for Wales

Evaluation Report 2

March 2025

GIG CYMRU NHS WALES

Gwiriad Iechyd yr Ysgyfaint
Bwrdd Iechyd Prifysgol
Cwm Taf Morgannwg
University Health Board
Lung Health Check

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Contents

EXECUTIVE SUMMARY

Background

1. Targeted low-dose CT (LDCT) screening for lung cancer has been recommended for implementation by the UK National Screening Committee. Lung cancer screening reduces lung cancer mortality by around 20% by finding lung cancer at an earlier stage.

2. Plans for the Wales Lung Health Check (LHC) Operational Pilot (OP) developed following scoping work by the National Strategic Clinical Network for Cancer.

The aims of the OP were to:

a. **Provide immediate health benefits to the pilot cohort**

b. **Provide advance learning and modelling to support and de-risk the roll-out of a future programme in Wales**

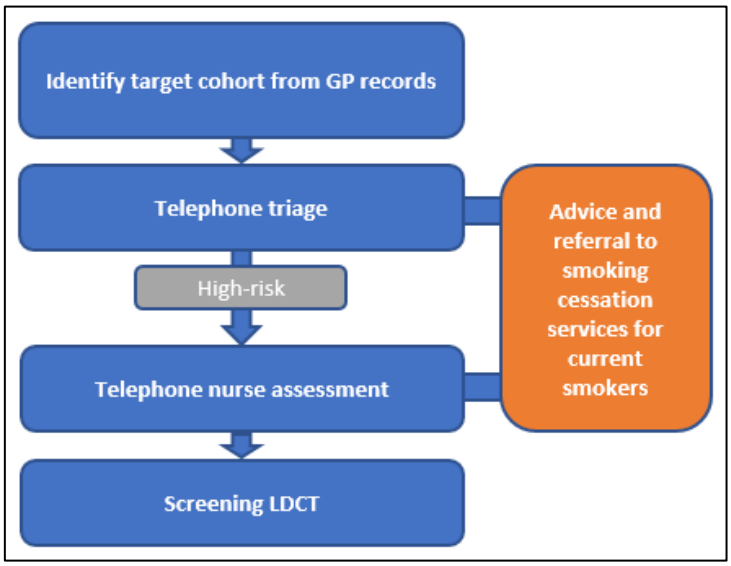
c. **Develop a core team who would gain experience to be used as the nucleus for a future national roll-out**

3. This report, Evaluation Report 2, complements Evaluation Report 1 which previously reported on the inception, planning, delivery and results of the OP up to the point of completion of baseline and 3-month recall LDCT scans. This final report covers the remaining clinical activity of the OP and final screening results; integration of smoking cessation pathways; and participants' and healthcare professionals' experience of the OP.

Delivery

4. The OP was delivered by Cwm Taf Morgannwg (CTM) University Health Board with support from the National Strategic Clinical Network for Cancer, and funding from Industry and Third Sector groups.

5. The OP invited people from selected GP practices in North Rhondda aged 60-74 years who had ever smoked for a LHC. The LHC included an opt-out telephone triage appointment to determine the participant's personalised risk of developing lung cancer using standardised multivariable risk assessment tools. Those at high risk were offered a telephone nurse assessment followed by a screening LDCT scan. Current smokers were offered advice and opt-out referral to local smoking cessation services.

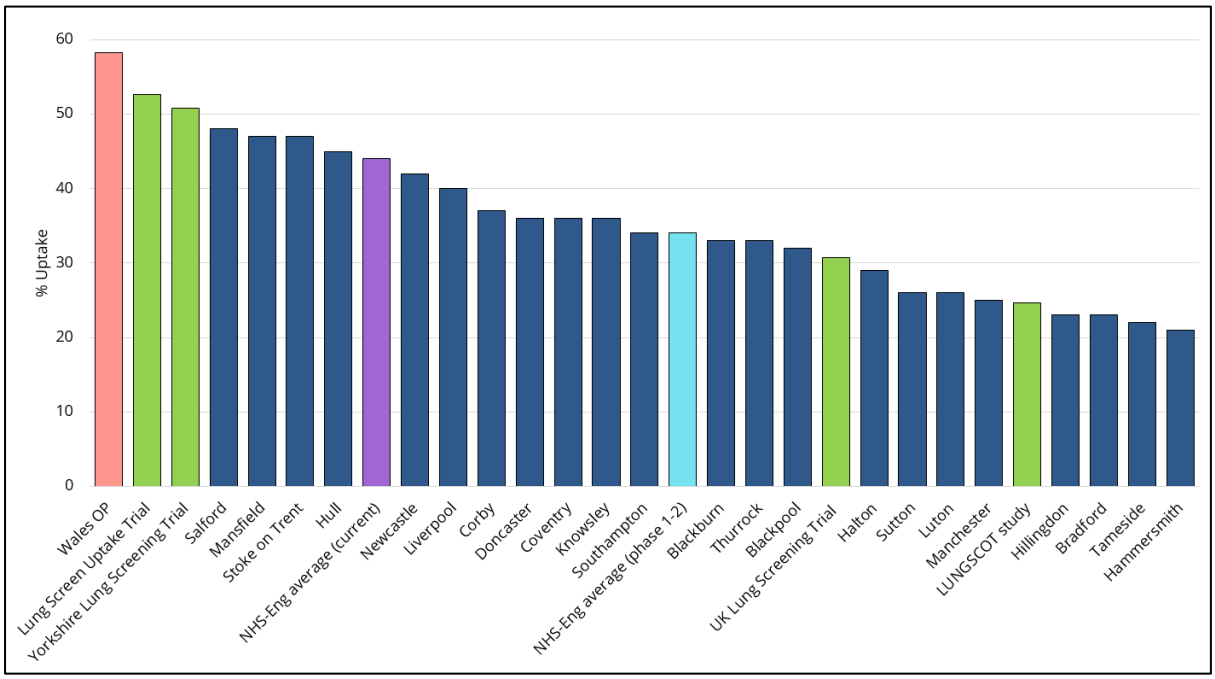


6. The OP formally commenced in August 2023 and completed in early 2025. LDCT screening scans were performed using a mobile CT scanner located at Ysbyty Cwm Rhondda. LDCT scans were reported by thoracic radiologists from across Wales supported by computer-aided detection lung nodule software.

7. All screening scans with potentially-actionable findings were discussed at a weekly Screening Review Meeting. Participants with suspected lung cancer underwent further investigation via the Single Cancer Pathway at the Royal Glamorgan Hospital lung cancer service. Participants with small lung nodules requiring surveillance were recalled for a further scan three and/or twelve months after their baseline scan.

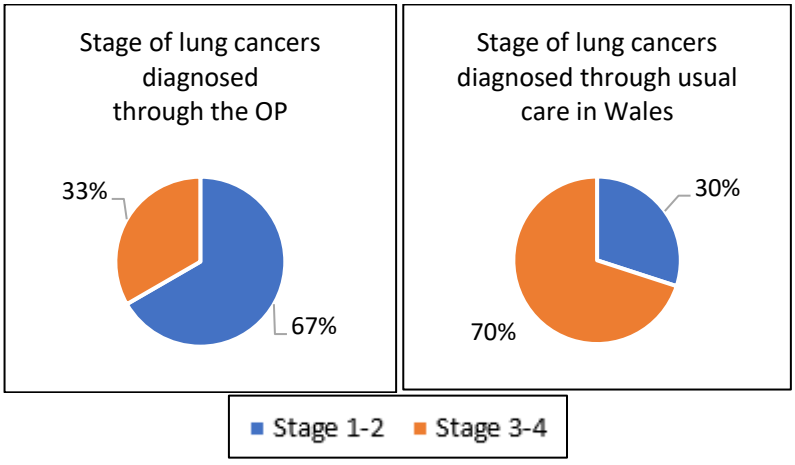
Clinical activity

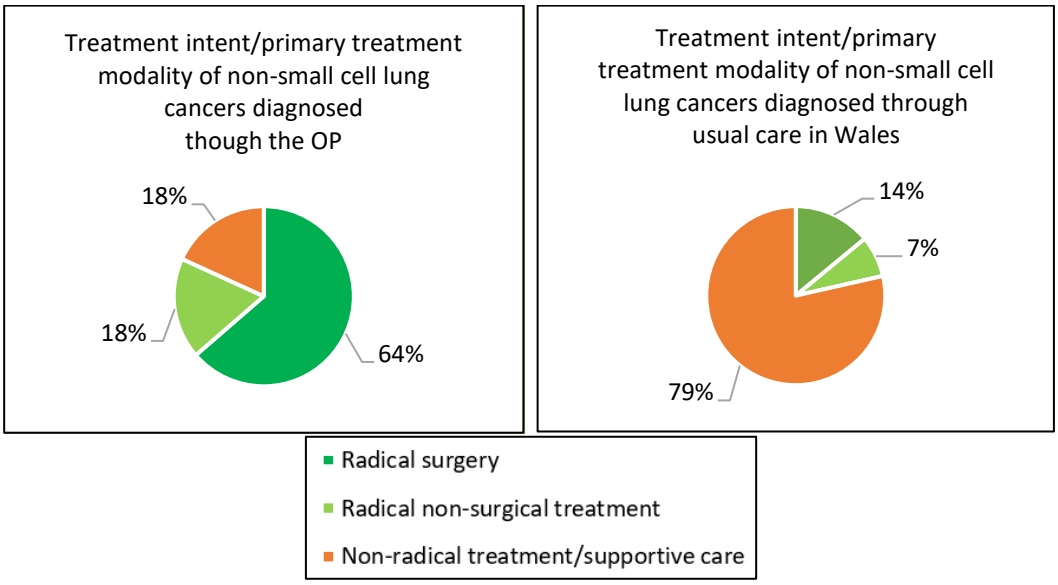
8. As previously reported, of those invited 1241/2128 (58.3%) completed a risk assessment at Telephone Triage. This compares favourably to other reported lung cancer screening/LHC activities elsewhere.



9. Of those referred for a baseline LDCT scan, 547/608 (90.0%) underwent this. Recall scans 3- and/or 12-months after a baseline scan were indicated for 17.6% of participants. In total, the OP delivered 690 LDCT scans to its main cohort.

10. Thirteen participants underwent further investigation for suspected lung cancer (13/547, 2.4%), with twelve participants subsequently being diagnosed with lung cancer (12/547, 2.2%). Of the lung cancers diagnosed through the OP, 66.7% were diagnosed at an early stage (stage 1-2), 66.7% underwent surgical resection as the primary treatment modality, and 83.3% received treatment with radical (curative) intent. The proportion of lung cancers diagnosed at an early stage and undergoing radical treatment was substantially higher than for lung cancers diagnosed through usual care in Wales.





11. One participant underwent investigation for suspected lung cancer and was not subsequently diagnosed with lung cancer (1/547, false positive rate: 0.2% of those scanned). No participants underwent invasive tests or surgical resections for benign disease.

12. The rate of actionable incidental findings was 7.3 per 100 baseline LDCT scans. The rate of actionable incidental findings for recall scans was substantially lower at 2.1 per 100 recall scans.

13. Attendance at 12-month recall scans was initially low, but improved following targeted intervention by the LHC Navigator.

14. Participants who had been found to be at high risk of lung cancer but had not undergone a baseline LDCT scan during the initial scanning period were offered an additional opportunity to complete their pathway. This increased the percentage of eligible participants who underwent a baseline LDCT scan from 75% to 83%.

Smoking cessation

15. Smoking cessation interventions were integrated into the OP's pathway, including advice and opt-out referral to the local NHS Wales Help Me Quit (HMQ) service for current smokers.

16. Of participants who completed a telephone triage appointment, 341/1241 (27.5%) were current smokers. Of these, 85/341 (24.9%) accepted referral to the HMQ service.

17. The integrated smoking cessation pathway proved complex to deliver: almost one-third of participants who agreed to referral did so through a route in the LHC pathway that was not the main intended pathway. This highlights the need for multiple entry points to smoking cessation services in order to maximise benefits.

18. Logistical challenges were encountered during a period when co-delivery of smoking cessation interventions was attempted alongside LDCT scanning. These included being unable to site smoking cessation counsellors close to the CT scanner; participants allowing time for their attendance for a scan only; and variable attendance at CT scan appointments by current smokers.

19. Participation in the OP appeared to have beneficial effects on smoking cessation beyond those captured through HMQ referral: participation in the LHC programme was stated as a trigger for successful quit attempts by many participants who chose to do so without additional support.

Participant experience

20. Feedback was sought from participants through an online survey. Feedback was universally positive, with 100% of respondents rating their overall experience of the OP as “Very good” (85%) or “Good” (15%), and 100% stating they would Strongly Encourage (79%) or Encourage (21%) a family member or friend to attend.

21. Respondents reported that they received “Just the right amount” of information with their invitation to the service (100%), that they felt comfortable having their appointment on the telephone (97.2% Strongly Agreed or Agreed), and that they were given clear guidance on next steps through the process.

22. Quotes from the feedback received included:

    - “I found everything about the service very good from the first telephone call to receiving the results.”

    - “I'm so glad I went for this appointment. It has highlighted health problems I didn't realise I had. It's a must for anyone who gets the chance.”

23. Two participants who were diagnosed and treated for lung cancers found through the OP discussed their experiences with the CTM Communications Team and agreed for their stories to be shared.

24. A selection of invitees who did not participate in the OP were contacted to explore reasons for this. Reported reasons for not participating were varied, including a lack of interest or active choice not to participate; poor health or functional status precluding participation; and competing priorities such as work or family.

Healthcare professional experience

25. The Clinical Lead and Radiologist Lead for the OP had numerous key responsibilities that would need to be replicated at national and/or local level in a future roll-out.

26. The LHC Clinical Team's responsibilities centred around a weekly Screening Review Meeting, with key tasks including preparing, delivering, and undertaking actions generated from the meeting.

27. The Clinical Team consisted of a Specialty Doctor, a Specialist Nurse and a Navigator. The team reported good job satisfaction and felt that the skills mix of a varied workforce was advantageous. There was a substantial volume of work that did not require a qualified doctor or nurse which was undertaken by the LHC Navigator.

28. Thoracic radiologists who contributed to LDCT reporting in the OP found the use of Artificial Intelligence Nodule Detection software, a lung cancer screening-specific reporting template, and protocols and support networks to inform their reporting, to all have been valuable features of the OP that should be replicated in a national programme.

29. Primary care was supportive of the OP and recognised benefits in their patients who had participated through earlier detection of lung cancer and smoking cessation. An increase in demand for appointments to discuss risk modification due to the incidental finding of coronary artery calcification was noted, and requires consideration during planning for a wider roll-out.

30. Due to the limited scale of the OP, downstream lung cancer diagnostic services were able to absorb the workload related to screen-detected lung cancers. Incidental findings requiring secondary care resulted in referrals to a wide range of specialties, but the number of referrals to any one service was usually small. The biggest impact was on echocardiography for the finding of aortic valve calcification. Prior engagement with the Cardiology service was noted to have been important: to gain "buy-in" of support for the OP and to agree the local pathway for this finding.

Conclusions

31. The stated aims of the OP have been successfully delivered:

    a) Providing immediate health benefits to the pilot cohort

    Lung cancers detected through the OP were more likely to undergo treatment with radical (curative) intent than lung cancers diagnosed through usual care in Wales. Participants also benefited from smoking cessation support, and targeted actions for clinically significant incidental findings. Protocols used in the OP ensured that potential harms to participants were minimised.

    b) Providing advance learning and modelling to support and de-risk the roll-out of a future programme in Wales

    The planning and delivery of the OP has provided an exceptional level of insight into the complexities and challenges of delivering lung cancer screening. The successful delivery of the OP has demonstrated that such challenges can be overcome through careful planning, leadership and collaboration.

    c) Development of a core team to gain experience and be used as the nucleus for a future national roll-out

    Members of the clinical and non-clinical teams who planned and delivered the OP are contributing to work underway by Public Health Wales to plan implementation of a national lung cancer screening programme in Wales.

32. The LHC OP has provided assurance that:

    i. **Lung cancer screening can be delivered effectively within the Welsh healthcare system**

    ii. **Lung cancer screening is likely to yield benefits similar to those seen in studies, pilots and programmes elsewhere**

    iii. **A lung cancer screening programme would significantly improve lung cancer outcomes compared to current care in Wales**

1. INTRODUCTION

1.1 Background

Lung cancer is by far the leading cause of cancer deaths in Wales.[1] Low-dose computed tomography (LDCT) screening of people at high risk of lung cancer reduces lung cancer mortality by around 20%.[2] In 2022, the UK National Screening Committee (NSC) recommended that targeted LDCT screening for lung cancer should implemented in the four UK nations.[3]

Prior to the UK NSC recommendation, the Wales Cancer Network (now the National Strategic Clinical Network for Cancer/ "Cancer Network") commissioned a scoping report on Lung Health Checks (LHCs), a delivery model for LDCT screening for lung cancer.[4] This recommended development of an operational pilot (OP) as a key next step towards implementation in Wales.

Planning for the Lung Health Check Operational Pilot for Wales commenced following this, with agreement that the OP would be delivered by Cwm Taf Morgannwg University Health Board (CTM UHB) with support from the Cancer Network, and would deliver approximately 500 LDCT screening scans. The OP aimed to:

a. **Provide immediate health benefits to the pilot cohort.**

b. **Provide advance learning and modelling to support and de-risk the roll-out of a future programme in Wales.**

c. **Develop a core team who would gain experience to be used as the nucleus for a future national roll-out.**

The OP formally commenced in summer 2023, offering an initial telephone assessment to people in the North Rhondda area aged 60-74 years who had ever smoked, followed by a LDCT screening scan at a mobile CT scanner located Ysbyty Cwm Rhondda for those at high risk of lung cancer (figure 1a). Participants found to have suspected lung cancer on their screening scan underwent further investigation through the Royal Glamorgan Hospital lung cancer service. Those with small lung nodules on screening scans were recalled for surveillance scans after 3 and/or 12 months.

The inception, planning, and delivery of the OP to the point of baseline and 3-month recall scans has previously been reported in Evaluation Report 1,[5] available here:

https://executive.nhs.wales/functions/networks-and-planning/cancer/workstreams/lung-health-check/

Figure 1a: Mobile CT scanner located at Ysbyty Cwm Rhondda.

1.2 Scope of this report

The present report, Evaluation Report 2, is the second and final evaluation report on the Lung Health Check Operational Pilot for Wales and complements the content of Evaluation Report 1. This report covers:

- The remaining clinical activity of the OP not previously covered in Evaluation Report 1, including results from 12-month recall scans, final screening results, and the effect of offering participants who did not originally complete their pathway an additional opportunity to do so;
- Integration of smoking cessation pathways in the OP;
- Participants' experience of the OP; and
- Healthcare professionals' experience of the OP.

2. CLINICAL ACTIVITY

2.1 Introduction

The OP was designed to deliver approximately 500 baseline LDCT scans to its target population. It was expected that some participants who underwent a baseline LDCT scan would be found to have small lung nodules requiring surveillance. Small lung nodules are often benign, but those that grow over time have a high probability of being early-stage lung cancers.[6] As such, recall scans after 3 and/or 12 months for participants with small lung nodules requiring surveillance were included as part of the OP pathway.

Activity from baseline and 3-month recall scans has previously been reported in the Lung Health Check Operational Pilot for Wales Evaluation Report 1.[5] Here the delivery and outcomes of 12-month recall scans within the OP are reported, with a summary of final results of LDCT screening in the OP as a whole.

In addition, during the OP the opportunity arose to deliver a number of additional baseline LDCT scans. It was determined to offer these scans to people who had completed a telephone triage appointment and been found at high risk of developing lung cancer, but who had not undergone a baseline LDCT scan during the original scanning period. This cohort has not been included in the final results summary for the OP due to the later delivery of their baseline LDCT scans and some pathways being incomplete at the time of writing. Nevertheless, important insights were gained from this activity, particularly the potential for greater participation in screening when additional opportunities to attend are offered to participants. A summary of this activity is included at the end of this section.

2.2 Twelve-month recall scans

2.2.1 Planned activity

Sixty-two 12-month recall scans were indicated from baseline and 3-month recall scans combined (figure 2a). This equates to 11.3% of those undergoing a baseline LDCT scan having a 12-month recall scan indicated.

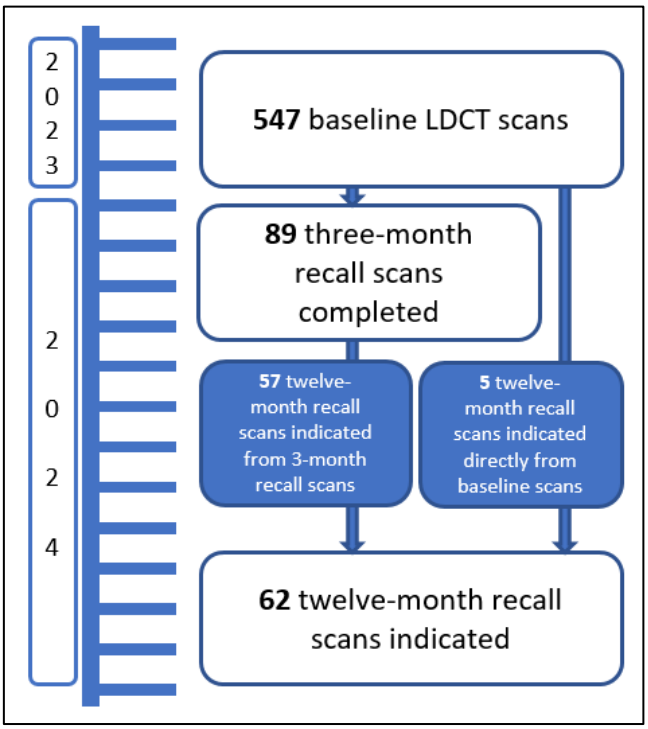


Figure 2a: Pathway summary for participants with a 12-month recall scan indicated.

2.2.2 Delivered activity

The mobile CT scanner that had previously undertaken baseline and 3-month recall scans returned to Ysbyty Cwm Rhondda to undertake 12-month recall scans between September and November 2024, with one day of scanning per month.

Of those for whom a 12-month recall scan was indicated, 54/62 (87.1%) underwent this within the OP. Table 2a summarises attendance for 12-month recall scans delivered within the OP. Participants who did not attend were offered a further scanning date when this was possible. Following poor attendance at the first 12-month recall scanning date the LHC Navigator undertook a targeted intervention, contacting those who had not attended by telephone to explore the reasons why and their understanding of the indication for the scan, encourage completion of their pathway, and to facilitate rebooking of the scan where necessary. For later 12-month recall scanning dates the LHC Navigator also pro-actively contacted participants to remind them of their appointment and to encourage attendance. This led to improved appointment attendances rates at the later scanning dates (77% and 81% at later scanning dates, vs. 43% at the first scanning date). This intervention by the LHC Navigator is discussed further in section 5.3.2.

Table 2a: Appointments and attendances for 12-month recall scans. Note that the number of scan appointments (78) is greater than the number of 12-month recall scans indicated (62) due to participants being offered an additional appointment if they did not attend their first appointment.

Scanning date	Scan appointments	Scan appointments attended
30/9/24	21	9 (43%)
31/10/24	30	23 (77%)
30/11/24	27	22 (81%)
Total	**78**	**54 (69%)**

Of participants for whom a 12-month recall scan was indicated, 8/62 (12.9%) did not undergo this within the OP. Reasons for this are summarised in table 2b.

Table 2b: Reasons for non-completion of 12-month recall scans.

Reason for non-completion	Number (% of non-completers)
Could not attend scanning date	5 (62.5%)
Other commitments	4 (50%)
Unwell on the day	1 (12.5%)
Did not attend	1 (12.5%)
Under active investigation for cancer	1 (12.5%)
Deceased (non-lung cancer cause)	1 (12.5%)
Total	**8**

Following completion of 12-month recall scans within the OP, the six participants who could not or did not attend their 12-month recall scan were contacted by letter to offer an out-of-programme scan to complete their pathway. Three months after sending these letters, 5/6 had contacted the LHC team and undergone an out-of-programme scan to complete their pathway. Therefore, after exclusion of two participants who were no longer suitable for a 12-month recall scan (1 under active investigation for cancer, 1 deceased), 59/60 (98.3%) of participants for whom a 12-month recall scan was indicated activity ultimately underwent this.

2.2.3 Outcomes of 12-month recall scans

The primary outcomes of the fifty-four 12-month recall scans delivered within the OP are summarised in Figure 2b. No further suspected lung cancers were identified. Six participants had a new or evolving abnormality (such as a newly identified lung nodule) that did not require immediate investigation but did warrant a further surveillance scan in three months. Twenty participants had findings requiring a further surveillance scan in a further 12 months (24 months after baseline scans). Reasons for this included sub-solid nodules which require prolonged surveillance, or solid nodules where volumetry measurements were unreliable and were therefore not suitable for discharge after 12 months of surveillance. Participants requiring surveillance beyond the completion of the OP will be monitored through the Royal Glamorgan Hospital Virtual Nodule Clinic. Only one actionable incidental finding was detected from 12-month recall scans (1/54, 1.9%).

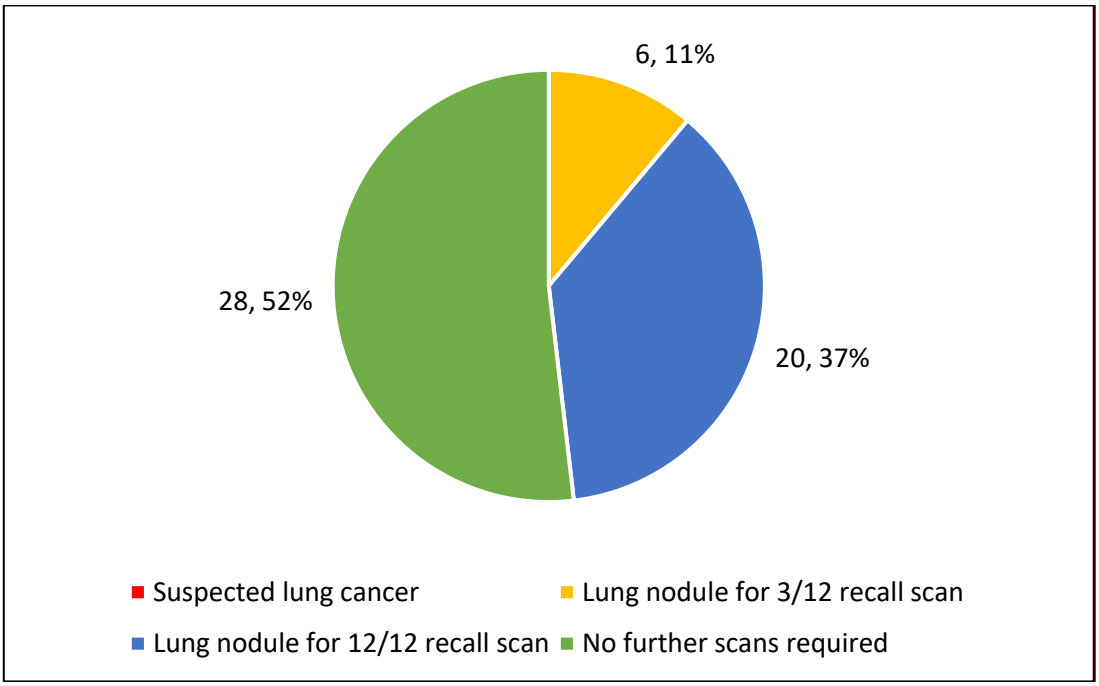


Figure 2b: Primary outcomes of 12-month recall scans delivered within the OP. Note that in an ongoing programme, participants who did not require further scans in the OP would be offered their next screening round after a 2-year interval until ageing out or otherwise exiting the programme.

2.2.4 Discussion

2.2.4.1 Attendance

Following completion of baseline and 3-month recall scans in the OP, a 12-month recall scan was indicated for 62 participants. At the point of delivery, two participants were no longer suitable to undergo this and of the remainder, 59/60 (98.3%) ultimately underwent a 12-month recall scan. However, there were challenges achieving this rate of participation, with less than half of appointments on the first day of 12-month recall scans attended. Reasons for this may include the longer time period between this scanning activity and the participants' previous interactions with the OP, or a sense of reassurance from previously receiving a stable 3-month recall scan result. It was only through targeted intervention by the LHC Navigator and offering several appointments to some participants that this high rate of participation was achieved.

These findings suggest that a high participation rate in 12-month recall scans is possible, but that clear communication, targeted intervention to support attendance, and flexibility and convenience of appointments are key factors required to achieve this.

2.2.4.2 Cancer detection

No additional lung cancers were detected through 12-month recall scans in the OP. This is likely due to the relatively limited size of the OP cohort, and does not diminish the importance of undertaking such recall scans; the value of monitoring small lung nodules to identify early-stage lung cancers is well-established from larger cohorts,[6–8] and remains an important aspect of lung cancer screening.

2.2.4.3 Incidental findings

Only one new actionable incidental finding was detected through 12-month recall scans in the OP. This demonstrates that the greatest burden of workload for incidental findings occurs from baseline scans (7.3 actionable incidental findings per 100 scans), with a much lower actionable incidental finding rate at recall scans (2.2 per 100 three-month recall scans; 1.9 per 100 twelve-month recall scans; 2.1 per 100 recall scans overall). This would also be expected to be the case at subsequent screening rounds. A large and sudden spike in clinical activity due to incidental findings from roll-out of a screening programme could be mitigated through a phased approach to implementation – introducing new participants undergoing baseline scans over time rather than scanning the full eligible cohort immediately.

2.2.4.4 Scanning intervals

The pathway design for the OP was intended to be simple: participants with small lung nodules on their baseline scan would undergo recall scans three and/or twelve months after their baseline scan. However, the real-world delivery of the OP has proven to be more complicated. Some participants developed new findings on their recall scans, requiring a further scan three months from that point. Some participants had nodules that resolved on recall scans; such participants would require a further scan two years from the point of that recall scan (rather than from the point of their baseline scan) in an ongoing programme. This mirrors the experience of the NHS England Targeted Lung Health Check programme (NHSE TLHCP), where an initially-simple pathway has been extensively revised to cover a wide range of scenarios.[9] The key learning from this has been that the interval to the next scan in a lung cancer screening programme needs to be determined following each scan, rather than following a pre-ordained pattern planned from the baseline scan. This approach would result in some participants undergoing additional scans (e.g. where a new nodule appears on a recall scan), but would reduce the number of scans for others (e.g. where a nodule had resolved on a recall scan, the next scan could occur two years after the recall scan rather than the baseline scan).

2.3 Final screening results

2.3.1 Summary of key results

Table 2c summarises a selection of key final results following completion of planned scanning activity in the OP. A small number of participants continue to be on surveillance programmes outside of the OP for findings discovered through the OP, and as such there may be further evolution of the results below. However, the findings below are reported as of early 2025 as agreed in the OP's evaluation plan.

Table 2c: Key results from clinical activity in the OP.

Metric	Result
Participation	
Invitees who completed telephone-based risk assessment	**1241**/2128 (58.3%)
Participants referred for a baseline LDCT scan who underwent this (excluding the *additional opportunity* cohort)	**547**/608 (90.0%)
Total LDCT scans completed within programme (including baseline, 3-month and 12-month recalls scans; not including the additional opportunity cohort or out-of-programme recall scans)	**690**
Lung cancers	
Participants who underwent investigation for suspected lung cancer due to findings on a screening scan	**13**/547 (**2.4%**)
Participants diagnosed with lung cancer following investigation due to findings on a screening scan	**12**/547 (**2.2%**)
Early-stage (stage 1-2) lung cancers	**8**/12 (**66.7%**)
Lung cancers that received treatment with radical (curative) intent	**10**/12 (**83.3%**)
Lung cancers that underwent surgical resection as the primary treatment modality	**8**/12 (**66.7%**)
Other findings	
% of participants who completed a baseline scan for whom a recall scan was indicated for surveillance of small lung nodules	**17.6%**
Rate of actionable incidental findings from baseline LDCT scans	**7.3** per 100 scans
Rate of actionable incidental findings from recall LDCT scans (3- and 12-months combined)	**2.1** per 100 scans
Harms	
False-positives (participants who underwent investigation for suspected lung cancer who were not subsequently diagnosed with lung cancer)	**1**/547 (**0.2%**)
Invasive tests for participants who were not subsequently diagnosed with lung cancer	**0 (0%)**
Surgical resections for benign disease	**0 (0%)**

2.3.2 Discussion

The results above remain largely unchanged since the publication of Evaluation Report 1, and as such the conclusions from that report remain valid. Lung cancers diagnosed through the OP were far more likely to be diagnosed at an early stage and undergo treatment with radical (curative) intent than lung cancers diagnosed through usual care in Wales (figures 2c-d). This mirrors the findings of lung cancer screening activity elsewhere, including the large randomised controlled trials that demonstrated significant reductions in lung cancer mortality with screening.[2,8,10] The safety profile of care in the OP was excellent, with only one participant having a false-positive scan and no participants undergoing invasive tests or surgical resection for benign disease.

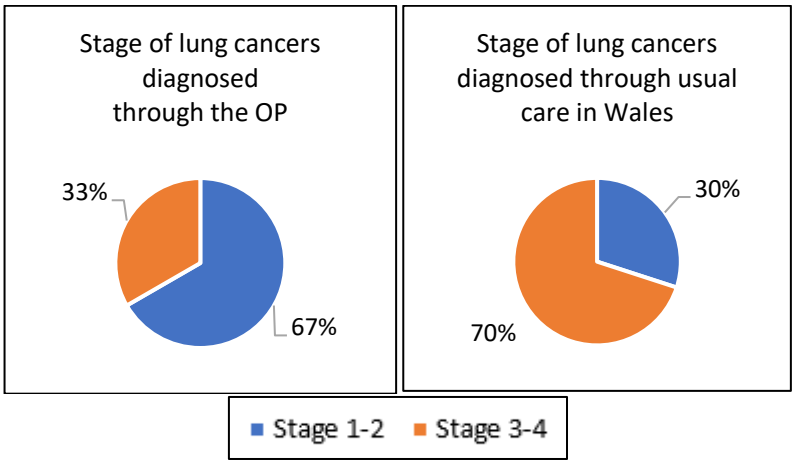


Figure 2c: Stage of lung cancers diagnosed through the OP (left), and through usual care in Wales (right; National Lung Cancer Audit, 2022 cohort)[11].

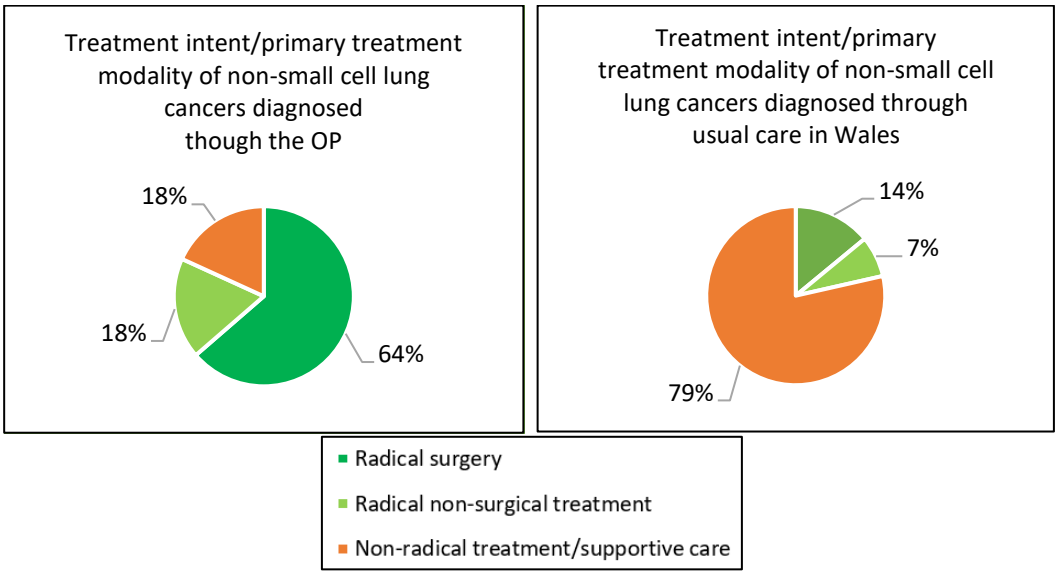


Figure 2d: Treatment intent and primary treatment modality for non-small cell lung cancers diagnosed through the OP (left) and detected through usual care in Wales (right; National Lung Cancer Audit, 2022 cohort)[11]. Non-small cell lung cancer accounted for 91.7% of lung cancers diagnosed through the OP, and 90.6% of lung cancers diagnosed in Wales in 2022. Data on radical treatment rates for small cell lung cancer is not available from the National Lung Cancer Audit, therefore treatment intent for non-small cell lung cancers only is displayed here.

2.4 Additional opportunity

2.4.1 Pathway

Following completion of baseline and 3-month recall scans in the OP, an opportunity arose to undertake a limited number of additional scans in summer 2024. After consideration of a number of options of how to utilise this additional capacity, it was agreed to re-invite participants who had been part of the initial cohort, had completed a telephone triage appointment and been found to be at high-risk of developing lung cancer, but had not undergone a baseline LDCT scan. Those with known ongoing exclusion criteria present (e.g. had undergone a CT thorax in the preceding 12 months) were excluded. Eligible participants were sent an open invitation letter explaining the additional opportunity and asked to telephone the service if they wished to participate.

2.4.2 Results

Figure 2e summarises participation in the additional opportunity. Following exclusion of those who were ineligible, 184 open invitation letters were sent. Of these, 60/184 (32.6%) responded and completed a telephone nurse assessment, all of whom were eligible and referred for a baseline LDCT scan. Of these, 59/60 (98.3%) went on to have a baseline LDCT scan.

One suspected cancer was identified from this cohort, which proved to be cancer from a non-lung tumour site. Nine participants had lung nodules reported on LDCT (9/59, 15.3%); following Screening Review Meeting (SRM) discussion only 5/59 (8.5%) required recall surveillance scans. Potentially actionable incidental findings were identified on 6/59 scans (10.2%), with 4/59 (6.8%) remaining actionable following SRM discussion. These results are broadly in keeping with those seen in the original cohort.

2.4.3 Discussion

Of participants who were found to be at high risk of developing lung cancer at telephone triage, 547/860 (69.3%) underwent a baseline LDCT scan during the initial scanning period. Of those who did not undergo a baseline LDCT scan during the initial period most were due to the presence of exclusion criteria or being unable to attend within the limited time-frame of the initial scanning period. At the point of the additional opportunity being offered, 129 participants had ongoing exclusion criteria present; of those remaining, the additional opportunity increased the number of eligible participants who underwent a baseline scan from 547/731 (74.8%) to 606/731 (82.9%) (+59, +8.1% absolute change). The response rate to the open invitation for the additional opportunity was just under one-third of those invited, with the subsequent completion rate to LDCT extremely high at 98.3%.

The findings from the additional opportunity demonstrate that participants who do not initially complete their pathway are often willing and able to do so if offered further opportunities. Many participants were unable to originally complete their pathway originally due to other commitments such as work, family or planned holidays, or due to acute illness at the time of their planned scan. Whilst attempts were made within the OP to accommodate these scenarios (e.g. by offering a later scanning date where one was available), this was not always possible due to the time-limited nature of the OP. The findings here show that participation in lung cancer screening can be meaningfully increased through additional appointment opportunities. Flexibility to reschedule inconvenient appointments, and repeat opportunities for participants who do not initially complete their pathway, should be considered for a future national programme.

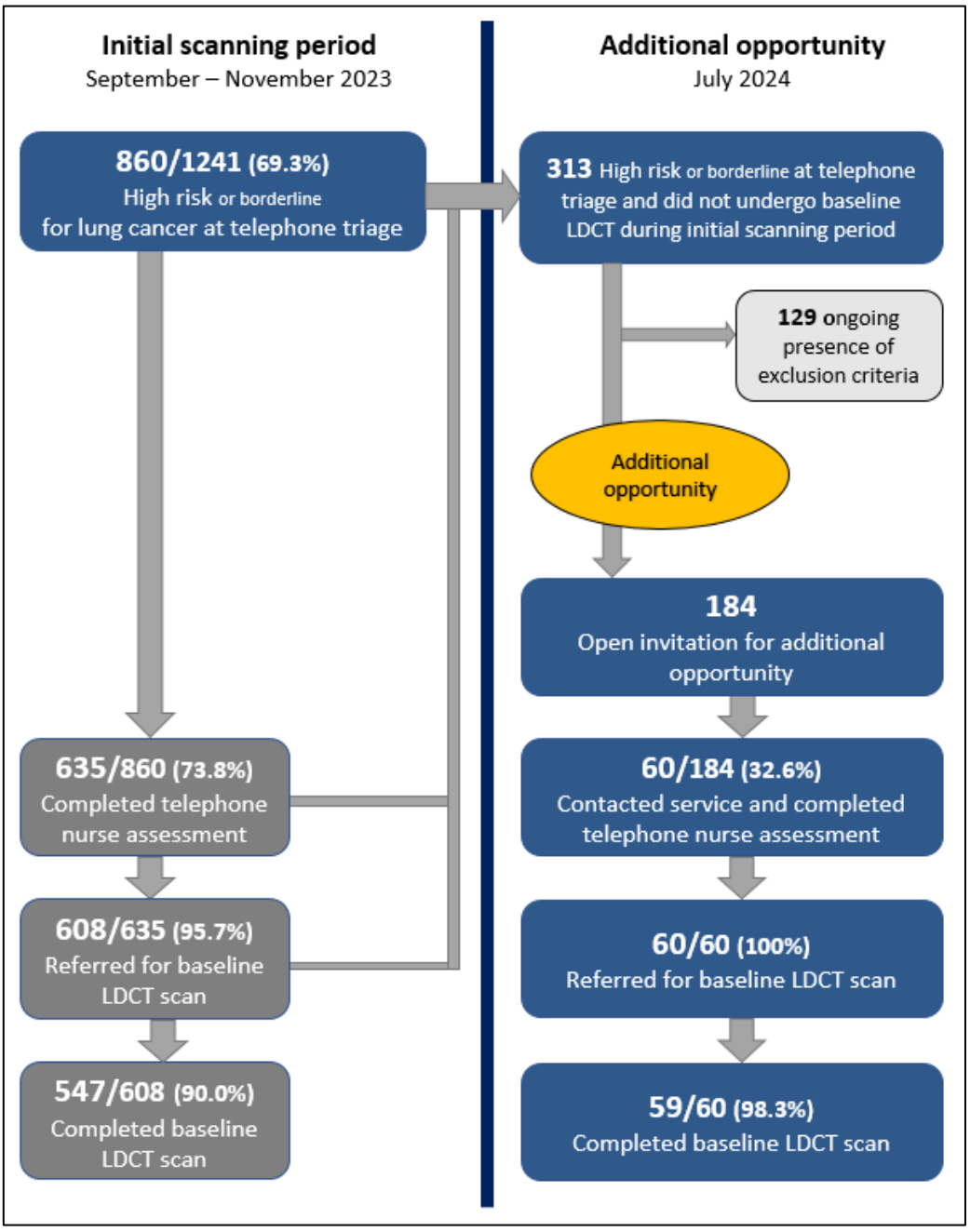


Figure 2e: Throughput of the additional opportunity for participants in July 2024.

3. SMOKING CESSATION

3.1 Background

Despite smoking prevalence progressively falling over recent decades, smoking remains the leading preventable factor in deaths worldwide,[12,13] and is the leading cause of lost years of healthy life in Wales.[14] Approximately 7 out of 10 cases of lung cancer in the UK are attributable to smoking.[15] However, the health effects of smoking extend far beyond lung cancer risk, also increasing the risk of cancers of the colon, bladder, oesophagus, head and neck, pancreas, stomach and kidney amongst others.[15] Smoking is also a major contributor to cardiovascular and respiratory diseases and deaths.[16,17] In Wales, more than one in ten deaths amongst people aged over 35 in Wales and more than 17,000 hospital admissions per year are attributable to smoking.[14] The economic cost of smoking to Wales was estimated to be £790.6 million in 2013, with an upper estimate of over £1 billion.[18]

The benefits of smoking cessation, and the cost-effectiveness of smoking cessation support, are well-established.[19,20] Lung cancer screening affords an opportunity to engage people who smoke and to offer them smoking cessation support; indeed, integration of smoking cessation services is specified in the UK NSC's recommendation for lung cancer screening.[3] Lung cancer screening and smoking abstinence have a synergistic effect on reducing lung cancer mortality; in the National Lung Screening Trial, people who underwent lung cancer screening and abstained from smoking long-term had almost double the reduction in lung cancer mortality compared to those who underwent screening and continued to smoke.[21]

There are, however, challenges to integrating smoking cessation support with lung cancer screening. Firstly, smoking has become increasingly stigmatised as smoking prevalence has fallen, and the majority of lung cancer patients report experiencing significant levels of stigma due to the relationship between lung cancer and smoking.[22] This represents a psychosocial barrier to participation in lung cancer screening, particularly amongst people at greatest risk. Prominent, up-front messaging about smoking was reported to be off-putting for current smokers by Patient and Public Involvement groups involved in the development of participant-facing materials for the OP. Therefore, integration of smoking cessation messaging and support alongside lung cancer screening must be sensitively timed, placed and worded to avoid disengaging potential participants.

A second concern had been that lung cancer screening could offer a "license to smoke", with people who smoke reassured that screening can offer protection against death from lung cancer, therefore reducing their incentive to stop smoking. This has not been the case: current smokers who participate in lung cancer screening may be more motivated to accept smoking cessation interventions, indicating that screening offers a "teachable moment" to trigger a quit attempt. Smoking cessation rates in lung cancer screening trials have been variable, but have generally been higher in those undergoing screening than background population quit rates.[4,23]

3.2 Pathway

3.2.1 Possible pathways

The most effective, and cost-effective, model for delivering integrated smoking cessation services with lung cancer screening has not been clearly established. More intense intervention generally leads to greater engagement, but requires greater resource to deliver.[4,24] Provision in lung cancer screening activity in England has been variable (table 3a).

Table 3a: Smoking cessation offers included as part of different LHC services in England.

Engagement	
Sign-posting only	Sign-posting, through participant-facing materials or verbally, to local pharmacy support and/or smoking cessation service. Action is required from the participant to initiate support.
Active referral	Details of participants are passed from the screening service to a smoking cessation service with their agreement. The smoking cessation service will usually then initiate contact. The offer of referral may be framed as "opt-in" or "opt-out".
Very Brief Advice	Evidence-based intervention as defined by the National Centre for Smoking Cessation and Training,[25] designed to increase quit attempts. Delivered at triage or nurse Lung Health Check step, in combination with sign-posting or active referral.
Service	
Local pharmacy	Smoking cessation support offered through local pharmacies. Usually sign-posted to from the LHC service.
Usual smoking cessation service	A dedicated smoking cessation service. In England this is usually delivered by Local Authorities. In Wales this is delivered by NHS Wales under the Help Me Quit brand.[26] Support varies from service to service and may include one-to-one telephone support, group sessions and others.
Immediate telephone support	Telephone contact made by smoking cessation service immediately (same day) following attendance for a Lung Health Check or screening scan. This model was used in the QuLIT2 study.[27]
Immediate in-person support	Provision of immediate smoking cessation support during an in-person attendance for a Lung Health Check or screening scan. This model was used in the QuLIT1 study[28] and the Yorkshire Enhanced Stop Smoking (YESS) study.[29] This has variably included immediate provision of nicotine replacement therapy and/or e-cigarettes.

3.2.2 Intended pathway

At the time of planning for the OP, there was little evidence available to inform what smoking cessation integration model should be used; progress reports from the NHSE TLHCP had reported difficulties with data collection on smoking cessation integration,[30] and results from the QuLIT and YESS studies were not yet available. Therefore, the smoking cessation pathway was designed pragmatically based on available evidence, guidance and expert opinion available at the time.

Features of the pathway included:

- Limited mention and destigmatisation of smoking in pre-invitation materials – "no judgements on smoking" mentioned on leaflet
- Very Brief Advice (VBA) as part of telephone triage (TT)
- Further discussion on smoking at telephone nurse assessment (TNA)
- Opt-out active referral of current smokers to the NHS Wales Help Me Quit (HMQ) service
- Written information about how to self-refer for support in participant information booklet and results letters

The intention was to engage people who smoke in a non-confrontational manner, using the National Centre for Smoking Cessation and Training's VBA as an entry point, followed by opt-out referral to the existing smoking cessation service in CTM UHB. It was also aimed to maximise the opportunities for engagement by giving participants the opportunity to be referred at multiple points of the pathway. The intended pathway is summarised in figure 3a.

When a referral was received by the HMQ service, a text message would be sent to the participant immediately, followed by a telephone call from the service to the participant. The options of HMQ telephone support or local pharmacy support would be discussed with the participant. Those opting for HMQ telephone support would be offered an assessment session followed by treatment sessions with the aim of successfully undertaking a quit attempt.

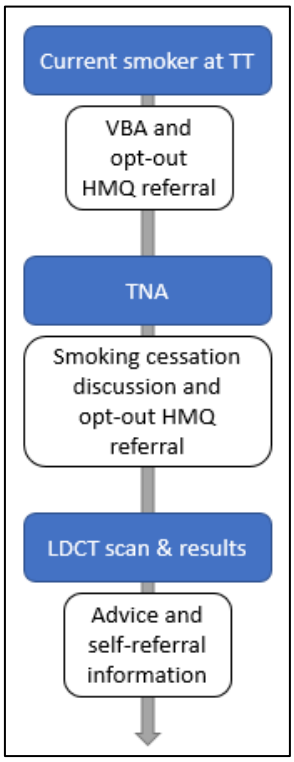


Figure 3a: Intended smoking cessation pathway for the OP. TT = Telephone Triage, VBA = Very Brief Advice, HMQ = Help Me Quit, TNA = Telephone Nurse Assessment, LDCT = low-dose CT.

3.2.3 Delivered pathway

There were ultimately some differences between the intended and delivered smoking cessation pathway in the OP; some differences were intentional, whilst others occurred due to complexities that only became apparent at the time of delivery. Firstly, the usual practice in LHC programmes delivered by the service provider is for participants who express an interest in smoking cessation support at a triage stage to discuss this further with a nurse at the subsequent pathway step, who then refers the participant to the smoking cessation service. This also occurred during the OP, with only those who were not eligible to proceed to TNA being referred directly to HMQ at the TT stage. However, not all participants who were at high risk of lung cancer at TT went on to complete a TNA, either due to the presence of exclusion criteria or due to participation attrition. It was identified that this could represent a missed opportunity for smoking cessation intervention in participants who were eligible for but did not complete TNA. This group was re-contacted at a later date to re-offer smoking cessation support.

Secondly, during the third week of baseline scans an opportunity arose for HMQ to have a smoking cessation counsellor present on site at Ysbyty Cwm Rhondda on some scanning dates. This proved logistically challenging to implement given that LDCT scans were being undertaken on a mobile scanner situated in the hospital car park, without any immediately adjoining facilities such as a consultation room or waiting area. These scans were undertaken in late November in inclement weather; as such, outdoor solutions such as a stall near the scanner or a temporary gazebo were not considered viable. Ultimately, a HMQ stand was located inside the hospital main entrance, approximately a 2-minute walk from the scanner location, with a consultation room that could be used by the counsellor located near the stall (figure 3b). Members of the LHC clinical team attended the scanner on these dates to try to engage current smokers and encourage them to visit the HMQ stand and speak to a smoking cessation counsellor.

Figure 3b: HMQ stand located at Ysbyty Cwm Rhondda.

The final delivered smoking cessation pathway is summarised in figure 3c.

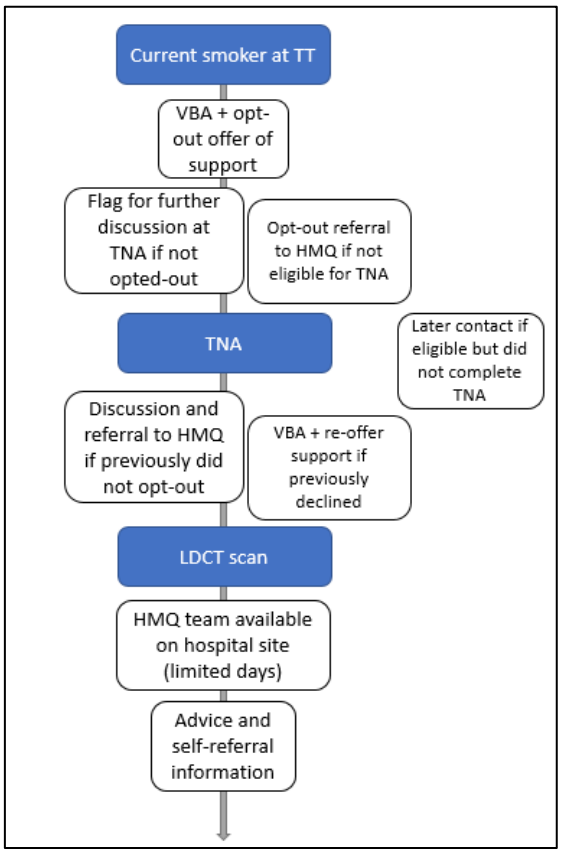


Figure 3c: Delivered smoking cessation pathway in the OP. TT = Telephone Triage, VBA = Very Brief Advice, HMQ = Help Me Quit, TNA = Telephone Nurse Assessment, LDCT = low-dose CT.

3.3 Results

3.3.1 Referrals from the OP to HMQ

Figure 3d summarises referrals from the OP to HMQ. In total, almost a quarter (85/341, 24.9%) of current smokers who participated in the OP were referred to HMQ.

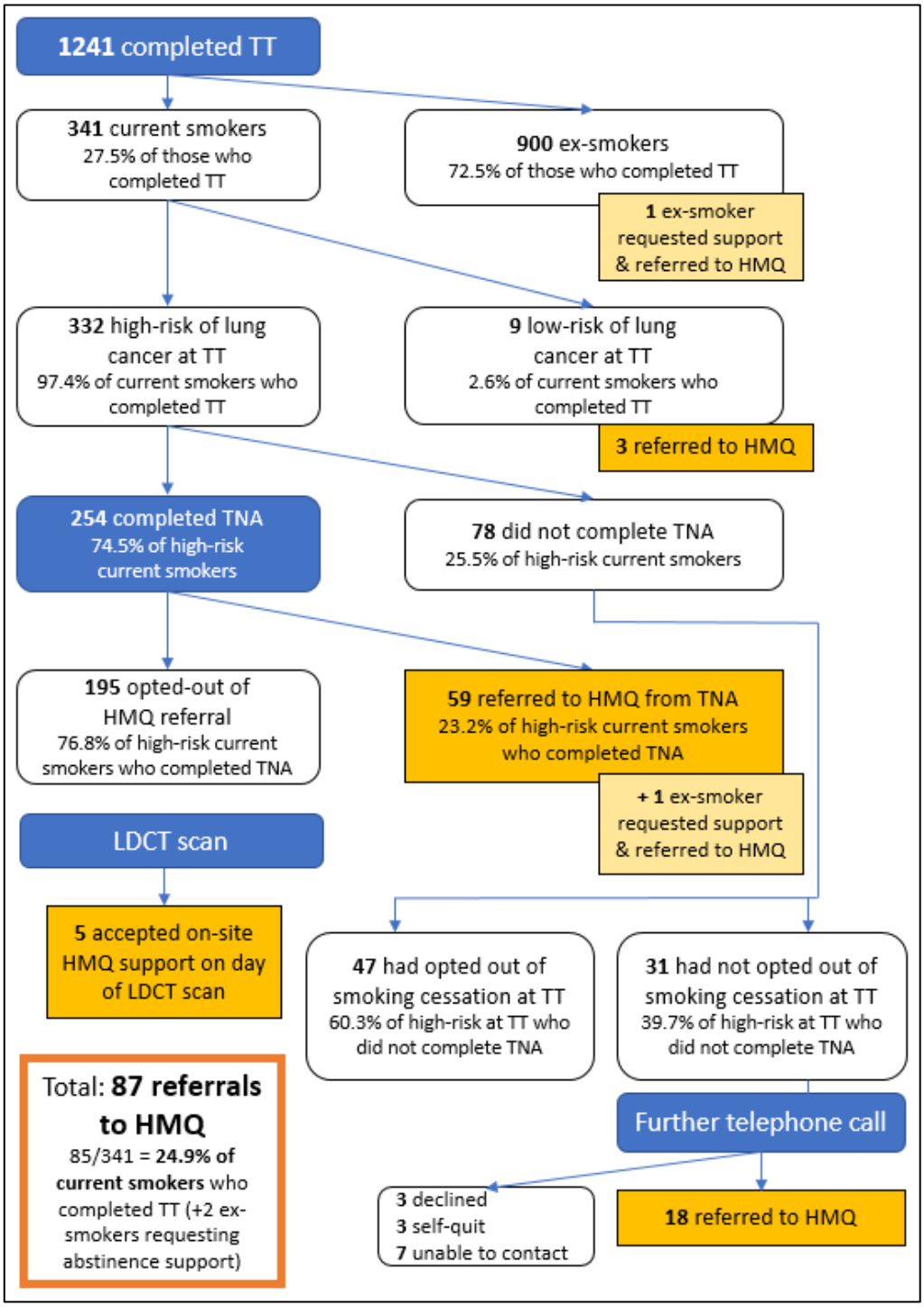


Figure 3d: Referrals from the OP to Help Me Quit. TT = telephone triage, HMQ = Help Me Quit, TNA = telephone nurse assessment, LDCT = low-dose CT.

The majority of referrals occurred after Very Brief Advice at TT and discussion with a nurse at TNA (59/87 referrals; 69.4%). However, almost one-third of referrals *did not* come through this most common pathway route. In particular, a quarter (25.5%) of current smokers who were found to be at high risk of lung cancer at TT did not go on to complete a TNA, either due to the participant not engaging further with the OP, or due to the presence of screening exclusion criteria being found between the TT and TNA stages. Of these, more than a third (31/78, 39.7%) had expressed an interest in smoking cessation referral by not opting out of this at the TT stage, more than half of whom (18/31, 58.1%) agreed to HMQ referral after a follow-up telephone call from the LHC Clinical Team. This highlights the importance of actioning referrals at the point participants agree to it, rather than deferring this to a later point in the pathway. It also highlights that having multiple possible points of referral from screening to smoking cessation services, whilst increasing complexity, can substantially increase the number of current smokers referred.

3.3.2 On-site smoking cessation support

Members of the LHC Clinical Team were present in-person at the LDCT scanner for parts of the third week of baseline LDCT scans, undertaken 27th-30th November 2023, with the aim of encouraging participants who were current smokers to engage with the HMQ team located near the hospital entrance. The Clinical team were present for 44/166 booked LDCT appointments on these days. This limited presence was due to competing commitments and inclement weather during this period. Of the booked LDCT appointments the Clinical Team were present for, 24/44 (54.5%) were for current smokers. Of these, 16/24 (66.7%) attended their LDCT scan appointment.

Of current smokers who attended their LDCT scan appointment during this period, 6/16 (37.5%) were willing to discuss their smoking with the Clinical Team. Four went on to see the on-site HMQ team, and two agreed to referral to HMQ for telephone contact at a later time. One of the six who engaged had already been referred to HMQ at an earlier point in the LHC pathway; the remaining five were new referrals who had previously declined referral to HMQ.

Table 3b describes the team's reflections on this part of the OP with some considerations of how delivery could be improved.

3.3.3 Referral turn-around times

Due to differences between the intended and delivered smoking cessation pathways described in section 3.2.3, delays occurred between the offer of HMQ referral and the referral actually occurring. This led to a median time from offer to actual referral of 22 days.

Once a referral was received by HMQ, participants were sent a text message immediately, followed by a later telephone call. A first call attempt was made within two working days to 93% of participants, and 89% of referrals were closed within five working days (by either completing assessment, opting for pharmacy support or declining further input).

Table 3b: Reflections and considerations for on-site provision of smoking cessation

Reflection	Consideration
Current smokers were pre-identified by cross-referencing LDCT appointment lists with smoking status data gathered at preceding pathway steps.	Grouping appointments for current smokers together could improve efficiency of on-site engagement.
Participants were not aware of the possibility of engagement regarding smoking or the availability of the HMQ team on-site. Some declined discussion stating they had only allowed time for the LDCT scan.	Participants could be informed of the availability of smoking cessation engagement on-site prior to their appointment. However, most participants who engaged on the day had declined HMQ referral previously, therefore it is uncertain whether this would have any effect for this group.
	Appointment times could be structured to factor in time to discuss smoking cessation around the LDCT scan.
The HMQ team were located some distance from the LDCT scanner; the services were not truly co-located. Some participants declined to engage as they had parked adjacent to the scanner and did not wish to walk round to the HMQ team. Those that did engage in person had all attended by public transport and were waiting for a return journey.	True co-location of smoking cessation services, connected or adjacent to the LDCT scanner, could improve engagement.
A free hot drink was offered as an incentive to visit the HMQ team. This appeared to have little effect, with practicalities (having free time whilst waiting for public transport, already having to walk in the direction of the HMQ team) appearing to be the dominant factors in whether people engaged.	Careful planning of the flow of participants through this step of the pathway, and on-the-ground arrangement of the smoking cessation offer, appeared more important than offering incentives.
Whilst the HMQ team were on-site they also had contact with passing patients, relatives and staff members outside of those attending for LDCT scans. This resulted in several additional people accepting HMQ support.	Whilst better co-location of smoking cessation services with the LDCT scanner would be preferable, visibility of the service to encourage "passing trade" could yield wider benefits and maximise efficient use of resources.

3.3.4 Outcomes of referrals

Figure 3e summaries the outcomes of HMQ referrals from the OP. Outcome data was obtained from the QuitManager system for participants who opted for HMQ telephone support. A follow-up telephone call was made by the LHC Clinical Team to those who opted for local pharmacy support.

For those with outcome data available, 16/26 (61.5%) participants who opted for HMQ telephone support became treated smokers (defined as attending at least one treatment session and setting a quit date), and 10/26 (38.5%) self-reported to have successfully quit at 4 weeks. For participants who stated they would pursue local pharmacy support and had outcome data available, 5/10 (50%) actually accessed pharmacy support, and 2/10 (20%) self-reported to have successfully quit. In total, 12/87 (13.8%) of current smokers who accepted referral to HMQ self-reported to have quit at follow-up, though the true figure may be higher due to difficulties obtaining follow-up data.

3.4 Discussion

The OP has given a number of insights into the benefits and challenges of integrating smoking cessation pathways with lung cancer screening.

Firstly, over a quarter of current smokers who completed TT accepted referral to HMQ but almost one-third of these did not come through the most common pathway route (referral following TNA). The OP has highlighted the importance of including multiple opportunities in the screening pathway for discussion and offer of referral for smoking cessation support if benefits are to be maximised.

Secondly, whilst including multiple opportunities for smoking cessation referral did increase the number of referrals made, this additional complexity led to differences between the intended and delivered pathways that resulted in delays between participants first agreeing to referral and referrals actually occurring. It is uncertain what effect this had on subsequent engagement and quit attempts. However, since the plans for the OP were finalised the results of the QuLIT1 & 2 studies, which investigated the effect of immediate smoking cessation support in a LHC pathway, have been published.[27,28] QuLIT1 offered same-day, in-person smoking cessation support with immediate access to NRT to people attending for a LHC, whilst QuLIT2 offered same-day telephone-based support. In both studies the control arm involved VBA and sign-posting to smoking cessation services (rather than active referral). In both studies, quit rates were significantly higher after 3 months for those offered immediate support: 29.2% vs 11% in QuLIT1, and 21.1% vs. 8.9% in QuLIT2. However, it is not possible to conclude from these studies how much of the difference was due to the immediacy of support and how much was due to the active offer of support as opposed to sign-posting only. Nevertheless, given the consistent finding of increased quit rates compared to usual care across these two studies, it is likely that avoiding delays between agreeing to referral and support commencing would lead to improved outcomes.

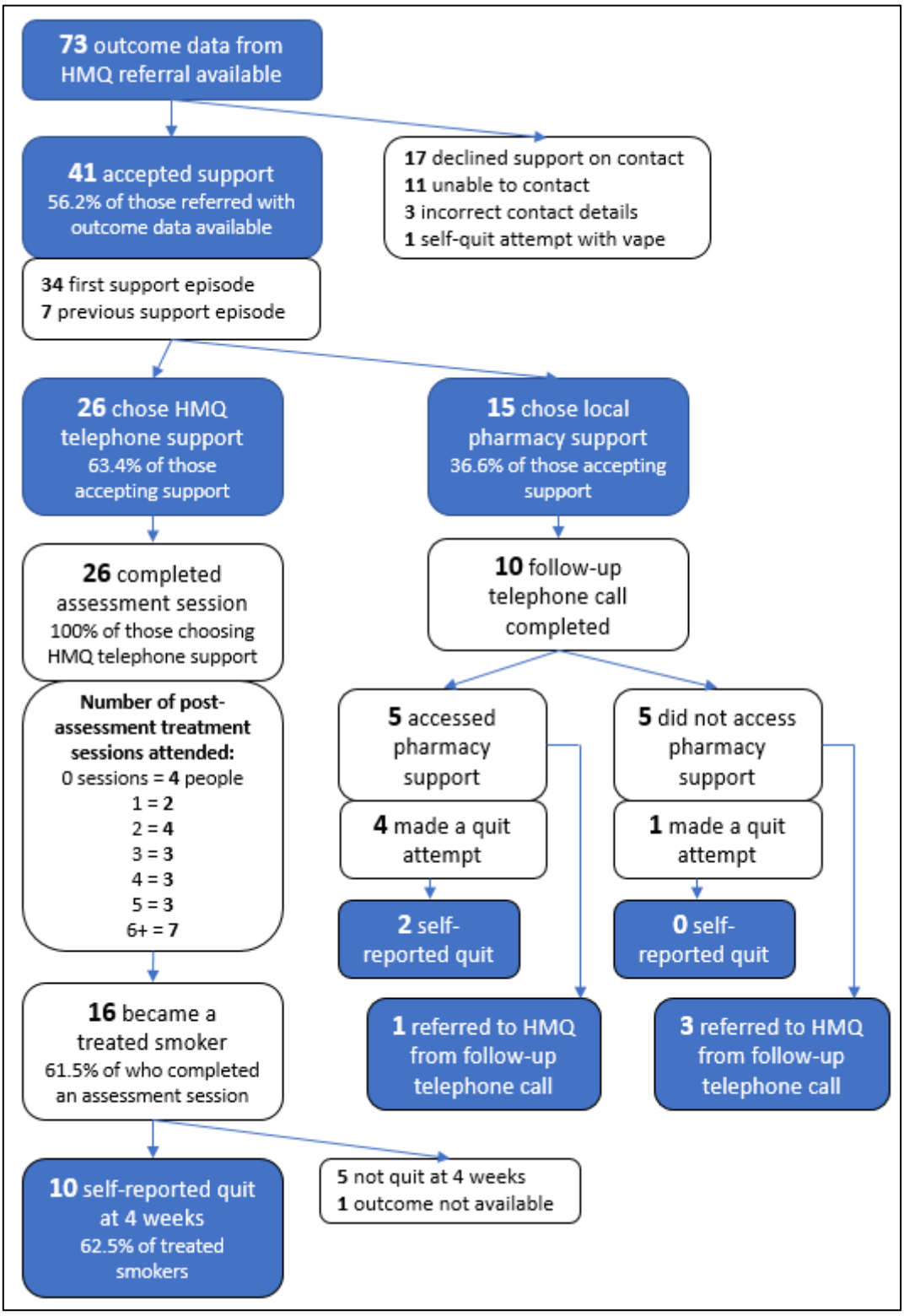


Figure 3e: Outcomes of HMQ referrals from the OP.

Thirdly, for those with outcome data available, HMQ telephone support appeared to be more effective than opting for local pharmacy support. Half of participants who opted for pharmacy support did not subsequently make contact with their local pharmacy, and none had successfully quit smoking at follow-up. Pharmacy support was dependent on participants taking action to pursue the offer, whereas HMQ telephone support was an active offer from the service (with the service contacting participants by telephone). Creating a more active offer from local pharmacy, or following up with participants who opt for local pharmacy support to ask about and encourage attendance and/or offer additional support, could improve participation in smoking cessation. Interestingly, 3/5 participants who opted for but did not pursue pharmacy support accepted referral to HMQ at the time of their follow-up telephone call. This suggests that this group are open to smoking cessation support but may require stronger engagement and support.

Fourthly, a number of logistical challenges were encountered when trying to deliver in-person smoking cessation support alongside a period of LDCT scanning. The opportunity to include an in-person offer during this period arose when the OP was already underway. Pursuing this opportunity with the OP already underway meant there were limitations as to how the in-person offer could be delivered; in particular, true co-location of LDCT scanning and the HMQ team was not possible. Improved planning of co-location, as well as addressing practical issues such as concentrating HMQ team availability around periods when current smokers were attending, and planning appointment times to ensure participants have time to engage with the team around their planned travel to and from the site, could lead to better engagement. During delivery of the OP, results have emerged from the Yorkshire Enhanced Stop Smoking (YESS) study.[29] This offered co-located, opt-out, in-person smoking cessation support with immediate NRT and/or e-cigarette provision. The service was designed so current smokers had to explicitly opt-out, otherwise their in-person pathway included meeting the smoking cessation team. The study was designed to test the impact of providing personalised information on smoking-related damage to individuals' hearts and lungs (through pictures from the participant's own LDCT scan of coronary artery calcification or emphysema). The intervention did not lead to a significant difference, but the core offer of both arms of the study led to high levels of engagement and quit attempts. Eighty-nine percent of current smokers accepted the initial in-person consultation, 85% of whom accepted further support. After 4 weeks, 17% of current smokers had quit smoking, rising to over 30% in both arms at 3 months. This study shows that a carefully planned in-person smoking cessation offer can lead to high quit rates, and the increase in successful quits between 4 weeks and 3 months highlights the value of continued support.

Participation in the OP also appears to have had beneficial effects on smoking cessation beyond that captured here. For example, 8/13 OP participants who underwent further investigation for suspected lung cancer were current smokers at the time of their initial risk assessment. However, by the time they were contacted to undergo further investigation, 3/8 had quit smoking without support, and one further participant quit smoking on learning they were to undergo further investigation. It is therefore likely that participation in lung cancer screening is an event that can trigger a quit attempt with or without support, and VBA and communications around smoking through lung cancer screening may be helpful interventions regardless of whether formal support is accepted.

Finally, despite some success in engaging current smokers through the OP, a large proportion current smokers who participated continue to smoke. This suggests that including additional opportunities for engagement and referral for smoking cessation support in subsequent screening rounds will be important. It is likely in an ongoing programme that a screening interval of 2 years will be used, but will include a LDCT scan only without the preceding risk assessment steps for people who have already undergone a baseline screening round. Consideration must be given as to how a smoking cessation support offer can be integrated into subsequent screening rounds.

4. PARTICIPANT EXPERIENCE

4.1 Participant survey

4.1.1 Planning

Collection of participant feedback was considered an important aspect of the OP. It was determined that the main area of focus would be to seek feedback via a survey. Consideration was given to how the survey should be delivered, what questions should be asked, which participants would be invited to complete the survey, and at what point they should receive this request.

Consideration was given to whether the survey should be paper- or electronic-based, with initial plans to offer both. However, as the questions for the survey were developed it became clear that a branching questionnaire would be needed (for example, some questions on smoking cessation support would only be relevant for current smokers), and the increasing complexity led to a paper version becoming unviable. Patient surveys for other services in CTM UHB utilise an electronic system, Civica, and it was decided to utilise this and proceed with an electronic questionnaire only. Questions were developed to determine participants' overall satisfaction, as well as the acceptability and satisfaction with specific aspects of the service, particularly where the OP had tested a new strategy for delivery or where the evidence for which strategy to use was unclear; for example, whether the participant-facing materials developed for the OP contained the right amount of information, and whether a telephone-based risk assessment was acceptable to participants. A draft version of the survey was circulated to the North Wales Cancer Patient Forum and revisions were made based on comments received. The final version was created on Civica in English and Welsh with assistance from CTM UHB's Patient Care and Safety Team.

It was initially planned to seek feedback from all participants who had completed risk assessment at TT, however, due to the timelines of developing the survey and the practicalities of delivering this, this did not prove to be possible. As such, feedback was requested from all participants who underwent a baseline LDCT scan. Consideration was also given to asking participants to complete the questionnaire at the time of attending for their LDCT scan, as providing access to do so (e.g. through provision of iPads with the questionnaire ready to be completed whilst waiting for their scan) could have led to an increased number of responses. However, it was felt that additional important insight would be gained if the survey addressed the full end-to-end participant experience including receiving of results. As such, a request for feedback was enclosed with results letters, which were usually received by participants 2-4 weeks after their baseline LDCT scan (figure 4a). Incentives such as a gift voucher prize draw to encourage completion were considered but not approved by the Health Board.

It was acknowledged that this approach would not target those who did not engage in the service at all. Therefore, it was determined that more targeted feedback would be sought from a sample of invitees to the OP who did not engage through telephone calls. Finally, informal feedback received from participants other than through the survey was logged to identify any additional themes.

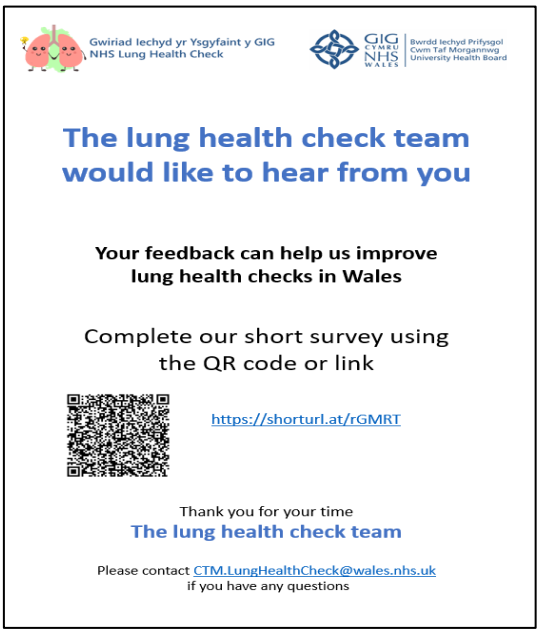


Figure 4a: A5 insert included with results letters inviting participants to completed a feedback survey.

4.1.2 Survey respondents

Thirty-six responses were received from participants (36/547, 6.6% response rate). All age groups within the OP's target age range of 60-74 years were represented in the respondents (figure 4b), and responses were received from participants from all participating GP practices. All participants identified their ethnic group as White, in keeping with 2021 census data where 96.7% of Rhondda Cynon Taf identified their ethnic group as White. Most respondents were male (72.7%) and fully retired from work (figure 4c).

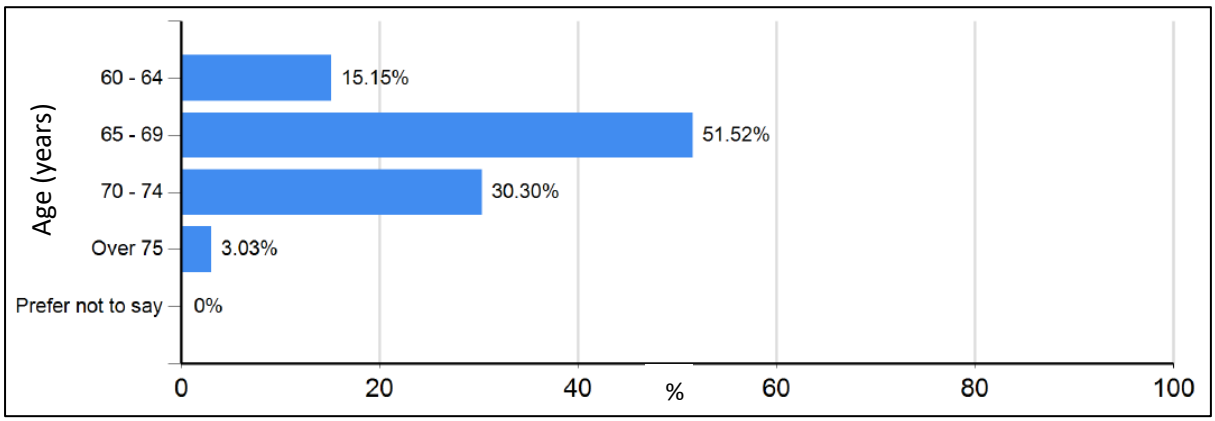


Figure 4b: Age of respondents to participant survey. Note one respondent was aged 74 years at the time of participation in the OP and had turned 75 when completing to the survey.

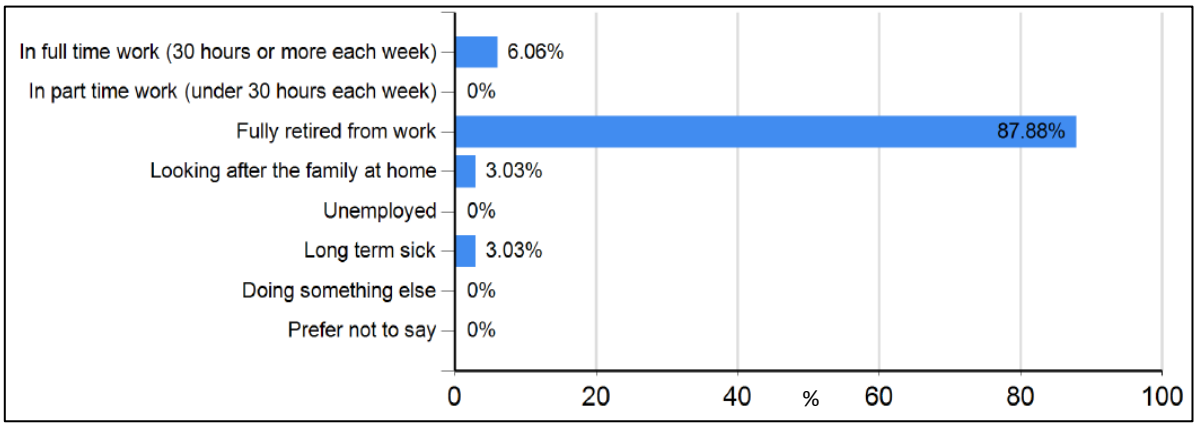


Figure 4c: Survey responses to the question:
"Which of the following best describes what you are doing at present?"

4.1.3 Overall satisfaction

Overall satisfaction with the OP was high, with 100% of respondents rating their overall experience as Very good or Good (figure 4d), and 100% responding that if a family member or friend asked them whether they should attend a telephone LHC, they would Strongly encourage or Encourage them to do so (figure 4e).

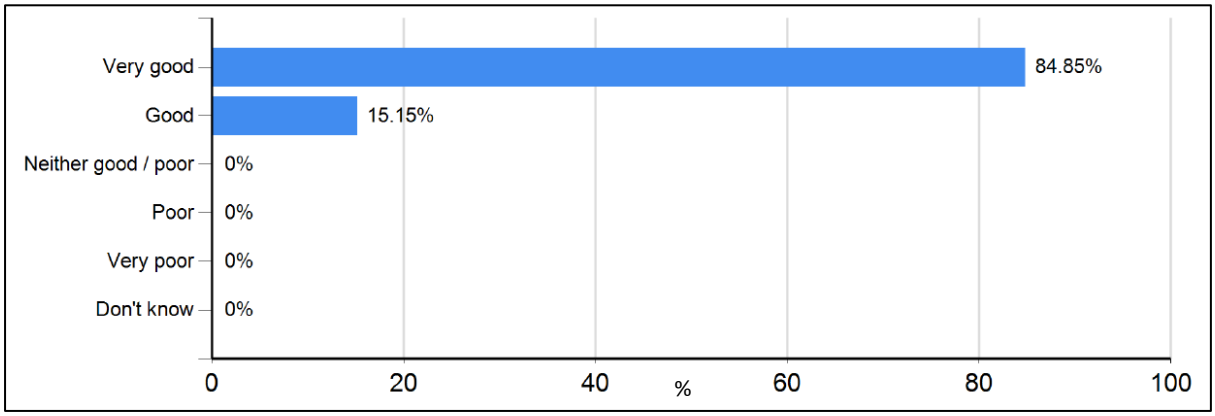


Figure 4d: Survey responses to the question:
"Overall, how was your experience of the lung health check service?"

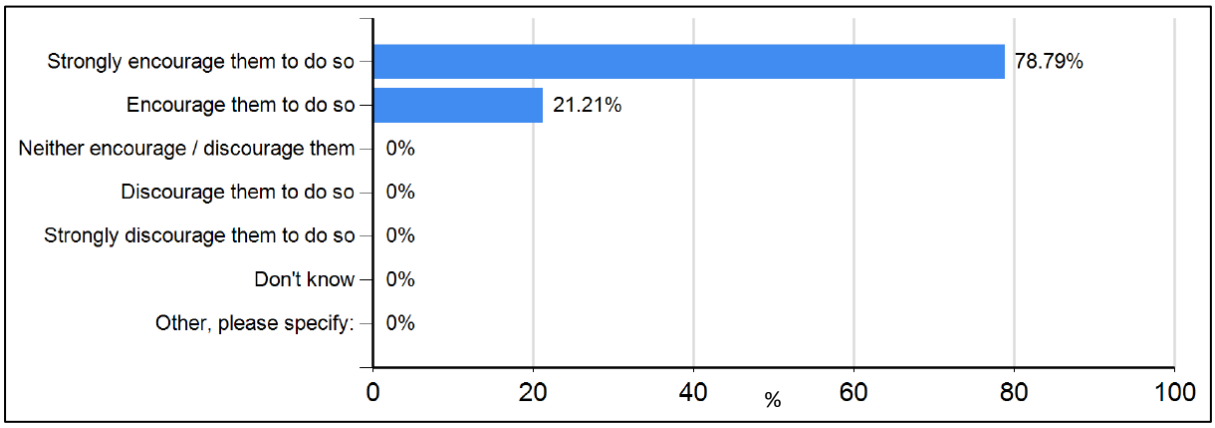


Figure 4e: Survey responses to the question: "If a family member/friend asked you whether they should attend a telephone lung health check, would you…"

4.1.4 Motivation

Respondents reported a range of reasons for attending their LHC, with the most common being concern about their own health. The service being free and knowing someone who has or has had lung cancer were other reported motivations (figure 4f).

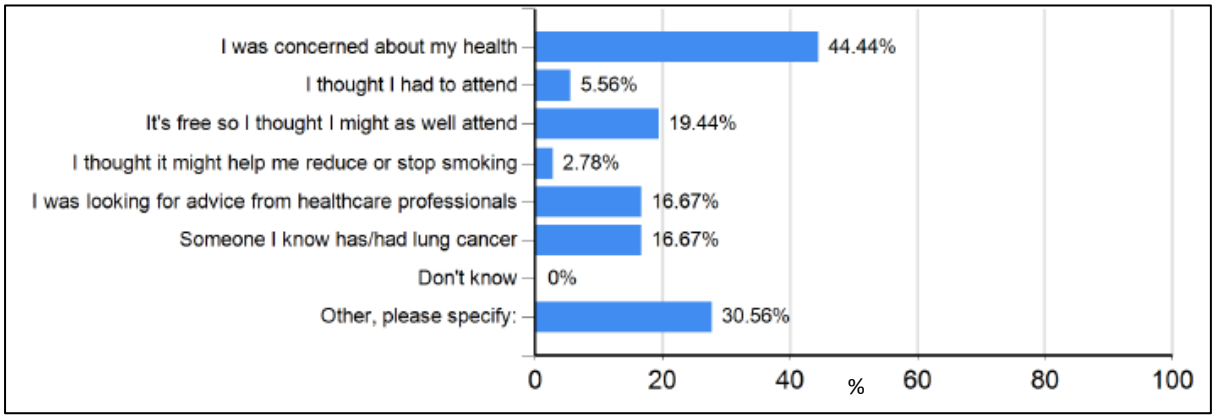


Figure 4f: Survey responses to the question: "What were your personal reasons for attending your telephone lung health check? (please tick all that apply)". "Other" responses included concerns about harms of smoking or occupational exposure to asbestos, and desire for a check-up for any problems.

Most respondents did not recall hearing about the service prior to receiving their invitation letter (figure 4g). This was not unexpected, as communications had been limited to posters and electronic screens in GP practices and local pharmacies at the time of roll-out.

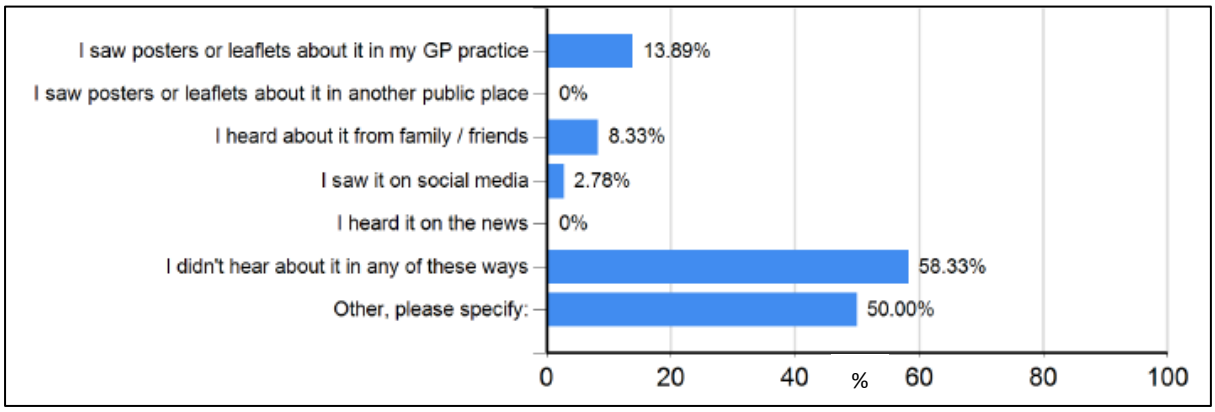


Figure 4g: Survey responses to the question: "How did you hear about the lung health check service before you received your invitation? (please tick all that apply)". "Other" responses mostly reported their first awareness of the service being the pre-invitation/invitation information from the service.

4.1.5 Service design

When asked how they felt about the amount of information received with their LHC invitation, all respondents (100%) reported that it was "Just the right amount". Almost all respondents (97.2%) reported that they felt comfortable having their LHC appointment on the telephone (61.1% Strongly agreed, 36.1% Agreed, 2.8% Don't know), and almost all (97.2%) reported being able to have their appointment on a date and time that suited them. Most respondents (91.2%) reported that they were content with the information given to them about the benefits and risks of having a scan (figure 4h), and most respondents (91.7%) reported that they were given clear guidance of the next steps after the telephone LHC (50.0% Strongly agreed, 41.7% Agreed, 5.6% Neither agreed/disagreed, 2.8% Don't know).

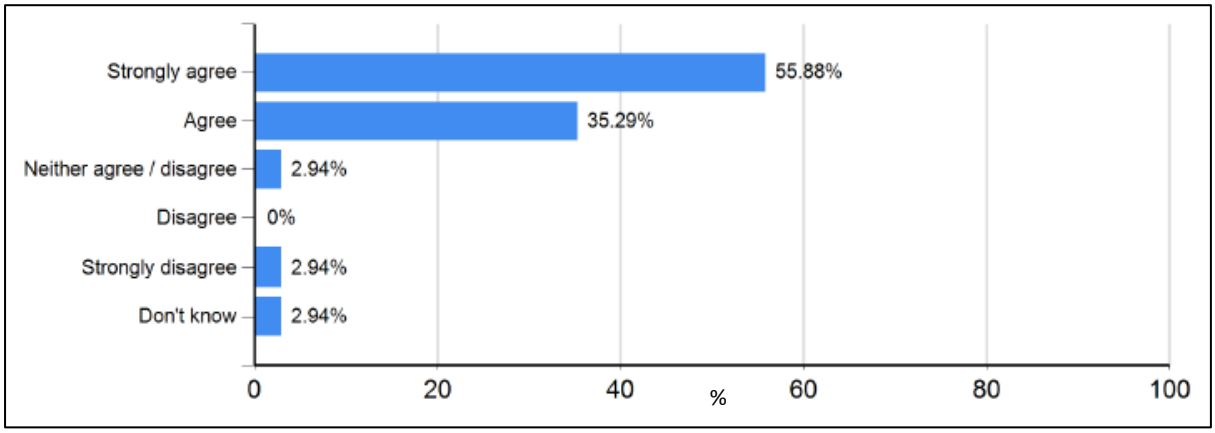


Figure 4h: Survey responses to the question: "To what extent do you agree or disagree with the following statement? I was content with the information given to me about the benefits and risks of having a lung scan."

Of those who could remember, approximately half of respondents reported that they underwent their LDCT scan within 2 weeks of their telephone LHC (48.4%), and all within four weeks (100%). Almost all respondents reported that they felt their scan took place soon enough after their telephone LHC (97.0%; 45.5% Strongly agreed, 51.5% Agreed, 3.0% Don't know).

Most respondents (84.8%) reported that they were given clear guidance of the next steps after the scan (45.4% Strongly agreed, 39.4% Agreed, 15.2% Neither agreed/disagreed), and most (87.9%) were happy with the time that it took to receive results of their scan (figure 4i).

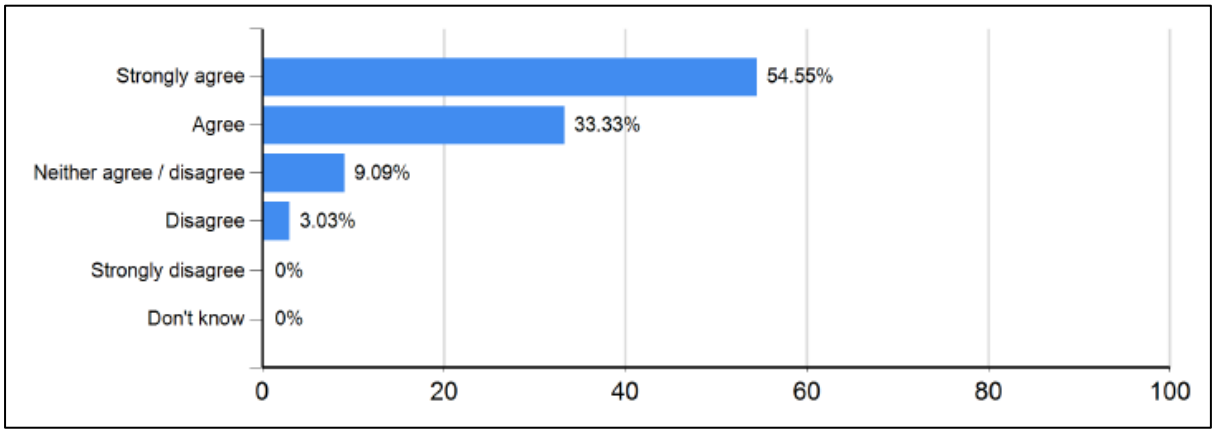


Figure 4i: Survey responses to the question: "To what extent do you agree or disagree with the following statement? I was happy with the time that it took to receive the results of my scan."

4.1.6 Smoking cessation

Only six of the 36 respondents (16.7%) were current smokers at the time of their LHC. Of these, 4/6 (66.7%) recalled receiving advice on quitting or reducing smoking at their telephone LHC, 3/4 (75.0%) of whom reported finding the advice Very helpful (50%) or Fairly helpful (25%; 25% Don't know). Most (5/6, 83.3%) had made a serious attempt to stop smoking in the past, and half (50.0%) stated they were Very likely (33.3%) or Likely (16.7%) to make a serious attempt to stop smoking following their telephone LHC.

4.1.7 Qualitative responses

Free text comments from respondents were overwhelmingly positive, with praise for the concept, service delivery and staff (a selection of representative responses are displayed):

- A very good idea as it gives people peace of mind.
- I found everything about the service very good from the first telephone call to receiving the results.
- The service was on time and very quick, and the staff were very polite and professional.
- I'm so glad I went for this appointment. It has highlighted health problems I didn't realise I had. It's a MUST DO FOR ANYONE WHO GETS THE CHANCE.
- I think this is an excellent service it puts people's minds at rest about any problems they may be having in the same way breast cancer and cervical cancer screening does.
- Everything went smoothly from start to finish.
- Excellent service, very quick and felt very comfortable.
- Very efficient, everything explained thoroughly, friendly staff, no waiting.
- Staff were very knowledgeable and helpful. Made me feel comfortable with no worries.

Several respondents reported positive feelings with regards to detection of incidental findings:

- The scan found that I had no problem with my lungs but pointed out that I had a build-up of calcification around my heart which I am now receiving medication for. Thank you for pointing this out, it was very helpful.
- Essential for people to have this check as it is a window for other unrelated illnesses that may be discovered through this check. In fact through this check they discovered I have what could become a serious heart problem. Now I know about this problem I can address it with my GP and hopefully slow it down or stop it getting worse. Unless I had this scan I wouldn't have known anything about it. It is imperative for people to turn up for the invite as it could save your life basically.

When asked to "tell us anything that could have been better about the service", most responses simply reinforced the positive feedback already given:

- Nothing really. I found everything to be very good.
- Nothing, everyone I was in contact with were helpful, informative and friendly, I had no problem.
- I honestly don't think that it could be improved.

One theme that emerged in response to this question was difficulty locating the CT scanner on the Ysbyty Cwm Rhondda site:

- Make directions to the mobile unit clearer. I could have parked much closer to save me walking/searching in the rain.
- Only that the unit was behind the main hospital building and was not very well signposted. Had to ask a porter in main building where the unit was located which could mean that people would maybe not find unit and go away thinking it was not on site.
- The scan test place was out of sight in the hospital grounds. There could have been better signs to show where to go, so I had to walk quite a long distance. If this had been signposted, I could have driven straight there.

For logistical reasons described in Evaluation Report 1, the only suitable site for the scanner at Ysbyty Cwm Rhondda was a staff car park to the rear of the hospital in an area not usually accessed by members of the public. An explanation of the location and a map was included with scan invitation letters, but participants reported difficulty locating the scanner nevertheless. Due to the mobile scanner visiting temporarily for short periods only, staff at Ysbyty Cwm Rhondda were not consistently aware of its presence or able to direct attendees asking for help locating the scanner. These difficulties became clear during the first week of scanning and as a result, efforts were made to keep reception staff in the main hospital building informed of the presence and location of the scanner, and signage was put in place directing attendees to the scanners location (figure 4j).

Figure 4j: Sign put in place at Ysbyty Cwm Rhondda in response to difficulties reported by participants locating the LDCT scanner.

The other theme to emerge in responses to this question related to the timeliness of appointment letters arriving:

- The letter for appointment didn't arrive until the day before. That was the only down side.
- Didn't receive my appointment letter till after I had the scan. Luckily I had a text reminding me of the date/time of the scan. These texts are very important and must continue to be sent as the postal system is diabolical.

It was felt desirable to avoid lengthy waits between telephone assessments and LDCT scans, as this could lead to participants disengaging. However, this shorter turn-around time led to difficulties in the timeliness of appointment letters arriving. There was praise for the text message reminders sent 72 and 24 hours before appointments. Where turnaround times were very short, telephone calls to confirm appointments were also made to participants. In future, electronic communications about appointments such as through the NHS Wales app or by email could provide an additional safety net.

4.2 Informal feedback

4.2.1 Sources

Informal feedback was received from participants at numerous points during the OP, including during face-to-face interactions at the LDCT scanner, when contacting participants about results, or when participants were seen through diagnostic pathways for suspected lung cancer or incidental findings. The majority of feedback mirrored that collected through the participant survey, with praise for the concept, service delivery and staff; gratitude for detection of health problems, particularly incidental findings; difficulties locating the scanner on the Ysbyty Cwm Rhondda site; and some appointments letters arriving close to or after appointments, but praise for text message and telephone call reminders. Two main additional themes emerged through informal feedback beyond what had been learned through survey responses, related to smoking cessation and coronary artery calcification.

4.2.2 Smoking cessation

Feedback was received from a number of current smokers who had declined referral to smoking cessation services during their participation in the OP but had gone on to quit smoking independently. For example, of the eight participants who underwent further investigation for suspected lung cancer following a 3-month recall scan, five were current smokers at the time of their initial TT appointment. Of these, three quit smoking around the time of their baseline LDCT scan without accepting referral to the Help Me Quit service, and remained abstinent from smoking at the time of their 3-month recall scan. One further participant quit smoking at the time of entry to the diagnostic pathway after their 3-month recall scan, again without accepting referral to Help Me Quit. This demonstrates that participation in lung cancer screening has positive effects on smoking cessation beyond those captured through referrals to smoking cessation services. Participants often reported that they had previously unsuccessfully attempted to quit smoking with support, and that they felt they were more likely to succeed with an independent quit attempt. This suggests that a "standard offer" from smoking cessation services linked to lung cancer screening may lead to low levels of engagement, and a more novel offer may be required to successfully engage this cohort.

4.2.3 Coronary artery calcification

A number of participants commented on the information they received on results letters regarding the finding of coronary artery calcification (CAC). Participants were informed if CAC was present on their LDCT scan, and received advice tailored to their smoking status and whether they were already prescribed a statin medication (figure 4k).

Your scan did show some hardening of the arteries around the heart. This is called coronary artery calcification. This is a common finding on CT scans and should not be cause for alarm. However, having coronary artery calcification can mean that your risk of problems such as angina or a heart attack is higher than for other people.

You can reduce your risk of health problems related to coronary artery calcification by:
1. Stopping smoking - more information on the support available to help you stop smoking is below.
2. Making sure your blood pressure is well-controlled.
3. Taking a statin medication if recommended by your GP - you told us you are taking a statin.

If you do not have symptoms such as chest pain, you do not usually need to see a heart specialist (Cardiologist) about coronary artery calcification. If you do have symptoms such as chest pain that you are concerned might be related to your heart, you should seek medical attention urgently.

We will also write to your GP to let them know your results.

Figure 4k: Excerpt from results letters sent to a participants with coronary artery calcification, with tailored advice based on the participant being a current smoker and already being prescribed a statin medication.

Some participants reported that this information made them anxious. This seemed to be related to it being an unexpected finding, and the idea that a problem with the heart must be serious. The text was written with the aim of reassuring that this was a common finding that should not be a cause for alarm, whilst also encouraging the participant to make choices that would reduce their risk of future problems. The informal feedback received from participants suggests that the approach in the OP did not strike the right balance. Considerations for a future roll-out include:

- Providing more information about common incidental findings to participants prior to the LDCT scan, so the finding is not so unexpected when the results letter is received. This could be through written information such as an additional section in an information booklet, and/or through greater discussion at the telephone nurse assessment.

- A more active offer for participants with this finding, for example, a plan for primary care to contact participants with CAC who are not already taking a statin and informing participants that this will happen. Given the prevalence of CAC on LDCT screening scans such an approach would have significant resource implications for primary care. Discussion is ongoing through national planning work for lung cancer screening in Wales to determine the most appropriate approach.

4.3 Participant stories

Following discussions with the CTM Communications Team, two participants agreed to discuss their experience of the OP and for this to be shared as a news story by the Health Board. Both participants were current smokers at the start of the OP, were diagnosed with lung cancer on LDCT screening scans, underwent radical (curative intent) treatment, and successfully quit smoking. The stories were shared through the Health Board's website and social media channels in July 2024 (figure 4l). The stories are available online at:

https://ctmuhb.nhs.wales/news/latest-news/cancer-patients-diagnosed-and-cured-through-the-award-winning-lung-health-check-pilot/

and

https://ctmuhb.nhs.wales/news/latest-news/lung-health-check-pilot-phils-story/

Figure 4l: Participant story shared through CTM's website.

Following the news stories, one participant agreed to a filmed interview, conducted by the CTM UHB Senior Communications and Engagement Officer. The video was published on social media channels in September 2024 (figure 4m). The video is available online via X:

https://x.com/CwmTafMorgannwg/status/1836761371284836795

Figure 4m: Social media post and screenshot of participant interview.

4.4 Non-participator invitees

Focussed telephone interviews were conducted with 20 invitees who did not participate in the OP. These individuals had been identified as ever-smokers within the target age range from GP records; were sent a pre-invitation letter and leaflet by post; sent an information booklet and opt-out invitation letter for a telephone LHC with a date and time that they would receive a telephone call from the service; and had at least two attempts to contact them by telephone for their TT appointment.

Non-participating invitees were selected at random from the OP database of invitees. Semi-structured interviews based on questions exploring reasons for non-participation were conducted by the LHC Navigator several months after baseline LDCT scans were completed.

Calls were attempted to 38 non-participating invitees to successfully achieve the target of gaining insight from 20 individuals. Reported reasons for not engaging in the OP were varied (figure 4o).

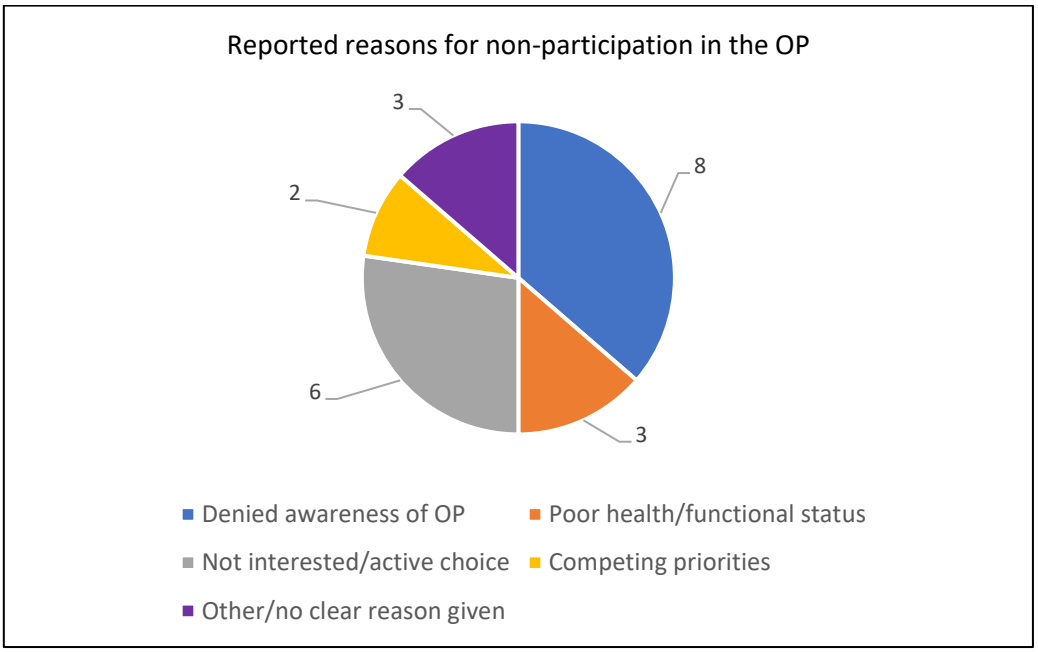


Figure 4o: Reasons given by invitees for not participating in the OP.
Note some individuals reported more than one reason for non-participation.

The most common reason reported for non-participation was reported unawareness of the OP. On further questioning however, several individuals who reported this reason softened their response to suggest they may have received an invitation but not acted on it:

- "I didn't have a letter… or at least not that I can remember. Wouldn't have been interested anyway."
- "Didn't get a letter, probably wouldn't have acted on it if I had."
- "I can't recall having a letter… can't say for sure though."

The next most common reason for non-participation was a lack of interest or an active choice not to participate. These responses fell into two distinct groups: (i) individuals who were likely to be at high risk (e.g. current smokers) who did not wish to engage, possibly due to lack of concern about their own health or known barriers to participation such as fear and fatalism related to lung cancer or smoking-related stigma, and (ii) individuals who perceived their risk to below and felt they were unlikely to benefit.

- "Not really interested… I enjoy my cigarettes and am not interested in giving up."
- "Just couldn't be bothered to be honest."
- "I should have phoned to opt out… Gave up smoking years ago and I'm fit and well and didn't want to take up an appointment that would have benefitted someone else more than me."

Three individuals were house-bound with poor health or functional status, two of whom were in residential homes. Two individuals did not engage due to competing priorities: one worked 7 days a week, and one stated they did not have time to participate due to commitments caring for their grandchildren.

Based on the responses received, it remains unclear what proportion of non-participators could or would participate if changes were made to communications or delivery of the service. Published evidence is lacking on the profile of non-participators in lung cancer screening. The responses here suggest that non-responders include a group who are unlikely to ever participate in or benefit from screening, either due to poor health or functional status, or due to being at low risk due to a limited historical smoking history. Efforts to increase participation of these groups is unlikely to increase health benefits to the population or be a cost-effective use of resources.

In contrast, there is also a group of non-responders who are likely to be at high risk of lung cancer, particularly due to ongoing smoking. This group have much to gain from participation, but likely lack motivation to participate. Targeted intervention through additional attempts to engage or additional/specific communications may have a role to play in this group. It is also possible that the awareness and acceptability of lung cancer screening would increase as a national programme becomes established as a routine offer rather than through a one-off pilot. Other national screening programmes in Wales have seen participation rise over time following lower participation at launch.

4.5 Digital engagement

4.5.1 Website

A website was created primarily to provide additional information on the OP to invitees, though was also available for access by the general public and healthcare professionals (figure 4p). At the time of writing the website remains live here:

https://ctmuhb.nhs.wales/services/lung-health-checks/

Details of the website, including the website address and QR code links, were included in written communications to invitees (e.g. on the leaflet and information booklet provided with invitation letters), on posters promoting the service located in participating GP practices and local pharmacies, and was linked to from the NHS Wales Cancer Network's Lung Health Check programme website.

The website included information about the LHC process, the benefits and risks of LDCT screening, contact details for appointment-related enquiries, Frequently Asked Questions, symptoms of lung cancer, and lifestyle advice on "How to keep your lungs healthy" including links to the Help Me Quit service.

During the period 1st June 2023 to 1st April 2024, which spans from the website launching shortly prior to invitations commencing through to completion and communication of results of 3-month recall scans, the website received visits from 1,252 users. The greatest activity was seen during periods of invitations and risk assessments, with the largest spikes in activity correlating with invitations being sent to the population registered at the largest participating practices in October 2023 (figure 4q).

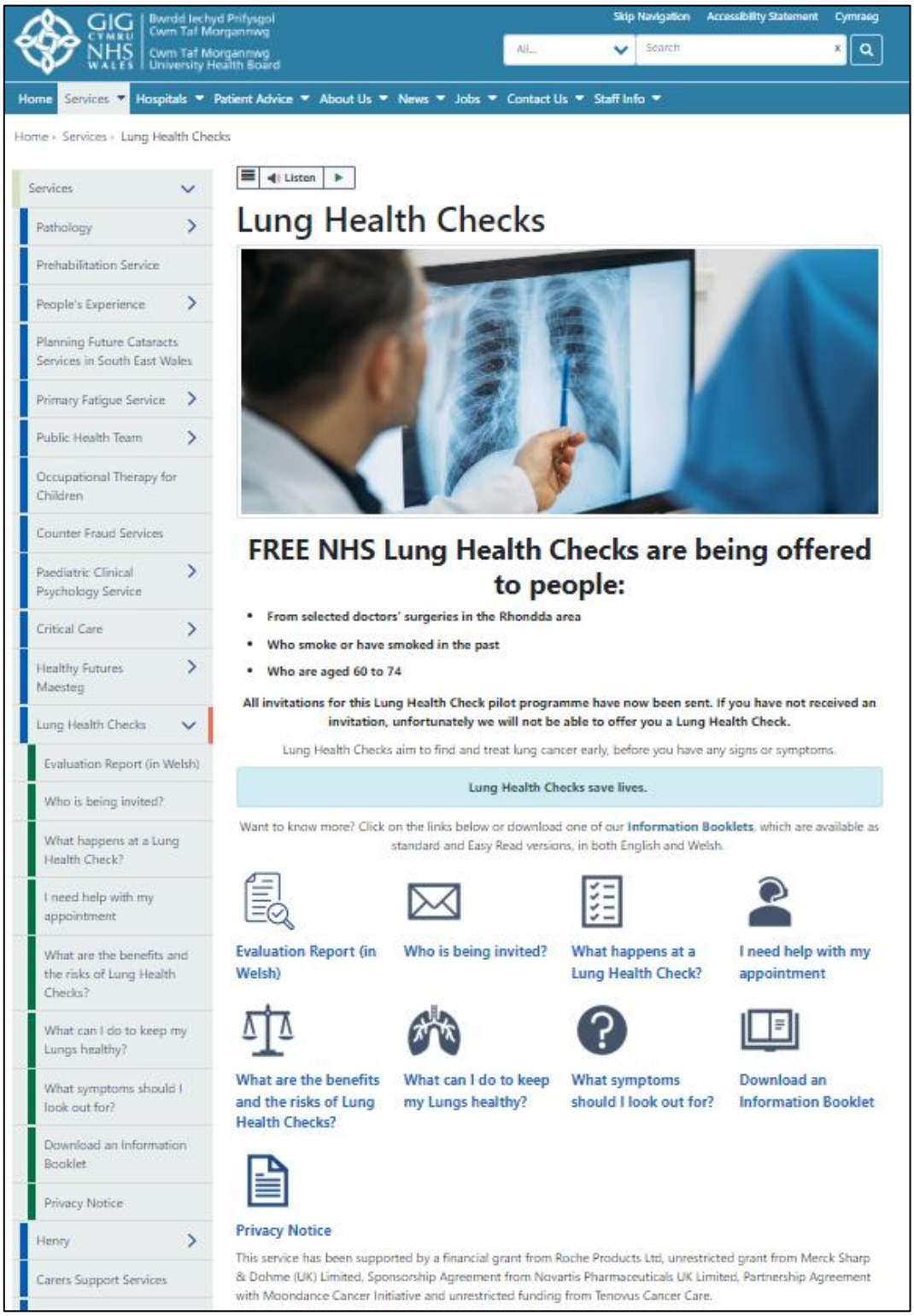


Figure 4p: Screenshot of the Lung Health Check Pilot website.

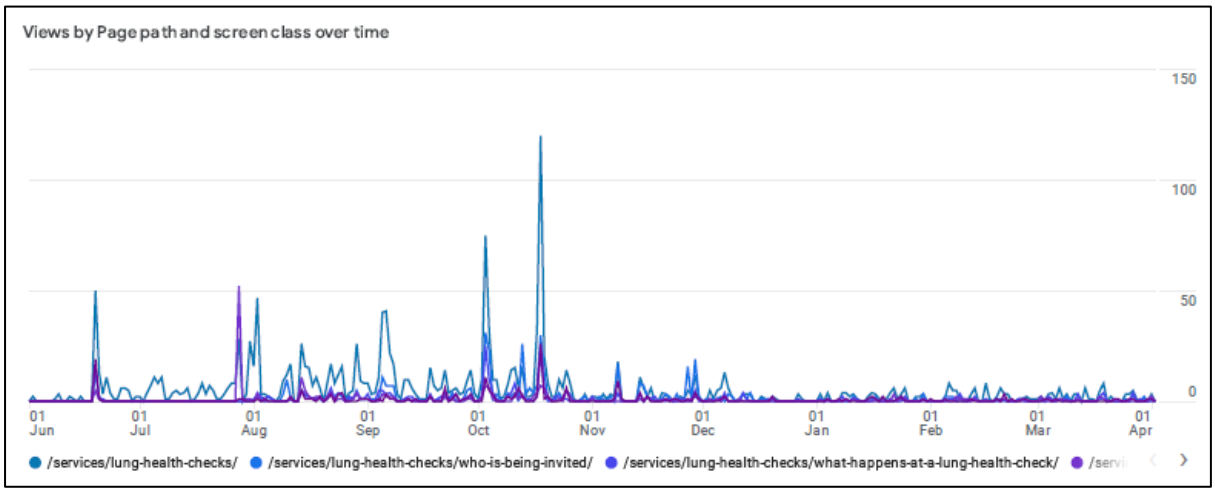


Figure 4q: Pilot website viewing activity between 1st June 2023 and 1st April 2024.

Website pages received 3,577 views, an average of 2.86 pages viewed per user. The most commonly viewed pages are shown in table 4a.

Table 4a: Most commonly viewed LHC Pilot website pages.

Page	Views
Home page	1,645
Who is being invited?	462
What happens at a Lung Health Check?	289
Download an Information Booklet	211
I need help with my appointment	208
What are the benefits and risks of Lung Health Checks?	102

The average time spent viewing a page was 1 minute 8 seconds. The pages which visitors spent the longest period of time viewing were the "Download an Information Booklet" page (average viewing time 2 minutes 38 seconds) and a page with more detailed information about benefits and risks of LDCT screening than was contained in the information booklet (average viewing time 2 minutes 31 seconds).

4.5.2 Social media

A series of social media posts were posted from CTM UHB English and Welsh accounts on X and Facebook during the course of the OP. During the early stages of the OP these were aimed at raising awareness of the service amongst the target population, whilst also communicating that the service was only available to a selected group. A post published on Facebook is shown in figure 4r.

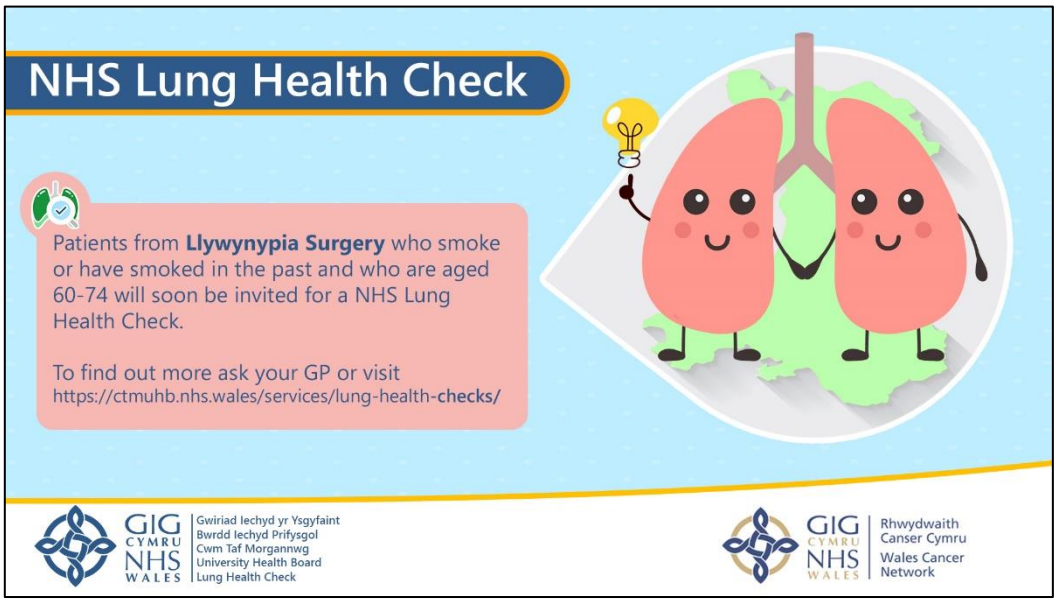


Figure 4r: Facebook post from the CTM UHB account.

Table 4b summarises engagement with social media posts on X and Facebook between August 2023 and January 2024.

Table 4b: Engagement with social media posts on X and Facebook relating to the OP posted by CTM UHB accounts. Engagements includes all interactions with a post, including clicks, reposts, replies, follows, likes, etc.

Account	**X** (English)	**Facebook** (English)	**X** (Welsh)	**Facebook** (Welsh)
Posts made	9	7	7	7
Views *Average (range)*	3413 (1401-5633)	4733 (1013-9834)	238 (20-860)	Data unavailable
Engagements *Average (range)*	104 (8-237)	213 (2-613)	4 (0-12)	Data unavailable
Likes/Reactions *Average (range)*	23 (2-49)	24 (0-49)	1 (0-4)	Data unavailable
Retweets/shares *Average (range)*	11 (2-27)	6 (0-21)	1 (0-4)	Data unavailable

Comments on posts were positive, frequently reflecting personal experiences of lung cancer (figure 4s).

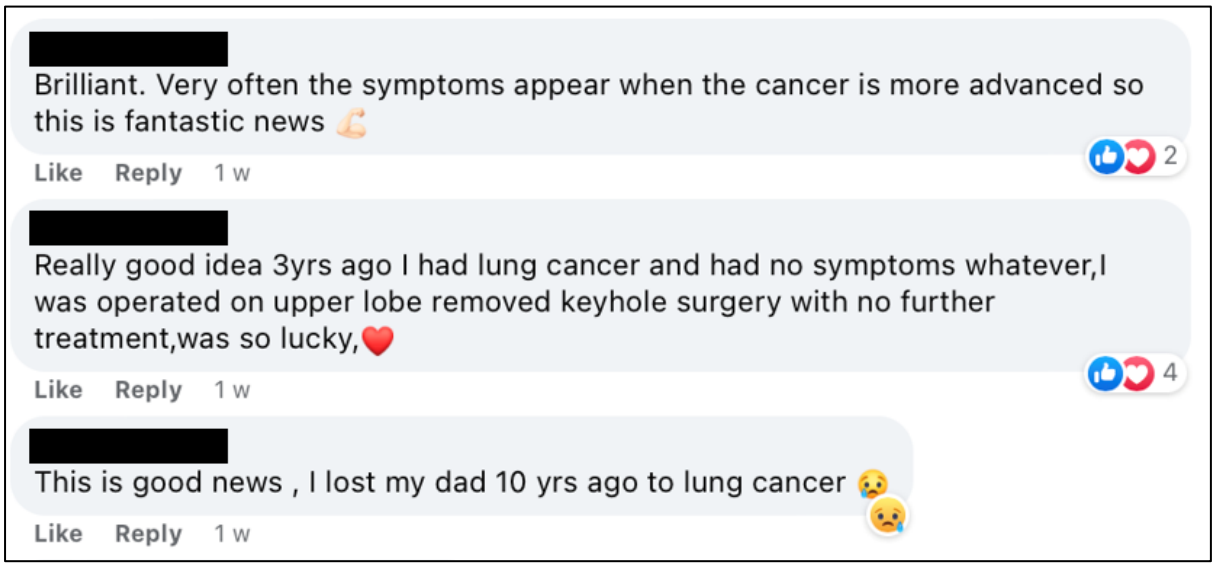


Figure 4s: Selection of comments on a Facebook post related to the OP.

4.5.3 Reflections

The age profile for lung cancer screening combined with the association between lung cancer and socio-economic deprivation led to avoidance of digital exclusion being an important consideration when planning the OP. However, the relatively high levels of digital engagement seen through the OP's website and related social media posts suggest that the target population may be more digitally enabled than previously assumed.

Whilst estimates vary depending on the source of data, some sources suggest that smartphone ownership in the UK is 95% for 55–64-year-olds, and 82% for over-65s.[31,32] This rises to 98% for 45–54-year-olds, who would age-in to a lung cancer screening programme in the coming years as the over-65 age group age-out at age 75. Social media reach can be extensive and low cost in comparison to other means of raising awareness amongst the general public. Digital solutions for other aspects of a future programme, such as to check or update recorded smoking status (to inform eligibility), book appointments, or to complete risk assessment questions through an electronic form, should be considered particularly where this could reduce demands on workforce. As for all aspects of the programme, consideration of alternative arrangements would be needed to ensure equitable access for less digitally-enabled invitees.

4.6 Complaints

The OP received one formal complaint during delivery. This related to miscommunication between the service provider and complainant regarding the availability of future scanning dates following a request for deferral. This was ultimately resolved with an alternative scanning date agreed and the complaint closed.

5. HEALTHCARE PROFESSIONAL EXPERIENCE

5.1 Healthcare professionals involved in the Pilot

The healthcare professional (HCP) roles involved in delivery of the OP are described in Evaluation Report 1 (section 4.2). Briefly, a Clinical Team consisting of a Specialty Doctor, Specialist Nurse and Navigator reported to a Clinical Lead, and thoracic radiologists from across Wales who contributed to LDCT reporting reported to a Radiologist Lead (figure 5a). The Clinical Lead also fulfilled the role of Clinical Director, taking overall responsibility for the service. In addition to these roles, the OP required the co-operation of other HCPs including those working in Primary Care at participating GP practices, and Secondary Care services who received referrals from the OP.

This section discusses themes that emerged from HCPs' experience of the OP.

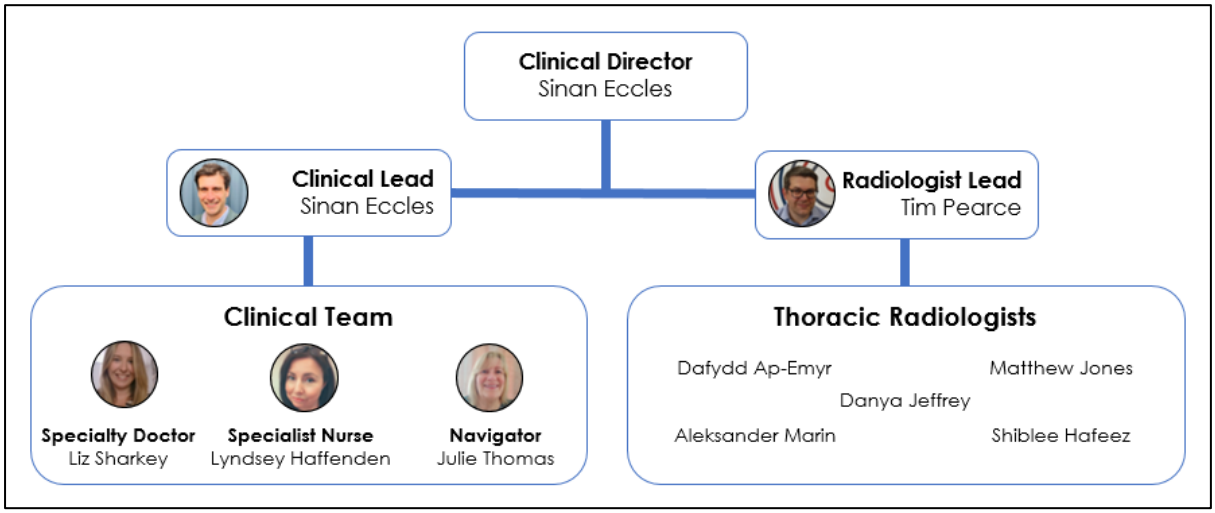


Figure 5a: Healthcare professional roles in the OP.

5.2 Lead roles

The Clinical Lead role included numerous responsibilities relating to the planning and delivery of the OP. Key areas included leading Screening Review Meetings (SRMs) and being ultimately responsible for decision-making and the safe management of participants through their pathways. As well as this "core" work, a key role was liaising with services receiving referrals from the screening programme. Developing good relationships with these services, agreeing local referral pathways and securing "buy-in" to support the service were critical to the successful delivery of the OP and the safe transfer or responsibility from the OP to downstream services. In the development of a future national programme, local Clinical Leads would be required to lead such discussions in addition to leading the SRM component of the screening pathway. The Clinical Lead for the OP was also ultimately responsible for the validity of data collected for evaluation, and this would have parallels with local Clinical Leads having responsibility for data collection for quality assurance purposes in a national programme.

The Radiologist Lead also had a number of responsibilities in the OP, including being ultimately responsible for ensuring that thoracic radiologists contributing to reporting in the OP were able to do so safely and effectively. This occurred through confirmation of training and monitoring of performance. In a future national programme, a similar governance structure for the Radiology component of the programme would be needed to oversee training, delivery and quality assurance aspects.

5.3 Lung Health Check Clinical Team

5.3.1 Clinical Team roles and tasks

The LHC Clinical Team for the OP consisted of a Specialty Doctor, Specialist Nurse and Navigator. Given the limited scope of the OP, the desire was to recruit a small team who would be able to perform a variety of tasks, and be able to cross-cover duties in the event of a team member being absent. Table 5a summarises key tasks that the Clinical Team performed.

Table 5a: Key tasks performed by the Clinical Team; shaded boxes indicate team member(s) who predominantly performed each task.

Pathway area	Task	Specialty doctor	Specialist nurse	Navigator
Selection	Appointment trouble-shooting, supporting uptake (e.g. sign-posting to travel support)		■	■
	Clinical interpretation of inclusion/exclusion criteria and previous imaging	■	■	
LDCT screening	Receive LDCT scan reports, action urgent findings, identify scans for SRM	■	■	
	Enhanced smoking cessation support conversations		■	■
SRM	SRM co-ordination: room bookings, preparation of list for discussion, distribute lists to attendees			■
	Transfer of LDCT images from screening system to local PACS			■
	SRM clinical preparation: focussed review of previous imaging/medical records prior to meeting	■	■	
	Attend/participate in SRM	■	■	■
	Undertake actions from SRM: onward referrals, telephone calls and support for participants, prepare results letters	■	■	
	Upload results letters to Welsh Clinical Portal			■
Other	Data collection for evaluation and support of quality assurance processes	■	■	■
	Engagement with and support for linked services (e.g. contact with primary care, lung cancer nurses, radiology, Help Me Quit, services receiving referrals for incidental findings)	■	■	■

When reflecting on their delivery of the OP, a number of themes emerged:

Manual processes

A large number of manual administrative tasks were performed to support delivery of the OP. These included manually transferring LDCT images from the screening Picture Archiving and Communication System (PACS) to local PACS, manually uploading results letters to Welsh Clinical Portal (WCP), and emailing referrals to the smoking cessation team. It was felt that with appropriate development of IT systems, and greater integration between screening and local systems, that many of these tasks could be partly or fully automated. Barriers to this occurring include lack of functionality of existing internal or external systems that would require agreement and development time to overcome, and challenges in gaining agreements relating to information governance or cybersecurity for greater integration between internal and external systems. For example, greater integration of systems to allow more automated transfer of LDCT images between the external screening system used and local PACS is possible, but the time and complexity of doing so was not considered feasible given the limited scope of the OP, and as such a manual work-around was put in place.

Ideally, such challenges would be fully overcome in the development of a national programme. However, from discussion with other screening programmes in Wales it is clear that such challenges are a common theme across programmes, with many manual workarounds in place. As such, whilst a future programme in Wales should endeavour to have robust automated processes in place as far as possible, ensuring that staff have adequate time to support any processes that require manual input will be an important consideration when planning the workforce required.

Skills mix

Having a varied workforce within the Clinical Team (i.e. the team not being exclusively doctors, or nurses for example), was felt to be beneficial. This allowed team members from different backgrounds and with different competencies to “play to their strengths”, and support other team members to develop their skills. Having at least one team member who had completed Ionising Radiation (Medical Exposure) Regulations (IRMER) training was important, as requesting further radiology investigations for incidental findings was a key team task.

Flexibility to adapt to challenges, and being comfortable working with electronic data and IT systems, were considered particularly important skills for the work involved.

Job satisfaction

The Clinical Team reported that they enjoyed their roles in the OP. The clear governance structure was reported to be beneficial, with the team stating that they felt well-supported. The team felt that several aspects of the role would be attractive to potential employees, including the positive nature of the work and the potential to develop new skills (e.g. the Specialist Nurse completed IRMER training as part of their role, allowing them to independently request radiology investigations). It was noted that in the event of a national roll-out, the throughput of work for the roles may be high, and certain tasks could be at high risk of human error due to their repetitive nature. As such, ensuring team members were able to perform a variety of tasks within their role was felt to be important. Contact with participants was valued; in particular, seeing the service have a positive outcome on participants

through treatment of lung cancer, incidental findings or smoking cessation, was reported to have a positive effect on morale and motivation. Contact with a wide variety of other healthcare professionals was also seen as a positive, with the team making links across clinical services, exchanging ideas to improve pathways, and providing education sessions. It was also noted that there were peaks and troughs of certain activities. This may be less of an issue in an ongoing programme, but would require consideration when developing job plans for such roles.

5.3.2 Navigator role

Navigator roles are a relatively new concept, emerging in recent years to complement existing multi-disciplinary teams and support patients through pathways. They have increasingly become embedded alongside lung cancer teams in Wales in recent years. The tasks undertaken by Navigators within these teams have varied, but usually include providing information to patients about appointments and where they can access advice and support, combined with various more administrative-orientated tasks that do not require a doctor or specialist nurse such as chasing scan appointments, co-ordinating results, and supporting certain administrative tasks.

During planning for the OP there was increasing interest in the use of Navigator roles to support LHC programmes in the UK. In particular, the challenges with ensuring equitable participation of the target population had led to interest into whether a Navigator role could help overcome some barriers to participation which are described in detail in Evaluation Report 1. It was therefore agreed to include this role as part of the LHC Clinical Team, with funding for the role provided by Moondance Cancer Initiative.

Supporting participation

One of the planned roles of the LHC Navigator was to be a source of support for invitees who may have had difficulties participating in the OP. The OP achieved high levels of participation in comparison to most other UK-based LHC activity, but this appears to have been primarily due to invitation/pathway design and the OP's targeted communication strategy.[5] Whilst invitees were informed that support was available if an appointment was not convenient, if they may struggle to undertake a telephone assessment, or they had questions about the service, the service experienced very few queries related to this. This suggests that those who were willing and able to attend did so, but that those with barriers to participation did not tend to contact the service for help to facilitate their attendance. This suggests that a more targeted, active offer of support may be required increase participation further.

Attempts were made to address this through Navigator support of attendance for 12-month recall scans. On the first date of 12-month recall scans, attendance was poor with only 9/21 (43%) booked participants attending. The LHC Navigator contacted those who had not attended to explore reasons for this, to confirm rebooking of their LDCT appointment, and to encourage their attendance. This resulted in all eligible participants who had previously not attended for their recall scan attending the rebooked appointment (figure 5b). This suggests that targeted intervention such as this may be an effective strategy for a future programme.

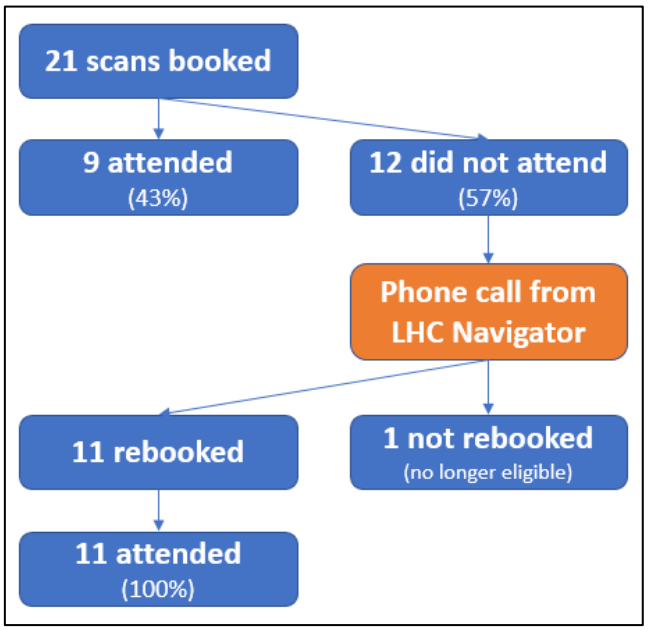


Figure 5b: Targeted Navigator intervention following low attendance at a 12-month recall scanning date.

Non-participant-facing tasks

There were a large number of tasks required to deliver the OP that did not require a doctor or specialist nurse, such as organising room bookings and distribution of lists for SRMs; and administrative tasks to ensure the right information was available to the right person at the right time, such as uploading results letters to Welsh Clinical Portal and ensuring LDCT images had been imported to the local Radiology systems prior to SRMs. The presence of a Navigator within the team to undertake these tasks allowed other members of the Clinical Team to focus on more clinically-orientated tasks that only they could perform.

In the context of the OP, the Navigator also supported data collection and elements of the OP's evaluation. A future screening programme would have similar requirements to support quality assurance processes.

Overall, the inclusion of the Navigator role in the OP was felt to have been highly valuable. In addition to supporting participation, it became clear that there are a very wide range of specific tasks that need to be undertaken to successfully deliver lung cancer screening, many of which would have fallen to more specialist clinical staff had the Navigator not been in place. This would be a poor use of resources for the service, taking specialist clinical staff away from delivering more specialist clinical tasks.

5.4 Thoracic Radiologists

Thoracic radiologists from across Wales contributed to the reporting of LDCT screening scans in the OP. Feedback on their experience of the OP was collected through a structured online questionnaire.

Preparation

Radiologists involved in the OP were required to attend the British Society of Thoracic Imaging lung nodule workshop and undergo training delivered by Heart&Lung Health (HLH). The training was well-received, with the focus on differences in approach between reporting in the screening and diagnostic settings being highlighted as a key learning point. The radiologists mentioned that additional training on reporting of recall (non-baseline) scans, and the principles of reporting or dismissing certain incidental findings, would have been of benefit.

Reporting

Radiologists praised the guidance provided to them on reporting of lung nodules and incidental findings; this included HLH's reporting manual which was aligned with local protocols. The availability of support to discuss cases with other radiologists was reported to be useful. There was also praise for the cloud-based PACS used in the OP (CIMAR), with the ability to access it from any workstation allowing more flexible reporting, and the developer's receptiveness to suggestions for improvements both mentioned. The speed of images being accessed through the system could sometimes be slower than ideal however.

Feedback was also positive about the Artificial Intelligence (AI) Nodule Detection Software used. Such software is not generally in use in routine clinical practice in Wales. Radiologists stated that the software sped up their reporting and improved their sensitivity for detecting lung nodules. They also acknowledged that the software could lack specificity, and "overcall" findings that the radiologist would need to dismiss. These observations have subsequently been confirmed in a systematic review of the technology.[33]

The use of reporting software with a lung cancer screening-specific template was also noted to be a significant change from the radiologists' usual practice. It was reported that there was a learning curve to using the template, but that it enabled faster reporting once radiologists were familiar with it. The presence of some redundant fields was noted, though there was praise for the receptiveness of the software provider to feedback with a view to improvements.

Radiologists stated that they were generally able to report baseline scans more quickly than recall scans, due to not needing to routinely compare the current scan to a previous one. On average, it was estimated that 8-10 baseline scans could be reported per hour, whereas this dropped to 5-8 recall scans per hour. A straight-forward scan took approximately five minutes to report, whereas complex scans could take up to 15 minutes. An important issue raised was reporting fatigue: some radiologists stated that they did not feel they could report screening scans for more than hour at a time without risking a drop in concentration or performance. This would need to be considered when planning how reporting of screening scans could be delivered at scale for a national programme.

Screening Review Meetings

Radiologists involved in the OP variably attended the weekly SRMs. Those who were able to attend stated that understanding the downstream discussions provided a useful feedback loop to radiologists, informing their reporting. Attendance of radiologists reporting lung cancer screening scans at a certain number of SRMs per year could be considered as an option to contribute to quality assurance of a national programme.

National screening programme

Radiologists involved in the OP were supportive of the prospect of a future national lung cancer screening programme in Wales, mentioning the benefits this would have on outcomes. This was caveated by the need to ensure that a programme would be adequately resourced in terms of scanner and reporting capacity. It was noted that expansion of the thoracic radiology workforce in Wales would be needed to successfully deliver a national programme.

5.5 Primary Care

Preparation

The target population invited to the OP was identified from GP records. This process was supported by Practice Managers who worked with InHealth to export the relevant information from the practices' Patient Administration Systems. Feedback suggests that this was relatively straight-forward for someone familiar with the practices' computer systems. A more automated system, with national data-sharing agreements in place, would be desirable in a future national programme to reduce the reliance on manual processes.

Whilst there was extensive communication between the OP Programme Team, practice managers and GPs in the preparation for the OP, it became clear during the early phases of delivery that other Primary Care staff were not sufficiently aware of the OP. For example, some invitees contacted their GP practice after receiving an invitation to the OP and due to practice reception staff being unaware of the OP, were unable to confirm that the referral was genuine. This lack of awareness amongst patient-facing staff meant that they were not able to reassure invitees of the authenticity of the service or encourage participation. During the preparation and implementation of a future programme, ensuring good communication with broader staff groups across healthcare services including Primary Care will be an important consideration.

Delivery

Primary Care were not directly involved in delivery of the screening component of the OP, but did receive results letters from the service and saw some patients following their participation for related matters. On the whole, the structure of the OP, where actionable incidental findings requiring further imaging or onward referral were the responsibility of the LHC Clinical Team, with Primary Care informed of the actions taken, was felt to be successful. The main workload encountered by Primary Care related to common incidental findings – particularly coronary artery calcification (CAC). When

CAC was present on a LDCT screening scan, advice was sent to the participant as part of the results letter including a brief explanation of the finding and lifestyle advice, including suggesting they consider making a routine appointment with their GP to discuss statin medication if they were not already taking this.

Both practice groups in the OP reported a subjective increase in consultations regarding cardiovascular risk assessment and statin prescription around this time. This is supported by data from the OP, showing an 11% increase in statin prescriptions for participants with CAC present on their LDCT six months after baseline scans, compared to a 3% increase for participants who did not have this finding (figure 5c). This suggests that lung cancer screening represents a significant opportunity to identify and benefit people at high risk of major cardiovascular events. As part of the national planning work being undertaken by Public Health Wales on lung cancer screening, modelling work and discussions with Primary Care representative are in progress to determine the potential benefit, and resource impact, of this.

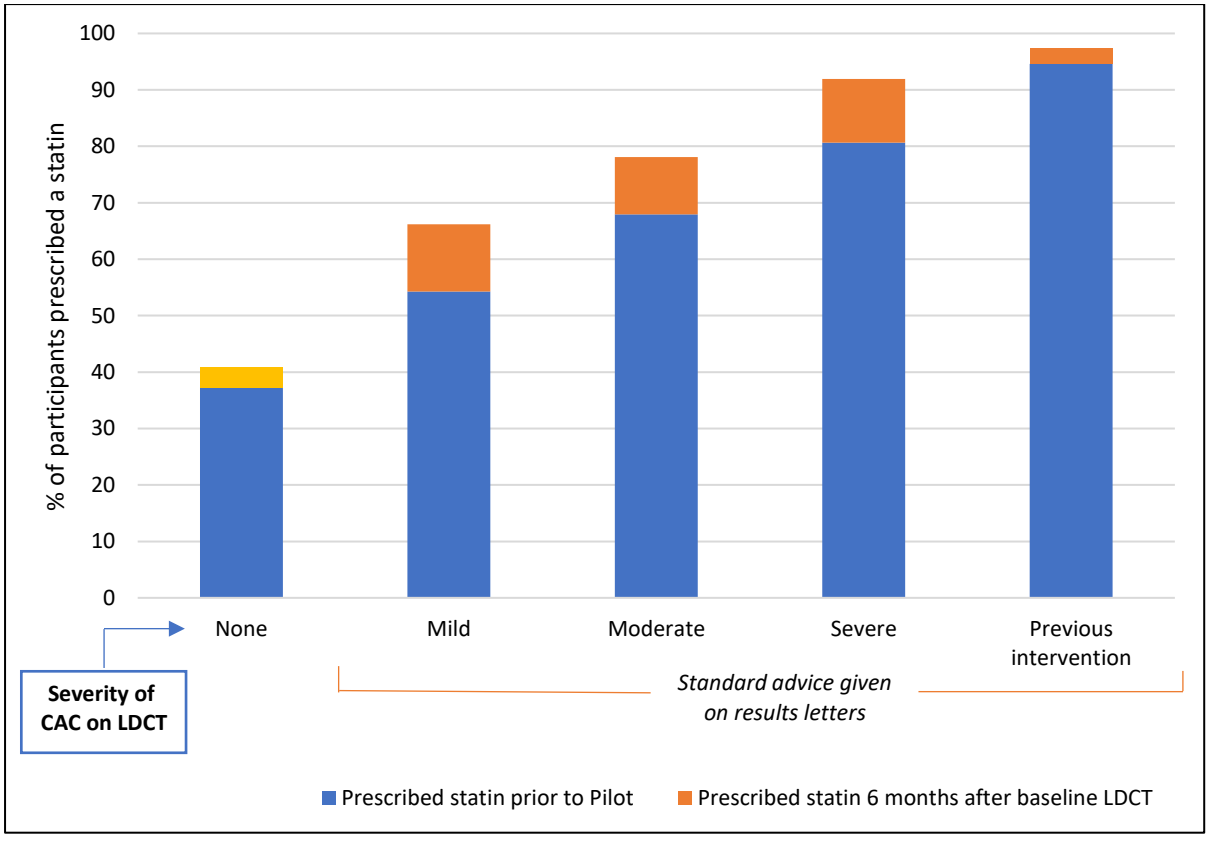


Figure 5c: Change in percentage of participants in the OP prescribed a statin before and after participation, stratified by severity of coronary artery calcification (CAC) on LDCT screening scan.

Other reflections

Primary Care staff involved in the OP were supportive of the case for lung cancer screening; the participating practices are in socio-economically deprived areas with a high prevalence of smoking and incidence of lung cancer, and were keenly aware of the potential benefits. They also reported contact with a number of participants who had stopped smoking following participation, both with and without support from the Help Me Quit service. The potential workload associated with the incidental finding of CAC was their main concern – whilst they were supportive of identifying individuals at high risk of major cardiovascular events and intervening with risk modification, this did represent an additional workload on top of already-stretched services. It was therefore felt to be important that Primary Care representatives should be consulted on this matter, through the NHS Executive Primary Care Network and GPC Wales, to ensure that this workload was accounted for in a future national programme.

5.6 Secondary Care

Respiratory and lung cancer service

The respiratory team at Royal Glamorgan Hospital deliver the local lung cancer diagnostic service and received referrals from the OP for cases of suspected lung cancer identified through screening. The OP Clinical Lead also leads the lung cancer service, meaning the lung cancer multidisciplinary team (MDT) were well-informed of the OP, its aims, and likely impact.

The lung cancer MDT were overwhelmingly supportive of the OP and lung cancer screening in general. They stated that they deal predominantly with late-stage disease when lung cancer is detected via other routes, and were enthusiastic about contributing to a project with potentially transformational outcomes for patients. Seeing patients diagnosed and treated for lung cancers that were detected through screening positively reinforced this.

Screening Review Meetings (SRMs) were delivered separately from lung cancer MDT meetings, meaning most lung cancer MDT members were not directly involved in SRM delivery. There was praise for the filtering of cases by the SRM to allow only those who required further investigation by the lung cancer service to be referred, limiting the workload of the MDT to cases that truly required their input.

Given the limited scale of the OP and the staggering of screening scans over a period of several months, the flow of suspected lung cancer cases to the lung cancer diagnostic service was steady. This meant that whilst a greater proportion of lung cancer cases detected through screening required Positron Emission Tomography (PET) scans, lung function tests and thoracic surgery, the avoidance of a rapid surge of cases meant that this was manageable and did not cause significant disruption to services. A controlled, phased roll-out of a national programme would allow downstream services to adapt to changes in demand; modelling work estimating the impact of different phased roll-out approaches is included in the national planning work that is underway through Public Health Wales.

The number of clinically significant respiratory incidental findings was small, having little impact on services at the scale of the OP. In a small number of cases, the LHC Clinical Team contacted participants to obtain further information, to allow incidental findings of borderline significance to be considered

with a clinical context. For example, one participant with some minor inflammatory changes in the lungs on LDCT, which was subjectively on the borderline of whether action should be taken or not, was contacted by the team to ascertain whether they had respiratory infection symptoms, which then informed what action was required. Keeping such actions as the responsibility of the LHC Clinical Team allowed more rapid decision-making and reduced the burden on other services by avoiding potentially unnecessary referrals.

Cardiology

Cardiology was the Secondary Care specialty most affected by incidental findings from the OP. Discussions were held between the LHC Clinical Lead and the Cardiology team prior to and during the OP. This was helpful, allowing local referral thresholds and pathways to be agreed, to ensure the Cardiology team were aware that referrals from the OP were likely to be forthcoming, and to ensure buy-in from the Cardiology team in accepting referrals and supporting delivery of the OP. The main impact was on echocardiography for suspected aortic valve disease (identified through aortic valve calcification on LDCT) and thoracic aorta dilatation.

Referrals were generally welcomed by the Cardiology team for these findings. Feedback from the Cardiology team suggested that they would rather know about aortic valve disease at an earlier stage rather than first detecting it at the point of an emergency admission, when prognosis is poor; a similar perspective to the lung cancer MDT relating to the lung cancer cases detected. The key issue, therefore, was ensuring that the threshold for referral was appropriate, to maximise the chances of detecting participants with significant findings, without generating a large number of referrals that may be of little benefit. To facilitate this, a one-off Cardiology-specific SRM was held to review all Cardiology cases detected by that point in the OP. This was extremely helpful to both the LHC team and the Cardiology team, to understand the processes on both sides and ensure the most appropriate cases were referred. Almost all referrals to Cardiology resulted in a further action after the initial echocardiogram, most commonly ongoing valve surveillance due to finding mild/moderate aortic valve disease on echocardiogram.

Other services

A small number of referrals were made to a range of other secondary care specialties. The low frequency of referrals to any one service meant that this did not have a significant impact on services. No negative feedback was received from services relating to the appropriateness or volume of referrals from the OP.

The LHC Clinical Lead invested time during the preparation for the OP to contact services likely to receive referrals for incidental findings. As was the case described with Cardiology above, this was helpful for two reasons: it allowed appropriate local referral pathways to be agreed with the receiving specialty, and it helped gain buy-in from other teams to support the OP and lung cancer screening generally. Having the opportunity to explain the benefits of lung cancer screening, the UK National Screening Committee position, and the likely impact on services was helpful. This highlights that local Clinical Leads and teams will have an important role during the planning and delivery of a national programme in gaining buy-in and support from other services, and agreeing local referral pathways.

6. CONCLUSIONS

6.1 Successful delivery of the aims of the Operational Pilot

6.1.1 Aims of the Operational Pilot

The aims of the Lung Health Check Operational Pilot for Wales were to:

a. **Provide immediate health benefits to the pilot cohort**
b. **Provide advance learning and modelling to support and de-risk the roll-out of a future programme in Wales**
c. **Develop a core team who would gain experience to be used as the nucleus for a future national roll-out**

These aims have all been successfully delivered.

6.1.2 Providing immediate health benefits to the pilot cohort

Participants in the OP saw benefits to their health both directly and indirectly related to lung cancer (figures 6a-b). Lung cancers diagnosed through the OP were more likely to be found at an early stage and undergo treatment with radical (curative) intent than lung cancers diagnosed through usual care in Wales.[11] Participants who were current smokers at the onset of the OP, many of whom were long-term smokers with multiple previous unsuccessful attempts to stop smoking, engaged in conversations about smoking cessation. Many went on to quit smoking either with the support of the NHS Wales Help Me Quit service, or independently.

Evidence-based management of incidental findings detected through LDCT screening also benefitted participants. Several incidental (non-lung) cancers were detected sooner than they otherwise would have been, and went on to receive active treatments. One participant was found to have (asymptomatic) severe aortic valve stenosis after an incidental finding of aortic valve calcification, and is undergoing work-up towards valve replacement.

People who are at high risk of lung cancer and eligible for lung cancer screening also have an elevated risk of major cardiovascular events such as myocardial infarction, stoke and cardiac death due to shared risk factors including age and smoking history. An increase in prescriptions for statin medications, which reduce the risk of major cardiovascular events in people at elevated risk, was seen following the OP in participants found to have the incidental finding of coronary artery calcification on screening LDCTs. This demonstrates the potential for wide-reaching health benefits related to LDCT screening, beyond the primary aim of reducing lung cancer mortality.

Lung cancer screening, like all forms of screening, has the potential to cause harm to participants. Reassuringly, this was extremely rare in the OP with only a single participant (0.2% of those scanned) having a false positive LDCT result, meaning lung cancer was suspected from the scan but not ultimately diagnosed). No participants underwent invasive tests or surgical resection for benign disease. Recall rates for small lung nodules and actionable incidental finding rates were in keeping with those reported by lung cancer screening activities elsewhere. These findings suggest that the evidence-based protocols used in the OP, and the inclusion of Screening Review Meetings as part of the screening pathway, can provide a safe and effective template for delivery of a national programme.

Figure 6a: The first participant in the OP to undergo a LDCT screening scan (left) with a member of the LHC team.

Figure 6b: A participant in the OP attending the mobile CT scanner.

6.1.3 Providing advance learning and modelling to support and de-risk the roll-out of a future programme in Wales

The planning and delivery of the OP has provided an exceptional level of insight into the complexities and challenges of delivering lung cancer screening. The successful delivery of the OP has demonstrated that such challenges can be overcome through careful planning, leadership and collaboration.

Some aspects of the OP were extremely successful: for example, uptake of the OP outperformed expectations and was higher than any other lung cancer screening activity reported in the UK at the time[30,34–37] (figure 6c). This suggests that the detailed planning of the participant pathway and execution of the OP's communications plan were successful in their goals of optimising participation.

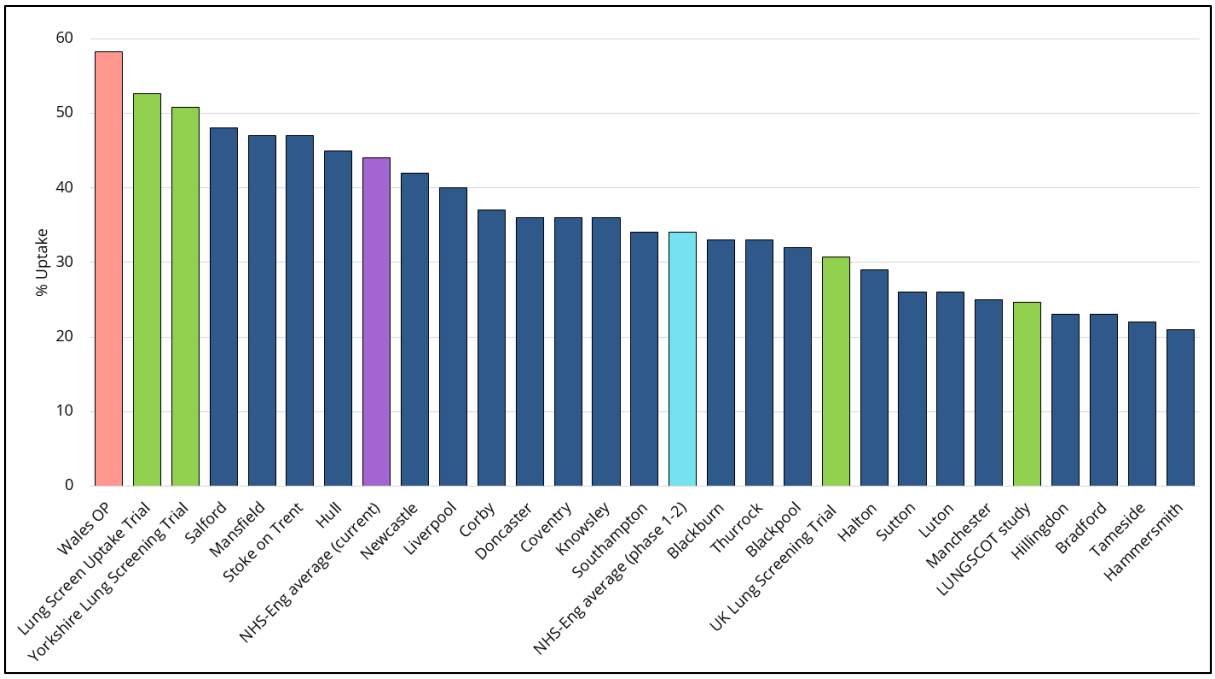


Figure 6c: Uptake of the OP (pink) compared to UK-based lung cancer screening studies (green), phase 1-2 NHS England TLHC programme sites (dark blue; average light blue), and NHSE TLHC programme uptake (purple, as of November 2023).

Results from the OP's clinical activity have demonstrated that lung cancer screening can be delivered effectively within the Welsh healthcare system. The results suggest that the clinical and radiology protocols utilised in the OP should act as a template for those in a future national programme. Participant feedback on their experience of the OP was overwhelmingly positive, confirming the acceptability of the service design, participant pathway and communications to the target population.

The OP has also provided important insights into how certain aspects of delivery could be improved upon in future. For example, the results, the healthcare professional experience and participant feedback related to integration of smoking cessation pathways in the OP has led to a better understanding of how this could be optimised further for a future national programme.

Delivery of the OP has provided an abundance of data that is being utilised in modelling work being undertaken as part of Public Health Wales's (PHW's) lung cancer screening project, which will make recommendations to Welsh Government on how lung cancer screening could be implemented nationally in Wales. It should, however, be noted that the OP's participants will not be representative of the national population of Wales across all areas of interest. The OP was conducted in a socio-economically deprived area where smoking prevalence and lung cancer incidence are higher than average. The age of 60-74 years for participants in the OP is also older and at higher risk of lung cancer than the range of 55-74 years recommended for lung cancer screening implementation by the UK NSC. As such, it is important that these differences are considered in any extrapolation of the results of the OP. The modelling work being undertaken by PHW's project is drawing on numerous data sources in addition to the OP to ensure that projections are as representative as possible of the all-Wales eligible population for lung cancer screening.

6.1.4 Development of a core team to gain experience and be used as the nucleus for a future national roll-out

The planning and delivery of the OP required input from a wide range of clinical and non-clinical teams and individuals (figure 6c). Naturally, much of the work was concentrated around the LHC Clinical Team for the OP in CTM UHB, and the LHC Programme Team based within the Cancer Network. However, every opportunity was utilised to ensure that important learning was captured and recorded, and where possible, experience and learning was extended beyond CTM UHB and the Cancer Network. For example, thoracic radiologists from across Wales were invited to contribute to LDCT scan reporting and SRMs, with radiologists from five different Health Boards in Wales ultimately involved in delivery of the OP.

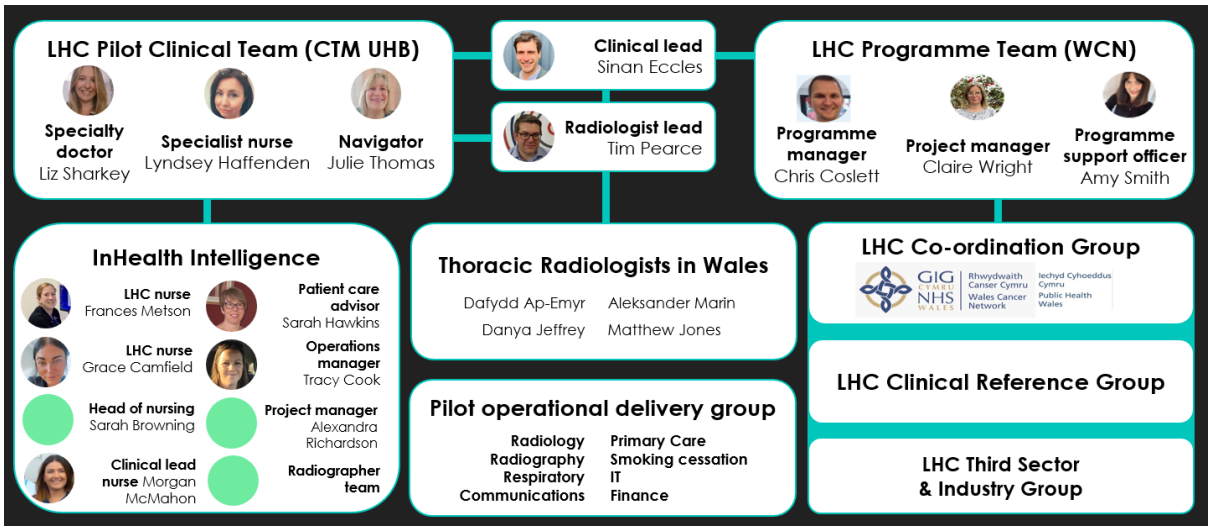


Figure 6c: Teams and individuals involved in planning and delivery of the OP.

The Clinical Team have shared their experience and learning through numerous forums in Wales, including the Welsh Thoracic Society; Welsh Thoracic Oncology Group; Wales Cancer Network Clinical Reference Group; Wales Cancer Industry Forum; Society of Physicians in Wales; all-Wales Medical Director and Chief Executive meetings; Welsh Government Cross-Party Groups on Cancer, and Smoking & Health; and the Welsh Labour Party Conference. The OP has also raised the profile of lung cancer screening in Wales at a UK level, with posters, presentations and publications including through the

British Thoracic Society, British Thoracic Oncology Group, and the British Institute of Radiology. This wide sharing of learning and experiences from the OP has raised awareness amongst healthcare professionals, and helped develop support and engagement from key stakeholders related to lung cancer screening.

Numerous members of the team that planned and delivered the OP, including the Clinical Lead, Radiology Lead, Lung Health Check Nurse Specialist, Programme Manager and Project Manager, now have roles in the project being delivered by PHW planning how a national lung cancer screening programme could be delivered in Wales. The team who delivered the OP are therefore now, as intended, acting as a nucleus for the next steps towards a national programme, and will hopefully continue to do so through to implementation.

6.2 Final conclusions

The LHC OP has successfully achieved its aims as described in the previous section. The results of the OP provide assurance that:

i. **Lung cancer screening can be delivered effectively within the Welsh healthcare system**

ii. **Lung cancer screening is likely to yield benefits similar to those seen in studies, pilots and programmes elsewhere**

iii. **A lung cancer screening programme would significantly improve lung cancer outcomes compared to current care in Wales**

6.3 Next steps

Welsh Government have commissioned PHW to undertake a project reviewing how targeted lung cancer screening could be delivered in Wales in future. This project commenced in April 2024 and is being informed by the delivery and findings of the OP. The project is due to report to Welsh Government in 2025.

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- Professor Tom Crosby OBE, National Cancer Clinical Director
- Dr Sharon Hillier, Director of the Screening Division, Public Health Wales
- Kimberley Meringolo, Strategic Network Manager for Cancer
- Gareth Popham, Deputy Network Manager

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- Lowri Griffiths, Director of Support, Policy and Insight, Tenovus Cancer Care
- Greg Pycroft, Policy & Public Affairs Manager, Tenovus Cancer Care
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9. LIST OF ABBREVIATIONS

Acronym/ abbreviation	Meaning
CTM UHB	Cwm Taf Morgannwg University Health Board
GP	General Practice *or* General Practitioner
IRMER	Ionising Radiation (Medical Exposure) Regulations
LDCT	Low-dose computed tomography
LHC	Lung Health Check
MDT	Multi-disciplinary team
NHS	National Health Service
NHSE TLHCP	NHS England Targeted Lung Health Check Programme
NSC	National Screening Committee
OP	Operational pilot
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
SRM	Screening review meeting
TNA	Telephone Nurse Assessment
TT	Telephone triage
UK	United Kingdom

10. CORRECTIONS

In Evaluation Report 1 due to a typographical error it was stated that sixty-four 12-month recall scans were indicated in the OP. The correct number is sixty-two, as stated in the present Evaluation Report (2): five indicated directly from baseline scans, plus 57 indicated as an outcome of 3-month recall scans.