

# Health economic analysis for the 'CURE Project' pilot: a hospital-based tobacco dependency treatment service in Greater Manchester

Matthew Evison ,<sup>1</sup> Julian Cox,<sup>2</sup> Freya Howle,<sup>3</sup> Kathryn Groom,<sup>3</sup> Ryan Moore,<sup>3</sup> Hannah Clegg,<sup>3</sup> Cheryl Pearse,<sup>1</sup> Michael Rutherford,<sup>1</sup> Alex Tempowski,<sup>4</sup> Seamus Grundy,<sup>5</sup> Beth Turnpenny,<sup>6</sup> Hou Law,<sup>7</sup> Ram Sundar,<sup>8</sup> Al-Tahoor Butt,<sup>9</sup> Muntasir Abdelaziz,<sup>9</sup> Jane Coyne,<sup>10</sup> Andrea Crossfield,<sup>10</sup> Claire O'Rourke,<sup>3</sup> David Shackley<sup>11</sup>

**To cite:** Evison M, Cox J, Howle F, *et al.* Health economic analysis for the 'CURE Project' pilot: a hospital-based tobacco dependency treatment service in Greater Manchester. *BMJ Open Res* 2021;**8**:e001105. doi:10.1136/bmjresp-2021-001105

Received 13 September 2021  
Accepted 7 December 2021

## ABSTRACT

**Introduction** Treating tobacco dependency in patients admitted to acute care National Health Service (NHS) trusts is a key priority in the NHS 10-year plan. This paper sets out the results of a health economic analysis for 'The CURE Project' pilot; a new hospital-based tobacco dependency service.

**Methods** A health economic analysis to understand the costs of the intervention (both for the inpatient service and postdischarge costs), the return on investment (ROI) and the cost per quality-adjusted life year (QALY) of the CURE Project pilot in Greater Manchester. ROI and cost per QALY were calculated using the European Study on Quantifying Utility of Investment in Protection from Tobacco and Greater Manchester Cost Benefit Analysis Tools.

**Results** The total intervention costs for the inpatient service in the 6-month CURE pilot were £96 224 with a cost per patient who smokes of £40.21. The estimated average cost per patient who was discharged on pharmacotherapy was £97.40. The cost per quit (22% quit rate for smokers at 12 weeks post discharge) was £475. The gross financial ROI ratio was £2.12 return per £1 invested with a payback period of 4 years. The cashable financial ROI ratio was £1.06 return per £1 invested with a payback period of 10 years. The public value ROI ratio was £30.49 per £1 invested. The cost per QALY for this programme was £487.

**Discussion** The CURE Project pilot has been shown to be exceptionally cost-effective with highly significant ROI in this health economic analysis. This supports the NHS priority to embed high-quality tobacco addiction treatment services in acute NHS trusts, and the CURE Project provides a blueprint and framework to achieve this.

## INTRODUCTION

Smoking tobacco is the single largest preventable cause of illness, disability and death in the UK.<sup>1</sup> The Royal College of Physicians (RCP) recommends that the National Health Service (NHS) provides opt-out tobacco addiction treatment services to all patients

## Key messages

- ▶ The aim of this study was to understand if the CURE Project, a new tobacco dependency treatment service for smokers admitted to hospital, is a cost-effective intervention.
- ▶ The CURE Project is a highly cost-effective intervention with a cost per quality-adjusted life year of £487 and a public value return on investment of £30.49 for every £1 invested.
- ▶ These results support the National Health Service long-term plan to embed tobacco dependency treatment services in acute care trusts, and the CURE Project provides a framework for implementation.

who smoke at any contact point with the NHS. Furthermore, the NHS long-term plan has committed to funding such tobacco addiction treatment services in acute care trusts, maternity services and mental health services.<sup>2</sup> However, the current provision of tobacco addiction treatment in acute care trusts is woefully inadequate; less than a third of patients who smoke are offered nicotine replacement therapy (NRT) when admitted to hospital and less than one in seven are referred to a specialist stop smoking practitioner.<sup>3</sup>

'The CURE (Conversation, Understand, Replace, Experts and Evidence-based interventions) Project' is a new, comprehensive and opt-out tobacco addiction treatment service for all patients who smoke admitted to secondary care, first piloted in Greater Manchester (GM), in the North West of England. The CURE pathway embeds the identification of current smokers, provision of brief advice and pharmacotherapy prescription by admitting clinicians at the



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For numbered affiliations see end of article.

**Correspondence to**  
Dr Matthew Evison;  
m.evison@nhs.net



point of hospital admission. This initial treatment is then augmented by behaviour change support and pharmacotherapy review during and after discharge by specialist stop smoking practitioners. The programme aims to upskill all clinical teams in tobacco addiction treatment through hospital-wide training with CURE e-learning modules and a standardised treatment protocol consisting of combination NRT and varenicline as monotherapies or in combination. Identification of current smokers is facilitated by the mandatory recording of smoking status within standardised electronic admission documentation for all patients. This, in turn, triggers an automated referral to the CURE specialist team for any patient identified as a 'current smoker' and allows an opt-out model of care to be provided. All patients who smoke are approached by a CURE specialist practitioner and offered more in-depth specialist treatment beyond that initiated by the admitting clinicians. This specialist support is then offered beyond discharge through referral to a local stop smoking service or follow-up with the hospital CURE team.

The CURE Project was first piloted at a single acute care trust in GM over a 6-month period from 1 October 2018 to 31 March 2019 and has since become a recurrently funded service at that site. The results of this pilot have been published previously but in short; during the 6-month pilot period, 14 690 adult admissions were recorded in hospital's electronic patient record (EPR) system (excluding paediatrics, maternity and day case admissions). Smoking status was recorded in 92% (13 515/14 690) and 18% (2393/13 515) were recorded as active smokers. Overall, 96% (2308/2393) of all patients who smoke were provided with brief advice at the point of admission, 66% (1568/2393) were prescribed any form of stop smoking pharmacotherapy, 61% (1450/2393) accepted specialist assessment from the CURE team and 22% (525/2393) remained abstinent from tobacco at 12 weeks post discharge.<sup>4</sup> Based on these initial pilot outcomes, the CURE Project is being implemented across seven additional acute care trusts in GM through cancer transformation funding and provides a potential blueprint for national implementation of the NHS long-term plan for tobacco dependency. Understanding the costs, the return on investment (ROI) and the cost per quality-adjusted life year (QALY) of the CURE Project may help support the future sustainability and commissioning of the GM programme as well as supporting delivery of the national tobacco programme.

## METHODS

### Study outline

A health economic analysis to understand the costs of the programme, the ROI and the cost per QALY of the CURE Project pilot in GM.

### Study setting

The CURE Project pilot was run at Wythenshawe Hospital, part of Manchester University NHS Foundation

Trust from 1 October 2018 to 31 March 2019. Wythenshawe Hospital is a large 900-bed teaching hospital in the city of Manchester, located in the North West of England. The city of Manchester is one of ten localities within GM, a metropolitan county with a population of 3.2 million. Each locality within GM represents an individual clinical commissioning group (CCG) including an acute care NHS trust. The city of Manchester has three acute NHS care trusts in the north, centre and south of the city. Wythenshawe Hospital is the South Manchester Hospital. In this densely populated region, it is very easy for patients to receive care across a number of different acute care trusts.

### The CURE Project pilot pathway

In the CURE pathway, a current smoker is defined as any patient who self-reports as a current smoker at the point of hospital admission. It is not possible to stratify any further in terms of intensity of smoking or level of dependency. At the time of the CURE pilot launch in 2018, the city of Manchester did not provide a community-based specialist stop smoking service. Therefore, during the CURE pilot, active smokers admitted to Wythenshawe Hospital that were seen by the CURE team and accepting of ongoing support after discharge were offered post-discharge support and follow-up with the Hospital CURE team. This was available both face to face and via telephone consultation. The standard follow-up was at 2 weeks, 4 weeks and 12 weeks post discharge but with a recognition that individualised follow-up with more intensive support could be offered on a case-by-case decision at the discretion of the specialist practitioners. For patients who were residents outside of the city of Manchester, in localities where community stop smoking services were provided, patients were offered either referral to their local community stop smoking services or follow-up with the Hospital CURE team though the community stop smoking services were the preferred route of follow-up. Those patients who were prescribed stop smoking pharmacotherapy during a hospital admission were provided with a 1-week supply of discharge medications. Further prescriptions were then provided within primary care (either by the general practitioner or via the community stop smoking service).

### Calculating the costs of the CURE pilot

Our aim was to understand the intervention costs for the CURE Project including cost per patient who smokes for providing the hospital service and a cost per patient who smokes for the entire pathway including post-discharge. Understanding the intervention cost per smoker could allow us to estimate the overall costs for all acute care trusts in GM to deliver CURE services. These data could also be used to calculate the cost per quit of the programme, which could then be compared with other stop smoking services to help assess its cost-effectiveness in comparison to those services.

To calculate the CURE intervention costs, we obtained the overall expenditure on stop smoking pharmacotherapy (NRT and varenicline) at Wythenshawe Hospital during the 6-month pilot from 1 October 2018 to 31 March 2019. This provides the estimated costs of inpatient pharmacotherapy used during the pilot as well as the 1 week of medication provided at discharge. We also obtained the salary expenditure for the CURE specialist practitioners and the CURE administrative support staff during the pilot. This represents the costs needed to deliver the inpatient specialist support and an average of three follow-up consultations post discharge. In order to understand the costs of ongoing prescription of stop smoking pharmacotherapy in primary care following discharge, we first obtained the percentage of adult admissions to Wythenshawe Hospital in patients who are residents in the city of Manchester for the period the pilot ran. The city of Manchester CCG prescribing database was used to provide the additional expenditure on stop smoking pharmacotherapy during the CURE pilot above that of the existing spending baseline. This additional cost for the 6-month period was divided by the total number of patients discharged from Wythenshawe Hospital with stop smoking medications adjusted to reflect the proportion of discharges in city of Manchester residents. This provided an estimated cost per patient discharged on stop smoking pharmacotherapy. These data combined could provide inpatient intervention costs per patient who smokes, total intervention cost per patient who smokes and cost per quit for the programme. By using total number of adult admissions and smoking prevalence data for each GM localities, we estimate the costs of the CURE project if implemented across all 10 localities.

### Return on investment

This was performed in a two-stage process using the European Study on Quantifying Utility of Investment in Protection from Tobacco (EQUIPT) tool and the Greater Manchester Cost Benefit Analysis (GM-CBA) tool. The EQUIPT tool is an economic modelling tool to assess the ROI of tobacco control interventions using the best available evidence.<sup>5</sup> It has been built following the success of the National Institute of Health and Care Excellence (NICE) Tobacco ROI Tool published in 2012 in order to transfer the applicability to fellow European countries. The EQUIPT tool uses a standardised method to source the economic costs of smoking tobacco to then determine the ROI for different tobacco control interventions. The Greater Manchester combined authority research team has pioneered the development of a CBA tool that articulates the fiscal, economic and social value of health and other public sector interventions.<sup>6</sup>

For this health economic analysis, the additional benefits from smoking cessation achieved by the CURE programme compared with the business-as-usual smoking cessation interventions were calculated using

the EQUIPT tool. The tool calculates the treatment cost-savings resulting from reduced levels of smoking caused disease for lung cancer, coronary heart disease, chronic obstructive pulmonary disease (COPD), myocardial infarction and stroke. In addition, it also estimates the increase in QALYs as a result of the programme.

These values derived from the EQUIPT tool were then inputted into the GM-CBA tool (this tool is used for all health economic analyses for transformation projects in GM to provide consistent metrics for comparison). The GM-CBA tool enables a full social cost benefit analysis of the programme to be done alongside the cost-effectiveness analysis from the EQUIPT tool. It was used to assess the potential reductions in healthcare costs and the ROI (the ratio of benefits to costs) related to reductions in smoking-attributable cases of lung cancer, coronary heart disease, COPD, myocardial infarction and stroke. It also assesses the individual health and well-being impacts using a QALYs approach. The analysis produces both fiscal outputs (impact on the public sector) and overall public value outputs (impact on society as a whole).

The fiscal outputs relate to outcomes that have a potential impact on the costs of delivering public services, including the potential reductions in healthcare costs related to the smoking-attributable diseases listed above. The modelling was carried out over a 10-year period. For fiscal outputs, two scenarios were modelled; first, gross fiscal benefits of the programme before any assessment of the cashability of the benefits and the second considers how much of the fiscal benefits are cashable (ie, result in a reduction in the overall spending required). The methodology uses standard percentages based on the government agency potentially making the savings; for the NHS, the assumption is that approximately 50% of the fiscal benefits can be cashable assuming that the scale of the transformation programme is large.

Public value outputs are related to improving the health of patients who stop smoking. The EQUIPT tool produces an estimation of the QALYs gained for the CURE Project and the GM-CBA tool uses this figure to produce a public value ROI using a value per QALY of £60 000.<sup>7</sup> Using the estimated QALYs gained over the lifetime of the patients treated and the incremental costs of the programme, a cost per QALY could be calculated.

Sensitivity analysis was carried out to explore the impact of uncertainty of values used in the calculations, for example, the impact of the programme when scaled up to a wider geography.

### Patient and public involvement

Patients were not involved in the design of this health economic study.

## RESULTS

### Summary of relevant CURE outcomes

In the 6-month CURE Project pilot, 2393 current smokers were identified at the point of admission to Wythenshawe



Hospital. Overall, 1450 (61%) accepted the specialist support of the CURE team during the inpatient admission. Overall, 1568 (66%) were prescribed any form of stop smoking pharmacotherapy during the inpatient stay and provided with 1 week of medications at discharge. Overall, 1105 (46%), 1179 (49%) and 800 (33%) patients completed postdischarge follow-up with the hospital CURE team at 2 weeks, 4 weeks and 12 weeks, respectively. Overall, 495 (21%) and 525 (22%) were abstinent from tobacco at 4 weeks and 12 weeks, respectively.<sup>4</sup> Any patient who did not complete follow-up was assumed to have relapsed to smoking tobacco.

### Intervention costs for the inpatient CURE Project service

In the 6-month CURE pilot, the total expenditure across the hospital for NRT and varenicline was £27974. The team of specialist CURE practitioners and administrative support staff that delivered the inpatient and outpatient specialist support was three whole-time equivalent pay-band six specialist nurses plus one whole-time equivalent pay band three administrative staff. The salary expenditure for this team for the pilot was £68250. The total intervention costs for the hospital service were therefore £96224 with a cost per patient who smokes of £40.21.

### Postdischarge intervention costs for the CURE Project pilot

In years 2018–2019, there were 57465 adult admissions to Wythenshawe Hospital and 19634 (34.2%) were in patients with a city of Manchester postcode. In the city of Manchester CCG there was additional £52000 spent on stop smoking pharmacotherapy, during the 6-month pilot, above the existing baseline monthly expenditure. During the 6-month pilot there were 1568 patients discharged on stop smoking pharmacotherapy and this represented 66% of all smokers. We estimate that 534 (34.2%) of these were residents in the city of Manchester. Therefore,

the estimated average spend per patient discharged on stop smoking pharmacotherapy was £97.40.

### Total intervention costs for the CURE Project pilot

The hospital intervention cost for the CURE Project pilot was £40.21 per patient who smokes admitted to hospital plus £97.40 of additional intervention costs post discharge in the 66% of all patients who are discharged with ongoing stop smoking pharmacotherapy. Therefore, using the total number of adult admissions to each acute care trust, the smoking prevalence in each CCG served by the acute care trust and the above-described costs, we are able to estimate the cost of the CURE Project across GM (table 1). The estimated annual cost for the hospital component of the CURE project across the 10 acute care trusts of GM is £5 806 106 and the total cost including the postdischarge costs is £15 050 105.

### Cost per quit for the CURE project pilot

Taking into consideration the above costs for both secondary and primary care, the cost per quit rate is £475.

### Health economic analysis: fiscal analysis

The GM-CBA model produced a gross financial ROI ratio of £2.12 return per £1 invested with a payback period of 4 years. The cashable financial ROI ratio is £1.06 return per £1 invested with a payback period of 10 years. Sensitivity analysis was carried out to estimate the breakeven point at which the gross fiscal returns on investment just match the costs of delivering the project. This indicated that the project would still be financially justified even with a quit rate when scaled up of just 10% (compared with the pilot result of 22% quit rate). Other sensitivities were explored. For example, doubling the costs of follow-up pharmacotherapy in the community reduced

**Table 1** Estimated annual costs of the CURE Project across Greater Manchester (2019 prices)

	Adult admissions	Smoking prevalence	Number of smokers admitted	Intervention costs (hospital service)	Smokers prescribed medication	Intervention costs (post discharge)	Total costs
Trust 1	73413	24%	17663	£710247	11658	£1130796	£1841043
Trust 2	52135	17%	8707	£350096	5746	£557393	£907489
Trust 3	61811	11%	6595	£265198	4353	£422227	£687425
Trust 4	136944	20%	26800	£1077642	17688	£1715732	£2793374
Trust 5	59986	22%	12987	£522214	8571	£831426	£1353640
Trust 6	75065	18%	13647	£548747	9007	£873669	£1422416
Trust 7	91416	24%	21684	£871922	14311	£1388202	£2260124
Trust 8	64261	26%	16605	£667699	10959	£1063055	£1730754
Trust 9	63831	8%	5330	£214318	3518	£341219	£555538
Trust 10	92443	16%	14375	£578023	9487	£920280	£1498303
GM				£5806106		£9243999	£15050105



**Table 2** Summary of the expected return on investment from a Greater Manchester (GM) CURE programme (2019 prices)

Annual cost of GM CURE programme	£15 050 105
Gross financial return (£2.12 per £1 invested)	£31 906 223
Cashable financial return (£1.06 per £1 invested)	£15 953 111
Public value return (£30.49 per £1 invested)	£458 877 702
Cost per quality-adjusted life year	£487

CURE, Conversation, Understand, Replace, Experts and Evidence-based interventions.

the gross financial ROI to £1.63 per £1 invested. When solely looking at the cashable financial ROI, this was more sensitive to the choice of cashability percentage, with a reduction from 50% to 47% resulting in the project just breaking even over the 10-year period.

### Health economic analysis: public value analysis

The public value ROI ratio is £30.49 per £1 invested. The cost per QALY for this programme is £487. As the public value ROI ratio is very high, achieving a return is very insensitive to reducing levels of impact of the programme or the costs of delivering the programme. A reduction of impact down to less than 0.5% would be needed before the programme was no longer justified when considering the value to society as a whole. Table 2 provides a summary of the annual ROI for a GM CURE project service based on the values provided by the EQUIPT and GM-CBA tools.

## DISCUSSION

### Key findings

This health economic analysis of the CURE Project pilot has shown very good value with highly significant ROI. The CURE cost per quit (£475) is cheaper than the costs published for four GM local authority stop smoking services where figures are available for 2018/2019,<sup>8</sup> the North West of England community stop smoking service average at £532 and the England community stop smoking service average at £490.<sup>9</sup> The cost per QALY was £487 and programmes with a cost per QALY of less than £20 000 are deemed by the NICE to be value for money. The fiscal returns for CURE outperform many other transformation programmes in GM and supports the investment made to date in the region as well as focusing on the long-term sustainability of the programme.

### Limitations

The first limitation when considering these data are that in the CURE pilot, the specialist support post discharge was provided by the hospital CURE staff. Therefore, the costs of specialist support for both inpatient and outpatient support are within the hospital intervention costs. The outpatient

follow-up provided in the CURE pilot was a minimum of three follow-up consultations at 2, 4 and 12 weeks. This is different to the present-day CURE delivery at Wythenshawe Hospital as a new community stop smoking service in the city of Manchester has been commissioned. Referral to the community stop smoking services is the standard of care at the new sites in the CURE roll out in GM. Different models of delivery might switch some of the costs from secondary to primary care and affect the hospital cost of the programme. The frequency of follow-up consultations may also differ with community stop smoking services offering 2 weekly appointments for 12 weeks (six consultations). However, not all smokers will complete such a regime, particularly in this opt-out model inclusive of all smokers admitted to hospital. Using an average of three follow-up consultations per smoker as provided in the CURE pilot funding therefore seems appropriate and likely to make the findings of this health economic analysis applicable to different models of care.

Second, there are a number of assumptions and estimations made in the describing the intervention costs of this programme. While the costs of hospital pharmacotherapy and staffing are taken directly from the hospitals finance department, the postdischarge costs are based on the estimated increase in pharmacotherapy spend above baseline in one specific locality. The CCG prescribing database in this locality demonstrated a clear and persistent uplift in stop smoking pharmacotherapy spending in comparison to a stable baseline from the same month the CURE project pilot launched. While there might be other explanations for this uplift, it is very likely that this does reflect the impact and expenditure related to the CURE pilot.

### Strengths

The assumptions made in the analysis are likely to show a worst-case scenario by overestimating the costs and minimising the benefits. The quit rate published for the CURE pilot assumes any patient smokes that did not engage with the CURE team or those that did not attend for follow-up had relapsed to smoking. There may be successful quitters not included in the final abstinent figures. Furthermore, the EQUIPT tool analysis is based on a basket of 4–5 health conditions rather than the 52 tobacco-related conditions outlined in the previous RCP report ‘hiding in plain sight’. Therefore, it is highly likely this economic analysis underestimates the health benefits and cost-effectiveness of the CURE Project.

### Conclusion

The CURE Project is a highly cost-effective service with significant public value impact. This provides additional evidence to support the ambitions of the NHS long-term plan to fund hospital-based tobacco addiction treatment services and the CURE pathway provides a blueprint and framework for implementation across all acute care trusts.

**Author affiliations**

<sup>1</sup>The CURE Project Team, Wythenshawe Hospital, Manchester University NHS Foundation Trust, Manchester, UK

<sup>2</sup>Data Analyst Team, Greater Manchester Combined Authority, Greater Manchester, UK

<sup>3</sup>Greater Manchester CURE Project Team, Greater Manchester Cancer, Greater Manchester, UK

<sup>4</sup>Department of Respiratory Medicine, Stockport NHS Foundation Trust, Stockport, UK

<sup>5</sup>Department of Respiratory Medicine, Salford Royal NHS Foundation Trust, Salford, UK

<sup>6</sup>Department of Respiratory Medicine, Fairfield & Rochdale Hospital, Pennine Acute Trust, Greater Manchester, UK

<sup>7</sup>Department of Respiratory Medicine, Royal Oldham Hospital, Pennine Acute Trust, Oldham, UK

<sup>8</sup>Department of Respiratory Medicine, Wrightington Wigan and Leigh NHS Foundation Trust, Wigan, UK

<sup>9</sup>Tameside General Hospital, Ashton-under-Lyne, UK

<sup>10</sup>Make Smoking History Programme, Greater Manchester Health & Social Care Partnership, Greater Manchester, UK

<sup>11</sup>Senior Leadership Team, Greater Manchester Cancer Alliance, Greater Manchester, UK

**Contributors** ME and FH developed the concept of the study. JCx designed the methodology and conducted the analysis. ME, FH, KG, RM and HC provided CURE outcomes from the pilot. ME, CP and MR provided costs for the programme. ME wrote the first draft of the manuscript and all authors edited and agreed the final version. ME is responsible for the overall content as the guarantor.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** This work is part of the service evaluation of the CURE Project and did not require ethical approval, confirmed during discussion with the local research team. This study does not involve human participants.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** No data are available.

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**ORCID iD**

Matthew Evison <http://orcid.org/0000-0003-4066-5253>

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