

**Title:** Leighton Hospital Self-Referral Chest X-Ray Service Evaluation

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### **Executive Summary**

Early diagnosis of lung cancer is pivotal in improving outcomes for those diagnosed with the disease in the UK. Mid Cheshire Hospitals NHS Foundation Trust (MCHFT) recognised that there are various reasons why patients are diagnosed at a late stage including access to diagnostic services (chest x-ray) and referral from primary care. The provision of a self-referral chest x-ray project was developed to overcome this barrier. The project was based on a similar project that has been delivered in Leeds Teaching Hospital since 2011. The project was provided alongside a public awareness campaign to residents of Crewe, an area with high rates of lung cancer. Over a 12 month period 231 patients presented to the project and chest x-rays were undertaken on 226 eligible patients. The project did not detect any cases of lung cancer, but there is a risk that this was due to the project not having enough participants to achieve the required sample size for at least one lung cancer to be detected. Therefore as the project did not achieve this sample size it is not unexpected that no cancers were detected. The symptoms and smoking status of the patients who engaged with the project suggest that the eligibility criteria may have failed to target those most at risk. A number of patients were also referred to the project by a health professional, suggesting that referral pathways for these professionals need to be improved. If the project is to continue, changes are needed to enable lung cancer to be diagnosed at an earlier stage by targeting those most at risk. Making changes to the eligibility criteria and targeted marketing of the project is required to improve early diagnosis.

### **Introduction**

It is well recognised that early diagnosis is pivotal to increasing lung cancer survival<sup>1</sup>. The Department of Health (2011) set out a number of approaches to improve early diagnosis of cancer. These include raising awareness of the signs and symptoms, and encouraging people to seek advice earlier<sup>2</sup>. It also includes supporting GPs to recognise the signs and symptoms and refer people for specialist care. A number of patients are also reluctant to visit their GP or find it difficult to secure a GP appointment. For these patients alternative options need to be considered to ensure efficient access to diagnostic tests are provided.

There are a number of risk factors associated with lung cancer. In the UK the population attributable risk for smoking in patients with lung cancer is 80%<sup>3</sup>. Lung cancer incidence is also strongly associated with deprivation with rates being 2.5 times higher in the most deprived males compared to the least deprived<sup>4</sup>. Among women this rate is 3 times higher in the most deprived compared to the least deprived<sup>4</sup>. The remainder of lung cancer is attributable to a number of exposures including radon gas, chemical and work place risks such as asbestos, air pollution, and previous radiotherapy<sup>5</sup>. Previous lung disease, family history of lung cancer, and having lowered immunity also increases a person's risk of developing lung cancer<sup>5</sup>. For non-symptomatic individuals it is possible to calculate their risk of lung cancer using tools such as the Liverpool Lung Project on-line tool My Lung Risk or the PLCO lung cancer risk model. But this project was interested in case finding of symptomatic individuals.

## Background

MCHFT services a catchment area of approximately 280,000. The Trusts main acute hospital is Leighton which is one of two hospitals in the borough of Cheshire East. It serves the population of South Cheshire Clinical Commissioning Group (CCG) as well as some residents of Vale Royal CCG from the neighbouring borough of Cheshire West and Chester.



In South Cheshire CCG there were 160 diagnoses of lung cancer (malignant neoplasm of lung and bronchus and mesothelioma) during 2013<sup>6</sup>. In 2013 the age standardised incidence of malignant neoplasm of lung and bronchus in South Cheshire CCG area was 86.56 per 100,000<sup>6</sup>. The age standardised incidence of mesothelioma for South Cheshire CCG in 2013 was 11.83 per 100,000 (95% CI: 5.54–18.12) which is significantly higher than the age standardised incidence rate for England which was 5.27 per 100,000 (95% CI: 5.04-5.48)<sup>6</sup>. For the purpose of this report malignant neoplasms of the lung and bronchus and mesothelioma will be reported together under the term lung cancer. This is due to the Somerset Cancer Registration system data extract process and baseline data which include Mesothelioma in lung cancer data extractions.

In 2013 partners including South Cheshire CCG, Vale Royal CCG and MCHFT recognised that improvements in lung cancer services were needed to achieve increases in lung cancer survival. The Crewe area was recognised as an area with the highest age standardised incidence of lung cancer in Cheshire East during 2009-11, with rates of 82 per 100,000<sup>7</sup>. This led to the Crewe area being prioritised for the 'Every Breath You Take' project. The project involved providing a Public Awareness Campaign, recruitment of lung champions and Self-Referral Chest X-ray service to Crewe residents. The service was modelled on a project delivered in Leeds Teaching Hospital since 2011. This project saw an increase in community requests for chest x-rays, a decline emergency admissions and a reduction in best supportive care after the project started in 2011.

Smoking is the main risk factors for lung cancer with 8 out of 10 lung cancers caused by smoking<sup>4</sup>. Local GP surgery Quality and Outcomes Framework (QOF) data for Crewe suggests that there are 15,552 smokers in the Crewe area<sup>8</sup>. Data for England estimates that 50% of smokers are aged 50 plus<sup>9</sup>. Using QOF data to estimate the number of smokers and national age profiles of smokers we can estimate there are approximately 7,776 smokers aged 50 and over in the Crewe area. The estimated prevalence of ex-smokers in 2015 for Cheshire East as a whole was 32%<sup>9</sup>. Assuming 32% of the Crewe population aged 50 plus are ex-smokers there are approximately 8,787 ex-smokers in the Crewe area. Therefore it is estimated that there are 16,563 current and ex-smokers who are

over 50 in Crewe that are at high risk of lung cancer and would be a priority for engagement in this project through either awareness raising or diagnostic testing if they are symptomatic.

### **Public Awareness campaign**

Starting on the 6<sup>th</sup> July 2015 and officially launched on the 16<sup>th</sup> August 2015 in Crewe, the project involved raising awareness of the self-referral chest x-ray project as well as the signs and symptoms of lung cancer. The target population was residents of the Crewe area. The campaign was developed in partnership with the local community who chose the name 'Every breath you take'. It involved developing a range of publicity campaign materials including posters, leaflets, and also involved radio interviews and a leaflet drop to homes in the Crewe area. The project also trained community volunteers to raise awareness of lung cancer.

### **Self-referral chest x-ray**

#### **Inclusion criteria**

This project commenced on the 6<sup>th</sup> July 2015 and targeted the residents of Crewe. The eligibility criteria for the project are being aged 50 or over and experiencing one or more of the following relevant symptoms:

- Cough
- Fatigue
- Shortness of breath
- Chest Pain
- Weight Loss
- Haemoptysis
- Change in voice

Patients meeting the eligibility criteria can present directly at the x-ray department in Leighton hospital to receive a chest x-ray. The purpose of the project was to enable patients who are either reluctant to attend their GP or find it difficult to secure an appointment with their GP and are experiencing symptoms they are concerned about, to directly access a chest x-ray.

#### **Exclusion criteria**

Being under 50 years old

Not experiencing any symptoms

Having had a chest x-ray in the past 3 months

#### **Evaluation Questions**

- Has the self-referral chest x-ray service resulted in earlier diagnosis of lung cancer?
- Has the public awareness campaign resulted in an increase in primary care requested chest x-rays?

#### **Methods**

The evaluation of the self-referral chest x-ray project is based on data over a 12 month period from the project commencement date of the 6<sup>th</sup> July 2015. The analysis was conducted in October 2016 which allowed enough time for all patients to have any required further diagnostic tests and a lung cancer diagnosis.

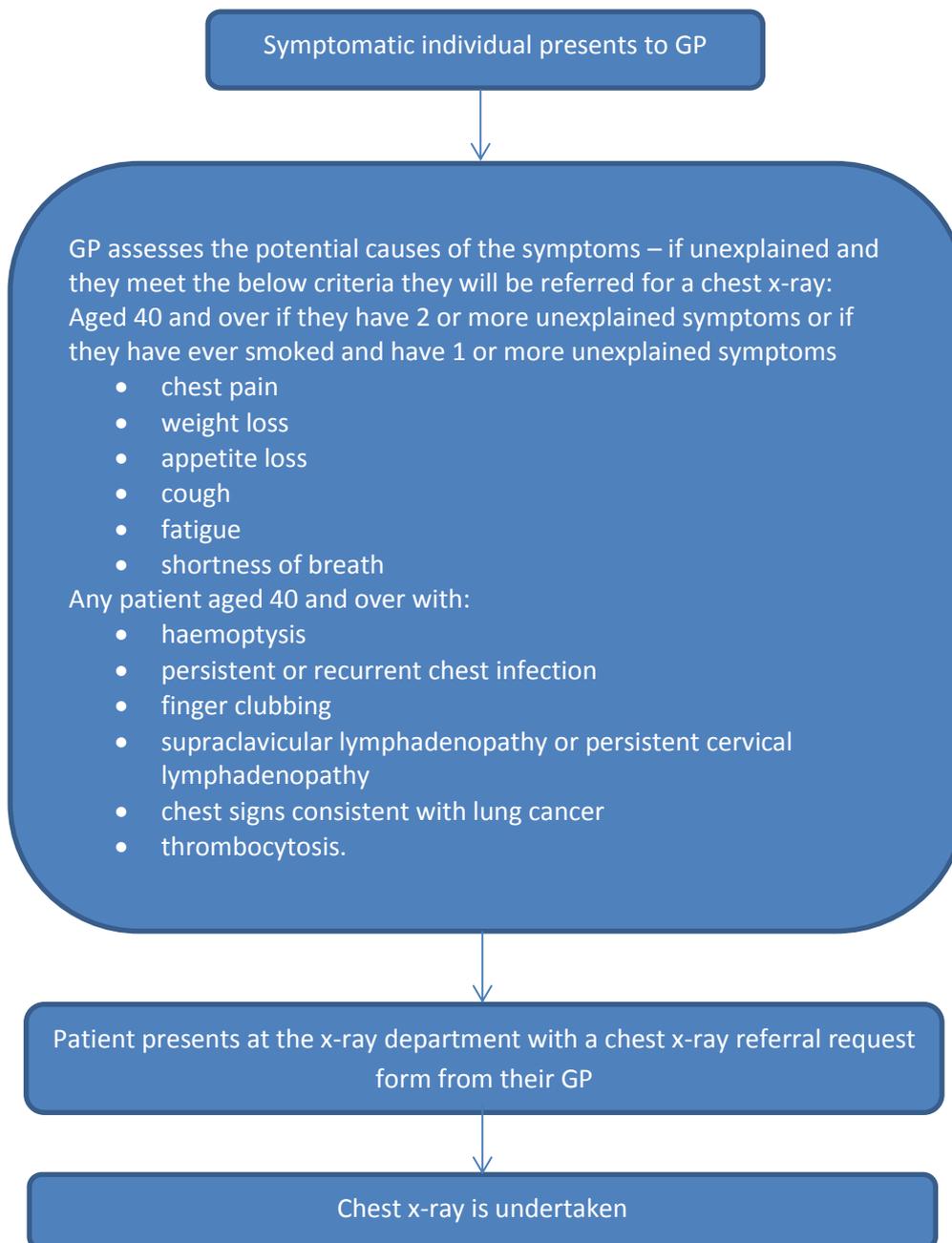
The outcomes of the self-referral chest x-ray project have been analysed using patient data held on a dedicated database developed by Leighton Hospital for patients who accessed this service from the launch date of 6<sup>th</sup> July 2015. Data from this database was then cross-referenced with the hospital patient care system record and radiology record using NHS number.

Exclusions – one patient who received a chest x-ray when they were not eligible due to their age and one patient who was diagnosed with lung cancer but presented to their practice nurse with symptoms and was signposted by the practice nurse straight to the x-ray department at Leighton for a chest x-ray. It was felt that it would not be appropriate to include this individual in the analysis as they clearly would not have engaged with the service if the nurse had not recognised their symptoms and sent them for a chest x-ray. This was not a self-referral, but the raising awareness of lung cancer as part of the project may have increased awareness in both the nurse and patient.

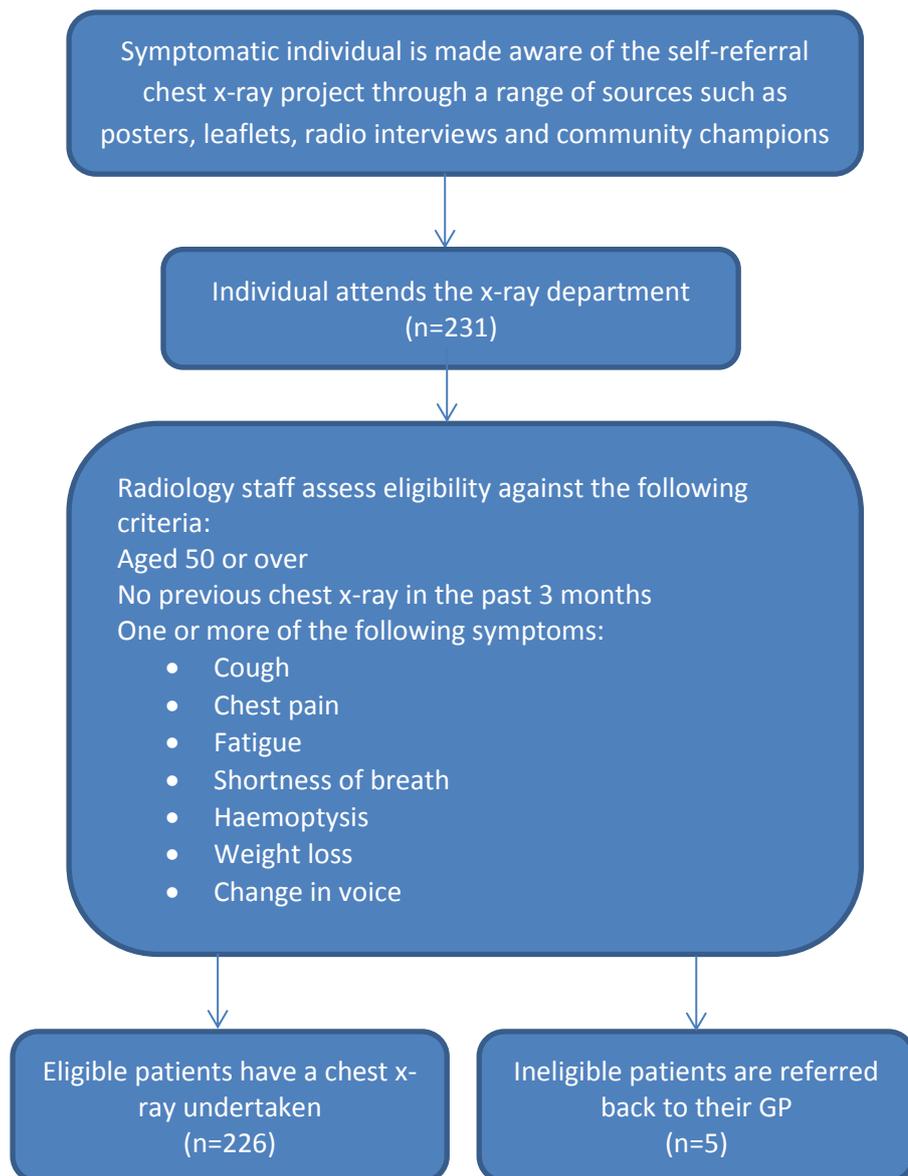
Informal discussions took place with the radiology department.

All patients who took part in this project provided consent for their data to be held as part of the project evaluation.

## Lung cancer referral pathway prior to the self-referral chest x-ray service



## Self-referral chest x-ray lung cancer pathway



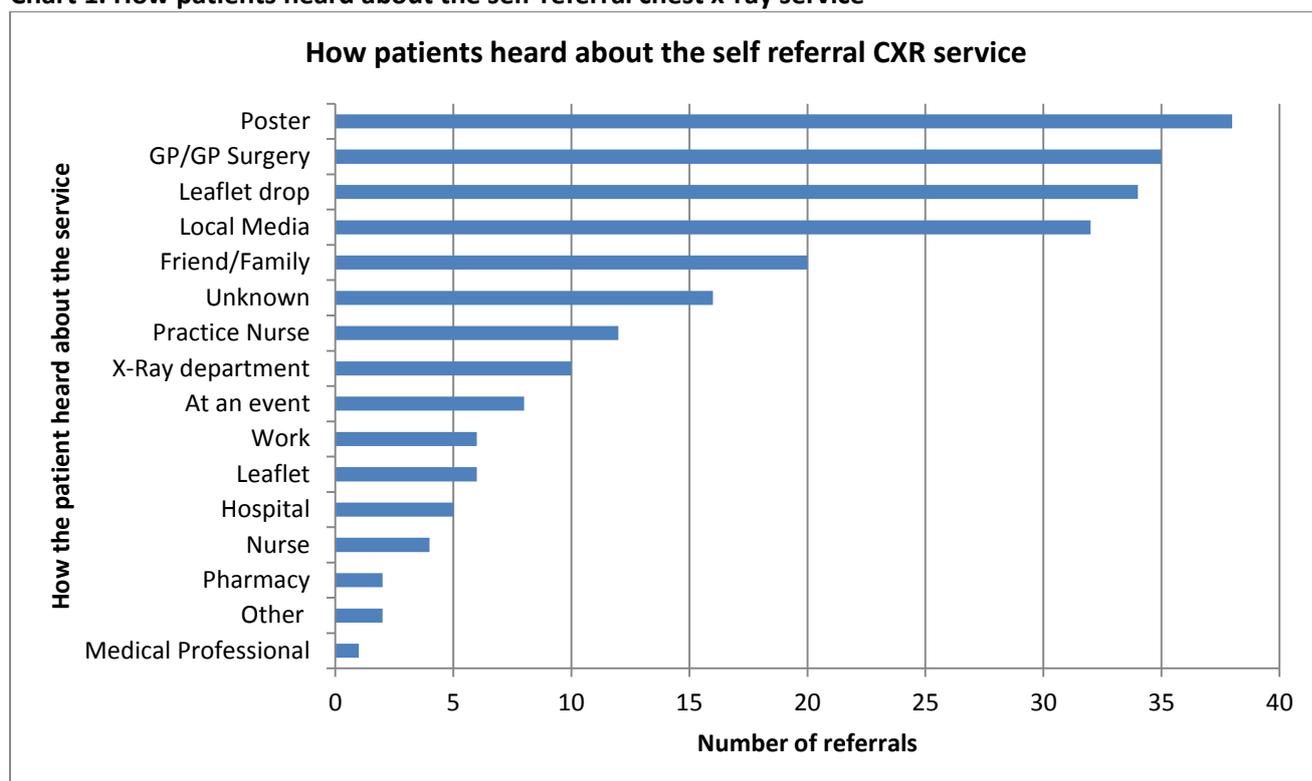
## Key Findings of the self-referral chest x-ray project

### Self-referrals demographic breakdown

#### How people heard about the service

Between the 6<sup>th</sup> July 2015 and 5<sup>th</sup> July 2016, 231 people referred themselves for a chest x-ray at Leighton Hospital. When patients arrived at the x-ray department they were required to complete a questionnaire which asked amongst other things how they heard about the service. Patients reported hearing about the service from a range of sources, the most commonly stated source of information about the service was a poster. This was closely followed by staff in GP surgeries.

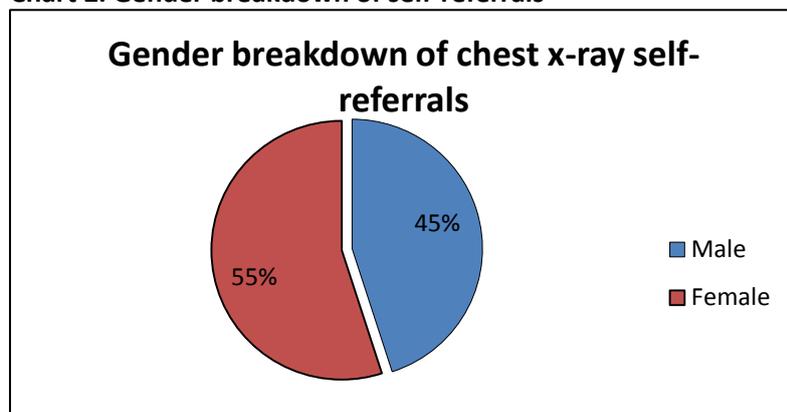
Chart 1. How patients heard about the self-referral chest x-ray service



#### Gender

Of the 231 patients who self-referred, 55% were female and 45% male.

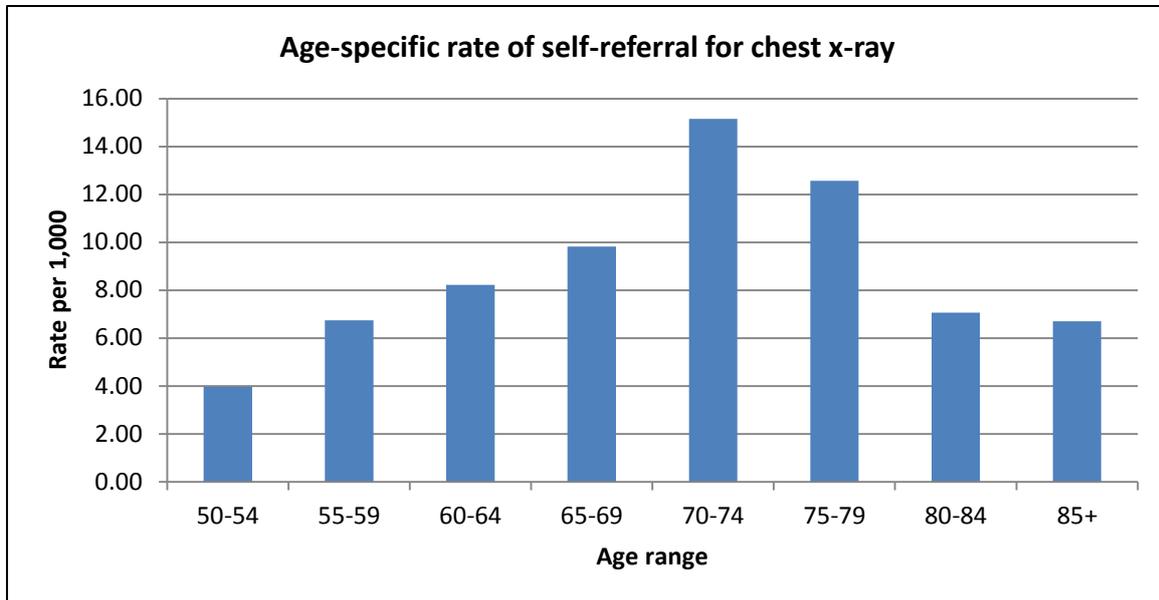
Chart 2. Gender breakdown of self-referrals



### Age

The highest rate of self-referrals came from the 70-74 age group.

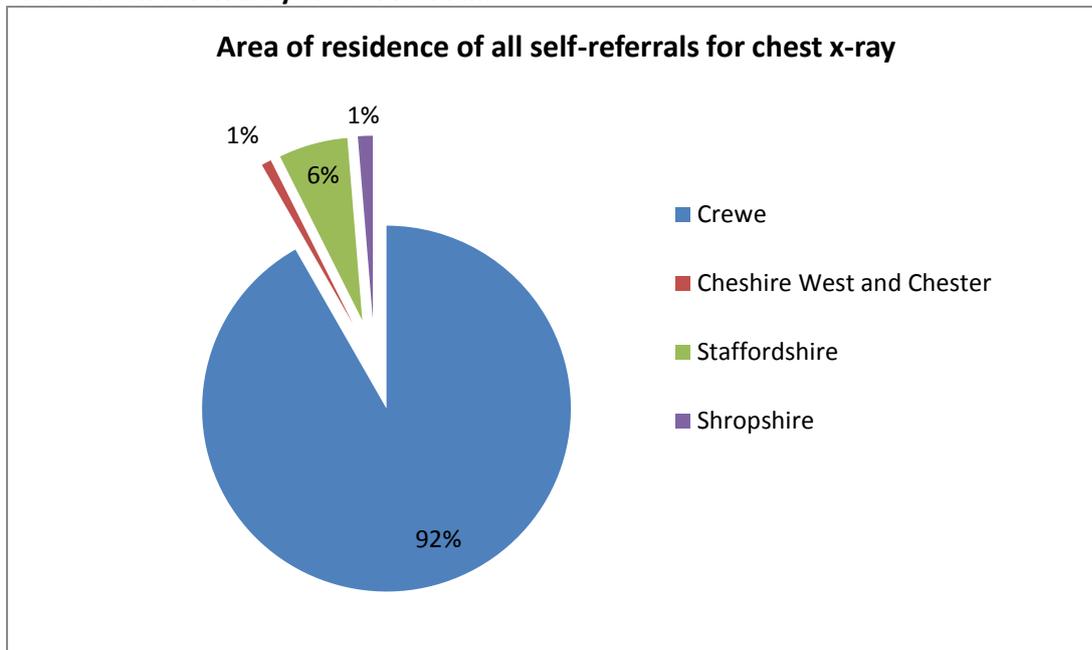
**Chart 3. Self-referral rate by age**



### Area of residence

Ninety-two percent of the 231 self-referrals resided in the Crewe area which indicates that the campaign was effective at engaging the target population.

**Chart 4. Self-referral by area of residence**



### Eligibility

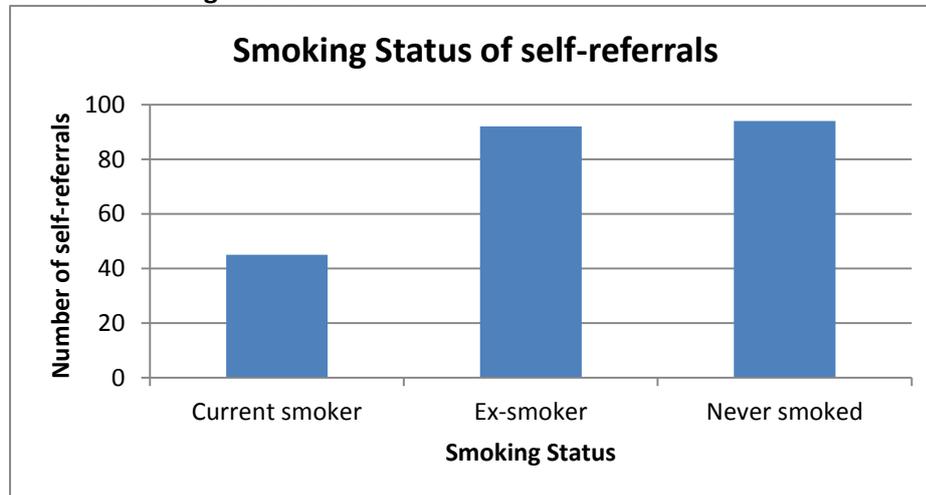
From the 231 self-referrals, 226 (97.8%) patients were eligible for a chest x-ray. Five patients were not eligible due to lack of symptoms or a recent chest x-ray.

## Smoking Status

Overall 59% of patients who self-referred were either smokers or ex-smokers. Ex-smokers accounted for 92 (40%) self-referrals, 45 (19%) were smokers and 94 (41%) had never smoked.

Among females, 50% were never smokers compared to 30% of males who were never smokers.

**Chart 5. Smoking status of self-referrals**



The largest proportion of those attending who were smokers among both males and females were in the 70-74 year old age group.

Among female ex-smokers attending the service, the 60-64 year old age group were the largest proportion of ex-smoker attenders. Among male ex-smokers attending the service the 65-69 and 70-74 year old age groups were the largest proportion of attenders.

Among the female non-smokers attending the service, the 75-79 year old age group were the largest proportion of attenders. Among male non-smokers attending the service, the 80-84 year old age group were the largest proportion of attenders.

## Symptoms

The majority (229) of self-referrals met the criteria of having one or more symptoms outlined within the eligibility criteria.

**Table 1. Number of symptoms the patient presented with**

Number of symptoms	Current Smoker	Ex-smoker	Never smoked
0	2.2%	0.0%	1.1%
1	17.8%	18.5%	24.5%
2	40.0%	29.3%	27.7%
3	13.3%	33.7%	27.7%
4	11.1%	14.1%	13.8%
5	13.3%	3.3%	3.2%
6	2.2%	1.1%	2.1%

Among women 11% of those who attended had 5 or more symptoms compared to 2% of the men attending.

**Table 2. Number of symptoms split by gender**

Number of symptoms	Female	Male
0	0.00%	1.92%
1	16.54%	25.96%
2	32.28%	28.85%
3	27.56%	26.92%
4	12.60%	14.42%
5	8.66%	0.96%
6	2.36%	0.96%

### **Procedures provided**

- 231 assessments for self-referral chest x-ray
- 226 initial chest x-rays
- 8 repeat chest x-rays
- 7 CT scans
- 2 Bronchoscopies

### **Outcomes**

The final outcomes of the 226 self-referrals who received a chest x-ray was that 202 (89.3%) patients had normal findings, 18 (8%) patients were diagnosed with other pathologies, four (1.8%) patients are receiving ongoing monitoring and two (0.9%) patients had further investigations for lung cancer which resulted in cancer being ruled out.

Alongside the self-referral chest x-ray project it was anticipated that the public awareness campaign would increase the number of requests for chest x-rays from primary care. The number of chest x-ray requests from GP practices in Crewe increased from 3191 to 4236 which is a 32.7% increase in referrals. Unfortunately it is not possible to secure data on the reason for the chest x-ray request so we are unable to conclude whether the increase in demand is due to requests for chest x-rays due to the patient experiencing lung cancer related symptoms.

### **Discussion**

How patients became aware of the self-referral chest x-ray service was a key issue for the project. Although posters and leaflets successfully raised awareness of the service a large proportion of the referrals came from health care staff (GPs and nurses). The purpose of the project was to engage symptomatic individuals that do not present to primary care for various reasons. In the case of practice nurses this pathway may have been used because they are not able to refer patients for a chest x-ray without the appropriate training. For GPs it may have been due to the new service providing a quicker referral pathway than the existing pathway between GPs and Leighton Hospital x-ray department. Although it is important that patients gain access to appropriate diagnostic tests, it is also important to understand why pathways for health professionals do not exist or are not being used.

The awareness campaign was successful in engaging the eligible residents of Crewe to attend the service. Out of 231 attendances 226 were eligible for the project which indicates that the messages about who should be attending were successful. In total 92% of those who attended were from the Crewe area indicating that the availability of the service was also well contained and did not attract many people attending from other areas of Cheshire East. The age of those who attended was also

positive as incidence of lung cancer is highest in the 80-89 years age group. Attendance by those aged 50-74 may result in earlier identification of lung cancers.

The eligibility criteria for the service only required individuals aged 50 and over to be experiencing one or more relevant symptoms. This eligibility criteria does risk engaging the worried well, if the service had applied the NICE guideline on suspected cancer recognition and referral, 25 of the 231 self-referrals would not have met the criteria recommended to health professionals for referral to a chest x-ray for suspected lung cancer<sup>10</sup>.

The eligibility criteria included smokers and non-smokers; again this risked engaging the worried well. Evidence suggests that 89% of lung cancers are preventable and a history of smoking is the greatest risk factor<sup>4</sup>. The relative risk for lung cancer in male and female current smokers is 23.26 and 12.69 respectively<sup>3</sup>. Therefore male smokers are 23.26 times more likely to develop lung cancer than non-smokers and female smokers are 12.69 times more likely to develop lung cancer compared to non-smokers. The individuals that should be prioritised for the service are those that have been exposed to the greatest risk factor associated with lung cancer which is tobacco smoking. Within the first 12 months the project engaged 0.6% of smokers and 1% of ex-smokers from the over 50 population of Crewe. There is a need to improve this as this population is at greatest risk of lung cancer. Reviewing the eligibility criteria to target those most at risk may increase the number of current and ex-smokers who engage with the service.

## Recommendations

- A referral pathway should be established for Practice Nurses to make referrals for x-rays. This could be achieved by establishing a policy for x-ray referral by qualified nurse practitioners working in general practice and the completion of the Health Education England e-learning IRMER training
- The existing GP x-ray referral pathway should be reviewed to identify any opportunities to streamline the process and prevent GPs from utilising alternative pathways.
- The eligibility criteria for the service should be amended to current or ex-smokers who have quit within the last 15 years and individuals who have had occupational exposure. This approach will ensure to those at greatest risk of lung cancer are identified and provided with an opportunity for early diagnosis. This criteria will also prevent unnecessary procedures being conducted on patients with a low risk of lung cancer. Existing primary care referral pathways will still exist alongside this pathway though as an alternative route to diagnosis.
- Further work needs to be undertaken to understand why patients accessed the service. This work may also identify what the psychological impact of the service was on patients. For those patients who had further investigations there was the potential for harm during those investigations both psychological and physical, but there was also their need for a clear understanding about whether their symptoms were caused by cancer or not.
- The opportunity costs of the project needs to be considered. Radiology staff did not feel that it had a significant impact on their capacity, but it does need to be recognised that conducting and reporting on a chest x-ray may result in the forgoing of another activity that may offer greater health benefits.

- If the service continues there needs to be a long-term plan for how the service will be promoted and monitored to ensure that eligible patients are engaging. An annual audit of patients accessing the programme and outcomes for these patients will enable this monitoring.
- The provision of brief interventions and onward referral to smoking cessation services should be integrated in to the self-referral chest x-ray pathway to ensure that those individuals who are at risk of lung cancer are provided with the opportunity to reduce their risk by modifying their smoking behaviour.

## Conclusions

In the first twelve months of operation the self-referral chest x-ray project at Leighton Hospital has successfully engaged with 231 individuals. This indicates that the marketing of the project was successful. The project did not detect any lung cancers during the initial twelve month period. Given the current incidence of the disease in Cheshire East it is questionable due to the number of individuals who presented whether any lung cancers would be detected.

The project has identified 16 patients with other pathologies which may offer benefits both to the individual patient and healthcare system. For the patients, they are receiving a diagnosis that explains the persistent symptoms they have been experiencing and access to treatment that will cure them or support them to manage a chronic condition. It may also offer benefits to the healthcare system by offering an earlier diagnosis. Quantifying these benefits was beyond the scope of this report though.

The project also increased the profile of lung cancer both in the population of Crewe and among health professionals which are crucial for increasing early diagnosis of lung cancer. This may have resulted in more symptomatic individuals presenting to their GP as well as GPs being more confident in recognising symptoms and referring patients for a chest x-ray.

The potential harms associated with providing this service to a large number of patients does need to be considered before deciding whether to roll it out further. Although the number needed to treat for chest x-ray is not available the number needed to treat with a CT scan for one lung cancer death to be prevented is 217<sup>11</sup>. In comparison 1 in 4 people are harmed by a CT scan as a result of a false positive<sup>11</sup>. A further 1 in 30 are harmed through unnecessary surgery and 1 in 161 is harmed through surgical complications<sup>11</sup>.

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