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A mixed methods evaluation of an in-reach secondary care tobacco dependency treatment service using the Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework.

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Abstract

Introduction: The NHS Long Term Plan requires all hospital inpatients in England to be systematically identified as smokers and offered opt-out tobacco dependency support. We evaluated an in-reach model in which inpatient treatment is initiated in the hospital and continued by community Smoking Cessation Services (SCS) after discharge.

Methods: A mixed-methods service evaluation was undertaken in two tertiary hospitals using the RE-AIM framework. Quantitative data (October 2022- February 2023) were extracted from the National Tobacco Dependency Services Dashboard and local SCS systems. Semi-structured interviews were conducted with stakeholders and tobacco dependency advisers, and telephone feedback was obtained from patients.

Results: Of 29,565 inpatients with recorded smoking status, 3,615 (12.2%) smoked and were referred on an opt-out basis; 1,140 (31.5%) were seen by the in-reach team. Of those seen, 955 (83.8%) accepted transfer to community SCS. Among 326 patients who set a quit date, 65.6% self-reported quitting at 4 weeks, and 57.9% of these remained quit at 12 weeks. Interviewees identified strong clinical leadership, dedicated advisers, and tailored training as key facilitators. Barriers included limited adviser capacity, weekday-only cover, fragmented information technology systems, variable access to nicotine replacement therapy, and uncertainty about long-term funding. Patients generally viewed the service as helpful.

Conclusions: An in-reach, opt-out tobacco dependency treatment model linking secondary care with established community services is feasible and can achieve encouraging short-term quit outcomes. Future refinement should focus on strengthening IT infrastructure, staffing capacity, training and secure funding to support wider scale-up and sustainability.

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Introduction

There is a lack of published literature focusing on tobacco dependency treatment services that use an in-reach model. An in-reach model is defined as a service in which there is a transfer of patient care from one organisation to another at the point of hospital discharge, to continue the tobacco treatment pathway. The in-reach model contrasts an in-house service in which the delivery of tobacco dependency treatment is initiated and monitored to completion by a single hospital-based service.

Smoking tobacco is the largest preventable cause of morbidity and mortality in the United Kingdom[1]. Approximately 74,800 deaths and 400,000 hospital admissions each year are attributed to smoking[2]. The extensive health implications of tobacco inhalation cost the National Health Service (NHS) an estimated £2.6 billion per year[3], as well as driving healthcare utilisation. The poorest members of society are more likely to smoke, contributing to health inequalities[4]. Whilst the total number of smokers has decreased in recent years, 6 million adults in the UK remain addicted to tobacco[5]. In 2021, a national audit of treatment for tobacco dependency in hospital inpatients found 95% of patients who smoke were not prescribed National Institute for Health and Care Excellence (NICE) recommended treatments[6,7].

The NHS Long Term Plan (LTP) specifies that all hospital inpatients should be systematically screened for smoking status and offered treatment for tobacco dependency on an opt-out basis[8]. These services should have been implemented across all hospitals and maternity providers in England by March 2024. This service aimed to provide tobacco dependency support to all inpatients who smoke.

The NHS LTP treatment model is based on published models including the 'Ottawa Model' and the 'CURE' programme (Conversation, Understand, Replace, Experts and evidence-based treatment). The CURE programme, first introduced in Greater Manchester (GM), was adapted from the Ottawa model in Canada. The Ottawa model demonstrated success in systematically identifying smokers admitted to secondary care and providing them with specialist advice alongside Nicotine Replacement Therapy (NRT) to treat tobacco dependency[9]. The Ottawa model resulted in lower 1- and 2-year mortality and a reduction in Emergency Department attendances, hospital re-admissions and GP utilisation for those who successfully stopped smoking. The CURE pilot in GM implemented an in-house tobacco dependency treatment service model for inpatients within the hospital. The pilot reported a smoking quit rate of 22% at 12 weeks amongst those who participated in the programme from October 2018 to March 2019[10], demonstrating the feasibility and effectiveness of an in-house service in an NHS setting.

Several qualitative studies have explored aspects of the in-house CURE project in GM. Wearn et al. assessed the barriers and facilitators of implementation where it was identified that staffing levels, availability of office space and knowledge of the programme amongst staff influenced success[11]. The most common barrier cited by participants was the lack of community follow up and input outside of the CURE project. In contrast, it was felt that well developed marketing materials, the flexibility of the service and peer support amongst the CURE team were facilitators of success. Rodrigues et al. conducted a study which aimed to identify recommendations for practice[12]. The recommended interventions were in line with addressing the barriers mentioned above such as ensuring continuity of care, adequate staffing levels and equipment.

A notable difference between the in-reach service and an in-house service is that prior to discharge in an in-reach model, NRT is prescribed to take home and an appointment is made with SCS for follow-on support. SCS contact the client via telephone to set a quit date and provide ongoing behavioural support and pharmacotherapy for up to 12 weeks. This process is summarised in Figure 1. The in-reach model takes advantage of the knowledge and experience of existing SCS and aims to strengthen the link between community and secondary care services.

The primary aim of this evaluation was to evaluate the feasibility of an in-reach service at UHL using the Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework. The primary outcomes were number of smokers who quit and

metathemes from qualitative interviews. The secondary aim is to identify facilitators and barriers to implementation of an in-reach model, the secondary outcome is a summary of these facilitators and barriers.

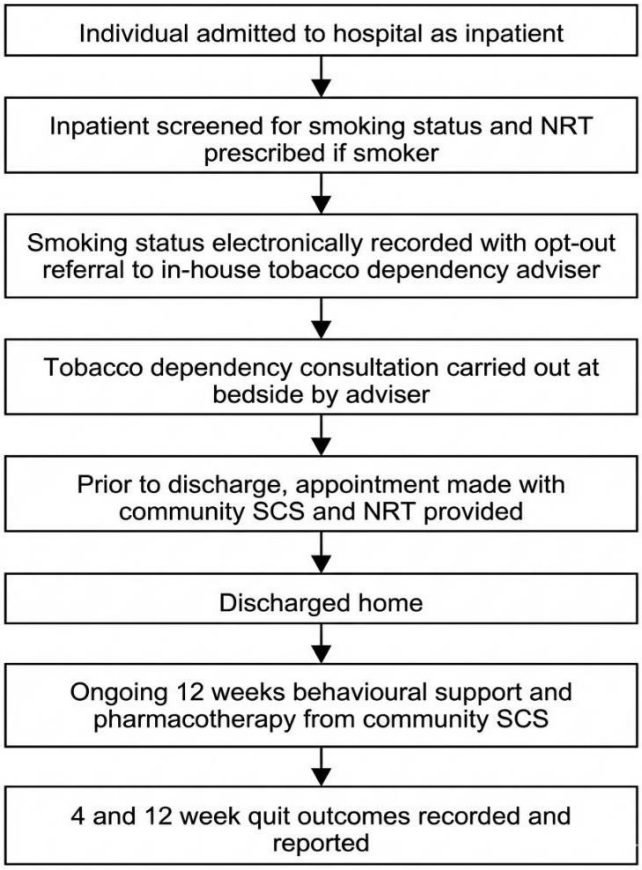

Figure 1: In-reach tobacco dependency treatment pathway. NRT= Nicotine Replacement Therapy, SCS= Smoking Cessation Services.

Methods

Study setting

This study relates to an in-reach service which was implemented in a phased approach at the University Hospitals of Leicester NHS Trust (UHL), a large tertiary acute hospital Trust, comprising of three hospitals, from April 2021. At the time of the evaluation, the tobacco dependency treatment service (henceforth referred to as the 'service'), had been implemented in two of the three hospitals in the Trust. In this service, a transfer of care upon hospital discharge took place from UHL to one of the two local authority Smoking Cessation Services (SCS) serving the hospital catchment area. In the local population, 15.8% of adults in Leicester City and 10.7% of Leicestershire County adults were classed as smokers in 2022/2023[13].

Design

This mixed methods service evaluation used the RE-AIM framework[14]. The mixed methods design allows triangulation of findings. The RE-AIM framework is a tool to guide service evaluation and has been previously applied to evaluate health promotion services[15]. The framework was chosen for its holistic, structured approach. This is the first application of the RE-AIM framework to an in-reach service.

Data collection and analysis

Quantitative data from 1 October 2022 to 28 February 2023, was extracted from the National Tobacco Dependency Services Dashboard (NTDSD)[16]. This is a national interactive tool which shows tobacco assessment and treatment data from secondary care services in England. A subset of the data, comprising of key indicators to describe the patient journey, was used. The flow of patients through the quantitative arm is summarised in Figure 2.

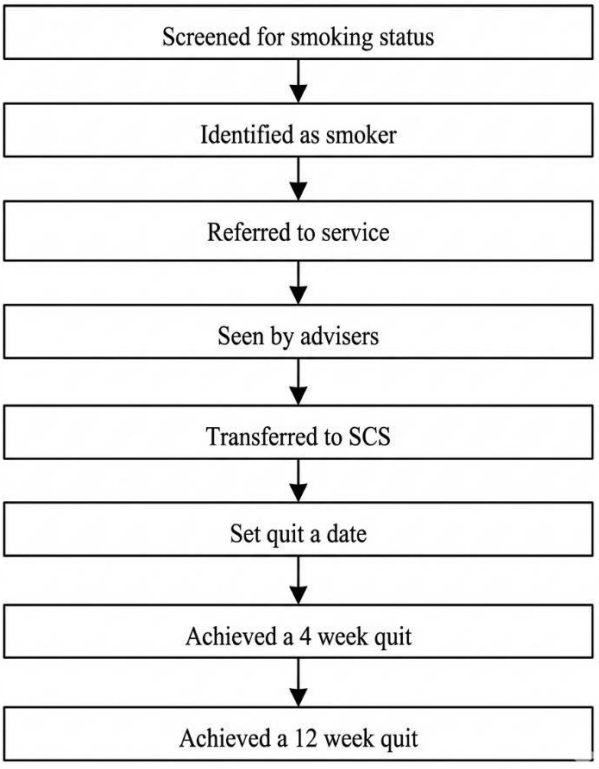

Figure 2: Flow of participants through the quantitative arm. SCS = Smoking Cessation Service

Data is transferred automatically from UHL to the NTDSD. Smoking status is identified during the admission nursing assessment and recorded

directly onto the Electronic Health Record (EHR). The EHR generates a daily list of all current smokers who are inpatients, which is sent to the six advisers who facilitated the identification and review of smokers from 9am to 5pm, Monday to Friday.

The first primary outcome was number of smokers who quit, this data was manually extracted from UHL hospital records and community SCS case management systems (Live Well for Leicester residents and Quit Ready for Leicestershire and Rutland residents). Patients who were not residents of LLR were referred to their local SCS, their data was not captured in this evaluation. UHL data submission to the NTDSD began in October 2022, 5 months of outcome data was available for inclusion in this paper.

The second primary outcome was metathemes from interviews. Qualitative data was collected from December 2022 to January 2023, from stakeholders such as public health leads, Trust partners and local authority representatives, who have a strategic role in designing and developing the service, and advisers, who had an operational role in delivering the frontline service to patients. A list of stakeholders was purposively compiled by the clinical lead and a list of all advisers provided by the service co-ordinator, all of those identified were invited, and agreed to participate. Bespoke semi-structured interview guides (see supplementary document) were developed for each group using the RE-AIM framework. The guide for stakeholders provided a strategic perspective, whereas the guide for advisers provided an operational perspective, results were therefore presented separately. Prior to each 30-minute interview on Microsoft Teams, participants were asked to read a Participant Information Sheet (PIS) and sign a consent form. Interviews were recorded, transcribed, anonymised and stored securely. At this stage, data was judged to have reached saturation. A hybrid inductive-deductive approach was taken for analysis. Firstly, a deductive approach was used to organise transcript data into the RE-AIM domains by one author (SS). Secondly, an inductive approach was taken to identify themes within the bounds of the RE-AIM domains (SS), the themes were reviewed and agreed with another author (AT)[17]. Data that did not fit into the RE-AIM framework was analysed separately and included in Table 3, as it was judged to be relevant to ongoing service development.

A small, telephone-based, patient feedback project was also undertaken for this evaluation. Patients who had been seen by the service 12-24 weeks prior and consented to be involved in evaluation were contacted in January 2023. They were asked about their experience with the service using a structured questionnaire (supplementary interview guides) until data saturation was reached. Results from both structured interviews were collated using Microsoft Word and Microsoft Excel.

The RAMESES II reporting standards for realist evaluations checklist[18] was completed and is attached in the supplement.

Results

The findings of this mixed methods service evaluation are summarised using the RE-AIM framework. Table 1 is a guide to summarise data sources and quantitative metrics used in the results section. Findings include quantitative data from the NTDSD; qualitative data from 10 stakeholder interviews and 6 adviser interviews and feedback from 20 patients. The primary outcomes were number of patients who quit smoking and metathemes of qualitative interviews and the secondary outcome was facilitators and barriers to implementation. These outcomes are referred to in the text and can be found in Table 2, Table 3, Supplemental Table 1 and Supplemental Table 2.

Reach

Between October 2022 and February 2023, 29,565 UHL patients were asked their smoking status. The prevalence of smoking in this population was 12.2%. All smokers who were identified on admission were referred to the service on an opt-out basis. Of the 3,615 patients referred, 1,140 (31.5%) were seen by the service. Of the 1,140 patients seen by advisers, 955 (83.8%) agreed to be transferred to the community SCS to receive ongoing tobacco dependency support and 520 of 710 (73.2%) patients receiving intervention from advisers accepted NRT (Table 2). Most stakeholders felt the service did not see as many smokers as initially intended (Table 3). The service model was seen as a helpful framework

Table 1: Summary of data sources and quantitative metrics used in results section. NTDSD= National Tobacco Dependency Services Dashboard, SCS= Smoking Cessation Service, NRT= Nicotine Replacement Therapy

RE-AIM component	Data sources	Quantitative metrics
Reach	NTDSD Stakeholder and Adviser interviews	Smoking prevalence Number of patients referred Number of patients seen Number of patients transferred to SCS Number of patients prescribed NRT
Effectiveness	SCS data Stakeholder and Adviser interviews Patient interviews	Quit date set Self reported quit at 4 weeks Self reported quit at 12 weeks
Adoption	Stakeholder and Adviser interviews	-
Implementation	NTDSD Stakeholder and Adviser interviews	Number of referred smokers seen by service Number of patients prescribed NRT
Maintenance	Stakeholder and Adviser interviews	-

to systematically identify people who smoke but participants felt this could be improved through offering weekend tobacco dependence support by advisers to ensure patients admitted on weekends are treated. Improvements to completion rates of the hospital admission nursing electronic module which asks for the patient's smoking status could also increase the number of smokers identified. The completion rate of this smoking assessment for all adult UHL inpatients (excluding maternity) on 31 May 2023 was 75.9%. Amongst advisers, language barriers were recognised as an inhibitor to engaging with patients, with knowledge on hospital translation services variable (Table 3).

Effectiveness

Transfer of care was made to 2 different SCS based on patients' residence with both services showing comparable outcomes. Quit dates were set by 326 smokers who were transferred to SCS with 214 (65.6%) self-reporting quitting at 4 weeks. Of those who had quit at 4 weeks, 124 (57.9%) quit by 12 weeks (Table 2).

All stakeholders viewed the hospital service as very effective (Supplemental Tables 1 and 2). Stakeholders felt the service led to increased assessment of a patient's smoking status; increased prescribing of NRT during an inpatient stay and increased referrals to community SCS. This was understood to result in more patients quitting smoking. From the perspective of advisers, effectiveness of patient identification and treatment could be improved through a more streamlined, user friendly and accessible IT system. In particular, advisers felt the service could be more effective if they were able to utilise the prescribing system, resulting in quicker access to NRT for patients. Advisers believed that improved awareness of the use, importance and prescription of NRT among clinical staff could increase effectiveness (Table 3). Generally, advisers believed that the needs of smokers were being met.

Feedback was collected from 20 patients and showed that most (85%) patients felt that the service was helpful; 65% felt that the service made quitting smoking easier and 30% felt they had learnt something new through the service.

Adoption

Stakeholders observed strong clinical leadership, project management and tailored training for clinical staff as important factors for successful adoption of the service (Supplemental Table 1 and Table 2). Additionally, advisers described branded t-shirts and posters as positively impacting visibility and awareness of the service.

Implementation

From October 2022 to February 2023, only 31.5% of patients referred to the service were seen by advisers (Table 2). Possible reasons for this, as ascertained from interviews, include staff absences having a higher impact on a small adviser team, high staff turnover and a 5-day service resulting in weekend patients not being seen.

Table 2: Findings from the National Tobacco Dependency Services Dashboard, October 2022- February 2023

Indicator	Total % (October 2022- February 2023)
% of activity where a patients smoking status is recorded (number with smoking status/total number)	94.4% (29,565/ 31,305)
% of patients with a recorded smoking status where the patient is recorded as a smoker (number of smokers/number with a recorded smoking status)	12.2% (3,615/ 29,565)
Initial nursing assessment completion rate (excluding maternity) for inpatients on 30/05/23 (number of assessments completed/number of inpatients)	75.9% (1314/1731)
% of smokers who are identified in the care setting that are referred to an in-house* tobacco dependence treatment service (number of smokers referred/number of smokers identified)	100% (3615/ 3615)
% of smokers referred to an in-house tobacco dependence treatment service that were seen by the service (number of smokers seen by service/ number of smokers referred to service)	31.5% (1,140/ 3,615)
% of smokers who were seen by an in-house tobacco dependence treatment service that were provided with care plans to support a quit attempt (number provided care plans (including pharmacotherapy and/or referral)/number seen by service)	59.2% (675/ 1,140)
% of patients receiving a tobacco dependence intervention who were provided with pharmacotherapy-based interventions (number provided pharmacotherapy intervention/number provided any intervention- not including verbal advice)	73.2% (520/ 710)
% of smokers who were identified in the care setting that are referred for follow up (number referred to community SCS/ number identified as smokers)	26.4% (955/3,615)
Bespoke metric: % of smokers seen by Tobacco Dependency Advisers who were referred for follow up (Number referred to community SCS/ number seen by service)	83.8% (955/1,140)
Local authority quit data for referrals to smoking cessation services (self reported)	
Number who set a quit date in community (Leicester)	118
4 week quit (Leicester)	60.2% (71/118)
12 week quit (Leicester)	50.7% (36/71)
Number who set a quit date in community (Leicestershire and Rutland)	208
4 week quit (Leicestershire and Rutland)	68.8% (143/208)
12 week quit (Leicestershire and Rutland)	61.5% (88/143)

** Whilst the NTDSD indicator refers to the service as "in-house" by default, our service in an in-reach service*

The key facilitator of the service was the team which comprised of advisers, clinical lead, project coordinator, project manager, administrator and members of the steering group. Participants felt that open communication; shared understanding and continual feedback enhanced the success of the service. The GM CURE model was identified as a helpful example that aided development of the service. The largest barrier to implementation was IT. Issues related to IT were multifaceted. A cross-organisation service led to difficulties with access to systems and data, a key disadvantage of the in-reach service. Lack of ownership of IT systems and prioritisation for associated work resulted in the use of a shared excel document to collect data related to the service, which was highly prone to human error.

Early planning for the development of new IT systems was a lesson for others identified by one stakeholder. A full list of facilitators and barriers can be found in Supplemental Table 2. In the sample period, 73.2% of smokers who engaged with advisers were prescribed NRT, with inconsistent access to NRT a commonly noted theme. Stakeholders felt a general increase in prescriptions of NRT had occurred since the launch of the service, but national NRT shortages had an impact on the type of NRT available. Community SCS stakeholders remarked on the differing NRT availability between hospital and community, which led to inconsistencies in patient access to pharmacotherapy. Advisers felt more training for clinical staff on the importance of NRT would increase confidence around its use.

Table 3: Summary of themes and metathemes from Tobacco Dependency Adviser (TDA) interviews. NRT=Nicotine Replacement Therapy

Question	Themes	Metathemes
Reach	Variable knowledge of translation services (1 TDA used language line, 1 TDA knew it existed and did not use it, 2 TDAs did not know it exists, 2 TDA did not discuss the topic of translation services). Methods to communicate with speakers of languages other than English include: Bilingual TDAs, asking ward staff, getting advice for ward staff, using family of the patient, sign language, phone based apps, no method (did not see patient).	There was variable knowledge of the hospital translation service among TDAs.
Effectiveness	Effectiveness could be improved by: Access to prescribing system for TDAs. Improvements to IT systems including more user friendly system, streamlining, access. Improving awareness of NRT (including its use, importance and prescription). A focus on face to face contact. Increased capacity of the TDA team. Generally, TDAs felt that we are meeting the needs of smokers.	The service could be more effective through improvements to the IT system and increased knowledge of NRT among clinical staff.
Adoption	Adoption has improved over time due to: Training sessions Posters There is a difference in adoption between the two hospital sites (Glenfield and Royal Infirmary), likely due to Glenfield being the first place to adopt. Glenfield having the cardiorespiratory unit. Glenfield being smaller. Glenfield having more clinical champions.	There is a difference in adoption between the two hospital sites.
Implementation	Unable to see all patients who are referred (small team, only working office hours, single admin support, large impacts of sickness, large admin load, delayed referrals, IT). We are much better known than when we started.	Our vision states that we aim to provide support to all smokers but the TDAs are unable to see every smoker.
Maintenance	Project co-ordinator is excellent. Feel appreciated as a member of the team. Some felt that patients can influence the service through the collection of their feedback whilst others stated that patients do not have influence over CURE.	TDAs felt that they have influence over the service but there were mixed opinions on whether patients can influence the service.
Training	Shadowing was seen as the most helpful part of training. Excellent feedback for manager. Suggestions for further training include: Mentoring; induction with case studies, success stories, interactive sessions; training on wider topics.	Training received very positive feedback and shadowing was seen as the most helpful part.
Wider environment	Participants named some wider factors that could improve smoking cessation in the population: Mental health support Signposting to relevant services Learning healthy coping mechanisms for stress Greater accessibility to NRT (including e- cigarettes) Make further improvements to the service	TDAs felt that smokers require a range of support to quit, they could be better supported through signposting to mental health support.

Maintenance Service improvements were noted by stakeholders and included an increased identification of smokers and stronger relationships between secondary care and community services. To ensure the successes of the service continue and remain a priority, participants felt certainty around funding and continued training for clinical staff would be beneficial. Adviser interviews revealed that staff felt they were able to input into the service and were appreciated by the wider team. However, there

were mixed thoughts on the level of patient and public involvement with some advisers commenting that patients were not asked to provide input into the running of the service.

Other themes

Themes from adviser interviews that did not fit into the RE-AIM framework were recorded for completeness. The themes were "training", where shadowing was perceived to be a particularly helpful educational element and "wider environment", where it was acknowledged that the environment of someone who smokes will have an impact on their ability to quit.

Discussion

Our in-reach service has proven feasible at systematically identifying people who smoke and providing opt-out treatment. There was an overall positive perception of the service from stakeholders and individuals working for the service.

Outcomes of the CURE in-house tobacco dependency treatment model have been published by GM[10]. Over 6 months, GM identified 2393 smokers. They were able to treat 1,450 (61%) of these smokers. Regarding medication, in Greater Manchester 1,568/2,393 (66%) of smokers were provided NRT by either advisers or the clinical team. The 4 week self-reported quit rate was 66% and the 12 week self-reported quit rate was 58%. Comparison of outcomes between GM and UHL are difficult due to differences in services. For example, GM employed an in-house model; did not have comparable population structure to UHL and collected data at a different time. For this reason, direct comparisons have not been made.

Facilitators and barriers from interviews with stakeholders and advisers show similarities to the Manchester CURE "pillars of success"[19]. Common enablers included: clinical leadership, specialist CURE/adviser team, IT systems, pharmacy, culture change and project management. Discharge pathways and branding also featured in the pillars of success but were not as prominent in this evaluation. Another study by Wearn et al. identified similar barriers and facilitators as those mentioned above, further demonstrating that enablers may not differ between in-house and in-reach services[11]. Barriers identified in this intervention included IT, staffing, and NRT availability, all of which were recommendations suggested by Rodrigues et al[12].

A qualitative study of patient experience was conducted in GM[20]. From a sample of 106 patients, authors concluded that patient needs were met through the CURE model as feedback from patients was excellent. We conducted a smaller telephone study with 20 patients and found that 85% of sample patients found the service to be helpful with the remainder stating it had no impact on them.

A National Institute for Health Research (NIHR) evaluation[21] of the implementation of the LTP named three barriers to implementation: (1) lack of transparency of funding (2) mandated data collection in the context of pre-existing IT systems and (3) healthcare professionals' role and perception of smoking. The NIHR barriers are similar to barriers identified in this evaluation. This also implies that some of the facilitators and barriers faced are not unique to the UHL service but could be experienced by other hospital Trusts.

The 2025 NHS 10 year health plan for England[22] proposes a switch from hospital to community and from sickness to prevention. An in-reach tobacco dependency treatment service aligns with both goals, by referring smokers into community services and tackling the biggest preventable cause of morbidity and mortality in England[1]. Therefore, implementation of in-reach tobacco dependency treatment services is likely to increase.

The findings show that an in-reach model has specific benefits. The model can strengthen relationships between secondary care and community services, resulting in a more streamlined patient journey to quit smoking. An in-reach model can be attractive to stakeholders, by making use of the experience of existing community services. Finally, this evaluation shows that it is possible to set up a successful in-reach service.

The in-reach model also has challenges. Successful implementation requires input from multiple organisations. Advisers described difficulties with gaining access to all required systems, managing many IT passwords and lack of timely IT support. At the strategic level, data had to be collected from a range of datasets across organisations, resulting in issues with missing data and reporting of patient

level outcomes. Various limitations in this evaluation were identified. Early quantitative data from the NTDSD are presented from a time where the service experienced adviser staff shortages and absences. This means that the data is not representative of a fully staffed service at UHL. In addition, only 5 months of data was available on the NTDSD, which represents a short period in the service which began implementation 17 months prior to the presented data. Linked quit data was not available on the NTDSD and was extracted separately, making comparison difficult. Furthermore, details of the statistical methods used by the NTDSD are unavailable. This needs to be considered when using any data on the NTDSD which is still developing. Another limitation is that only 31.5% of the patients referred to the service were seen. This is likely due to staffing capacity, which was found to be a barrier, alongside staff turnover and the fact that patients were not seen at weekends. Finally, selection and recall bias from participants taking part in the qualitative research may affect the themes and metathemes extracted from interviews. A longer-term evaluation is required to mitigate these limitations and measure long term outcomes.

This project shows that an in-reach tobacco dependency service is feasible and can strengthen links between hospital and community teams while making better use of existing support. Success depends on early planning for a simple IT pathway, strong staff awareness of tobacco treatment, and secure, ongoing funding. Future development should prioritise regular training for healthcare professionals, robust data linkage between secondary and community care to track quit outcomes, and active use of the National Tobacco Dependency Services Dashboard to monitor performance and build the case for sustained investment.

Ethics: This evaluation was registered as a quality improvement project with UHL, Ref No 12505. No other approvals were required as this project qualified as a service improvement project as per UHL guidelines.

Conflicts of interest: none

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Data sharing statement: data available on request

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