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## Understanding the implementation strategy of a secondary care tobacco addiction treatment pathway (The CURE Project) in England: A Strategic Behavioural Analysis

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3 1 Understanding the implementation strategy of a secondary care tobacco  
4 addiction treatment pathway (The CURE Project) in England: A Strategic  
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8 Behavioural Analysis  
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## 30 **Abstract**

31 **Objectives:** The Conversation, Understand, Replace, Expert and evidence-based treatment  
32 (CURE) project implemented an evidence-based intervention that offers a combination of  
33 pharmacotherapy and behavioural support to inpatients. To support recommendations for  
34 the development of nationwide tobacco dependence treatment, this study aimed to specify  
35 the successful characteristics of the CURE project implementation strategy and use  
36 established behavioural theory to understand mechanisms of action in changing clinician's  
37 practice. This study aimed to identify ways to optimise the CURE implementation strategy.

38 **Design and Methods:** Data were collected via document review and semi-structured  
39 interviews with 10 healthcare professionals in one NHS trust. Intervention content was  
40 specified through Behaviour Change Techniques (BCTs) and intervention functions within  
41 the Behaviour Change Wheel. A logic model was also developed to further specify the  
42 content of the CURE implementation strategy and its mechanisms of impact. Potential areas  
43 of refinement were determined by linking previously identified barriers and facilitators of  
44 CURE implementation (categorised by the theoretical domains framework (TDF)),  
45 intervention functions and BCTs. The development of recommendations for optimisation was  
46 conducted over a two-round Delphi exercise.

47 **Results:** The behavioural analysis identified 26 BCTs, five intervention functions and four  
48 policy categories present within the implementation strategy. 'Environmental Context and  
49 Resources' (Physical Opportunity), 'Goals' (Reflective Motivation), 'Social Professional Role  
50 and Identity' (Reflective Motivation), 'Social Influences' (Social Opportunity), 'Reinforcement'  
51 (Automatic Motivation), and 'Skills' (Psychological Capability & Physical Capability) were  
52 previously identified as key areas influencing implementation. The existing implementation  
53 strategy included half the potentially relevant intervention functions and BCTs to target TDF  
54 domains influencing CURE implementation. Recommendations to optimise content were  
55 revised following stakeholder engagement.

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3 56 **Conclusions:** The CURE project offers a strong foundation from which a tobacco  
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5 57 dependence treatment model can be developed in England. This research suggests content  
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7 58 modifications to improve the design of further implementation strategies and health policy in  
8  
9 59 this area.  
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### 61 **Strengths and limitations of this study**

- 16  
17 62 • Despite treating tobacco addiction being one of the most cost-effective health  
18  
19 63 interventions any healthcare system can provide, adherence to smoking cessation  
20  
21 64 standards within hospital settings remains poor in England.  
22  
23 65 • The existing implementation strategy of CURE included half the potentially relevant  
24  
25 66 content to target barriers and facilitators identified by stakeholders. Strategies  
26  
27 67 targeted mostly knowledge, as opposed to strategies targeting motivational, social  
28  
29 68 and environmental influences.  
30  
31 69 • This study is the first to qualitatively explore behavioural factors underpinning the  
32  
33 70 implementation of the CURE project, using a theoretically guided approach to specify  
34  
35 71 the content and possible mechanisms of action and impact.  
36  
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41 73 **Keywords:** Implementation intervention, intervention content, intervention function,  
42  
43 74 behaviour change intervention, Strategic behavioural analysis, Theoretical Domains  
44  
45 75 Framework, Behaviour Change Technique, smoking, Health professional behaviour  
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50 77 **Word count: 5498**  
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## 79 Introduction

80 The government NHS Long Term Plan (1) has outlined a commitment to offer NHS-funded  
81 tobacco treatment services to all those admitted to hospital by 2023/24. However, the most  
82 recent National Smoking Cessation Audit Report from the British Thoracic Society (2)  
83 suggests that adherence to national smoking cessation standards remain poor. For example,  
84 despite the expected standard being 100%, only 77% of inpatients had their smoking status  
85 recorded. Of those who smoked, just 44% were asked if they would like to quit, and of those  
86 who were referred for smoking cessation support, just 16% were referred to hospital-based  
87 services (with a further 8% referred to community-based services). In addition, only 31% of  
88 smokers were offered nicotine replacement therapy (NRT). As a result, the report set  
89 national improvement objectives to support and offer NRT to all inpatient smokers, and to  
90 provide further support and training to hospital staff to ensure they are able to implement  
91 tobacco dependence treatment into their everyday practice.

92 Hospitalisation provides a unique opportunity to identify and engage smokers, initiate  
93 cessation treatments, and facilitate appropriate follow-up and support (3,4). Intensive  
94 smoking cessation interventions that begin in hospital and include pharmacotherapy,  
95 counselling, and post-discharge support for  $\geq 1$  month, increase the likelihood of smoking  
96 abstinence (risk ratio 1.37, 95% confidence interval [CI] 1.27–1.48; 25 studies) compared to  
97 hospital only interventions with no follow-up (4).

98 The Ottawa model for smoking cessation (OMSC), initially implemented in Canada, aims to  
99 increase the rate at which smoking cessation support is offered to all smokers within  
100 secondary care (i.e. hospital settings) (5,6). The OMSC provides a systematic approach to  
101 screening all inpatients for smoking status, with those who smoke offered a combination of  
102 pharmacotherapy and behavioural support. Patients are then attached to ongoing  
103 community stop-smoking support post-discharge (7). The OMSC model was found to have  
104 positive outcomes in increased smoking abstinence at 6 months, reduced all-cause re-

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3 105 admissions at 30 days and 1 year, and reduced mortality at 1 year when compared to a  
4  
5 106 control group receiving usual care (7).

6  
7  
8 107 The positive outcomes observed in Canada led to the development of the Conversation,  
9  
10 108 Understand, Replace, Experts and evidence-based treatments (CURE) and has recently  
11  
12 109 been piloted within an NHS trust in the North West of England (8). Importantly, CURE aims to  
13  
14 110 increase awareness about the medicalisation of tobacco dependence and support clinicians  
15  
16 111 in offering smoking cessation support to all inpatient smokers. Similar to the OMSC, the  
17  
18 112 CURE project aims to improve smoking outcomes by providing combination of  
19  
20 113 pharmacotherapy (e.g. NRT, varenicline) and behavioural support to patients, as well as  
21  
22 114 post-discharge support at 2, 4- and 12-weeks. The CURE implementation intervention  
23  
24 115 includes various strategies designed to change behaviours at organisational, practitioner or  
25  
26 116 patient levels and to enhance the adoption of a clinical (9). Examples of implementation  
27  
28 117 strategies include outreach activities, in-house training, audit and feedback, and computer  
29  
30 118 prompts.

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33  
34 119 Evaluation of the CURE pilot (October 2018-March 2019) showed that 92% of all adult  
35  
36 120 admissions (total admissions:14,690) were screened for smoking status with a cost per quit  
37  
38 121 of £183 (10). More importantly, the evaluation demonstrated a positive patient impact; out of  
39  
40 122 2,293 patients identified as current smokers, 96% were provided with brief advice, 61%  
41  
42 123 accepted and completed specialist behavioural support, 66% were prescribed  
43  
44 124 pharmacotherapy (e.g. NRT, varenicline) to support quit attempts, and 22% were abstinent  
45  
46 125 at 3 months post-discharge (10). These findings suggest that the model may be useful in  
47  
48 126 assisting clinicians' behaviour change when compared to national audit data. It would  
49  
50 127 therefore be valuable to determine how the CURE project was delivered in practice. This  
51  
52 128 knowledge would support recommendations for a national specification model, based on the  
53  
54 129 OMSC and CURE, for further testing and piloting (1).

55  
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57  
58 130 To maximise the potential benefits of CURE, there is a need to understand the  
59  
60 131 implementation process of this evidence-based smoking cessation intervention in routine



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2  
3 132 secondary care. Several theoretical approaches (i.e. theories, models, frameworks) can be  
4  
5 133 used to provide a better understanding and explanation of how and why implementation  
6  
7 134 succeeds or fails (11,12). For instance, the Theoretical Domains Framework (TDF)  
8  
9 135 represents an approach to understand what determinants are hypothesized to influence  
10  
11 136 implementation outcomes, (e.g. healthcare practitioners' adoption of an evidence-based  
12  
13 137 patient intervention) (12,13). The TDF summarises 14 broad domains relevant to changing  
14  
15 138 behaviour, 'knowledge', 'beliefs about consequences', 'beliefs about capabilities', 'skills',  
16  
17 139 'environmental context & resources', 'social influences', 'memory, attention & decision  
18  
19 140 processes', 'behavioural regulation', 'emotion', 'social or professional role/identity',  
20  
21 141 'optimism', 'intentions', 'goals' and 'reinforcement' (14,15).

22  
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25 142 Another theoretical approach to explain the causal mechanisms of implementation is the  
26  
27 143 COM-B (Capability, Opportunity, Motivation and Behaviour) model, which suggests  
28  
29 144 behaviour is a function of physical and psychological capability, physical and social  
30  
31 145 opportunity and automatic and reflective motivation. The COM-B model sits at the hub of the  
32  
33 146 BCW (see Figure 1) (13,16), a well-established guide, applied to health services research,  
34  
35 147 to provide a systematic approach to identifying intervention content and specifying  
36  
37 148 mechanisms of action (i.e. how interventions elicit behaviour change) (13). The wheel  
38  
39 149 comprises three main 'layers' 1) sources of behaviour (i.e. the COM-B model), 2) nine  
40  
41 150 intervention functions (i.e. means by which behaviour can be changed) and 3) policy  
42  
43 151 categories (i.e. that may support delivery of intervention functions) (p.17).

44  
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46  
47 152 [Insert Figure 1 here]

48  
49 153 **Figure 1: Visual representation of the Behaviour Change Wheel (13)**

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51  
52 154 When aiming to understand how behaviour may be changed and/or specify implementation  
53  
54 155 content, the intervention functions within the BCW can be linked to specific BCTs, which are  
55  
56 156 defined as "an active component of an intervention designed to change behaviour". BCTs  
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3 157 have been associated with many types of behaviour which have been brought together to  
4  
5 158 form an international BCT Taxonomy v1 with 93 BCTs (17).  
6  
7

8 159 Theoretical approaches such as BCW, the COM-B model (Fig. 1), the TDF, and the BCT  
9  
10 160 Taxonomy (BCTTv1), may be applied in conjunction with one another to understand the  
11  
12 161 implementation process, identify implementation strategy content, and to explore barriers to  
13  
14 162 and facilitators of behaviour. Prior research has successfully integrated these theoretical  
15  
16 163 approaches to explore determinants influencing the implementation process of evidence-  
17  
18 164 based practice in healthcare (15,18).  
19

20  
21 165 When planning implementation, developing a logic model of links between implementation  
22  
23 166 strategies, mechanisms and outcomes is crucial (19). The BCW facilitates the specification  
24  
25 167 of outcomes, determinants, change objectives and intervention, and it thereby enables  
26  
27 168 intervention developers to map specific BCTs to behavioural determinants (16).  
28

29  
30 169 Informed by the BCW (13), the present study aimed to describe the core elements of the  
31  
32 170 CURE implementation strategy in the pilot site, particularly the activities directed at  
33  
34 171 promoting behaviour change in healthcare practitioners and wider organisational  
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36 172 implementation strategies (organisational/professional level).  
37

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39 173 The specific objectives of this study were to:  
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- 41  
42 174 1. Identify the content of the implementation strategy for the CURE project in secondary  
43  
44 175 care, using the BCW functions, policy categories, and the BCT Taxonomy (v1)(20);  
45  
46 176 2. Describe the intervention in a logic model to clarify causal assumptions and  
47  
48 177 mechanism of impact using the Medical Research Council (MRC) guidance (20);  
49  
50 178 3. Explore to what extent the barriers and facilitators of CURE implementation are  
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52 179 addressed by existing implementation strategy components;  
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54 180 4. Develop recommendations to support the refinement of the current implementation  
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56 181 strategy and inform future implementation.  
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3 182 This work was conducted alongside a TDF-based, qualitative study which explored the  
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5 183 barriers and facilitators of CURE implementation and delivery, from the perspective of  
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7 184 healthcare professionals engaged in the project pilot (21).  
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9

## 10 185 **Methods**

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13 186 We undertook a systematic, theoretically guided approach to specify the content and  
14  
15 187 possible mechanisms of action and impact of the implementation strategy of CURE. This  
16  
17 188 process has previously been coined as 'strategic behavioural analysis' (18). We have  
18  
19 189 employed the use of the StaRI (Standards for Reporting Implementation Studies) as our  
20  
21 190 reporting standard (22).  
22  
23

### 24 191 Setting and participants

25  
26 192 The pilot site is a major acute teaching hospital with approximately 900 beds and 27,500  
27  
28 193 inpatient admissions per year (excluding maternity, paediatrics, and AE/ICU admissions),  
29  
30 194 providing both district general hospital services and specialist tertiary services. Tertiary  
31  
32 195 services include cardiology, cardiothoracic surgery, heart and lung transplantation,  
33  
34 196 respiratory conditions, burns and plastics, cancer, and breast care services.  
35  
36

37 197 The smoking prevalence included in the pilot site was modelled based on 20% of inpatient  
38  
39 198 admissions (approximately 5,500 smokers per year).  
40  
41

42 199 At admission, the admitting clinicians (doctor or nurse) were responsible for recording  
43  
44 200 smoking status, assessing level of addiction, and offering initial rapid treatment. A CURE  
45  
46 201 specialist team would then perform a visit, review all smokers admitted (opt-out service), and  
47  
48 202 complete specialist assessment, update treatment plan and plan for discharge (e.g. refer to  
49  
50 203 community service). For the pilot study, the implementation plan modelled the need for five  
51  
52 204 specialist CURE nurses to deliver the specialist assessment, treatment planning and follow  
53  
54 205 up for all smokers admitted as inpatients.  
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### 57 206 Patient and public involvement

58  
59  
60 207 No patient involved.

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3 208 Procedure and sources of data  
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5 209 To collect data on the implementation strategy content, we used two different methods:  
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7 210 1. *Document analysis.* Researchers read and re-read training materials (i.e. training  
8 manual, training poster, teaching slides, level 1 and 2 eLearning modules, Steering  
9 211 Group Terms of Reference) and the CURE project webpage (available from  
10 212 <https://thecureproject.co.uk/>) describing implementation strategy content, including  
11 213 the training materials, practice tools, promotional/educational materials and smoke  
12 214 free policy. We reviewed and appraised documentation (AR, AH, AW; health  
13 215 psychology specialists) by systematically mapping information against the Template  
14 216 for Intervention Description and Replication (TIDieR) (23) and the BCW components,  
15 217 including BCTs, intervention functions and policy categories (13). This information  
16 218 was also used to develop an initial logic model.  
17 219

18 220 2. *Semi-structured interviews.* An experienced researcher conducted one-to-one  
19 221 telephone interviews with 10 purposively sampled individuals, who were involved in  
20 222 the implementation and delivery of the CURE evidence-based intervention.  
21 223 Participants spanned core CURE management (n=2) and specialist nursing staff  
22 224 (n=3), pharmacy (n=1), primary care (n=1) and public health (n=3). Interview topic  
23 225 guides were informed by TDF domains and asked participants to discuss barriers  
24 226 and facilitators to implementing the CURE project pilot (reported in full elsewhere; 21)  
25 227 and detail implementation strategy content (i.e. describing the what was delivered,  
26 228 with what aim, how much, to whom, and by whom). All interviews were digitally  
27 229 recorded, transcribed verbatim and analysed using the Framework Method (24). Data  
28 230 from interviews were also used to revise the logic model.

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50 231 Data analysis  
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52 232 *Step 1 - Implementation strategy content analysis*  
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54

55 233 Using the TIDieR framework (23), we created a broad outline of the implementation strategy  
56 234 that included the content delivered, to whom and by whom, why, by what mode of delivery,  
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3 235 how often, where, when and how much, tailoring, modifications, and how well. Data from all  
4  
5 236 data sources were used. Data collected from both the document analysis and interviews  
6  
7 237 were coded for implementation strategy content (AR, AH and AW) using existing coding  
8  
9 238 frameworks provided by the BCW guide (13); Appendix 4 (p.259 of the guide) for BCTs,  
10  
11 239 Table 2.1 (p.111 of the guide) to code intervention functions, and Table 2.7 (p.135 of the  
12  
13 240 guide) to code policy categories. Any discrepancies in coding were resolved via consensus  
14  
15 241 discussion.

### 16 242 *Step 2 – Mechanisms of impact (Logic model)*

17  
18  
19 243 Following the guidance on developing logic models in process evaluations of complex  
20  
21 244 interventions, issued by the Medical Research Council (20), we developed a logic model by  
22  
23 245 reviewing the CURE documentation and service specification (<https://thecureproject.co.uk/>),  
24  
25 246 current evidence (7,8,25), and theoretical understandings of both the evidence-based  
26  
27 247 intervention and the implementation strategy as suggested in the TiDIER guidelines. Public  
28  
29 248 Health England liaised with the CURE project team (via email) who provided additional  
30  
31 249 documentation (pathway mapping workshop slides, early evaluation options, inpatient  
32  
33 250 numbers and time commitments for specialist nurses, communications plan, Tobacco  
34  
35 251 Addiction Service data) to further inform the logic model. An initial logic model was reviewed  
36  
37 252 and updated based on findings from the qualitative interviews and behavioural analysis  
38  
39 253 demonstrating the intended mechanisms of impact (initial model) vs. actual mechanisms of  
40  
41 254 impact i.e. what was delivered in practice (revised model).

### 42 255 *Step 3 – Identifying opportunities for optimisation*

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44  
45 256 In line with previous research (18,26), the following mapping exercise was conducted in  
46  
47 257 order to explore the extent to which barriers and facilitators of CURE implementation (21)  
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49 258 were addressed by existing implementation strategy components, and to identify any missed  
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51 259 opportunities for further design:  
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3 260 1. A concurrent qualitative study (21) reported eight key TDF domains that influenced  
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5 261 CURE implementation (see additional file 1 for a summary of these findings). To  
6  
7 262 identify key domains influencing the implementation of CURE, we ranked these  
8  
9 263 previously reported TDF/COM-B domains using established criteria: frequency  
10  
11 264 (number of transcripts in which a domain occurred), elaboration (number of themes  
12  
13 265 within a domain) and evidence of conflicting statements within domains (e.g. if some  
14  
15 266 participants report lack of specific skills whereas others report having the relevant  
16  
17 267 skills) (27–29). All of these factors were considered concurrently in establishing  
18  
19 268 domain relevance. This process was facilitated through consensus discussion  
20  
21 269 between the two researchers (AR, AW) and supported by a third researcher to  
22  
23 270 resolve any discrepancies (AH).
- 24  
25  
26 271 2. The outputs of the key domains and content analysis stages were combined by  
27  
28 272 mapping the identified influences to the identified BCT and intervention functions of  
29  
30 273 the CURE implementation strategy. This was achieved by combining two available  
31  
32 274 matrices that map the TDF to the BCT Taxonomy v1 (30,31) and the Theory &  
33  
34 275 Techniques Tool (<https://theoryandtechniquetool.humanbehaviourchange.org/>) as  
35  
36 276 was developed for previous research (18). This analysis investigated the level of  
37  
38 277 theoretical congruence between implementation strategy components of CURE and  
39  
40 278 the qualitative data on barriers and facilitators influencing its implementation.
- 41  
42  
43 279 3. The level of theoretical congruence between influences on behaviour (TDF domains)  
44  
45 280 and implementation strategy content to change behaviour (BCTs) was achieved by  
46  
47 281 analysing the extent to which the BCTs identified in the CURE implementation  
48  
49 282 strategy targeted the key TDF domains (identified in the qualitative data). Each BCT  
50  
51 283 identified was coded as either low congruence (did not target any key domain),  
52  
53 284 medium congruence (targeted at least one key domain) or high congruence (targeted  
54  
55 285 2+ key domains) (18).
- 56  
57  
58 286 4. The mapping exercise was repeated for intervention functions and policy categories,  
59  
60 287 by consulting the matrices mapping BCW against COM-B/TDF (13) to identify the

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2  
3 288 extent to which functions (matrix on p. 116) and policy categories (matrix on p. 138)  
4  
5 289 in the CURE implementation strategy targeted key factors influencing the  
6  
7 290 implementation process, and what additional intervention functions and policies may  
8  
9 291 address barriers/facilitators within the key domains. The following definitions were  
10  
11 292 applied:

- 13 293 a. Opportunity seized - instances where a theoretically congruent intervention  
14  
15 294 function/policy category (according to the matrices) was identified in the  
16  
17 295 existing CURE implementation strategy at least once.  
18  
19  
20 296 b. Missed opportunity – instances where the theoretically congruent intervention  
21  
22 297 function/policy category was not identified in existing implementation strategy.

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24  
25 298 *Step 4 – Development of recommendations to support future implementation.*

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27  
28 299 Following steps 1-3, the research team used the findings from the qualitative interviews and  
29  
30 300 strategic behavioural analysis to draft a list of practical recommendations to strengthen  
31  
32 301 implementation strategy content (i.e. content likely to encourage healthcare professional  
33  
34 302 behaviour change and support implementation of a secondary care-based tobacco  
35  
36 303 dependence treatment model). These recommendations included example strategies to  
37  
38 304 deliver BCTs relevant to the key TDF domains. To enhance the suitability and acceptability  
39  
40 305 of these recommendations, a Delphi study was conducted by collecting data from a panel of  
41  
42 306 six experts until consensus was reached (32). Experts included the CURE management  
43  
44 307 team, PHE Programme Managers (e.g. Tobacco Control and NHS Long Plan), and NHS  
45  
46 308 England representatives. The six experts independently rated whether each  
47  
48 309 recommendation was affordable, practical, effective, acceptable, safe and equitable (the  
49  
50 310 APEASE criteria) (13), on a dichotomous scale of yes (1), no/uncertain (0) for each criteria.  
51  
52 311 This gave a total possible score of 36 for each recommendation. These ratings were then  
53  
54 312 used to structure and encourage discussion surrounding uncertainties and potential  
55  
56 313 modifications during a collaborative, stakeholder workshop. A total of 11 stakeholders  
57  
58 314 participated in the stakeholder workshop. Participants included 2 members of the research



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2  
3 315 team (1 workshop facilitator and 1 scribe), 2 members of the CURE management team, 4  
4  
5 316 PHE Programme Managers (e.g. Tobacco Control and NHS Long Plan), 1 representative  
6  
7 317 from NHS England, and 2 consultants.  
8

9 318 Workshop feedback was incorporated into a refined recommendations table, which was then  
10  
11 319 circulated via email for further stakeholder comment and review. This process resulted in the  
12  
13 320 final list of recommendations.  
14  
15

## 16 321 **Results**

### 17 322 *Step 1 - Implementation strategy content*

18  
19  
20 323 Table 1 summarises the content of the implementation strategy, using the TiDieR  
21  
22 324 framework. The following broad components of CURE implementation strategy were  
23  
24 325 identified: staff training, practice tools, reminder systems, educational outreach visits, audit  
25  
26 326 and feedback, primary care incentives, use of a steering group, branding materials, clinician  
27  
28 327 implementation team meetings to promote reflective discussion, provision of local technical  
29  
30 328 assistance (e.g. admin support), promotion of network weaving (e.g. information sharing),  
31  
32 329 physical environment changes (e.g. consultation facilities), and a triage system.  
33  
34 330 Through content coding we identified 26 BCTs (i.e. 'active components'), five intervention  
35  
36 331 functions and four policy categories. Further details of these activities, BCTs, intervention  
37  
38 332 functions and policy categories can be found in Table 2.  
39  
40  
41  
42  
43

### 44 333 *Step 2 -Mechanisms of impact (Logic model)*

45  
46  
47 334 The initial model is presented in Figure 2. The original logic model, based on the CURE  
48  
49 335 implementation strategy, shows all patients who are admitted to hospital should be asked  
50  
51 336 whether they smoke, and their response should be recorded in the hospitals' electronic  
52  
53 337 patients records. All smokers should be offered immediate Nicotine Replacement Therapy  
54  
55 338 and specialist support through motivational interviewing and behavioural change support as  
56  
57 339 well as access to additional evidence-based pharmacotherapy treatments for tobacco  
58  
59  
60



1  
2  
3 340 addiction. All smokers should be offered further appointments with a specialist team after  
4  
5 341 discharge from hospital to continue their support.  
6

7 342

9 343 [Insert Figure 2 here]

11 344 **Figure 2. CURE stop smoking project: Initial logic model**

13  
14 345

15  
16 346 The logic model was reviewed and updated iteratively based on findings from the qualitative  
17  
18 347 interviews and behavioural analysis. The final model is presented in Figure 3. The final logic  
19  
20 348 model contains further facilitators identified as important by key stakeholders (e.g. funding,  
21  
22 349 tobacco policy, nurse champion) as well as clarification of the meaning of an adequately  
23  
24 350 resourced and staffed implementation strategy (e.g. office space, clerical support,  
25  
26 351 phone/computer access). Other local stakeholders essential to the smooth implementation  
27  
28 352 and delivery of CURE were also added to the revised model (e.g. Clinical Commissioning  
29  
30 353 Group (CCG); Local Medical Committee (LMC); local GPs) as well as barriers to successful  
31  
32 354 implementation and delivery (e.g. staff turnover, staff confidence, paperwork). While a  
33  
34 355 structured protocol and treatment pathway was an important facilitator, the final model  
35  
36 356 includes more detail regarding the potential variety of patient journeys and the role of  
37  
38 357 hospital pharmacy. The importance of patient choice was added to the final model, because  
39  
40 358 it was highlighted as important to both choices of Nicotine Replacement Therapy (NRT) and  
41  
42 359 of the discharge pathways. However, there were many challenges to implementing many of  
43  
44 360 the pathways as intended. This tension between primary and secondary care was  
45  
46 361 highlighted in the final model.  
47  
48

49 362

51 363 [Insert Figure 3 here]

53 364 **Figure 3. CURE stop smoking model: Final logic model following stakeholder**  
54  
55 365 **consultations and behavioural analysis**

57  
58  
59 366 *Step 3 - Identifying opportunities for optimisation*  
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3 367 Previously identified TDF/COM-B domains influencing implementation are summarised in  
4  
5 368 additional file 1. Considering the frequency, elaboration of the domains and evidence of  
6  
7 369 conflict, the following six domains were considered the key domains of influence relating to  
8  
9 370 the implementation strategy; (i) Environmental Context and Resources (Physical  
10  
11 371 Opportunity; e.g. integration with the wider healthcare context, staffing resources, hospital  
12  
13 372 delivery environment, availability of CURE related knowledge and training, CURE branding  
14  
15 373 and flexibility of the service specification), (ii) Goals (Reflective Motivation; e.g. promoting  
16  
17 374 CURE, adhering to a CURE service specification, identifying and evaluating outcomes), (iii)  
18  
19 375 Social Influences (Social Opportunity; e.g. peer support, CURE champions, organisational  
20  
21 376 culture change), (iv) Reinforcement (Automatic Motivation; e.g. reflection on intrinsic rewards  
22  
23 377 related to CURE involvement and delivery), (v) Social Professional Role and Identity  
24  
25 378 (Reflective Motivation; e.g. commitment to patient choice, acceptance of responsibility for  
26  
27 379 delivering tobacco dependence treatment.), and (vi) Skills (Psychological Capability &  
28  
29 380 Physical Capability; e.g. previous experience and skills supporting smoking cessation and  
30  
31 381 using hospital-based IT systems). These domains acted as both barriers and facilitators to  
32  
33 382 implementation. Based on the criteria, we suggest these six key domains are prioritised for  
34  
35 383 change (see **Error! Reference source not found.**  
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39 384

40  
41 385 Of the 26 BCTs identified in the current implementation strategy content, six had high  
42  
43 386 theoretical congruence with the key domains identified above, nine had medium congruence  
44  
45 387 and eleven BCTs had low theoretical congruence (see Table 4). The BCTs observed to have  
46  
47 388 high theoretical congruence were (i) Social support (practical), (ii) Social support (emotional),  
48  
49 389 (iii) Social support (unspecified), (iv) Reward (outcome), (v) Restructuring the social  
50  
51 390 environment, and (vi) Demonstration of the behaviour. These BCTs were paired with  
52  
53 391 domains rated as important in influencing CURE implementation. For instance, the domain  
54  
55 392 *Social influences* (e.g. peer support, visibility of CURE champions) was appropriately  
56  
57 393 targeted via the BCT *Social support (practical)*, delivered through the implementation  
58  
59 394 strategy component *educational outreach visits* (whereby nurse leads, clinical leads and/or

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3 395 CURE nurses visit colleagues, providing information and advice to support their ability to  
4  
5 396 engage with CURE).

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7 397

8  
9 398 Table 5 shows whether intervention functions identified in the CURE implementation strategy  
10  
11 399 appropriately targeted the six most important TDF/COM-B components. The potential  
12  
13 400 missed opportunities (e.g. as highlighted by the analysis) were related to the intervention  
14  
15 401 functions Coercion and Restriction, which were not identified in the CURE implementation  
16  
17 402 strategy. The Coercion intervention function may have been useful in targeting the domains  
18  
19 403 linked to Reflective Motivation addressing themes under the TDF domain 'Goals' such as  
20  
21 404 *Managing competing goals and priorities* and *Promoting CURE*. Nevertheless, other  
22  
23 405 intervention functions were used to target this component: Education, Incentivisation and  
24  
25 406 Persuasion. The Restriction intervention function may have been useful in targeting  
26  
27 407 Environmental Context and Resources (Physical Opportunity) and Social Influences (Social  
28  
29 408 Opportunity). Other intervention functions were used to target these TDF/COM-B  
30  
31 409 components: Enablement, Environmental restructuring, Training, and Modelling.

32  
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34  
35 410 Table 6 shows whether intervention functions identified in the CURE implementation strategy  
36  
37 411 were delivered through policy categories suggested by the BCW intervention function/policy  
38  
39 412 category matrix. All intervention functions were delivered through at least one policy  
40  
41 413 category suggested by the matrix.

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43  
44 414 There were missed opportunities to deliver functions identified in implementation strategy  
45  
46 415 through the policy category of fiscal measures, regulation and legislation. This was  
47  
48 416 particularly important for the Training (1 out of 4 opportunities were 'seized') and Environmental  
49  
50 417 restructuring (2 out of 5 opportunities were 'seized') intervention functions, as they could  
51  
52 418 have been better supported by including these policy categories.

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56 419 *Step 4 - Development of recommendations to support future implementation.*  
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3 420 Twenty-six recommendations were developed to address the themes identified within the six  
4  
5 421 most important TDF domains. Recommendation ratings from the Delphi survey ranged from  
6  
7 422 3 to 36 (maximum score) with a median of 28.5 (IQR, 25.25 - 31). Survey responses are  
8  
9 423 available in additional file 2. These ratings were used to structure discussion within the  
10  
11 424 subsequent stakeholder workshop. The workshop focused predominately on  
12  
13 425 recommendations which had greatest levels of uncertainty, further contextualised these  
14  
15 426 recommendations considering the existing healthcare system and specified the feasibility of  
16  
17 427 implementing recommendations in practice. This included the removal of a recommendation  
18  
19 428 related to financial incentives for GPs (i.e., *Provide financial incentive on performance (e.g.,*  
20  
21 429 *when prescribing NRT) for primary care staff supporting service outpatients in the*  
22  
23 430 *community*). This was the lowest rated recommendation within the Delphi survey, with  
24  
25 431 further stakeholder discussion suggesting financial incentives were not deemed acceptable  
26  
27 432 nor considered effective within the pilot phase. Another recommendation relating to the  
28  
29 433 delivery environment (i.e., *Ensure adequate facilities are available to support delivery,*  
30  
31 434 *including physical spaces for one-to-one sessions, hospital accessibility for patients (i.e.,*  
32  
33 435 *through parking, public transport) and vaping facilities*) was thought to cover a lot of separate  
34  
35 436 components and thus was separated into three recommendations covering the need to  
36  
37 437 provide 1) adequate office space for delivery staff 2) physical space to deliver one-to-one  
38  
39 438 support to patients and 3) on-site vaping facilities. Access to IT equipment (e.g., laptops),  
40  
41 439 was also added as a recommendation in light of increased need to self-isolate due to the  
42  
43 440 COVID-19 pandemic. A highly rated recommendation relating to deliverers' skill  
44  
45 441 development (i.e., *Provide additional training on how to use tools associated with*  
46  
47 442 *intervention delivery, so staff practice and observe use of these tools to facilitate day to day*  
48  
49 443 *delivery*) was expanded to support deliverers capacity to provide behavioural support to  
50  
51 444 patients. As such, an additional recommendation (to allow deliverers to shadow experienced  
52  
53 445 staff members) was added, as this was identified as a facilitator of delivery during the pilot  
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55 446 phase.  
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3 447 As a result of these discussions, the final list includes 29 recommendations. Following  
4  
5 448 further stakeholder consultation, no changes were recommended. Table 7 presents the final  
6  
7 449 overview of recommendations, with a brief indication of stakeholder APEASE evaluations.  
8  
9

## 10 450 **Discussion**

### 11 451 Summary of findings

12  
13  
14  
15 452 This study aimed to understand the implementation of the CURE project, a secondary care  
16  
17 453 /hospital-based tobacco dependence treatment model, recently piloted in the North West of  
18  
19 454 England. The study used a systematic, theoretically guided approach to specify the content  
20  
21 455 and possible mechanisms of action of an implementation strategy using behavioural science  
22  
23 456 methodology and triangulation from different data sources (i.e. semi-structured interviews,  
24  
25 457 document analysis, Delphi survey, stakeholder engagement). We have also illustrated how  
26  
27 458 theory can be used to optimise the implementation strategy of the CURE project. From  
28  
29 459 interviews with healthcare professionals, six themes were identified as influences for the  
30  
31 460 implementation of CURE (21). These were used to identify gaps in the existing  
32  
33 461 implementation strategy and informed recommendations for refinement. The implementation  
34  
35 462 strategy consisted of 26 BCTs (i.e. 'active components'), seven intervention functions, and  
36  
37 463 four policy categories that could stimulate behaviour change through several mechanisms of  
38  
39 464 action, especially 'beliefs about consequences' (Reflective Motivation) and 'knowledge'  
40  
41 465 (Psychological Capability).  
42  
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44

45 466 The existing implementation strategy incorporated half the potentially relevant content to  
46  
47 467 target identified barriers and facilitators for the CURE project. More theoretically congruent  
48  
49 468 BCTs should be included in the implementation strategy, particularly for the TDF domains  
50  
51 469 'Environmental Context and Resources,' 'Social Professional Role and Identity', and 'Social  
52  
53 470 Influences'. There were missed opportunities for implementation strategy as a large  
54  
55 471 proportion of the BCTs currently featured in the implementation strategy are linked with the  
56  
57 472 TDF domain 'knowledge'. These findings highlight that some of the implementation strategy  
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1  
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3 473 features were primarily educational, though many of the barriers related to the social and  
4  
5 474 environmental context. Similarly, previous systematic reviews have shown that educational  
6  
7 475 strategies were the most commonly used strategies in multi-strategy interventions (33,34).  
8  
9 476 Current evidence suggests that organisational-level interventions in the healthcare context  
10  
11 477 can influence clinical outcomes and efficiency (Straus, Tetroe, & Graham, 2009). When used  
12  
13 478 as part of multi-strategy interventions, group education and organisational strategies (e.g.  
14  
15 479 creation of an implementation team) corresponded with positive significant changes in  
16  
17 480 outcomes (33). Incorporating theory (11) in the design of implementation strategies would  
18  
19 481 enhance the field's understanding of the causal mechanisms by which the strategies lead, or  
20  
21 482 do not lead, to changes in outcomes at all levels.

22  
23  
24  
25 483 The logic model specifies the theory of change related to mechanisms, assumptions and  
26  
27 484 outcomes of the CURE model. The initial version of the model (as presented in Figure 2.  
28  
29 485 **CURE stop smoking project: Initial logic model**) presents the intended process of  
30  
31 486 change, as informed by the document review. The final iteration of the model (as presented  
32  
33 487 in Figure 3) demonstrates a more accurate overview of what ultimately was delivered in the  
34  
35 488 programme, and documents the actual process of change, as informed by document review,  
36  
37 489 stakeholder views and behavioural analysis.

38  
39  
40 490 Our findings also suggest recommendations for optimising the implementation strategy, and  
41  
42 491 these can be found in Table 7. Stakeholder feedback was used to refine recommendations,  
43  
44 492 so they were suitable and acceptable to the healthcare context. One new implementation  
45  
46 493 strategy was recommended to allow deliverers to shadow experienced staff members as this  
47  
48 494 was identified as a facilitator of delivery during the pilot. In addition, modifications were made  
49  
50 495 to existing strategies, e.g. the delivery environment recommendation was further specified  
51  
52 496 and separated into three (i.e. provide adequate office space for delivery staff, physical space  
53  
54 497 to deliver one-to-one support to patients, and on-site vaping facilities). One implementation  
55  
56 498 strategy recommendation related to financial incentives for GPs was removed. Stakeholder  
57  
58 499 discussion suggested that financial incentives were not deemed acceptable within the pilot.  
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3 500 Several challenges to adoption and implementation of the Ottawa model have been  
4  
5 501 identified previously (Reid et al 2010). Likewise, these challenges typically included staff  
6  
7 502 regarding smoking as a 'lifestyle choice' and a lack of support from key opinion leaders and  
8  
9 503 clinical managers. Leadership and performance feedback from managers, training about  
10  
11 504 tobacco-dependence treatment, and smoke-free hospital policies were the key  
12  
13 505 recommendations to improve adoption and implementation (Reid et al 2010). This evidence  
14  
15 506 base has been used to underpin the delivery of smoking cessation in secondary care  
16  
17 507 settings, and to inform future implementation strategies (36).  
18  
19  
20 508 Other studies have successfully integrated similar theoretical approaches (i.e. BCW, TDF)  
21  
22 509 and methodologies (e.g. qualitative interviews/Delphi) to characterise the content and  
23  
24 510 theoretical mechanisms of action of an existing implementation strategy, and to optimise an  
25  
26 511 existing implementation strategy (37,38).  
27  
28 512 The findings from this strategic behavioural analysis are similar to those of other studies,  
29  
30 513 particularly that only a small percentage of BCTs used in interventions (21% to 37.5%) are  
31  
32 514 theoretically relevant for targeting identified barriers to deliver or implement behaviour  
33  
34 515 change interventions (18, 29). Likewise, missed opportunities in the implementation strategy  
35  
36 516 content are similar across other behavioural analyses that highlighted that most focus on  
37  
38 517 shaping knowledge rather than addressing motivational, social and environmental influences  
39  
40 518 (18, 29).  
41  
42  
43 519 This study provides relevant evidence to further guide the implementation process and  
44  
45 520 selection of strategies; ensuring that enough attention is paid to planning implementation;  
46  
47 521 and a flexible approach that allows response to emerging barriers, particularly at the  
48  
49 522 organisational level. According to Li et al. (39) organisational contextual features (e.g.  
50  
51 523 organisational culture; leadership; networks and communication; resources; evaluation,  
52  
53 524 monitoring and feedback; and champions) were most commonly reported to influence  
54  
55 525 implementation outcomes across a wide range of healthcare settings.  
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3 526 Strengths and limitations  
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5 527 This study is the first to qualitatively explore behavioural factors underpinning the  
6  
7 528 implementation of the CURE project. Considering barriers and facilitators to implementation  
8  
9 529 through the lens of the TDF allows for the identification of both internal and external factors  
10  
11 530 which are known to influence behaviour change and evidence-based intervention  
12  
13 531 implementation. Moreover, the behavioural analysis links these barriers and facilitators to  
14  
15 532 specific components underpinning the CURE implementation strategy. This therefore  
16  
17 533 provides novel insight into key factors which can facilitate implementation of such an  
18  
19 534 intervention in a hospital setting. From these findings, relevant decision makers can make a  
20  
21 535 strategic, informed decision using evidence-based recommendations to optimise the  
22  
23 536 implementation and delivery of future NHS-funded tobacco dependence treatment and target  
24  
25 537 mechanisms of healthcare professional's behaviour change. This approach also provides  
26  
27 538 further insight into potentially overlooked, yet relevant, intervention functions (i.e. missed  
28  
29 539 opportunities) which may be considered by decision makers to optimise the implementation  
30  
31 540 of the CURE model. Overall, the systematic approach taken throughout the present  
32  
33 541 research, and use of established theoretical frameworks, results in evidence which,  
34  
35 542 importantly, facilitates efficient translation to policy and practice (13).  
36  
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40  
41 544 Implications for practitioners, policymakers, and future research  
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43 545 Based on the appraisal of the CURE implementation strategy content, the current package  
44  
45 546 shows good practice for implementation including relevant BCTs, intervention functions and  
46  
47 547 policy categories. However, the additional recommendations provided in Table 7 may  
48  
49 548 optimise and inform future implementation. This is a set of practical recommendations co-  
50  
51 549 developed with stakeholders and informed by robust behaviour change theoretical  
52  
53 550 approaches.  
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57 551 The BCTs currently in use are linked to multiple intervention functions, including the most  
58  
59 552 relevant intervention functions to tackle the key domains. The introduction of strategies using  
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3 553 the intervention function of Coercion (not currently in use) might not be considered  
4  
5 554 acceptable/appropriate in the hospital context and future research could explore the  
6  
7 555 practicalities of introducing this intervention function in secondary care settings (e.g. having  
8  
9 556 behavioural/letter commitments for staff involved in CURE) (40) This strategy was successful  
10  
11 557 in avoiding inappropriate antibiotic prescribing by having poster-sized commitment letters  
12  
13 558 featuring clinician photographs and signatures stating a commitment in wards (41).

14  
15  
16 559 The inclusion of fiscal measures (i.e., using the tax system to reduce or increase the  
17  
18 560 financial cost), and legislation (i.e., making or changing laws) was considered less  
19  
20 561 practicable in the hospital context. For the policy category of regulation, further strategies  
21  
22 562 could be introduced, e.g., establishing rules or principles for vaping within the hospital  
23  
24 563 premises, and further evaluated through research.

25  
26  
27 564 The findings presented in this paper are related to only one pilot implementation strategy  
28  
29 565 rather than the CURE model generally. It will be important to conduct qualitative work and  
30  
31 566 strategic behavioural analysis in other pilot sites where the delivery and/or  
32  
33 567 barriers/facilitators might be different. In addition, suggested future research should also try  
34  
35 568 to understand how these findings differ in different contexts given different structures and  
36  
37 569 systems within hospitals. Implementation fidelity across different pilot sites should be  
38  
39 570 evaluated and compared with adherence to protocols. For example, implementation fidelity  
40  
41 571 could be assessed by measuring the completeness of smoking cessation consultation forms  
42  
43 572 and the proportion of patients for whom cessation medications were ordered in hospital.

#### 44 573 Conclusion

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47 574 This strategic behavioural analysis study demonstrates how the use of a variety of behaviour  
48  
49 575 change tools can be used to specify the content and possible mechanisms of action of an  
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51 576 existing implementation strategy which has achieved some level of success in clinical  
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53 577 practice but requires further improvement and evaluation.  
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3 578 This study provides comprehensive evidence about current practice in the pilot site that can  
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5 579 further inform implementation strategy improvement and the implementation of an NHS-  
6  
7 580 funded tobacco dependence treatment and policy in secondary care in England.  
8  
9

10 581

## 11 12 13 582 **List of abbreviations**

14  
15 583 CURE: Conversation, Understand, Replace, Expert and Evidence based Treatments.

16  
17  
18 584 OMSC: Ottawa Model for Smoking Cessation

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21 585 TDF: Theoretical Domains Framework

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24 586 BCT: Behaviour Change Technique

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27 587 BCW: Behaviour Change Wheel

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29  
30 588 MRC: Medical Research Council

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32 589 APEASE: Affordability, Practicality, Efficacy, Acceptability, Safety and Equity/Side Effects

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## 36 37 38 591 **Declarations**

39  
40  
41 592 Availability of data and material: The datasets used and/or analysed during the current study  
42  
43 593 are available from the corresponding author on reasonable request.

44  
45 594 Competing interests: VM is employed by project funders, Public Health England. ME and FH  
46  
47 595 led the pilot evaluation of the CURE project in Greater Manchester.

48  
49  
50 596 Funding: This research was commissioned and funded by Public Health England  
51  
52 597 (award/grant number: not applicable).

53  
54  
55 598 Authors' contributions: AR, AH and CH developed the initial study design and secured  
56  
57 599 funding for the study. AW conducted preparation of study materials, data collection and  
58  
59 600 analysis for the qualitative interviews and drafted summary reports. AR conducted the

1  
2  
3 601 behavioural analysis. CH developed the logic models. AR and AW drafted the manuscript.  
4  
5 602 CH, AH, VM, FH AND ME contributed and provided comments on data analysis and  
6  
7 603 interpretation, and report drafts. All co-authors have reviewed and agreed the final draft of  
8  
9 604 the paper submitted for publication.

11  
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13  
14 606 participate in this research, the CURE team, and PHE Behavioural Insights and Tobacco  
15  
16 607 Control teams for their helpful comments and insight, particularly Martyn Willmore,  
17  
18 608 Aleksandra Herbec, Anna Sallis and Michelle Havill.

19  
20  
21 609 Patient and Public Involvement: No patient involved.

22  
23  
24 610 Ethics statement: Ethical Approval was granted from Northumbria University Faculty of  
25  
26 611 Health and Life Sciences Ethics Committee (Ref 21358). Informed consent was obtained  
27  
28 612 from all study participants. All methods were carried out in accordance with relevant  
29  
30 613 guidelines and regulations.

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754 **Table 1: TIDieR table for the CURE project implementation intervention in the pilot**755 **site.**

<b>TIDieR checklist item</b>	CURE project implementation intervention
<b>What</b>	<p>The primary focus of the CURE project implementation strategy is to:</p> <ul style="list-style-type: none"> <li>- Implement systematic screening of all hospital admissions for smoking status</li> <li>- Implement an automated opt-out referral process to a specialist tobacco addiction treatment team for active smokers</li> <li>- Train the medical workforce to have the competence and confidence to discuss and initiate the treatment for tobacco addiction with smokers;</li> <li>- Provide a standardised assessment and treatment pathway for smokers admitted to secondary care;</li> <li>- Provide an appropriately resourced Specialist Nurse team to see all smokers admitted to secondary care and design individualised treatment plans including beyond discharge;</li> <li>- Promote standardised and robust handover of treatment plan to primary care upon discharge;</li> <li>- Promote culture change within secondary care to embed the treatment of tobacco addiction into all medical teams' day-to-day practice;</li> <li>- Provide IT systems to support the delivery of this programme.</li> </ul>
<b>Who delivered</b>	<p>Two eLearning modules developed by the CURE Project Team and Dynamic to fit the needs of the gaps in knowledge for staff in the hospital as well as the new treatment pathway.</p> <p>Bespoke face to face teaching sessions delivered by Clinical Lead, Nurse Lead and Project Manager (induction, departmental teaching, grand rounds, ward walk-arounds, educational resources)</p>
<b>How</b>	<p>Two eLearning modules developed and promoted by internal communications/education teams prior to formal launch of CURE Project.</p> <p>Specialist Nurse Training manual developed to support the CURE Nursing Team in their role.</p> <p>Posters, screensavers, flyers, ID badge foldout prescribing protocol created to promote project and key elements of the pathway.</p>

	Bespoke teaching sessions (induction, departmental teaching, grand rounds, ward walk-arounds, educational resources)
<b>Where</b>	Online training Face to face training sessions Slots on existing educational training sessions for doctors and nurses Hospital setting
<b>When and How much</b>	Elearning module launched September 2018 – one month prior to launch to give time to embed Face to face training/updates given over 3-4 months before and after launch of the CURE Project in October 2018
<b>Tailoring</b>	No tailoring
<b>Fidelity</b>	No fidelity checks

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757 **Table 2. BCTs, intervention functions and policy categories identified in the CURE**  
 758 **intervention.**

Activities and intervention strategies	Source of information	Behaviour Change Techniques	Intervention functions	Policy Categories
HCP Training (i.e. training manual, training poster, teaching slides, Level 1 and Level 2 eLearning modules)	Document analysis	<ul style="list-style-type: none"> <li>Action Planning;</li> <li>Monitoring of behaviour by others without feedback;</li> <li>Monitoring outcome(s) of behaviour by others without feedback</li> <li>Instruction on how to perform the behaviour;</li> <li>Information about Antecedents;</li> <li>Information about health consequences;</li> <li>Salience of consequences;</li> <li>Information about social and environmental consequences;</li> <li>Information about emotional consequences;</li> <li>Demonstration of the behaviour;</li> <li>Credible source;</li> <li>Verbal persuasion about capability.</li> </ul>	Education Training Modelling Enablement Persuasion	Service provision Guidelines Communication/marketing Environmental/social planning
Other features of HCP training (i.e. shadowing, observation of	Interviews only	<ul style="list-style-type: none"> <li>Monitoring of behaviour by others without feedback;</li> <li>Social support (practical)</li> <li>Social support (emotional);</li> <li>Demonstration of the behaviour;</li> </ul>		

Activities and intervention strategies	Source of information	Behaviour Change Techniques	Intervention functions	Policy Categories
new staff, repetition of training, lunchtime training sessions, certificate upon completion of training)		<ul style="list-style-type: none"> <li>• Behavioural practice/rehearsal;</li> <li>• Credible source;</li> <li>• Reward (outcome).</li> </ul>		
Practice tools (e.g. assessment forms, prescribing protocols, NRT products for demonstration)	Document analysis; interviews	<ul style="list-style-type: none"> <li>• Goal setting (behaviour)</li> <li>• Action planning</li> <li>• Instruction on how to perform the behaviour;</li> <li>• Adding objects to the environment</li> </ul>	Education Enablement Training Environmental restructuring	
Reminder systems (e.g. lanyard card, IT systems)	Document analysis; interviews	<ul style="list-style-type: none"> <li>• Prompts/ cues</li> <li>• Adding objects to the environment</li> </ul>	Education Environmental restructuring	
Educational outreach visits (inclusive of both senior management and the wider healthcare team/staff)	Interviews only	<ul style="list-style-type: none"> <li>• Social support (practical)</li> <li>• Instruction on how to perform the behaviour</li> <li>• Information about health consequences;</li> <li>• Information about social and environmental consequences;</li> <li>• Demonstration of the behaviour;</li> <li>• Credible source;</li> </ul>	Education Enablement Modelling Persuasion	

Activities and intervention strategies	Source of information	Behaviour Change Techniques	Intervention functions	Policy Categories
Ongoing audit and feedback	Interviews only	<ul style="list-style-type: none"> <li>Review outcome goal(s)</li> <li>Feedback on behaviour</li> <li>Feedback on outcome(s) of behaviour</li> <li>Social support (unspecified)</li> </ul>	Education Enablement Persuasion Incentivisation Training	
GP financial incentives (i.e. discharge pathway in primary care)	Interviews only	<ul style="list-style-type: none"> <li>Cue signalling reward</li> <li>Material incentive (behaviour)</li> </ul>	Incentivisation Environmental restructuring	
Steering groups meetings	Document analysis; Interviews only	<ul style="list-style-type: none"> <li>Monitoring of behaviour by others without feedback</li> <li>Monitoring outcome(s) of behaviour by others without feedback</li> <li>Restructuring the social environment</li> </ul>	Education Enablement Environmental restructuring	
Branding and educational tools (e.g. posters, website, e-learning modules, pens, media campaign)	Document analysis; interviews	<ul style="list-style-type: none"> <li>Prompts/ cues</li> <li>Adding objects to the environment</li> </ul>	Environmental restructuring	
Reflective discussions	Interviews only	<ul style="list-style-type: none"> <li>Social support (unspecified)</li> <li>Restructuring the social environment</li> </ul>	Enablement Environmental restructuring	

Activities and intervention strategies	Source of information	Behaviour Change Techniques	Intervention functions	Policy Categories
Information sharing	Interviews only	<ul style="list-style-type: none"> <li>• Social support (practical)</li> <li>• Information about social and environmental consequences</li> <li>• Restructuring the Physical environment</li> </ul>	Education Persuasion Enablement Environmental restructuring	
Admin Support	Interviews only	<ul style="list-style-type: none"> <li>• Restructuring the social environment</li> </ul>	Enablement Environmental restructuring	
Consultation facilities	Interviews only	<ul style="list-style-type: none"> <li>• Restructuring the Physical environment</li> </ul>	Environmental restructuring	
Triaging system	Interviews only	<ul style="list-style-type: none"> <li>• Restructuring the Physical environment</li> </ul>	Environmental restructuring	

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767 **Table 3. Prioritisation of TDF domains for the implementation of the CURE model by**  
 768 **frequency, thematic elaboration, and evidence of conflicting beliefs.**

Ranking	TDF Domain (COM-B)	Frequency (No. of transcripts identified in; max n=10)	Elaboration (Number of themes [barriers/facilitators])	Evidence of conflicting beliefs within domains (Yes/No)
1	<b>Environmental Context and Resources (physical opportunity)</b>	10	13	Yes
2	<b>Goals (reflective motivation)</b>	7	4	Yes
3	<b>Social Influences (social opportunity)</b>	9	3	Yes
4	<b>Reinforcement (automatic motivation)</b>	8	2	Yes
5	<b>Social Professional Role and Identity (reflective motivation)</b>	7	2	Yes
6	<b>Skills (psychological capability &amp; Physical Capability combined)</b>	7	1	Yes
7	Beliefs about consequences (reflective motivation)	7	2	No
8	Knowledge (psychological capability)	3	1	No
Joint 9 <sup>th</sup> – 14 <sup>th</sup>	Beliefs about capabilities (reflective motivation)	0	0	-
	Intentions (reflective motivation)	0	0	-
	Memory, Attention, and Decision Making (psychological capability)	0	0	-
	Behavioural Regulation (psychological capability)	0	0	-
	Emotions (automatic motivation)	0	0	-
	Optimism (reflective motivation)	0	0	-

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772 **Table 4. Theoretical congruence between the BCTs identified in CURE implementation**  
 773 **strategy content and the key TDF domains influencing implementation of CURE within**  
 774 **the pilot site**

BCT	Linked TDF domains according to integrated mapping matrix*	Domain importance ranking**	Theoretical congruence between BCT and domain***
<b>Social support (practical)</b>	<b>Environmental Context and Resources</b>	1	<b>HIGH</b>
	<b>Goals</b>	2	
	<b>Social professional role/ identity</b>	3	
	<b>Social influences</b>	3	
<b>Social support (emotional)</b>	Beliefs about capabilities	9-14	<b>HIGH</b>
	<b>Goals</b>	2	
	<b>Social professional role/ identity</b>	3	
	<b>Social influences</b>	3	
	Beliefs about capabilities	9-14	
<b>Social support (unspecified)</b>	Emotions	9-14	<b>HIGH</b>
	<b>Goals</b>	2	
	<b>Social professional role/ identity</b>	3	
	<b>Social influences</b>	3	
	Beliefs about capabilities	9-14	
<b>Reward (outcome)</b>	<b>Goals</b>	2	<b>HIGH</b>
	<b>Reinforcement</b>	5	
	<b>Skills</b>	6	
	Beliefs about consequences	9-14	
<b>Restructuring the social environment</b>	<b>Environmental Context and Resources</b>	1	<b>HIGH</b>
	<b>Social influences</b>	3	
<b>Demonstration of the behaviour</b>	<b>Social influences</b>	3	<b>HIGH</b>
	<b>Skills</b>	6	
	Beliefs about capabilities	9-14	

<b>BCT</b>	<b>Linked TDF domains according to integrated mapping matrix*</b>	<b>Domain importance ranking**</b>	<b>Theoretical congruence between BCT and domain***</b>
<b>Prompts/cues</b>	<b>Environmental Context and Resources</b>	1	<b>MED</b>
	Memory, Attention, Decision Making	9-14	
	Behavioural Regulation	9-14	
<b>Restructuring the Physical environment</b>	<b>Environmental Context and Resources</b>	1	<b>MED</b>
<b>Adding objects to the environment</b>	<b>Environmental Context and Resources</b>	1	<b>MED</b>
<b>Action Planning</b>	<b>Goals</b>	2	<b>MED</b>
	Behavioural Regulation	9-14	
	Memory, Attention, Decision Making	9-14	
<b>Verbal persuasion about capability</b>	<b>Goals</b>	2	<b>MED</b>
	Beliefs about capabilities	9-14	
	Optimism	9-14	
<b>Review outcome goal(s)</b>	<b>Goals</b>	2	<b>MED</b>
<b>Material incentive (behaviour)</b>	<b>Reinforcement</b>	5	<b>MED</b>
	Beliefs about consequences	9-14	
<b>Instruction on how to perform the behaviour</b>	<b>Skills</b>	6	<b>MED</b>
	Knowledge	8	
	Beliefs about capabilities	9-14	
<b>Behavioural practice/rehearsal</b>	<b>Skills</b>	6	<b>MED</b>
	Beliefs about capabilities	9-14	
<b>Credible source</b>	Beliefs about consequences	9-14	<b>LOW</b>
<b>Feedback on outcome(s) of behaviour</b>	Beliefs about consequences	9-14	<b>LOW</b>
<b>Feedback on behaviour</b>	Knowledge	8	<b>LOW</b>
	Beliefs about consequences	9-14	

BCT	Linked TDF domains according to integrated mapping matrix*	Domain importance ranking**	Theoretical congruence between BCT and domain***
<b>Information about Antecedents</b>	Knowledge	8	<b>LOW</b>
	Behavioural regulation	9-14	
<b>Information about health consequences</b>	Knowledge	8	<b>LOW</b>
	Beliefs about consequences	9-14	
	Intentions	9-14	
<b>Salience of consequences</b>	Knowledge	8	<b>LOW</b>
	Beliefs about consequences	9-14	
<b>Information about social and environmental consequences</b>	Knowledge	8	<b>LOW</b>
	Beliefs about consequences	9-14	
<b>Information about emotional consequences</b>	Knowledge	8	<b>LOW</b>
	5	9-14	
<b>Cue signalling reward</b>	None	NA	<b>LOW</b>
<b>Monitoring of behaviour by others without feedback</b>	None	NA	<b>LOW</b>
<b>Monitoring outcome(s) of behaviour by others without feedback</b>	None	NA	<b>LOW</b>

775 \* TDF x BCT mapping matrices (30,31) and The Theory and Techniques Tool (42).  
 776 \*\*Domain ranking based on thematic analysis of barrier/facilitators data from interviews (see **Error!**  
 777 **Reference source not found.**)  
 778 \*\*\*Classification of theoretical congruence: Low: BCT is not paired with any of the 6 key domains  
 779 identified as important in the thematic analysis; Medium: BCT is paired with at least one domain  
 780 identified as important; High: BCT is paired with two or more domains identified as important.

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787 **Table 5. Seized and missed opportunities: Intervention functions linked with the**  
 788 **CURE intervention.**

	Intervention functions								
TDF domain (COM-B)	Education	Enablement	Environmental restructuring	Incentivisation	Coercion	Modelling	Persuasion	Training	Restriction
Skills (Physical capability)									
Skills (Psychological capability)									
Goals, Professional role, (Reflective motivation)									
Reinforcement (Automatic motivation)									
Environmental context and resources (Physical opportunity)									
Social Influences (Social opportunity)									

789 Table seven displays links between the intervention functions coded in the existing CURE intervention, and the intervention

790 functions linked to the top TDF domains using the BCW matrix (p.116). Green indicate an opportunity seized, and red indicate

1  
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3 791 an opportunity missed. White is not paired. Note: the definition of Skills used for this exercise combines Physical Skills and  
4 792 Cognitive/Interpersonal Skills (see Table 1.5, p.88 of The Behaviour Change Wheel(Michie et al., 2014)). Furthermore, both  
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6 793 types of Skill are linked to the same intervention functions and BCTs in the mapping matrices used throughout this paper.  
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795 **Table 6. Seized and missed opportunities: Policy Categories linked with the CURE**  
 796 **intervention.**

Intervention functions	Policy Categories						
	Communication/marketing	Guidelines	Fiscal Measures	Regulation	Legislation	Environmental/Social planning	Service provision
Education							
Enablement							
Environmental restructuring							
Incentivisation							
Coercion							
Modelling							
Persuasion							
Training							
Restriction							

797 Table eight shows whether intervention functions identified in the CURE interventions were delivered through policy categories  
 798 suggested by the BCW intervention function × policy category matrix. Green indicates an opportunity seized, grey indicates an  
 799 intervention function not identified in the intervention, and red indicate an opportunity missed. White is not paired.

800 **Table 7. Recommendations to support the implementation of a nationwide, secondary care-based tobacco dependence treatment**  
 801 **model, based upon the CURE project.**

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
<i>Environmental context and resources</i>			
Clearly define discharge pathways, at the set-up of the implementation process, that support continuity of care/follow-up for outpatients.	Restructuring the physical environment	Set up a steering group to consider options for discharge pathways, involving representation from secondary care, primary care, community services, community pharmacists.	High, if flexible to local service availability.
Collaborative working and discussion with external stakeholders and organisations, from the pre-planning stages.	Restructuring the physical environment	Arrange educational outreach workshops and/or steering group meetings involving, for example, Local Medical Committees, Local Care	Uncertain, dependent on 'buy-in' from stakeholder groups.

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<b>Summary of what needs to occur to support implementation, by TDF domain.</b>	<b>Behaviour Change Technique</b>	<b>Example delivery</b>	<b>Feasibility of recommendation (in line with APEASE criteria)<sup>a</sup></b>
		Organisations and Medicine Optimisation Services.	
Financial support for outpatient follow-up care within the community.	Restructuring the physical environment	Project team to allocate specific funding for discharge pathways, to enhance integration with services external to secondary care.	Potentially high if acceptable and practical locally.
Appropriate level of staffing across groups (i.e. support staff, delivery staff, project team and community support).  Designated hours for management to focus on the implementation of the	Restructuring the social environment	Model and implement staffing requirements appropriate to the location, particularly in terms of support staff (e.g. admin, IT support).	High



Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
intervention, particularly during the pre-launch phase.			
<p>Ability to access space(s) and equipment which enable delivery of the intervention.</p> <p>On-site smoking policy that aligns with intervention principles.</p>	Restructuring the physical environment	<p>Provide adequate office space to specialist nursing staff/deliverers, to facilitate private telephone calls to patients and for use of IT.</p> <p>Ensure those involved in delivery and/or implementation of the intervention can access and use IT equipment (e.g. laptops) in light of the increasing need to work from home and self-isolate.</p> <p>Provide physical space for one-to-one support sessions, ensuring that these spaces are</p>	<p>Variable</p> <p>Uncertain</p> <p>Variable</p>

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Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
		<p>accessible to both staff and outpatients from the surrounding areas.</p> <p>Provision of on-site vaping space/facilities</p>	Uncertain
Ability to provide a choice of Nicotine Replacement Therapy (NRT) to service users during their time in hospital and upon discharge.	Restructuring the physical environment	Provide access to a range of NRT products within secondary care, ensuring stock/options on wards are reflective of what is available in the community as much as practicable.	Uncertain, as may be unaffordable to offer a full range of NRT options.
Integration with existing IT systems to document/ review patient information.	<p>Prompts/Cues</p> <p>Adding objects to the environment</p>	<p>Prioritise the amendment of existing data storage systems to allow recording and documenting of patient information and journey through the</p>	Moderate

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
Integration with existing IT systems to remind wider healthcare staff to deliver the brief intervention.		intervention (e.g. computers programmed with pop up requests for data).	
Ability for all those involved in the delivery/ implementation of the intervention to easily access information and training tools.	Adding objects to the environment	Refer to (and/or provide if not already available) freely accessible e-learning modules/online training resources.	High
Clear branding of the intervention and signposting in the hospital setting.	Prompts/Cues  Adding objects to the environment	Provide marketing materials in a range of formats i.e. posters, pens, and screensavers to promote awareness of the service and prompt staff engagement.	High

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
Flexibility in the core service specification, as much as practicable, to facilitate shared decision making.	Instruction on how to perform the behaviour	Advise deliverers that shared decision-making is encouraged in relation to NRT options and post-discharge support (For example, choosing face to face or telephone support depending on local restrictions).	High, depending on the availability of NRT options and physical space for one-to-one sessions.
<b>Goals</b>			
Ability to access a service specification which clearly stipulates the core intervention	Goal setting (behaviour)  Action planning	Communicate shared goals of the intervention across management and deliverers, so required behaviours can be agreed upon and planned.	High

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
model, to ensure the intervention is delivered as intended.			
Motivate healthcare staff to promote the intervention to others within their workplace.	Goal setting (behaviour)  Review of outcome goal(s)  Review behaviour goals  Verbal persuasion	Arrange face-to-face or virtual discussions, training and the use of marketing materials to facilitate constant promotion of the intervention to a wide range of healthcare professionals (including new junior doctors).	Moderate

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
Integration of the intervention with existing hospital goals and priorities, to encourage 'buy-in' from senior decision makers.	Goal setting (behaviour)  Review of outcome goal(s)  Review behaviour goals  Action planning	Clearly communicate goals of the intervention, demonstrating how these align with existing hospital priorities.	Moderate
Identification and monitoring of outcomes that provide evidence	Goal setting (outcome)  Review of outcome goal(s)	Advise project team to plan specific outcomes of interest from the earliest stages and engage in	Moderate

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
of the success of the programme and return on investment.	Feedback (outcome)  Verbal persuasion	ongoing audit and feedback of these outcomes on a regular basis.  Share performance related feedback to delivery teams and wider stakeholders (e.g. in primary care) to encourage further 'buy-in'.	High
<i>Social/Professional Identity</i>			
Those involved in delivery/implementation to hold the view that the intervention allows for patient choice.	Social support (unspecified)	Educational outreach and training content to highlight that the intervention is aligned with a commitment to shared decision making.	High

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
Clear project and peer leadership within the locality.	Social support (unspecified)  Social support (practical)  Social support (emotional)	Implement a full-time project manager and clinical lead(s), ensuring they are able to provide troubleshooting and peer support in implementing/delivering the intervention.	Moderate
Healthcare staff, across settings, to hold the view that delivery of the service aligns with their professional identity.	Social support (unspecified)	Educational outreach and training content to highlight how the intervention aligns with healthcare practice across settings and stakeholder groups.	Uncertain



<p><b>Summary of what needs to occur to support implementation, by TDF domain.</b></p>	<p><b>Behaviour Change Technique</b></p>	<p><b>Example delivery</b></p>	<p><b>Feasibility of recommendation (in line with APEASE criteria)<sup>a</sup></b></p>
<p><i>Social Influences</i></p>			
<p>Those involved in implementation and delivery to hold the view that healthcare staff have a responsibility to support patients in smoking cessation.</p>	<p>Social comparison</p>	<p>Encourage positive social comparison to share good practice and facilitate a culture change of smoking cessation being everyone's responsibility by, for example, comparing no. of patients screened, no. referred to the service and/or no prescribed pharmacotherapy across wards/hospitals</p>	<p>High</p>
<p>Strong teamwork and collaborative working within and across stakeholder groups.</p>	<p>Information about others' approval</p>	<p>Educational outreach and training content to highlight clear, visible senior leadership to ensure staff are aware of others' support of the intervention.</p>	<p>High</p>

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Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
Strong and visible peer leadership across stakeholder groups.	<p>Restructuring the social environment</p> <p>Social support (unspecified)</p> <p>Credible source</p> <p>Verbal persuasion</p>	<p>Identify champions of the intervention within organisations, informing individuals that their own behaviour may set a good example for others and have positive consequences. This may relate to:</p> <ul style="list-style-type: none"> <li>• Clinical/Nurse/Pharmacy champion</li> <li>• Primary Care Champion</li> <li>• in different Hospital wards/departments</li> </ul> <p>As much as practicable, integrate opportunities for staff to observe peers presenting/discussing the intervention. For example, within educational</p>	<p>High, depending on affordability.</p> <p>High, depending on practicality/ availability of peer leads.</p>

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
	Identification of self as a role model  Vicarious Consequences	outreach/information should be delivered by local clinical and nursing leads.	
<i>Reinforcement</i>			
Those involved in delivery and implementation to hold the view that intervention involvement is intrinsically rewarding.	Self-reward	Prompt self-praise or intrinsic rewards of involvement, when performing intervention related tasks. For example, prompting staff to reflect on the likely health benefits for patients as a result of the treatment they are providing	High
Engagement from those working within primary care to support	Cue signalling reward	Educational outreach workshops or online information provision to advise GPs that funding is	Uncertain

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Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
ongoing treatment/prescribing within the community.	Material incentive (behaviour)	allocated for NRT prescriptions in the community and that this is a cost-effective approach	Provision of a material (e.g. financial) incentive not deemed acceptable in the current context.
<i>Skills</i>			
Ensure deliverers have capability to provide behavioural support to patients.  Ensure deliverers have capability to use supporting IT systems.	Instruction on how to perform behaviour  Demonstration of the behaviour	Allow deliverers to shadow experienced staff providing support to patients.  Provide training on how to use tools associated with intervention delivery (i.e. I.T systems).	High  High

<b>Summary of what needs to occur to support implementation, by TDF domain.</b>	<b>Behaviour Change Technique</b>	<b>Example delivery</b>	<b>Feasibility of recommendation (in line with APEASE criteria)<sup>a</sup></b>
	Behavioural practice		

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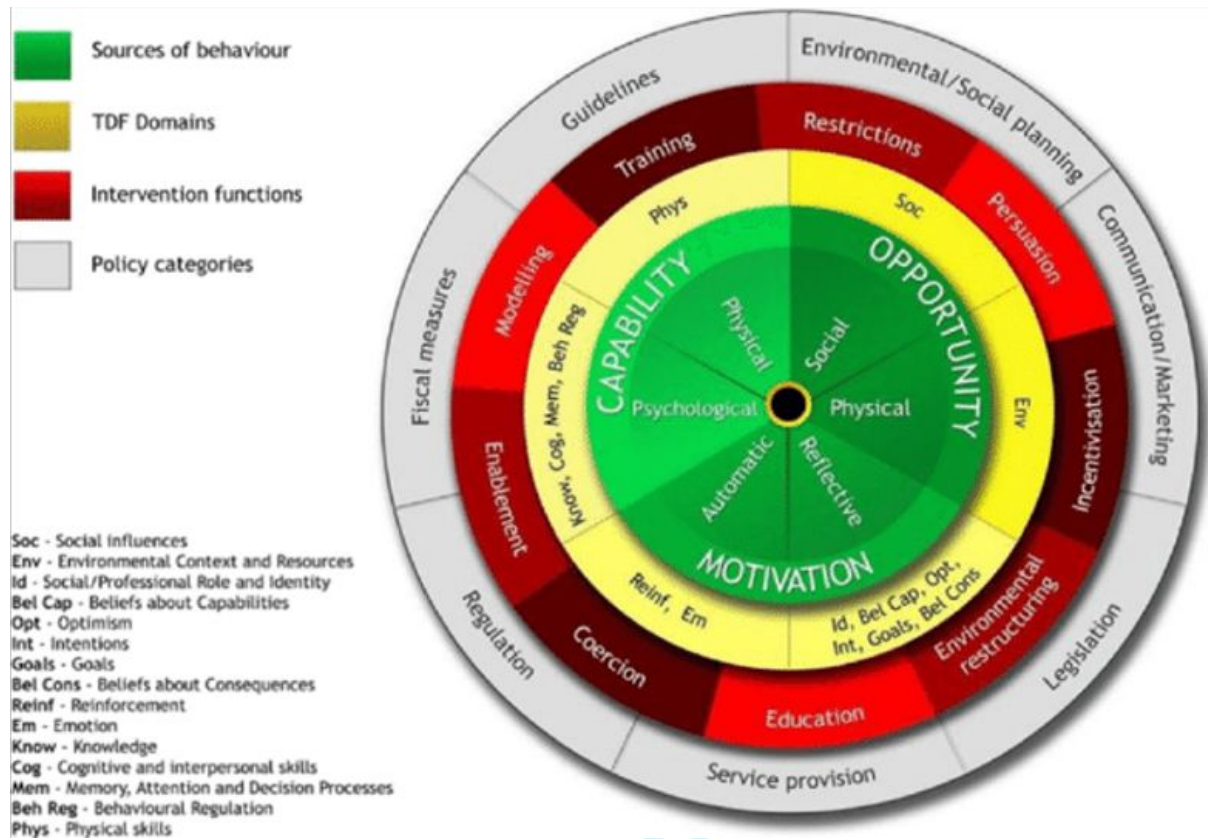
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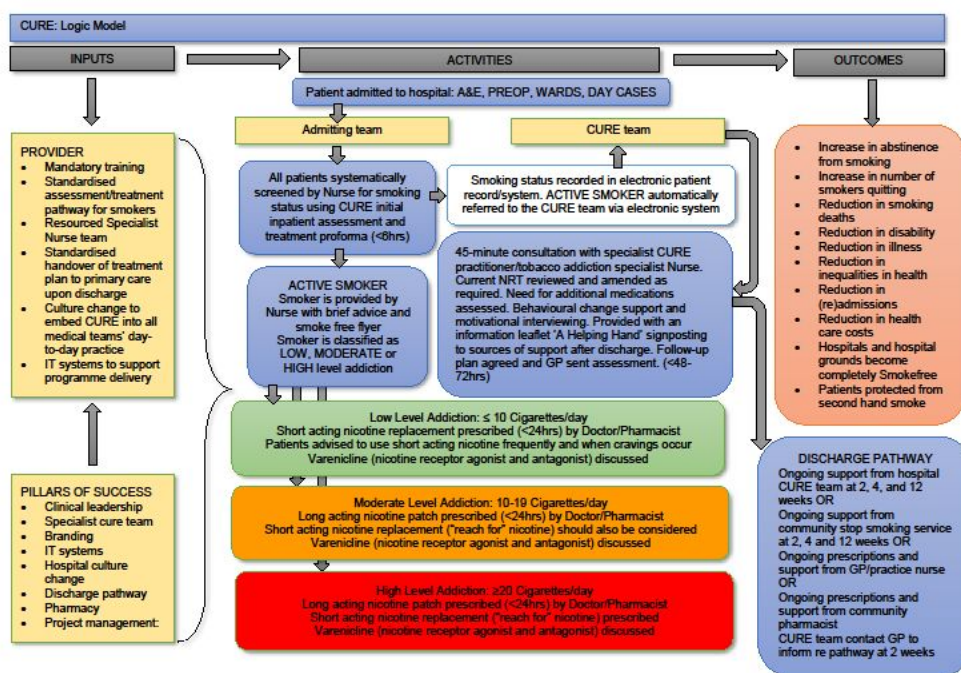
Figures

Figure 1: Behaviour Change Wheel.



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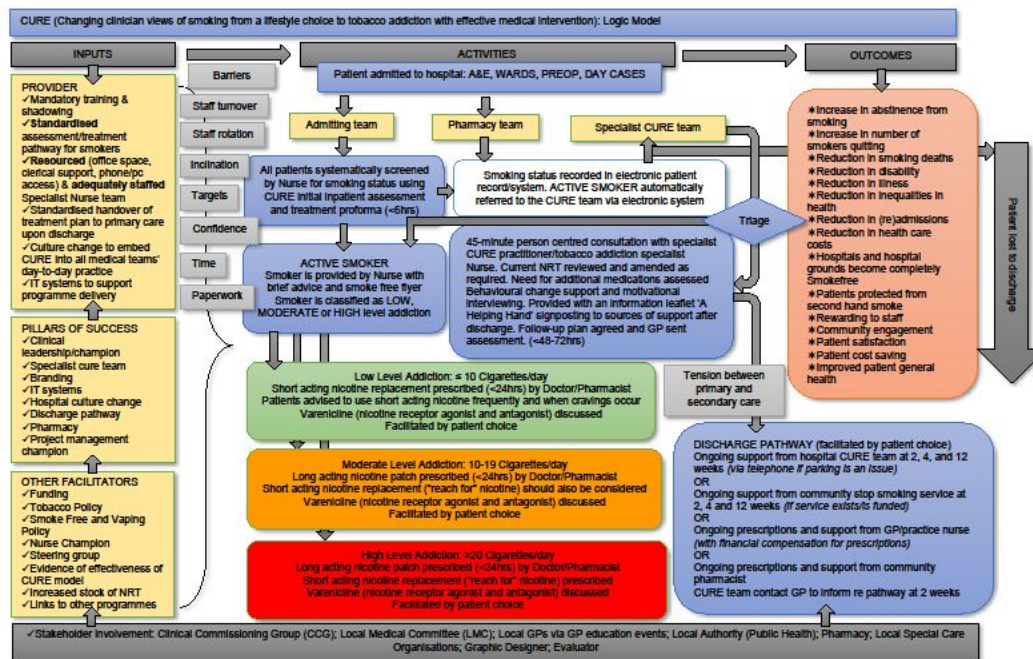
Figure 2: CURE logic model



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Figure 3: Revised CURE logic model.



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**Table 1. Summary of barriers and facilitators to implementation of the CURE project pilot, with key quotes (see Wearn, Haste, Haighton, Mallion & Rodrigues, 2020).**

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
<b>Physical Opportunity</b>			
<b>Environmental Context and Resources</b>	Lack of integration with the wider healthcare context (i.e., primary care, community smoking cessation support).	B	'...the variation in support after discharge across Greater Manchester is huge. So, we had to deal with that and that is probably the biggest ongoing challenge that there is'. – P7, management.
	Adequate staffing resources (e.g. project management support, administrative staff, CURE specialist nursing team).	M	...we're only just catching up on [follow-up calls] now and we've had help from an admin person who screens the calls first, see if patients want to be followed up. So that's working quite well at the moment. So, she follows them up. Anybody that wants to be seen by a specialist nurse she refers them on to us. Well it's taken lots of pressure off really as well. -P6, deliverer
	The influence of the hospital/secondary-care delivery environment (e.g. office space and resources, time pressures, access to NRT and pharmacy colleagues, existing data systems).	M	We were in a crowded office with two or three other teams. We had two chairs between five of us. Two computers between five of us. And not a lot of space and you couldn't make phone calls and we were disturbing them, they were disturbing us, and it was just terrible. So, we've got this nice big office now which has now become full. -P6, deliverer.
	Availability of CURE related knowledge and training.	M	There is a CURE level one and two training for anybody that starts with the [core delivery] team. Online training. And then they're also encouraged to access the NCSCT [National Centre for Smoking Cessation] training.... So, on the NCSCT website they're encouraged to become trained up with that. And there is a lot of shadowing that's done.

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
			When the members of staff first start they go out on the wards, because every single member of the team, they shadow them doing one-to-one work right through the whole process from documentation to chatting with the patients, looking at the whole treatment process. The PGD. It is quite well structured. – P5, deliverer.
	Clear and recognisable branding of the CURE project across hospital setting.	F	It starts at the basics, like a logo, and you start to realise the power just something of a simple logo. It started to build momentum behind it and started to get seen and started getting recognised. – P1, management.
	Flexibility in the core service specification to amend CURE in light of patient need and available resources.	F	Even though we have set clinic times, like we do morning clinics and afternoon clinics, if a patient can't make those, I can say right [when] can you get to the hospital? They say well I can get there for tea. So quite often we'll make an appointment to see them in a Costa coffee or there's a Subway whatever it is – P4, deliverer
<b>Social Opportunity</b>			
<b>Social Influences</b>	Information sharing and social support across CURE nursing team.	F	I introduce certain things myself...within the team, of things that I've done before. So we do share knowledge as well.... [I send] information over to other colleagues, less experienced colleagues who then get regular updates on that. – P5, deliverer.
	Visibility of, and support from, CURE champions/peer leaders.	F	'[The clinical lead] was an incredibly persuasive individual, and he, for me, not only when he was selling it within the hospital, and certainly within this group, his leadership was incredible.' – P2, management.

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
	Problematic cultural beliefs across the wider healthcare context (i.e., that smoking is a lifestyle choice).	B	...if the person who's making the decision still sees smoking as a lifestyle choice, they won't stump up funding to treat it. And I know that's a really hard thing to say, and I'm not saying it happens anywhere in particular, but as in we do have those challenges as well as personal opinion of people as to whether it's important or not can create challenges. – P7, management.
<b>Reflective Motivation</b>			
<b>Goals</b>	Setting and working towards shared goals (i.e., promoting CURE, adhering to the CURE service specification, identifying and evaluating CURE outcomes).	M	It's quite hard to keep the level [of promotion] up and not let it dwindle, because in a years' time you're going to have a whole new set of junior doctors. And so, you need to do the same thing again. [...] But that is a challenge, keeping the level of enthusiasm and message up over time. – P1, management.
<b>Professional role and identity</b>	Commitment to patient choice within CURE aligns with professional identity.	F	We do [CURE] on a patient led thing. We give them the guidelines and just offer them support and encouragement. We don't say you've got to stop smoking sort of thing. It's about sowing the seeds and hoping that they'll still somewhere along the line they'll decide that they want to stop smoking – P6, deliverer.
	Acceptance of responsibility for delivering tobacco dependence treatment	M	For a long time, it's been well, this is someone else's [role], we've never seen it as doctors or prescribing nurses. We've not seen it as our role to be really proactive in smoking.' - P1, management.
<b>Beliefs about consequences</b>	Perceived benefits of CURE implementation (i.e., increased patient engagement with tobacco dependence	F	I do believe in what I'm doing. I mean I had a lot of positive experiences in the past with people changing their life

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
	treatment, improved health related outcomes for patients).		around, so difficult not to believe in it and be enthusiastic about it, you know – P5, deliverer.
<b>Automatic Motivation</b>			
<b>Reinforcement</b>	Reflection on the intrinsic rewards related to CURE involvement and delivery (i.e. positive changes to others' practice, observing health and/or financial benefits for patients)	F	Most [patients] do want to quit. You want to see the benefits of that and yeah that keeps you going really. And also, when they do manage to quit, we become so pleased. I've had patients that say even whatever they spend buying cigarettes, tobacco, each week they put money in the jar and it's that financial benefits as well. But I think it's the main that their long-term health benefits'. – P4, deliverer.
	Inclusion of incentives for GP engagement	M	Although we put a solution in place to recognise a GPs time, virtually none actually completed it. Or sought it out. Now that might be because we make it too hard, because it's another form to fill in and it's just it's just not worth it. Or is it actually that GPs are doing this, and they were engaged with the process, and the fact we've been out and talked to lots of local GPs...we found that they were really supportive. So, there were times when you need to change medication, so there are times you need to actually talk to the GPs. And any time we've been on the phone to then it's been yeah, fine, no problems, and we've not had any GPs contacting the service saying I'm not prepared to do this'. - P1, management.
<b>Psychological Capability</b>			
<b>Skills</b>	Previous experience and skills supporting smoking cessation and using hospital	M	I suppose through my background and experience I have a way of working with people that's worked for a long time – P5, deliverer.

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
<b>Knowledge</b>	based IT systems to support day-to-day delivery. Knowledge of the supporting evidence around secondary-care based smoking cessation treatment.	F	So, reading all the papers on the effectiveness of the drugs that are given for tobacco addiction [was important]. So, all that needed to be done so that we are a voice which is not just passionate but is well educated and informed. – P10, management.

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4 Understanding the implementation of a secondary care tobacco  
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6 Behavioural Analysis  
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**Table 1. APEASE ratings from pre-workshop survey (total of 36 for 6 scorers).**

<b>Recommendation</b>	<b>A</b>	<b>P</b>	<b>E</b>	<b>A</b>	<b>S</b>	<b>E</b>	<b>TOTAL</b>
<b>Recommendation 1:</b> Plan for different discharge pathways at the set-up of the implementation process (i.e. secondary care, primary care, community services, community pharmacists).	3	3	3	2	4	3	18
<b>Recommendation 2:</b> Ensure adequate staffing is in place from earliest possible stages, particularly in terms of support staff (e.g. admin, IT) to facilitate the day to day smooth running of the intervention and allow nursing staff to focus on supporting patients.	5	4	6	6	6	5	32
<b>Recommendation 3:</b> Engage with external stakeholders and organisations, for example, Local Medical Committees and Medicine Optimisation Services, early in the planning process.	6	4	5	5	5	6	31
<b>Recommendation 4:</b> Provide easily accessible e-learning tools for training to all stakeholders involved in the implementation of the intervention.	6	4	6	6	5	4	31
<b>Recommendation 5:</b> Provide access to a wide range of Nicotine Replacement Therapy (NRT) products, ensuring stock levels are adequate on hospital wards.	4	3	4	5	5	5	26
<b>Recommendation 6:</b> Amend existing data storage systems to allow recording and documenting of patient information and journey through the intervention (e.g. computers programmed with pop up requests for data).	4	4	4	4	6	5	27
<b>Recommendation 7:</b> Provision of adequate funding to facilitate and support implementation of the intervention in secondary care, but also outside of secondary care (i.e. for primary care and community services) in order to develop standardised discharge pathways and integration with external services. For instance, integration with community-based lung health screening vehicle to provide stop smoking advice after CT scans.	2	2	5	4	6	6	25
<b>Recommendation 8:</b> Ensure adequate facilities are available to support delivery, including physical spaces for one-to-one sessions, hospital accessibility for patients (i.e. through parking, public transport) and vaping facilities.	1	1	1	2	5	5	15
<b>Recommendation 9:</b> Implement additional staffing resources and presence in the community, so as to lessen the impact of time pressures in secondary care.	1	0	2	2	4	3	12
<b>Recommendation 10:</b> Ensure high coverage of branding materials in a range of formats i.e. posters, pens, and screensavers to promote awareness of the service.	6	5	5	5	6	4	31
<b>Recommendation 11:</b> Allow enough flexibility in the service specification to facilitate patient engagement and accessibility (e.g. allowing for flexible amounts of follow up support, choice of NRT etc. dependant on patient preference and circumstances).	6	4	5	4	6	5	30
<b>Recommendation 12:</b> Communicate shared goals of the intervention across management and deliverers, so required behaviours can be agreed upon and planned.	6	6	6	6	6	6	36
<b>Recommendation 13:</b> Provide access to a core, but flexible service specification to ensure the intervention is delivered as intended.	6	6	6	6	6	6	36
<b>Recommendation 14:</b> Arrange face-to-face discussions, training and the use of marketing materials to facilitate constant promotion of the intervention to a wide range of healthcare professionals (including new junior doctors).	4	4	5	4	5	4	26

<b>Recommendation 15:</b> Recognise the need to manage competing priorities and implement the intervention within the context of a secondary care setting by providing flexible targets within the context of urgent medical issues.	4	2	4	4	3	3	20
<b>Recommendation 16:</b> From the earliest stages, identify and monitor outcomes that provide evidence of the success of the programme. Plan to disseminate these outcomes to wider stakeholders (e.g. in primary care) to encourage further 'buy-in'.	6	5	6	4	6	6	33
<b>Recommendation 17:</b> Engage in ongoing audit and feedback of outcomes and performance to delivery teams.	5	5	6	6	6	6	34
<b>Recommendation 18:</b> Encourage those involved in the intervention to offer, and support, patient choice in terms of treatment and support options as a part of delivery staff's role.	5	4	5	5	5	5	29
<b>Recommendation 19:</b> Implement a full-time project manager and a clinical lead(s), ensuring they are able to provide constant troubleshooting and peer support in implementing/delivering the intervention.	4	4	6	4	6	4	28
<b>Recommendation 20:</b> Encourage positive social comparison to facilitate a culture change of smoking cessation being everyone's responsibility by, for example, comparing rates of smoking cessation across wards/hospitals and corresponding rates of relevant health outcomes.	5	2	5	5	4	5	26
<b>Recommendation 21:</b> Inform stakeholders when other peers/senior staff approve of engagement with the intervention, so individuals are aware of others' support of the service (e.g. to encourage engagement with meetings).	3	3	4	3	5	4	22
<b>Recommendation 22:</b> Identify champions of the intervention within organisations, informing individuals that their own behaviour may set a good example for others and have positive consequences. This may relate to:  - Clinical/Nurse/Pharmacy champion - Primary Care champion - champions across different hospital wards/departments	5	5	6	5	6	5	32
<b>Recommendation 23:</b> Integrate opportunities for staff to observe peers presenting/discussing the intervention. For example, clinical lead and nursing lead can act as motivators and facilitators of 'buy-in' at both management and delivery staff level.	5	1	5	5	6	5	27
<b>Recommendation 24:</b> Prompt self-praise or intrinsic rewards of involvement, when performing intervention related tasks. For example, prompting staff to reflect on the likely health benefits for patients as a result of the treatment they are providing.	6	5	5	5	5	5	31
<b>Recommendation 25:</b> Provide financial incentive on performance (e.g. when prescribing NRT) for primary care staff supporting service outpatients in the community.	0	0	0	0	2	1	3*
<b>Recommendation 26:</b> Provide additional training on how to use tools associated with intervention delivery (i.e. I.T systems) so staff practice and observe use of these tools to facilitate day to day delivery.	5	5	5	5	6	5	31

\* Missing one participant's rating due to survey error.





## Standards for Reporting Implementation Studies: the StaRI checklist for completion

The StaRI standard should be referenced as: Pinnock H, Barwick M, Carpenter C, Eldridge S, Grandes G, Griffiths CJ, Rycroft-Malone J, Meissner P, Murray E, Patel A, Sheikh A, Taylor SJC for the StaRI Group. Standards for Reporting Implementation Studies ([StaRI statement](#)). *BMJ* 2017;356:i6795

The detailed Explanation and Elaboration document, which provides the rationale and exemplar text for all these items is: Pinnock H, Barwick M, Carpenter C, Eldridge S, Grandes G, Griffiths C, Rycroft-Malone J, Meissner P, Murray E, Patel A, Sheikh A, Taylor S, for the StaRI group. Standards for Reporting Implementation Studies ([StaRI Explanation and Elaboration document](#)). *BMJ Open* 2017 2017;7:e013318

Notes: A key concept of the StaRI standards is the dual strands of describing, on the one hand, the implementation strategy and, on the other, the clinical, healthcare, or public health intervention that is being implemented. These strands are represented as two columns in the checklist.

The primary focus of implementation science is the implementation strategy (column 1) and the expectation is that this will always be completed.

The evidence about the impact of the intervention on the targeted population should always be considered (column 2) and either health outcomes reported or robust evidence cited to support a known beneficial effect of the intervention on the health of individuals or populations.

The StaRI standards refers to the broad range of study designs employed in implementation science. Authors should refer to other reporting standards for advice on reporting specific methodological features. Conversely, whilst all items are worthy of consideration, not all items will be applicable to, or feasible within every study.

Checklist item	Reported on page #	Implementation Strategy	Reported on page #	Intervention
		“Implementation strategy” refers to how the intervention was implemented		“Intervention” refers to the healthcare or public health intervention that is being implemented.
<b>Title and abstract</b>				
Title	1	1		Identification as an implementation study, and description of the methodology in the title and/or keywords
Abstract	2	2		Identification as an implementation study, including a description of the implementation strategy to be tested, the evidence-based intervention being implemented, and defining the key implementation and health outcomes.
<b>Introduction</b>				
Introduction	3	4		Description of the problem, challenge or deficiency in healthcare or public health that the intervention being implemented aims to address.
Rationale	4	4-6	4	The scientific background and rationale for the implementation strategy (including any underpinning theory/framework/model, how it is expected to achieve its effects and any pilot work).  The scientific background and rationale for the intervention being implemented (including evidence about its effectiveness and how it is expected to achieve its effects).

Aims and objectives	5	7	The aims of the study, differentiating between implementation objectives and any intervention objectives.		
<b>Methods: description</b>					
Design	6	8	The design and key features of the evaluation, (cross referencing to any appropriate methodology reporting standards) and any changes to study protocol, with reasons		
Context	7	8	The context in which the intervention was implemented. (Consider social, economic, policy, healthcare, organisational barriers and facilitators that might influence implementation elsewhere).		
Targeted 'sites'	8	8	The characteristics of the targeted 'site(s)' (e.g locations/personnel/resources etc.) for implementation and any eligibility criteria.	8	The population targeted by the intervention and any eligibility criteria.
Description	9	13	A description of the implementation strategy	13	A description of the intervention
Sub-groups	10	--	Any sub-groups recruited for additional research tasks, and/or nested studies are described		
<b>Methods: evaluation</b>					
Outcomes	11	--	Defined pre-specified primary and other outcome(s) of the implementation strategy, and how they were assessed. Document any pre-determined targets	--	Defined pre-specified primary and other outcome(s) of the intervention (if assessed), and how they were assessed. Document any pre-determined targets
Process evaluation	12	8-13	Process evaluation objectives and outcomes related to the mechanism by which the strategy is expected to work		
Economic evaluation	13	--	Methods for resource use, costs, economic outcomes and analysis for the implementation strategy	--	Methods for resource use, costs, economic outcomes and analysis for the intervention
Sample size	14	--	Rationale for sample sizes (including sample size calculations, budgetary constraints, practical considerations, data saturation, as appropriate)		
Analysis	15	8-13	Methods of analysis (with reasons for that choice)		
Sub-group analyses	16	--	Any a priori sub-group analyses (e.g. between different sites in a multicentre study, different clinical or demographic populations), and sub-groups recruited to specific nested research tasks		

<b>Results</b>					
Characteristics	<b>17</b>	--	Proportion recruited and characteristics of the recipient population for the implementation strategy	--	Proportion recruited and characteristics (if appropriate) of the recipient population for the intervention
Outcomes	<b>18</b>	--	Primary and other outcome(s) of the implementation strategy	--	Primary and other outcome(s) of the Intervention (if assessed)
Process outcomes	<b>19</b>	13-17	Process data related to the implementation strategy mapped to the mechanism by which the strategy is expected to work		
Economic evaluation	<b>20</b>	--	Resource use, costs, economic outcomes and analysis for the implementation strategy	--	Resource use, costs, economic outcomes and analysis for the intervention
Sub-group analyses	<b>21</b>	--	Representativeness and outcomes of subgroups including those recruited to specific research tasks		
Fidelity/adaptation	<b>22</b>	--	Fidelity to implementation strategy as planned and adaptation to suit context and preferences	--	Fidelity to delivering the core components of intervention (where measured)
Contextual changes	<b>23</b>	--	Contextual changes (if any) which may have affected outcomes		
Harms	<b>24</b>	--	All important harms or unintended effects in each group		
<b>Discussion</b>					
Structured discussion	<b>25</b>	18-21	Summary of findings, strengths and limitations, comparisons with other studies, conclusions and implications		
Implications	<b>26</b>	21-22	Discussion of policy, practice and/or research implications of the implementation strategy (specifically including scalability)	--	Discussion of policy, practice and/or research implications of the intervention (specifically including sustainability)
<b>General</b>					
Statements	<b>27</b>	23-24	Include statement(s) on regulatory approvals (including, as appropriate, ethical approval, confidential use of routine data, governance approval), trial/study registration (availability of protocol), funding and conflicts of interest		

# BMJ Open

## Understanding the implementation strategy of a secondary care tobacco addiction treatment pathway (The CURE Project) in England: A Strategic Behavioural Analysis

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Secondary Subject Heading:	Smoking and tobacco, Health services research
Keywords:	PREVENTIVE MEDICINE, PUBLIC HEALTH, QUALITATIVE RESEARCH, RESPIRATORY MEDICINE (see Thoracic Medicine)

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3 1 Understanding the implementation strategy of a secondary care tobacco  
4 addiction treatment pathway (The CURE Project) in England: A Strategic  
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8 Behavioural Analysis  
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## 30 **Abstract**

31 **Objectives:** The Conversation, Understand, Replace, Expert and evidence-based treatment  
32 (CURE) project implemented an evidence-based intervention that offers a combination of  
33 pharmacotherapy and behavioural support to tobacco-dependent inpatients. Understanding  
34 key characteristics of CURE's implementation strategy, and identifying areas for  
35 improvement, is important to support the roll-out of nationwide tobacco dependence  
36 services. This study aimed to 1) specify key characteristics of CURE's exiting  
37 implementation strategy, and 2) develop theoretical- and stakeholder-informed  
38 recommendations to optimise wider roll-out.

39 **Design and Methods:** Data were collected via document review and secondary analysis of  
40 interviews with 10 healthcare professionals of a UK hospital. Intervention content was  
41 specified through Behaviour Change Techniques (BCTs) and intervention functions within  
42 the Behaviour Change Wheel. A logic model was developed to specify CURE's  
43 implementation strategy and its mechanisms of impact. We explored the extent to which  
44 BCTs and intervention functions addressed the key theoretical domains influencing  
45 implementation using prespecified matrices. The development of recommendations was  
46 conducted over a two-round Delphi exercise.

47 **Results:** We identified six key theoretical domains of influences: 'environmental context and  
48 resources', 'goals', 'social professional role and identity', 'social influences', 'reinforcement',  
49 and 'skills'. The behavioural analysis identified 26 BCTs, five intervention functions and four  
50 policy categories present within the implementation strategy. The implementation strategy  
51 included half the relevant intervention functions and BCTs to target theoretical domains  
52 influencing CURE implementation, with many BCTs focusing on shaping knowledge.  
53 Recommendations to optimise content were developed following stakeholder engagement.

54 **Conclusions:** CURE offers a strong foundation from which a tobacco dependence  
55 treatment model can be developed in England. The exiting strategy could be strengthened  
56 via the inclusion of more theoretically congruent BCTs, particularly relating to 'environmental

1  
2  
3 57 context and resources'. The recommendations provide routes to optimisation that are both  
4  
5 58 theoretically grounded and stakeholder informed. Future research should assess the  
6  
7 59 feasibility/acceptability of these recommendations in the wider secondary-care context.  
8  
9  
10 60

## 61 **Strengths and limitations of this study**

- 62 • This study is the first to qualitatively explore behavioural factors underpinning the  
63 implementation of the CURE project.
- 64 • The behavioural analysis, and subsequent stakeholder involvement, has resulted in  
65 tailored, practical recommendations for optimisation of future tobacco dependence  
66 services, which facilitate efficient translation of findings into policy and practice.
- 67 • Due to its early phase of roll-out, our recommendations have been developed from  
68 implementation within a single UK hospital implementing CURE, therefore  
69 generalisability of findings to other contexts may be limited.
- 70 • Feedback was not gathered from patients or members of the public, therefore the  
71 barriers and facilitators of implementation and the stakeholder-informed  
72 recommendations are limited to the views of those commissioning, delivering and  
73 implementing CURE.

74  
75 **Keywords:** Implementation intervention, intervention content, intervention function,  
76 behaviour change intervention, Strategic behavioural analysis, Theoretical Domains  
77 Framework, Behaviour Change Technique, smoking, Health professional behaviour  
78

79 **Word count: 5637**  
80



## 81 Introduction

82 The government NHS Long Term Plan (1) has outlined a commitment to offer NHS-funded  
83 tobacco treatment services to all those admitted to hospital by 2023/24. However, the most  
84 recent National Smoking Cessation Audit Report from the British Thoracic Society (2)  
85 suggests that adherence to national smoking cessation standards remain poor. For example,  
86 despite the expected standard being 100%, only 77% of inpatients had their smoking status  
87 recorded. Of those who smoked, just 44% were asked if they would like to quit, and of those  
88 who were referred for smoking cessation support, just 16% were referred to hospital-based  
89 services (with a further 8% referred to community-based services). In addition, only 31% of  
90 smokers were offered nicotine replacement therapy (NRT). As a result, the report set  
91 national improvement objectives to support and offer NRT to all inpatient smokers, and to  
92 provide further support and training to hospital staff to ensure they are able to implement  
93 tobacco dependence treatment into their everyday practice.

94 Hospitalisation provides a unique opportunity to identify and engage smokers, initiate  
95 cessation treatments, and facilitate appropriate follow-up and support (3,4). Intensive  
96 smoking cessation interventions that begin in hospital and include pharmacotherapy,  
97 counselling, and post-discharge support for  $\geq 1$  month, increase the likelihood of smoking  
98 abstinence (risk ratio 1.37, 95% confidence interval [CI] 1.27–1.48; 25 studies) compared to  
99 hospital only interventions with no follow-up (4).

100 The Ottawa model for smoking cessation (OMSC), initially implemented in Canada, aims to  
101 increase the rate at which smoking cessation support is offered to all smokers within  
102 secondary care (i.e. hospital settings) (5,6). The OMSC provides a systematic approach to  
103 screening all inpatients for smoking status, with those who smoke offered a combination of  
104 pharmacotherapy and behavioural support. Patients are then attached to ongoing  
105 community stop-smoking support post-discharge (7). The OMSC model was found to have  
106 positive outcomes in increased smoking abstinence at 6 months, reduced all-cause re-

1  
2  
3 107 admissions at 30 days and 1 year, and reduced mortality at 1 year when compared to a  
4  
5 108 control group receiving usual care (7).

6  
7  
8 109 The positive outcomes observed in Canada led to the development of the Conversation,  
9  
10 110 Understand, Replace, Experts and evidence-based treatments (CURE) and has recently  
11  
12 111 been piloted within an NHS trust in the North West of England (8). Importantly, CURE aims  
13  
14 112 to increase awareness about the medicalisation of tobacco dependence and encourage  
15  
16 113 clinicians in offering smoking cessation care to all inpatient smokers. Similar to the OMSC,  
17  
18 114 the CURE project aims to improve smoking outcomes by providing combination of  
19  
20 115 pharmacotherapy (e.g. NRT, varenicline) and behavioural support to patients, as well as  
21  
22 116 post-discharge care at 2, 4- and 12-weeks. The CURE implementation intervention includes  
23  
24 117 various strategies designed to change behaviours at organisational, practitioner or patient  
25  
26 118 levels and to enhance the adoption of a clinical innovation (9). Examples of implementation  
27  
28 119 strategies include outreach activities, in-house training, audit and feedback, and computer  
29  
30 120 prompts.

31  
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33  
34 121 Evaluation of the CURE pilot (October 2018-March 2019) showed that 92% of all adult  
35  
36 122 admissions (total admissions:14,690) were screened for smoking status (10) with a cost per  
37  
38 123 quit of £475 (11). More importantly, the evaluation demonstrated a positive patient impact;  
39  
40 124 out of 2,293 patients identified as current smokers, 96% were provided with brief advice,  
41  
42 125 61% accepted and completed specialist behavioural support, 66% were prescribed  
43  
44 126 pharmacotherapy (e.g. NRT, varenicline) to support quit attempts, and 22% were abstinent  
45  
46 127 at 3 months post-discharge (10). These findings suggest that the model may be useful in  
47  
48 128 assisting clinicians' behaviour change when compared to national audit data. It would  
49  
50 129 therefore be valuable to determine how the CURE project was delivered in practice. This  
51  
52 130 knowledge would support recommendations for a national specification model, based on the  
53  
54 131 OMSC and CURE, for further testing and piloting (1).

55  
56  
57  
58 132 To maximise the potential benefits of CURE, there is a need to understand the  
59  
60 133 implementation process of this evidence-based smoking cessation intervention in routine

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2  
3 134 secondary care. Several theoretical approaches (i.e. theories, models, frameworks) can be  
4  
5 135 used to provide a better understanding and explanation of how and why implementation  
6  
7 136 succeeds or fails (12,13). For instance, the Theoretical Domains Framework (TDF)  
8  
9 137 represents an approach to understand what determinants are hypothesized to influence  
10  
11 138 implementation outcomes, (e.g. healthcare practitioners' adoption of an evidence-based  
12  
13 139 patient intervention) (13,14). The TDF summarises 14 broad domains relevant to changing  
14  
15 140 behaviour, 'knowledge', 'beliefs about consequences', 'beliefs about capabilities', 'skills',  
16  
17 141 'environmental context & resources', 'social influences', 'memory, attention & decision  
18  
19 142 processes', 'behavioural regulation', 'emotion', 'social or professional role/identity',  
20  
21 143 'optimism', 'intentions', 'goals' and 'reinforcement' (15,16).

22  
23  
24  
25 144 Another theoretical approach to explain the causal mechanisms of implementation is the  
26  
27 145 COM-B (Capability, Opportunity, Motivation and Behaviour) model, which suggests  
28  
29 146 behaviour is a function of physical and psychological capability, physical and social  
30  
31 147 opportunity and automatic and reflective motivation. The COM-B model sits at the hub of the  
32  
33 148 Behaviour Change Wheel (BCW) (see Figure 1) (14,17), a well-established guide, applied to  
34  
35 149 health services research, to provide a systematic approach to identifying intervention content  
36  
37 150 and specifying mechanisms of action (i.e. how interventions elicit behaviour change) (14).  
38  
39 151 The wheel comprises three main 'layers' 1) sources of behaviour (i.e. the COM-B model), 2)  
40  
41 152 nine intervention functions (i.e. means by which behaviour can be changed) and 3) policy  
42  
43 153 categories (i.e. that may support delivery of intervention functions) (p.17).

44  
45  
46  
47 154 [Insert Figure 1 here]

48  
49 155 **Figure 1: Visual representation of the Behaviour Change Wheel (14)**

50  
51  
52 156 When aiming to understand how behaviour may be changed and/or specify implementation  
53  
54 157 content, the intervention functions within the BCW can be linked to specific BCTs, which are  
55  
56 158 defined as "an active component of an intervention designed to change behaviour". BCTs  
57  
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1  
2  
3 159 have been associated with many types of behaviour which have been brought together to  
4  
5 160 form an international BCT Taxonomy v1 with 93 BCTs (18).  
6  
7

8 161 Theoretical approaches such as BCW, the COM-B model (Fig. 1), the TDF, and the BCT  
9  
10 162 Taxonomy (BCTTv1), may be applied in conjunction with one another to understand the  
11  
12 163 implementation process, identify implementation strategy content, and to explore barriers to  
13  
14 164 and facilitators of behaviour. Prior research has successfully integrated these theoretical  
15  
16 165 approaches to explore determinants influencing the implementation process of evidence-  
17  
18 166 based practice in healthcare (16,19).  
19

20  
21 167 When planning implementation, developing a logic model of links between implementation  
22  
23 168 strategies, mechanisms and outcomes is crucial (20). The BCW facilitates the specification  
24  
25 169 of outcomes, determinants, change objectives and intervention, and it thereby enables  
26  
27 170 intervention developers to map specific BCTs to behavioural determinants (17).  
28

29  
30 171 Informed by the BCW (14), the present study aimed to describe the core elements of the  
31  
32 172 CURE implementation strategy in the pilot site, particularly the activities directed at  
33  
34 173 promoting behaviour change in healthcare practitioners and wider organisational  
35  
36 174 implementation strategies (organisational/professional level).  
37

38  
39 175 The specific objectives of this study were to:  
40

- 41  
42 176 1. Describe the content of CURE's implementation strategy, using BCW functions,  
43  
44 177 policy categories, and the BCT Taxonomy (v1)(21);  
45  
46 178 2. Characterise the intervention in a logic model to clarify causal assumptions and  
47  
48 179 mechanism of impact using the Medical Research Council (MRC) guidance (21);  
49  
50 180 3. Explore to what extent the barriers and facilitators of CURE implementation are  
51  
52 181 addressed by existing implementation strategy components;  
53  
54 182 4. Develop recommendations to optimise the future implementation.  
55  
56

57  
58 183 This work is a first step in designing a successful theoretical-informed implementation  
59  
60 184 strategy for wider, national roll-out. This work was conducted alongside a TDF-based,

1  
2  
3 185 qualitative study which explored the barriers and facilitators of CURE implementation and  
4  
5 186 delivery, from the perspective of healthcare professionals engaged in the project pilot (22).  
6  
7

## 8 187 **Methods**

9  
10 188 We undertook a systematic, theoretically guided approach to specify the content and  
11  
12  
13 189 possible mechanisms of action and impact of the implementation strategy of CURE. This  
14  
15 190 process has previously been coined as 'strategic behavioural analysis' (19). We have  
16  
17 191 employed the use of the StaRI (Standards for Reporting Implementation Studies) as our  
18  
19 192 reporting standard (23). Ethical approval for this study was granted from Northumbria  
20  
21 193 University Faculty of Health and Life Sciences (Ref: 21358).  
22  
23

### 24 194 Setting and participants

25  
26 195 The pilot site is a major acute teaching hospital with approximately 900 beds and 27,500  
27  
28 196 inpatient admissions per year (excluding maternity, paediatrics, and AE/ICU admissions),  
29  
30 197 providing both district general hospital services and specialist tertiary services. Tertiary  
31  
32 198 services include cardiology, cardiothoracic surgery, heart and lung transplantation,  
33  
34 199 respiratory conditions, burns and plastics, cancer, and breast care services. The smoking  
35  
36 200 prevalence included in the pilot site was modelled based on 20% of inpatient admissions  
37  
38 201 (approximately 5,500 smokers per year).  
39  
40

41 202 At admission, the admitting clinicians (doctor or nurse) were responsible for recording  
42  
43 203 smoking status, assessing level of addiction, and offering initial rapid treatment. A CURE  
44  
45 204 specialist team would then perform a visit, review all smokers admitted (opt-out service), and  
46  
47 205 complete specialist assessment, update treatment plan and plan for discharge (e.g. refer to  
48  
49 206 community service). For the pilot study, the implementation plan modelled the need for five  
50  
51 207 specialist CURE nurses to deliver the specialist assessment, treatment planning and follow  
52  
53 208 up for all smokers admitted as inpatients.  
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3 209 Patient and public involvement  
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5  
6 210 As this study focussed on healthcare professionals' behaviour change, no patients or  
7  
8 211 members of the public were involved.  
9

10  
11 212 Procedure and sources of data  
12

13 213 To collect data on the implementation strategy content, we used two different methods:  
14

- 15 214 1. *Document analysis.* Researchers read and re-read training materials (i.e. training  
16  
17 215 manual, training poster, teaching slides, level 1 and 2 eLearning modules, Steering  
18  
19 216 Group Terms of Reference) and the CURE project webpage (available from  
20  
21 217 <https://thecureproject.co.uk/>) describing implementation strategy content, including  
22  
23 218 the training materials, practice tools, promotional/educational materials and smoke  
24  
25 219 free policy. We (AR, AH, AW; health psychology specialists) reviewed and appraised  
26  
27 220 documentation by systematically mapping information against the Template for  
28  
29 221 Intervention Description and Replication (TIDieR) (24) and the BCW components,  
30  
31 222 including BCTs, intervention functions and policy categories (14). This information  
32  
33 223 was also used to develop an initial logic model.  
34  
35  
36 224 2. *Semi-structured interviews.* We conducted secondary analysis of semi-structured  
37  
38 225 interview data with 10 purposively sampled healthcare professionals, who were  
39  
40 226 involved in the implementation and delivery of the CURE evidence-based  
41  
42 227 intervention (reported in full elsewhere; 22). Participants spanned core CURE  
43  
44 228 management (n=2) and specialist nursing staff (n=3), pharmacy (n=1), primary care  
45  
46 229 (n=1) and public health (n=3). Interview topic guides were informed by TDF domains  
47  
48 230 and asked participants to discuss barriers and facilitators to implementing the CURE  
49  
50 231 project pilot and detail implementation strategy content (i.e. describing the what was  
51  
52 232 delivered, with what aim, how much, to whom, and by whom). All interviews were  
53  
54 233 digitally recorded, transcribed verbatim and analysed using the Framework Method  
55  
56 234 (25). Data from interviews were also used to revise the logic model.  
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3 235 Data analysis  
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6 236 *Step 1 - Implementation strategy content analysis*  
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8

9 237 Using the TiDieR framework (24), we created a broad outline of the implementation strategy  
10 238 that included the content delivered, to whom and by whom, why, by what mode of delivery,  
11 239 how often, where, when and how much, tailoring, modifications, and fidelity. Data from all  
12 240 data sources were used. Data collected from both the document analysis and interviews  
13 241 were coded for implementation strategy content (AR, AH and AW) using existing coding  
14 242 frameworks provided by the BCW guide (14); Appendix 4 (p.259 of the guide) for BCTs,  
15 243 Table 2.1 (p.111 of the guide) to code intervention functions, and Table 2.7 (p.135 of the  
16 244 guide) to code policy categories. Any discrepancies in coding were resolved via consensus  
17 245 discussion.  
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29 246 *Step 2 – Mechanisms of impact (Logic model)*  
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32 247 Following the guidance on developing logic models in process evaluations of complex  
33 248 interventions, issued by the Medical Research Council (21), we developed a logic model by  
34 249 reviewing the CURE documentation and service specification (<https://thecureproject.co.uk/>),  
35 250 current evidence (7,8,26), and theoretical understandings of both the evidence-based  
36 251 intervention and the implementation strategy as suggested in the TiDieR guidelines. Public  
37 252 Health England liaised with the CURE project team (via email) who provided additional  
38 253 documentation (pathway mapping workshop slides, early evaluation options, inpatient  
39 254 numbers and time commitments for specialist nurses, communications plan, Tobacco  
40 255 Addiction Service data) to further inform the logic model. An initial logic model was reviewed  
41 256 and updated based on findings from the qualitative interviews and behavioural analysis  
42 257 demonstrating the intended mechanisms of impact (initial model) vs. actual mechanisms of  
43 258 impact i.e. what was delivered in practice (revised model).  
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58 259 *Step 3 – Identifying opportunities for optimisation*  
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3 260 In line with previous research (19,27), the following mapping exercise was conducted in  
4  
5 261 order to explore the extent to which barriers and facilitators of CURE implementation (22)  
6  
7 262 were addressed by existing implementation strategy components, and to identify any missed  
8  
9 263 opportunities for further design:

- 11 264 1. A concurrent qualitative study (22) reported eight key TDF domains that influenced  
12  
13 265 CURE implementation (see additional file 1 for a summary of these findings). To  
14  
15 266 identify key domains influencing the implementation of CURE, we ranked these  
16  
17 267 previously reported TDF/COM-B domains using established criteria: frequency  
18  
19 268 (number of transcripts in which a domain occurred), elaboration (number of themes  
20  
21 269 within a domain) and evidence of conflicting statements within domains (e.g. if some  
22  
23 270 participants report lack of specific skills whereas others report having the relevant  
24  
25 271 skills) (28–30). All of these factors were considered concurrently in establishing  
26  
27 272 domain relevance. This process was facilitated through consensus discussion  
28  
29 273 between the two researchers (AR, AW) and supported by a third researcher to  
30  
31 274 resolve any discrepancies (AH).
- 32  
33 275 2. The outputs of the key domains and content analysis stages were combined by  
34  
35 276 mapping the identified influences to the identified BCT and intervention functions of  
36  
37 277 the CURE implementation strategy. This was achieved by combining two available  
38  
39 278 matrices that map the TDF to the BCT Taxonomy v1 (31,32) and the Theory &  
40  
41 279 Techniques Tool (<https://theoryandtechniquetool.humanbehaviourchange.org/>) as  
42  
43 280 was developed for previous research (19). This analysis investigated the level of  
44  
45 281 theoretical congruence between implementation strategy components of CURE and  
46  
47 282 the qualitative data on barriers and facilitators influencing its implementation.
- 48  
49 283 3. The level of theoretical congruence between influences on behaviour (TDF domains)  
50  
51 284 and implementation strategy content to change behaviour (BCTs) was achieved by  
52  
53 285 analysing the extent to which the BCTs identified in the CURE implementation  
54  
55 286 strategy targeted the key TDF domains (identified in the qualitative data). Each BCT  
56  
57 287 identified was coded as either low congruence (did not target any key domain),



1  
2  
3 288 medium congruence (targeted at least one key domain) or high congruence (targeted  
4  
5 289 2+ key domains) (19).

6  
7 290 4. The mapping exercise was repeated for intervention functions and policy categories,  
8  
9 291 by consulting the matrices mapping BCW against COM-B/TDF (14) to identify the  
10 292 extent to which functions (matrix on p. 116) and policy categories (matrix on p. 138)  
11 293 in the CURE implementation strategy targeted key factors influencing the  
12 294 implementation process, and what additional intervention functions and policies may  
13 295 address barriers/facilitators within the key domains. The following definitions were  
14 296 applied:

- 15  
16 297 a. Opportunity seized - instances where a theoretically congruent intervention  
17 298 function/policy category (according to the matrices) was identified in the  
18 299 existing CURE implementation strategy at least once.  
19  
20 300 b. Missed opportunity – instances where the theoretically congruent intervention  
21 301 function/policy category was not identified in existing implementation strategy.

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33 302 *Step 4 – Development of recommendations to support future implementation.*

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35  
36 303 Following steps 1-3, the research team used the findings from the qualitative interviews and  
37 304 strategic behavioural analysis to draft a list of practical recommendations to strengthen  
38 305 implementation strategy content (i.e. content likely to encourage healthcare professional  
39 306 behaviour change and support implementation of a secondary care-based tobacco  
40 307 dependence treatment model). These recommendations included example strategies to  
41 308 deliver BCTs relevant to the key TDF domains. To enhance the suitability and acceptability  
42 309 of these recommendations, a Delphi study was conducted by collecting data from a panel of  
43 310 six experts until consensus was reached (33). Experts included the CURE management  
44 311 team, PHE Programme Managers (e.g. Tobacco Control and NHS Long Plan), and NHS  
45 312 England representatives. The six experts independently rated whether each  
46 313 recommendation was affordable, practical, effective, acceptable, safe and equitable (the  
47 314 APEASE criteria) (14), on a dichotomous scale of yes (1), no/uncertain (0) for each criteria.

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2  
3 315 This gave a total possible score of 36 for each recommendation. These ratings were then  
4  
5 316 used to structure and encourage discussion surrounding uncertainties and potential  
6  
7 317 modifications during a collaborative, stakeholder workshop. A total of 11 stakeholders  
8  
9 318 participated in the stakeholder workshop. Participants included 2 members of the research  
10  
11 319 team (1 workshop facilitator and 1 scribe), 2 members of the CURE management team, 4  
12  
13 320 PHE Programme Managers (e.g. Tobacco Control and NHS Long Plan), 1 representative  
14  
15 321 from NHS England, and 2 consultants. Workshop feedback was incorporated into a refined  
16  
17 322 recommendations table, which was then circulated via email for further stakeholder comment  
18  
19 323 and review. This process resulted in the final list of recommendations.  
20  
21  
22

## 23 324 **Results**

### 24 25 26 325 *Step 1 - Implementation strategy content*

27  
28  
29 326 Table 1 summarises the content of the implementation strategy, using the TIDieR  
30  
31 327 framework. The following broad components of CURE implementation strategy were  
32  
33 328 identified: staff training, practice tools, reminder systems, educational outreach visits, audit  
34  
35 329 and feedback, primary care incentives, use of a steering group, branding materials, clinician  
36  
37 330 implementation team meetings to promote reflective discussion, provision of local technical  
38  
39 331 assistance (e.g. admin support), promotion of network weaving (e.g. information sharing),  
40  
41 332 physical environment changes (e.g. consultation facilities), and a triage system.  
42  
43 333 Through content coding we identified 26 BCTs (i.e. 'active components'), five intervention  
44  
45 334 functions and four policy categories. Further details of these activities, BCTs, intervention  
46  
47 335 functions and policy categories can be found in Table 2.  
48  
49  
50

### 51 336 *Step 2 -Mechanisms of impact (Logic model)*

52  
53  
54 337 The initial model is presented in Figure 2. The original logic model, based on the CURE  
55  
56 338 implementation strategy, shows all patients who are admitted to hospital should be asked  
57  
58 339 whether they smoke, and their response should be recorded in the hospitals' electronic  
59  
60 340 patients records. All smokers should be offered immediate Nicotine Replacement Therapy

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2  
3 341 and specialist support through motivational interviewing and behavioural change support as  
4  
5 342 well as access to additional evidence-based pharmacotherapy treatments for tobacco  
6  
7 343 addiction. All smokers should be offered further appointments with a specialist team after  
8  
9 344 discharge from hospital to continue their support.  
10

11 345

12  
13 346 [Insert Figure 2 here]

14  
15  
16 347 **Figure 2. CURE stop smoking project: Initial logic model**

17 348

18  
19  
20 349 The logic model was reviewed and updated iteratively based on findings from the qualitative  
21  
22 350 interviews and behavioural analysis. The final model is presented in Figure 3. The final logic  
23  
24 351 model contains further facilitators identified as important by key stakeholders (e.g. funding,  
25  
26 352 tobacco policy, nurse champion) as well as clarification of the meaning of an adequately  
27  
28 353 resourced and staffed implementation strategy (e.g. office space, clerical support,  
29  
30 354 phone/computer access). Other local stakeholders essential to the smooth implementation  
31  
32 355 and delivery of CURE were also added to the revised model (e.g. Clinical Commissioning  
33  
34 356 Group (CCG); Local Medical Committee (LMC); local GPs) as well as barriers to successful  
35  
36 357 implementation and delivery (e.g. staff turnover, staff confidence, paperwork). While a  
37  
38 358 structured protocol and treatment pathway was an important facilitator, the final model  
39  
40 359 includes more detail regarding the potential variety of patient journeys and the role of  
41  
42 360 hospital pharmacy. The importance of patient choice was added to the final model, because  
43  
44 361 it was highlighted as important to both choices of Nicotine Replacement Therapy (NRT) and  
45  
46 362 of the discharge pathways. However, there were many challenges to implementing many of  
47  
48 363 the pathways as intended. This tension between primary and secondary care was  
49  
50 364 highlighted in the final model.  
51

52 365

53  
54  
55 366 [Insert Figure 3 here]

56  
57  
58 367 **Figure 3. CURE stop smoking model: Final logic model following stakeholder**  
59  
60 368 **consultations and behavioural analysis**

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3 369 *Step 3 - Identifying opportunities for optimisation*  
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5  
6 370 Previously identified TDF/COM-B domains influencing implementation are summarised in  
7  
8 371 additional file 1. Considering the frequency, elaboration of the domains and evidence of  
9  
10 372 conflict, the following six domains were considered the key domains of influence relating to  
11  
12 373 the implementation strategy; (i) Environmental Context and Resources (Physical  
13  
14 374 Opportunity; e.g. integration with the wider healthcare context, staffing resources, hospital  
15  
16 375 delivery environment, availability of CURE related knowledge and training, CURE branding  
17  
18 376 and flexibility of the service specification), (ii) Goals (Reflective Motivation; e.g. promoting  
19  
20 377 CURE, adhering to a CURE service specification, identifying and evaluating outcomes), (iii)  
21  
22 378 Social Influences (Social Opportunity; e.g. peer support, CURE champions, organisational  
23  
24 379 culture change), (iv) Reinforcement (Automatic Motivation; e.g. reflection on intrinsic rewards  
25  
26 380 related to CURE involvement and delivery), (v) Social Professional Role and Identity  
27  
28 381 (Reflective Motivation; e.g. commitment to patient choice, acceptance of responsibility for  
29  
30 382 delivering tobacco dependence treatment.), and (vi) Skills (Psychological Capability &  
31  
32 383 Physical Capability; e.g. previous experience and skills supporting smoking cessation and  
33  
34 384 using hospital-based IT systems). These domains acted as both barriers and facilitators to  
35  
36 385 implementation. Based on the criteria, we suggest these six key domains are prioritised for  
37  
38 386 change (see Table 3).

39  
40  
41 387 Of the 26 BCTs identified in the current implementation strategy content, six had high  
42  
43 388 theoretical congruence with the key domains identified above, nine had medium congruence  
44  
45 389 and eleven BCTs had low theoretical congruence (see Table 4). The BCTs observed to have  
46  
47 390 high theoretical congruence were (i) Social support (practical), (ii) Social support (emotional),  
48  
49 391 (iii) Social support (unspecified), (iv) Reward (outcome), (v) Restructuring the social  
50  
51 392 environment, and (vi) Demonstration of the behaviour. These BCTs were paired with  
52  
53 393 domains rated as important in influencing CURE implementation. For instance, the domain  
54  
55 394 *Social influences (e.g. peer support, visibility of CURE champions)* was appropriately  
56  
57 395 targeted via the BCT *Social support (practical)*, delivered through the implementation  
58  
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3 396 strategy component *educational outreach visits* (whereby nurse leads, clinical leads and/or  
4  
5 397 CURE nurses visit colleagues, providing information and advice to support their ability to  
6  
7 398 engage with CURE).  
8  
9 399 Table 5 shows whether intervention functions identified in the CURE implementation strategy  
10  
11 400 appropriately targeted the six most important TDF/COM-B components. The potential  
12  
13 401 missed opportunities (e.g. as highlighted by the analysis) were related to the intervention  
14  
15 402 functions Coercion and Restriction, which were not identified in the CURE implementation  
16  
17 403 strategy. The Coercion intervention function may have been useful in targeting the domains  
18  
19 404 linked to Reflective Motivation addressing themes under the TDF domain 'Goals' such as  
20  
21 405 *Managing competing goals and priorities* and *Promoting CURE*. Nevertheless, other  
22  
23 406 intervention functions were used to target this component: Education, Incentivisation and  
24  
25 407 Persuasion. The Restriction intervention function may have been useful in targeting  
26  
27 408 Environmental Context and Resources (Physical Opportunity) and Social Influences (Social  
28  
29 409 Opportunity). Other intervention functions were used to target these TDF/COM-B  
30  
31 410 components: Enablement, Environmental restructuring, Training, and Modelling.  
32  
33  
34  
35 411 Table 6 shows whether intervention functions identified in the CURE implementation strategy  
36  
37 412 were delivered through policy categories suggested by the BCW intervention function/policy  
38  
39 413 category matrix. All intervention functions were delivered through at least one policy  
40  
41 414 category suggested by the matrix.  
42  
43  
44 415 There were missed opportunities to deliver functions identified in implementation strategy  
45  
46 416 through the policy category of fiscal measures, regulation and legislation. This was  
47  
48 417 particularly important for the Training (1 out of 4 opportunities were 'seized') and Environmental  
49  
50 418 restructuring (2 out of 5 opportunities were 'seized') intervention functions, as they could  
51  
52 419 have been better supported by including these policy categories.  
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3 420 *Step 4 - Development of recommendations to support future implementation.*  
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6 421 Following stakeholder involvement, the final list includes 29 recommendations. Table 7  
7  
8 422 presents the final overview of recommendations, with a brief indication of stakeholder  
9  
10 423 APEASE evaluations.

11  
12  
13 424 Initially, 26 recommendations were developed to address the themes identified within the six  
14  
15 425 most important TDF domains. Recommendation ratings from the Delphi survey ranged from  
16  
17 426 3 to 36 (maximum score) with a median of 28.5 (IQR, 25.25 - 31). Survey responses are  
18  
19 427 available in additional file 2. These ratings were used to structure discussion within the  
20  
21 428 subsequent stakeholder workshop. The workshop focused predominately on  
22  
23 429 recommendations which had greatest levels of uncertainty, further contextualised these  
24  
25 430 recommendations considering the existing healthcare system and specified the feasibility of  
26  
27 431 implementing recommendations in practice. This included the removal of a recommendation  
28  
29 432 related to financial incentives for GPs (i.e., *Provide financial incentive on performance (e.g.,*  
30  
31 433 *when prescribing NRT) for primary care staff supporting service outpatients in the*  
32  
33 434 *community*). This was the lowest rated recommendation within the Delphi survey, with  
34  
35 435 further stakeholder discussion suggesting financial incentives were not deemed acceptable  
36  
37 436 nor considered effective within the pilot phase. Another recommendation relating to the  
38  
39 437 delivery environment (i.e., *Ensure adequate facilities are available to support delivery,*  
40  
41 438 *including physical spaces for one-to-one sessions, hospital accessibility for patients (i.e.,*  
42  
43 439 *through parking, public transport) and vaping facilities*) was thought to cover a lot of separate  
44  
45 440 components and thus was separated into three recommendations covering the need to  
46  
47 441 provide 1) adequate office space for delivery staff 2) physical space to deliver one-to-one  
48  
49 442 support to patients and 3) on-site vaping facilities. Access to IT equipment (e.g., laptops),  
50  
51 443 was also added as a recommendation in light of increased need to self-isolate due to the  
52  
53 444 COVID-19 pandemic. A highly rated recommendation relating to deliverers' skill  
54  
55 445 development (i.e., *Provide additional training on how to use tools associated with*  
56  
57 446 *intervention delivery, so staff practice and observe use of these tools to facilitate day to day*  
58  
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3 447 *delivery*) was expanded to support deliverers capacity to provide behavioural support to  
4  
5 448 patients. As such, an additional recommendation (to allow deliverers to shadow experienced  
6  
7 449 staff members) was added, as this was identified as a facilitator of delivery during the pilot  
8  
9 450 phase.

## 11 12 451 **Discussion**

### 13 14 452 Summary of findings

15  
16  
17 453 This study aimed to specify the content of CURE's implementation strategy and to develop  
18  
19 454 theory-based recommendations to optimise future implementation of secondary-care  
20  
21 455 /hospital-based tobacco dependence services. The existing implementation strategy  
22  
23 456 incorporated half the potentially relevant content to target key identified barriers and  
24  
25 457 facilitators for the CURE project. However, there were missed opportunities to further  
26  
27 458 facilitate implementation as a large proportion of the BCTs within the current implementation  
28  
29 459 strategy focused on the TDF domain 'knowledge'. These findings highlight that some of the  
30  
31 460 implementation strategy features were primarily educational, though many of the barriers  
32  
33 461 related to the social and environmental context. More theoretically congruent BCTs should  
34  
35 462 be included in the implementation strategy, particularly for the TDF domains 'environmental  
36  
37 463 context and resources,' 'social professional role and identity', and 'social influences'. The  
38  
39 464 recommendations presented within Table 7 highlight potentially feasible ways in which these  
40  
41 465 BCTs could be operationalised.

42  
43  
44  
45 466 The study used a systematic, theoretically guided approach to specify the content and  
46  
47 467 possible mechanisms of action of an implementation strategy using behavioural science  
48  
49 468 methodology and triangulation from different data sources (i.e. semi-structured interviews,  
50  
51 469 document analysis, Delphi survey, stakeholder engagement). We have also illustrated how  
52  
53 470 theory can be used to optimise the implementation strategy of the CURE project. From  
54  
55 471 interviews with healthcare professionals, six themes were identified as influences for the  
56  
57 472 implementation of CURE (22). These were used to identify gaps in the existing  
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3 473 implementation strategy and informed recommendations for refinement. The implementation  
4  
5 474 strategy consisted of 26 BCTs (i.e. 'active components'), seven intervention functions, and  
6  
7 475 four policy categories that could stimulate behaviour change through several mechanisms of  
8  
9 476 action, especially 'beliefs about consequences' (Reflective Motivation) and 'knowledge'  
10  
11 477 (Psychological Capability). Similarly, previous systematic reviews have shown that  
12  
13 478 educational strategies were the most commonly used strategies in multi-strategy  
14  
15 479 interventions (34,35). Current evidence suggests that organisational-level interventions in  
16  
17 480 the healthcare context can influence clinical outcomes and efficiency (36). When used as  
18  
19 481 part of multi-strategy interventions, group education and organisational strategies (e.g.  
20  
21 482 creation of an implementation team) corresponded with positive significant changes in  
22  
23 483 outcomes (34). Incorporating theory (12) in the design of implementation strategies would  
24  
25 484 enhance the field's understanding of the causal mechanisms by which the strategies lead, or  
26  
27 485 do not lead, to changes in outcomes at all levels.

30  
31 486 The logic model specifies the theory of change related to mechanisms, assumptions and  
32  
33 487 outcomes of the CURE model. The initial version of the model (as presented in Figure 2.  
34  
35 488 **CURE stop smoking project: Initial logic model**) presents the intended process of  
36  
37 489 change, as informed by the document review. The final iteration of the model (as presented  
38  
39 490 in Figure 3) demonstrates a more accurate overview of what ultimately was delivered in the  
40  
41 491 programme, and documents the actual process of change, as informed by document review,  
42  
43 492 stakeholder views and behavioural analysis.

44  
45  
46 493 Several challenges to adoption and implementation of the Ottawa model have been  
47  
48 494 identified previously (Reid et al 2010). Likewise, these challenges typically included staff  
49  
50 495 regarding smoking as a 'lifestyle choice' and a lack of support from key opinion leaders and  
51  
52 496 clinical managers. Leadership and performance feedback from managers, training about  
53  
54 497 tobacco-dependence treatment, and smoke-free hospital policies were the key  
55  
56 498 recommendations to improve adoption and implementation (Reid et al 2010). This evidence  
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2  
3 499 base has been used to underpin the delivery of smoking cessation in secondary care  
4  
5 500 settings, and to inform future implementation strategies (37).  
6  
7 501 Other studies have successfully integrated similar theoretical approaches (i.e. BCW, TDF)  
8  
9 502 and methodologies (e.g. qualitative interviews, Delphi, stakeholder involvement) to  
10  
11 503 characterise the content and theoretical mechanisms of action of an existing implementation  
12  
13 504 strategy, and to optimise an existing implementation strategy (38,39). The findings from this  
14  
15 505 strategic behavioural analysis are similar to those of other studies, particularly that only a  
16  
17 506 small percentage of BCTs used in interventions (21% to 37.5%) are theoretically relevant for  
18  
19 507 targeting identified barriers to deliver or implement behaviour change interventions (18, 29).  
20  
21  
22 508 Likewise, missed opportunities in the implementation strategy content are similar across  
23  
24 509 other behavioural analyses that highlighted that most focus on shaping knowledge rather  
25  
26 510 than addressing motivational, social and environmental influences (18, 29).  
27  
28 511 This study provides relevant evidence to further guide the implementation process and  
29  
30 512 selection of strategies; ensuring that enough attention is paid to planning implementation;  
31  
32 513 and a flexible approach that allows response to emerging barriers, particularly at the  
33  
34 514 organisational level. According to Li et al. (40) organisational contextual features (e.g.  
35  
36 515 organisational culture; leadership; networks and communication; resources; evaluation,  
37  
38 516 monitoring and feedback; and champions) were most commonly reported to influence  
39  
40 517 implementation outcomes across a wide range of healthcare settings.

#### 43 518 Strengths and limitations

45 519 This study is the first to qualitatively explore behavioural factors underpinning the  
46  
47 520 implementation of the CURE project. Considering barriers and facilitators to implementation  
48  
49 521 through the lens of the TDF allows for the identification of both internal and external factors  
50  
51 522 which are known to influence behaviour change and evidence-based intervention  
52  
53 523 implementation. The behavioural analysis links these barriers and facilitators to specific  
54  
55 524 components underpinning the CURE implementation strategy. This therefore provides novel  
56  
57 525 insight into key factors which can facilitate implementation of such an intervention in a  
58  
59 526 hospital setting. The NHS long-term plan aims to roll-out adaptations of the CURE and  
60

1  
2  
3 527 Ottawa models across acute, maternity and mental health settings (1). As such, this study is  
4  
5 528 further informing and supporting implementation of NHS-funded tobacco dependence  
6  
7 529 services in England (41). Given the time and financial constraints of this study (conducted  
8  
9 530 during the early stages of the COVID-19 pandemic), and the focus on facilitating healthcare  
10  
11 531 professionals' implementation behaviour, stakeholder consultation was limited to healthcare  
12  
13 532 professionals. As such, patients or the public were not involved in the development of this  
14  
15 533 research. The inclusion of patient perspectives should therefore be prioritised in future work.  
16  
17 534 Due to its early phase of roll-out, our recommendations were developed from data relating to  
18  
19 535 a single UK hospital implementing CURE. As such, generalisability of findings to other  
20  
21 536 contexts may be limited. From these findings, relevant decision makers can make a  
22  
23 537 strategic, informed decision using evidence-based recommendations to optimise the  
24  
25 538 implementation and delivery of future NHS-funded tobacco dependence treatment and target  
26  
27 539 mechanisms of healthcare professional's behaviour change. This approach also provides  
28  
29 540 further insight into potentially overlooked, yet relevant, intervention functions (i.e. missed  
30  
31 541 opportunities) which may be considered by decision makers to optimise the implementation  
32  
33 542 of secondary care-based tobacco dependence services. Overall, the systematic approach  
34  
35 543 taken throughout the present research, and use of established theoretical frameworks,  
36  
37 544 results in evidence which, importantly, facilitates efficient translation to policy and practice  
38  
39 545 (14).  
40  
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#### 45 547 Implications for practitioners, policymakers, and future research

46  
47 548 Based on the appraisal of the CURE implementation strategy content, the current package  
48  
49 549 shows good practice for implementation including relevant BCTs, intervention functions and  
50  
51 550 policy categories. However, the additional recommendations provided may optimise and  
52  
53 551 inform future implementation. This is a set of practical recommendations co-developed with  
54  
55 552 stakeholders and informed by robust behaviour change theoretical approaches.  
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3 553 The BCTs currently in use are linked to multiple intervention functions, including the most  
4  
5 554 relevant intervention functions to tackle the key domains. The introduction of strategies using  
6  
7 555 the intervention function of Coercion (not currently in use) might not be considered  
8  
9 556 acceptable/appropriate in the hospital context and future research could explore the  
10  
11 557 practicalities of introducing this intervention function in secondary care settings (e.g. having  
12  
13 558 behavioural/letter commitments for staff involved in CURE) (42). This strategy was  
14  
15 559 successful in avoiding inappropriate antibiotic prescribing by having poster-sized  
16  
17 560 commitment letters featuring clinician photographs and signatures stating a commitment in  
18  
19 561 wards (43).

22  
23 562 The inclusion of fiscal measures (i.e., using the tax system to reduce or increase the  
24  
25 563 financial cost), and legislation (i.e., making or changing laws) was considered less  
26  
27 564 practicable in the hospital context. For the policy category of regulation, further strategies  
28  
29 565 could be introduced, e.g., establishing rules or principles for vaping within the hospital  
30  
31 566 premises, and further evaluated through research.

33  
34 567 The findings presented in this paper are related to the CURE pilot implementation strategy  
35  
36 568 within an acute care setting. Given the long term plan aims to roll out similar tobacco  
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38 569 dependence services within acute, maternity and mental health settings (1), it will be  
39  
40 570 important to conduct qualitative work and strategic behavioural analysis in other contexts  
41  
42 571 where the delivery and/or barriers/facilitators might be different. In addition, suggested future  
43  
44 572 research should also try to understand how these findings differ in different geographical  
45  
46 573 locations given different structures and systems within hospitals. Implementation fidelity  
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48 574 across different pilot sites should be evaluated and compared with adherence to protocols.  
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50 575 For example, implementation fidelity could be assessed by measuring the completeness of  
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52 576 smoking cessation consultation forms and the proportion of patients for whom cessation  
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54 577 medications were ordered in hospital.  
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3 578 Conclusion  
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5 579 Despite treating tobacco dependence being one of the most cost-effective health  
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7 580 interventions any healthcare system can provide, adherence to smoking cessation standards  
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9 581 within hospitals settings remains poor in England. This strategic behavioural analysis study  
10  
11 582 demonstrates how the use of a variety of behaviour change tools can be used to specify the  
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13 583 content and possible mechanisms of action of an existing implementation strategy which has  
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15 584 achieved some level of success in clinical practice but requires further improvement and  
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17 585 evaluation. The CURE implementation strategy may be further optimised by using additional  
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19 586 theoretically congruent BCTs to target the less commonly addressed influences related to  
20  
21 587 the social and environmental context (e.g. 'restructuring the physical environment' by  
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23 588 creating a steering group to consider options for discharge pathways).  
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27 589 This study provides comprehensive evidence about current practice in the pilot site that can  
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29 590 further inform implementation strategy improvement and the implementation of an NHS-  
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31 591 funded tobacco dependence treatment and policy in secondary care in England.  
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37 593 **List of abbreviations**  
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39 594 CURE: Conversation, Understand, Replace, Expert and Evidence based Treatments.  
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42 595 OMSC: Ottawa Model for Smoking Cessation  
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45 596 TDF: Theoretical Domains Framework  
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48 597 BCT: Behaviour Change Technique  
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51 598 BCW: Behaviour Change Wheel  
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54 599 MRC: Medical Research Council  
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57 600 APEASE: Affordability, Practicality, Efficacy, Acceptability, Safety and Equity/Side Effects  
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3 **602 Declarations**  
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5  
6 **603 Availability of data and material:** The datasets used and/or analysed during the current study  
7  
8 **604** are available from the corresponding author on reasonable request.  
9

10  
11 **605 Competing interests:** VM is employed by project funders, Public Health England. ME and FH  
12  
13 **606** led the pilot evaluation of the CURE project in Greater Manchester.  
14

15  
16 **607 Funding:** This research was commissioned and funded by Public Health England  
17  
18 **608** (award/grant number: not applicable).  
19

20  
21 **609 Authors' contributions:** AR, AH and CH developed the initial study design and secured  
22  
23 **610** funding for the study. AW conducted preparation of study materials, data collection and  
24  
25 **611** analysis for the qualitative interviews and drafted summary reports. AR conducted the  
26  
27 **612** behavioural analysis. CH developed the logic models. AR and AW drafted the manuscript.  
28  
29 **613** CH, AH, VM, FH and ME contributed and provided comments on data analysis and  
30  
31 **614** interpretation, and report drafts. All co-authors have reviewed and agreed the final draft of  
32  
33 **615** the paper submitted for publication.  
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43  
44

45 **620 Patient and Public Involvement:** As this study focussed on healthcare professionals'  
46  
47 **621** behaviour change, no patients or members of the public were involved.  
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49

50 **622 Ethics statement:** Ethical Approval was granted from Northumbria University Faculty of  
51  
52 **623** Health and Life Sciences Ethics Committee (Ref 21358). Informed consent was obtained  
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54 **624** from all study participants. All methods were carried out in accordance with relevant  
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56 **625** guidelines and regulations.  
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For peer review only

800 **Table 1: TIDieR table for the CURE project implementation strategy in the pilot site.**

<b>TIDieR checklist item</b>	CURE project implementation intervention
<b>What</b>	<p>The primary focus of the CURE project implementation strategy is to:</p> <ul style="list-style-type: none"> <li>- Implement systematic screening of all hospital admissions for smoking status</li> <li>- Implement an automated opt-out referral process to a specialist tobacco addiction treatment team for active smokers</li> <li>- Train the medical workforce to have the competence and confidence to discuss and initiate the treatment for tobacco addiction with smokers;</li> <li>- Provide a standardised assessment and treatment pathway for smokers admitted to secondary care;</li> <li>- Provide an appropriately resourced Specialist Nurse team to see all smokers admitted to secondary care and design individualised treatment plans including beyond discharge;</li> <li>- Promote standardised and robust handover of treatment plan to primary care upon discharge;</li> <li>- Promote culture change within secondary care to embed the treatment of tobacco addiction into all medical teams' day-to-day practice;</li> <li>- Provide IT systems to support the delivery of this programme.</li> </ul>
<b>Who delivered</b>	<p>Two eLearning modules developed by the CURE Project Team and Dynamic to fit the needs of the gaps in knowledge for staff in the hospital as well as the new treatment pathway.</p> <p>Bespoke face to face teaching sessions delivered by Clinical Lead, Nurse Lead and Project Manager (induction, departmental teaching, grand rounds, ward walk-arounds, educational resources)</p>
<b>How</b>	<p>Two eLearning modules developed and promoted by internal communications/education teams prior to formal launch of CURE Project.</p> <p>Specialist Nurse Training manual developed to support the CURE Nursing Team in their role.</p> <p>Posters, screensavers, flyers, ID badge foldout prescribing protocol created to promote project and key elements of the pathway.</p> <p>Bespoke teaching sessions (induction, departmental teaching, grand rounds, ward walk-arounds, educational resources)</p>
<b>Where</b>	<p>Online training</p> <p>Face to face training sessions</p> <p>Slots on existing educational training sessions for doctors and nurses</p> <p>Hospital setting</p>
<b>When and How much</b>	<p>Elearning module launched September 2018 – one month prior to launch to give time to embed</p> <p>Face to face training/updates given over 3-4 months before and after launch of the CURE Project in October 2018</p>
<b>Tailoring</b>	No tailoring
<b>Fidelity</b>	No fidelity checks

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802 **Table 2. BCTs, intervention functions and policy categories identified in CURE.**

Activities and intervention strategies	Source of information	Behaviour Change Techniques	Intervention functions	Policy Categories
HCP Training (i.e. training manual, training poster, teaching slides, Level 1 and Level 2 eLearning modules)	Document analysis	Action Planning; Monitoring of behaviour by others without feedback; Monitoring outcome(s) of behaviour by others without feedback; Instruction on how to perform the behaviour; Information about Antecedents; Information about health consequences; Salience of consequences; Information about social and environmental consequences; Information about emotional consequences; Demonstration of the behaviour; Credible source; Verbal persuasion about capability.	Education Training Modelling Enablement Persuasion	Service provision Guidelines Communication/marketing Environmental/social planning
Other features of HCP training (i.e. shadowing, observation of new staff, repetition of training, lunchtime training sessions, certificate upon completion of training)	Interviews only	Monitoring of behaviour by others without feedback; Social support (practical); Social support (emotional); Demonstration of the behaviour; Behavioural practice/rehearsal; Credible source; Reward (outcome).	Education Training Modelling Enablement Persuasion	
Practice tools (e.g. assessment forms, prescribing protocols, NRT products for demonstration)	Document analysis; interviews	Goal setting (behaviour); Action planning; Instruction on how to perform the behaviour; Adding objects to the environment	Education Enablement Training Environmental restructuring	
Reminder systems (e.g. lanyard card, IT systems)	Document analysis; interviews	Prompts/ cues; Adding objects to the environment	Education Environmental restructuring	
Educational outreach visits (inclusive of both senior management and the wider healthcare team/staff)	Interviews only	Social support (practical); Instruction on how to perform the behaviour; Information about health consequences; Information about social and environmental consequences; Demonstration of the behaviour; Credible source;	Education Enablement Modelling Persuasion	
Ongoing audit and feedback	Interviews only	Review outcome goal(s); Feedback on behaviour; Feedback on outcome(s) of behaviour; Social support (unspecified)	Education Enablement Persuasion Incentivisation Training	

Activities and intervention strategies	Source of information	Behaviour Change Techniques	Intervention functions	Policy Categories
GP financial incentives (i.e. discharge pathway in primary care)	Interviews only	Cue signalling reward; Material incentive (behaviour)	Incentivisation Environmental restructuring	
Steering groups meetings	Document analysis; Interviews only	Monitoring of behaviour by others without feedback; Monitoring outcome(s) of behaviour by others without feedback; Restructuring the social environment	Education Enablement Environmental restructuring	
Branding and educational tools (e.g. posters, website, e-learning modules, pens, media campaign)	Document analysis; interviews	Prompts/ cues; Adding objects to the environment	Environmental restructuring	
Reflective discussions	Interviews only	Social support (unspecified); Restructuring the social environment	Enablement Environmental restructuring	
Information sharing	Interviews only	Social support (practical); Information about social and environmental consequences; Restructuring the Physical environment	Education Persuasion Enablement Environmental restructuring	
Admin Support	Interviews only	Restructuring the social environment	Enablement Environmental restructuring	
Consultation facilities	Interviews only	Restructuring the Physical environment	Environmental restructuring	
Triaging system	Interviews only	Restructuring the Physical environment	Environmental restructuring	

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811 **Table 3. Prioritisation of TDF domains for the implementation of the CURE model by**  
 812 **frequency, thematic elaboration, and evidence of conflicting beliefs.**

Ranking	TDF Domain (COM-B)	Frequency (No. of transcripts identified in; max n=10)	Elaboration (Number of themes [barriers/facilitators])	Evidence of conflicting beliefs within domains (Yes/No)
1	<b>Environmental Context and Resources (physical opportunity)</b>	10	13	Yes
2	<b>Goals (reflective motivation)</b>	7	4	Yes
3	<b>Social Influences (social opportunity)</b>	9	3	Yes
4	<b>Reinforcement (automatic motivation)</b>	8	2	Yes
5	<b>Social Professional Role and Identity (reflective motivation)</b>	7	2	Yes
6	<b>Skills (psychological capability &amp; Physical Capability combined)</b>	7	1	Yes
7	Beliefs about consequences (reflective motivation)	7	2	No
8	Knowledge (psychological capability)	3	1	No
Joint 9 <sup>th</sup> – 14 <sup>th</sup>	Beliefs about capabilities (reflective motivation)	0	0	-
	Intentions (reflective motivation)	0	0	-
	Memory, Attention, and Decision Making (psychological capability)	0	0	-
	Behavioural Regulation (psychological capability)	0	0	-
	Emotions (automatic motivation)	0	0	-
	Optimism (reflective motivation)	0	0	-

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816 **Table 4. Theoretical congruence between the BCTs identified in CURE implementation**  
 817 **strategy content and the key TDF domains influencing implementation of CURE within**  
 818 **the pilot site**

BCT	Linked TDF domains according to integrated mapping matrix*	Domain importance ranking**	Theoretical congruence between BCT and domain***
<b>Social support (practical)</b>	<b>Environmental Context and Resources</b>	1	<b>HIGH</b>
	<b>Goals</b>	2	
	<b>Social professional role/ identity</b>	3	
	<b>Social influences</b>	3	
	Beliefs about capabilities	9-14	
<b>Social support (emotional)</b>	<b>Goals</b>	2	<b>HIGH</b>
	<b>Social professional role/ identity</b>	3	
	<b>Social influences</b>	3	
	Beliefs about capabilities	9-14	
Emotions		9-14	
		9-14	
<b>Social support (unspecified)</b>	<b>Goals</b>	2	<b>HIGH</b>
	<b>Social professional role/ identity</b>	3	
	<b>Social influences</b>	3	
	Beliefs about capabilities	9-14	
<b>Reward (outcome)</b>	<b>Goals</b>	2	<b>HIGH</b>
	<b>Reinforcement</b>	5	
	<b>Skills</b>	6	
	Beliefs about consequences	9-14	
<b>Restructuring the social environment</b>	<b>Environmental Context and Resources</b>	1	<b>HIGH</b>
	<b>Social influences</b>	3	
<b>Demonstration of the behaviour</b>	<b>Social influences</b>	3	<b>HIGH</b>
	<b>Skills</b>	6	
	Beliefs about capabilities	9-14	
<b>Prompts/cues</b>	<b>Environmental Context and Resources</b>	1	<b>MED</b>
	Memory, Attention, Decision Making	9-14	
	Behavioural Regulation	9-14	
<b>Restructuring the Physical environment</b>	<b>Environmental Context and Resources</b>	1	<b>MED</b>
<b>Adding objects to the environment</b>	<b>Environmental Context and Resources</b>	1	<b>MED</b>
<b>Action Planning</b>	<b>Goals</b>	2	<b>MED</b>
	Behavioural Regulation	9-14	
	Memory, Attention, Decision Making	9-14	
<b>Verbal persuasion about capability</b>	<b>Goals</b>	2	<b>MED</b>
	Beliefs about capabilities	9-14	
	Optimism	9-14	
<b>Review outcome goal(s)</b>	<b>Goals</b>	2	<b>MED</b>
<b>Material incentive (behaviour)</b>	<b>Reinforcement</b>	5	<b>MED</b>
	Beliefs about consequences	9-14	
<b>Instruction on how to perform the behaviour</b>	<b>Skills</b>	6	<b>MED</b>
	Knowledge	8	
	Beliefs about capabilities	9-14	
<b>Behavioural practice/rehearsal</b>	<b>Skills</b>	6	<b>MED</b>
	Beliefs about capabilities	9-14	
<b>Credible source</b>	Beliefs about consequences	9-14	<b>LOW</b>
<b>Feedback on outcome(s) of behaviour</b>	Beliefs about consequences	9-14	<b>LOW</b>
<b>Feedback on behaviour</b>	Knowledge	8	<b>LOW</b>
	Beliefs about consequences	9-14	

BCT	Linked TDF domains according to integrated mapping matrix*	Domain importance ranking**	Theoretical congruence between BCT and domain***
<b>Information about Antecedents</b>	Knowledge Behavioural regulation	8 9-14	<b>LOW</b>
<b>Information about health consequences</b>	Knowledge Beliefs about consequences Intentions	8 9-14 9-14	<b>LOW</b>
<b>Saliency of consequences</b>	Knowledge Beliefs about consequences	8 9-14	<b>LOW</b>
<b>Information about social and environmental consequences</b>	Knowledge Beliefs about consequences	8 9-14	<b>LOW</b>
<b>Information about emotional consequences</b>	Knowledge Beliefs about consequences	8 9-14	<b>LOW</b>
<b>Cue signalling reward</b>	None	NA	<b>LOW</b>
<b>Monitoring of behaviour by others without feedback</b>	None	NA	<b>LOW</b>
<b>Monitoring outcome(s) of behaviour by others without feedback</b>	None	NA	<b>LOW</b>

819 \* TDF x BCT mapping matrices (31,32) and The Theory and Techniques Tool (44).  
 820 \*\*Domain ranking based on thematic analysis of barrier/facilitators data from interviews (see **Error!**  
 821 **Reference source not found.**)  
 822 \*\*\*Classification of theoretical congruence: Low: BCT is not paired with any of the 6 key domains  
 823 identified as important in the thematic analysis; Medium: BCT is paired with at least one domain  
 824 identified as important; High: BCT is paired with two or more domains identified as important.

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834 **Table 5. Seized and missed opportunities: Intervention functions linked with CURE.**

Intervention functions

TDF domain (COM-B)	Educational	Enablement	Environmental restructuring	Incentivisation	Coercion	Modelling	Persuasion	Training	Restriction
Skills (Physical capability)		Green						Green	
Skills (Psychological capability)	Green	Green						Green	
Goals, Professional role, (Reflective motivation)	Green			Green	Red		Green		
Reinforcement (Automatic motivation)		Green	Green	Green	Red	Green	Green	Green	
Environmental context and resources (Physical opportunity)		Green	Green					Green	Red
Social Influences (Social opportunity)		Green	Green			Green			Red

835 Table seven displays links between the intervention functions coded in the existing CURE intervention, and the intervention

836 functions linked to the top TDF domains using the BCW matrix (p.116). Green indicate an opportunity seized, and red indicate

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3 837 an opportunity missed. White is not paired. Note: the definition of Skills used for this exercise combines Physical Skills and  
4 838 Cognitive/Interpersonal Skills (see Table 1.5, p.88 of The Behaviour Change Wheel(Michie et al., 2014)). Furthermore, both  
5 839 types of Skill are linked to the same intervention functions and BCTs in the mapping matrices used throughout this paper.  
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841 **Table 6. Seized and missed opportunities: Policy Categories linked with CURE.**

Intervention functions	Policy Categories						
	Communication/marketing	Guidelines	Fiscal Measures	Regulation	Legislation	Environmental/Social planning	Service provision
Education	Green	Green	White	Red	Red	White	Green
Enablement	White	Green	Red	Red	Red	Green	Green
Environmental restructuring	White	Green	Red	Red	Red	Green	White
Incentivisation	Green	Green	Red	Red	Red	White	Green
Coercion	Grey	Grey	Grey	Grey	Grey	White	Grey
Modelling	Green	White	White	White	White	White	Green
Persuasion	Green	Green	White	Red	Red	White	Green
Training	White	Green	Red	Red	Red	White	Green
Restriction	White	Grey	White	Grey	Grey	White	White

842 Table eight shows whether intervention functions identified in the CURE interventions were delivered through policy categories  
 843 suggested by the BCW intervention function × policy category matrix. Green indicates an opportunity seized, grey indicates an  
 844 intervention function not identified in the intervention, and red indicate an opportunity missed. White is not paired..

845 **Table 7. Recommendations to support the implementation of a nationwide, secondary care-based tobacco dependence treatment**  
 846 **model, based upon the CURE project.**

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
<i>Environmental context and resources</i>			
Clearly define discharge pathways, at the set-up of the implementation process, that support continuity of care/follow-up for outpatients.	Restructuring the physical environment	Set up a steering group to consider options for discharge pathways, involving representation from secondary care, primary care, community services, community pharmacists.	High, if flexible to local service availability.
Collaborative working and discussion with external stakeholders and organisations, from the pre-planning stages.	Restructuring the physical environment	Arrange educational outreach workshops and/or steering group meetings involving, for example, Local Medical Committees, Local Care	Uncertain, dependent on 'buy-in' from stakeholder groups.

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<b>Summary of what needs to occur to support implementation, by TDF domain.</b>	<b>Behaviour Change Technique</b>	<b>Example delivery</b>	<b>Feasibility of recommendation (in line with APEASE criteria)<sup>a</sup></b>
		Organisations and Medicine Optimisation Services.	
Financial support for outpatient follow-up care within the community.	Restructuring the physical environment	Project team to allocate specific funding for discharge pathways, to enhance integration with services external to secondary care.	Potentially high if acceptable and practical locally.
Appropriate level of staffing across groups (i.e. support staff, delivery staff, project team and community support).  Designated hours for management to focus on the implementation of the	Restructuring the social environment	Model and implement staffing requirements appropriate to the location, particularly in terms of support staff (e.g. admin, IT support).	High

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
intervention, particularly during the pre-launch phase.			
<p>Ability to access space(s) and equipment which enable delivery of the intervention.</p> <p>On-site smoking policy that aligns with intervention principles.</p>	Restructuring the physical environment	<p>Provide adequate office space to specialist nursing staff/deliverers, to facilitate private telephone calls to patients and for use of IT.</p> <p>Ensure those involved in delivery and/or implementation of the intervention can access and use IT equipment (e.g. laptops) in light of the increasing need to work from home and self-isolate.</p> <p>Provide physical space for one-to-one support sessions, ensuring that these spaces are</p>	<p>Variable</p> <p>Uncertain</p> <p>Variable</p>



Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
		<p>accessible to both staff and outpatients from the surrounding areas.</p> <p>Provision of on-site vaping space/facilities.</p>	Uncertain
Ability to provide a choice of Nicotine Replacement Therapy (NRT) to service users during their time in hospital and upon discharge.	Restructuring the physical environment	Provide access to a range of NRT products within secondary care, ensuring stock/options on wards are reflective of what is available in the community as much as practicable.	Uncertain, as may be unaffordable to offer a full range of NRT options.
Integration with existing IT systems to document/ review patient information.	Prompts/Cues  Adding objects to the environment	Prioritise the amendment of existing data storage systems to allow recording and documenting of patient information and journey through the	Moderate

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
Integration with existing IT systems to remind wider healthcare staff to deliver the brief intervention.		intervention (e.g. computers programmed with pop up requests for data).	
Ability for all those involved in the delivery/ implementation of the intervention to easily access information and training tools.	Adding objects to the environment	Refer to (and/or provide if not already available) freely accessible e-learning modules/online training resources.	High
Clear branding of the intervention and signposting in the hospital setting.	Prompts/Cues  Adding objects to the environment	Provide marketing materials in a range of formats i.e. posters, pens, and screensavers to promote awareness of the service and prompt staff engagement.	High

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
Flexibility in the core service specification, as much as practicable, to facilitate shared decision making.	Instruction on how to perform the behaviour	Advise deliverers that shared decision-making is encouraged in relation to NRT options and post-discharge support (For example, choosing face to face or telephone support depending on local restrictions).	High, depending on the availability of NRT options and physical space for one-to-one sessions.
<i>Goals</i>			
Ability to access a service specification which clearly stipulates the core intervention	Goal setting (behaviour)  Action planning	Communicate shared goals of the intervention across management and deliverers, so required behaviours can be agreed upon and planned.	High

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
model, to ensure the intervention is delivered as intended.			
Motivate healthcare staff to promote the intervention to others within their workplace.	Goal setting (behaviour)  Review of outcome goal(s)  Review behaviour goals  Verbal persuasion	Arrange face-to-face or virtual discussions, training and the use of marketing materials to facilitate constant promotion of the intervention to a wide range of healthcare professionals (including new junior doctors).	Moderate

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<b>Summary of what needs to occur to support implementation, by TDF domain.</b>	<b>Behaviour Change Technique</b>	<b>Example delivery</b>	<b>Feasibility of recommendation (in line with APEASE criteria)<sup>a</sup></b>
Integration of the intervention with existing hospital goals and priorities, to encourage 'buy-in' from senior decision makers.	Goal setting (behaviour)  Review of outcome goal(s)  Review behaviour goals  Action planning	Clearly communicate goals of the intervention, demonstrating how these align with existing hospital priorities.	Moderate
Identification and monitoring of outcomes that provide evidence	Goal setting (outcome)  Review of outcome goal(s)	Advise project team to plan specific outcomes of interest from the earliest stages and engage in	Moderate

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Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
of the success of the programme and return on investment.	Feedback (outcome)  Verbal persuasion	ongoing audit and feedback of these outcomes on a regular basis.  Share performance related feedback to delivery teams and wider stakeholders (e.g. in primary care) to encourage further 'buy-in'.	High
<i>Social/Professional Identity</i>			
Those involved in delivery/implementation to hold the view that the intervention allows for patient choice.	Social support (unspecified)	Educational outreach and training content to highlight that the intervention is aligned with a commitment to shared decision making.	High

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
Clear project and peer leadership within the locality.	Social support (unspecified)  Social support (practical)  Social support (emotional)	Implement a full-time project manager and clinical lead(s), ensuring they are able to provide troubleshooting and peer support in implementing/delivering the intervention.	Moderate
Healthcare staff, across settings, to hold the view that delivery of the service aligns with their professional identity.	Social support (unspecified)	Educational outreach and training content to highlight how the intervention aligns with healthcare practice across settings and stakeholder groups.	Uncertain

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
<i>Social Influences</i>			
Those involved in implementation and delivery to hold the view that healthcare staff have a responsibility to support patients in smoking cessation.	Social comparison	Encourage positive social comparison to share good practice and facilitate a culture change of smoking cessation being everyone's responsibility by, for example, comparing no. of patients screened, no. referred to the service and/or no prescribed pharmacotherapy across wards/hospitals	High
Strong teamwork and collaborative working within and across stakeholder groups.	Information about others' approval	Educational outreach and training content to highlight clear, visible senior leadership to ensure staff are aware of others' support of the intervention.	High





Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
	Identification of self as a role model  Vicarious Consequences	outreach/information should be delivered by local clinical and nursing leads.	
<i>Reinforcement</i>			
Those involved in delivery and implementation to hold the view that intervention involvement is intrinsically rewarding.	Self-reward	Prompt self-praise or intrinsic rewards of involvement, when performing intervention related tasks. For example, prompting staff to reflect on the likely health benefits for patients as a result of the treatment they are providing	High
Engagement from those working within primary care to support	Cue signalling reward	Educational outreach workshops or online information provision to advise GPs that funding is	Uncertain

Summary of what needs to occur to support implementation, by TDF domain.	Behaviour Change Technique	Example delivery	Feasibility of recommendation (in line with APEASE criteria) <sup>a</sup>
ongoing treatment/prescribing within the community.	Material incentive (behaviour)	allocated for NRT prescriptions in the community and that this is a cost-effective approach.	Provision of a material (e.g. financial) incentive not deemed acceptable in the current context.
<i>Skills</i>			
Ensure deliverers have capability to provide behavioural support to patients.  Ensure deliverers have capability to use supporting IT systems.	Instruction on how to perform behaviour  Demonstration of the behaviour	Allow deliverers to shadow experienced staff providing support to patients.  Provide training on how to use tools associated with intervention delivery (i.e. I.T systems).	High  High

<b>Summary of what needs to occur to support implementation, by TDF domain.</b>	<b>Behaviour Change Technique</b>	<b>Example delivery</b>	<b>Feasibility of recommendation (in line with APEASE criteria)<sup>a</sup></b>
	Behavioural practice		

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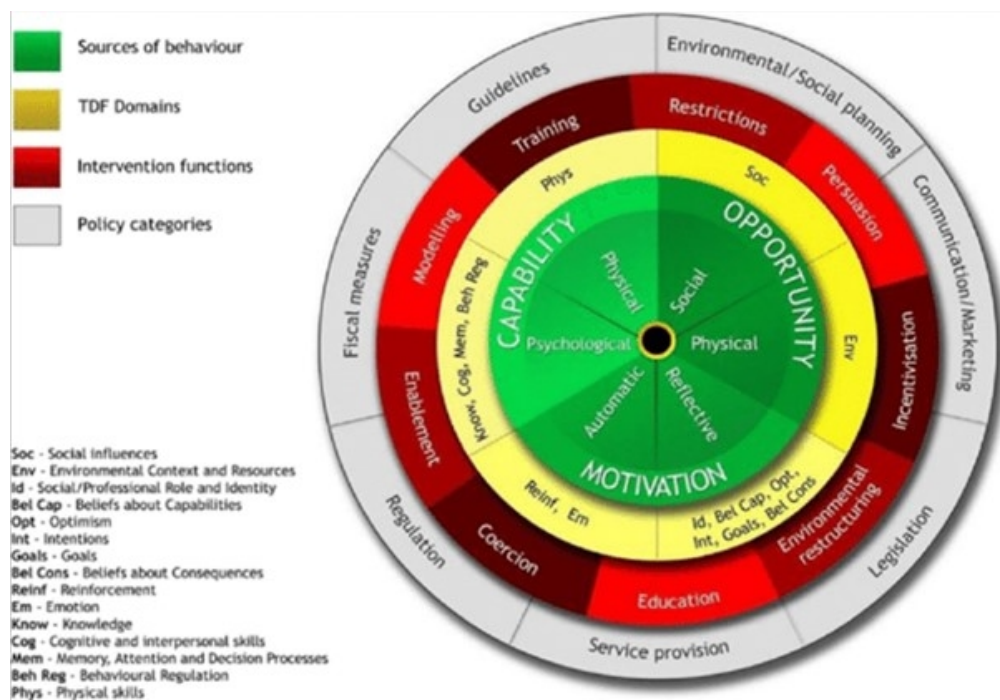
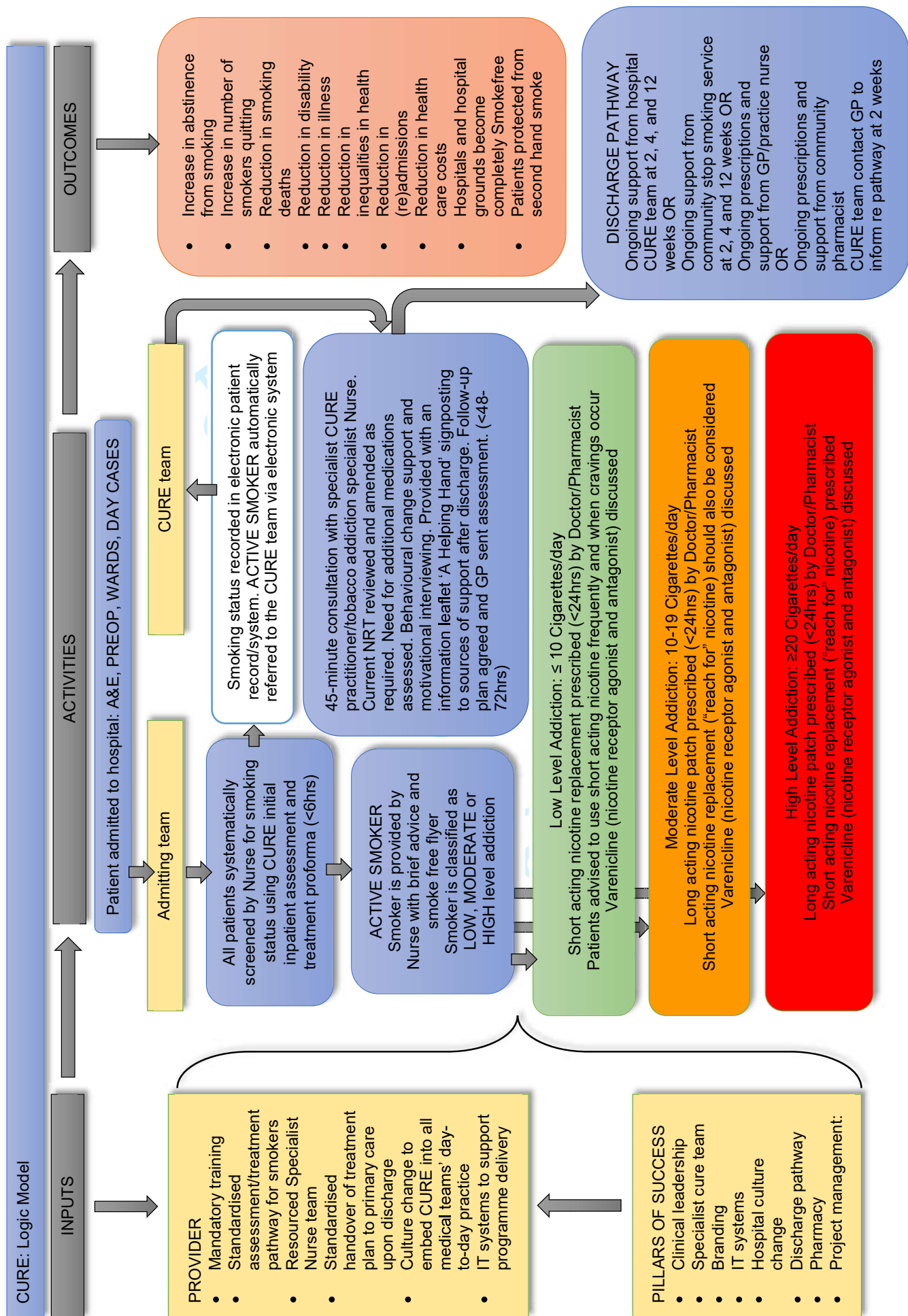
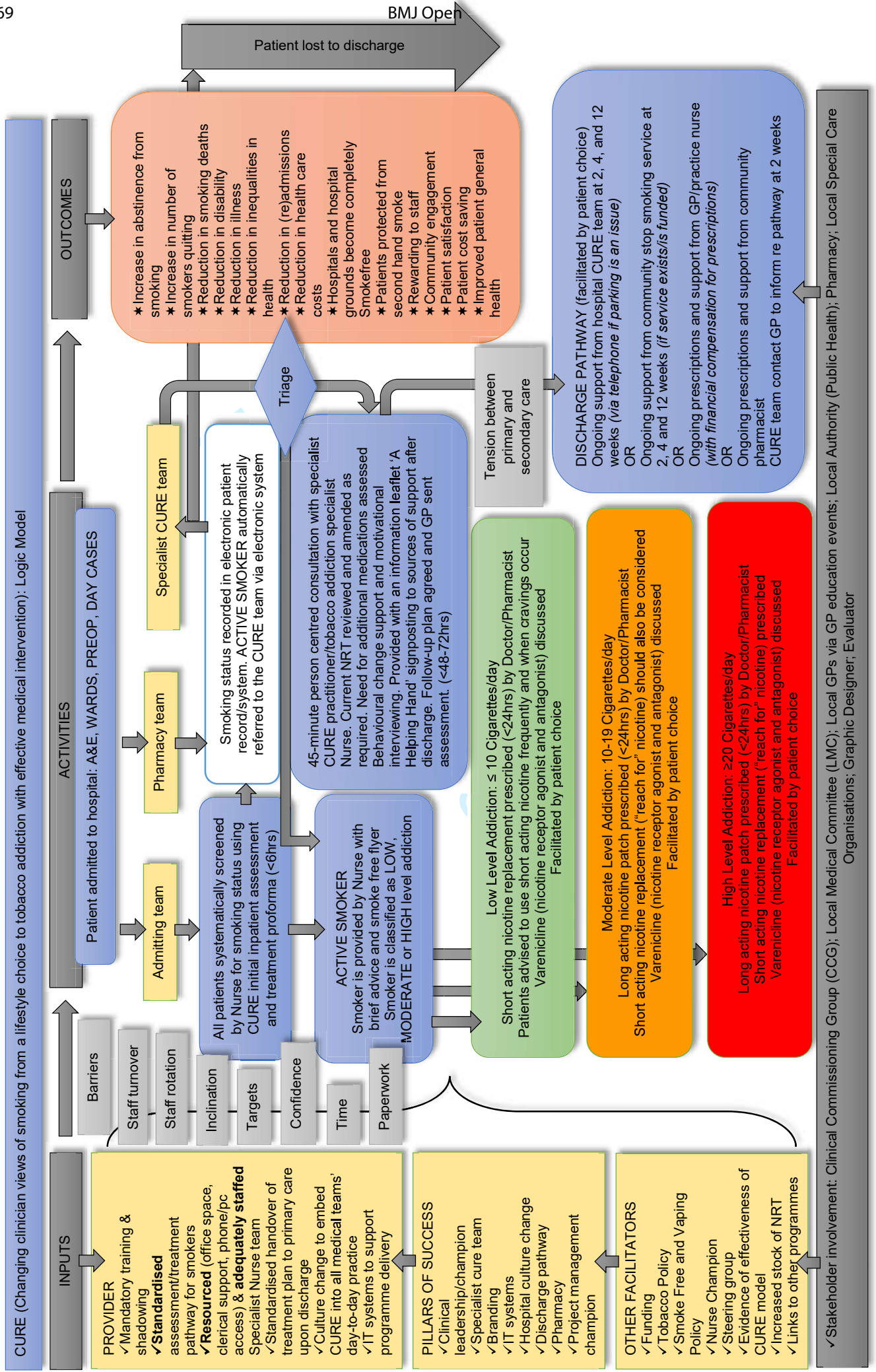


Figure 1: Behaviour Change Wheel.

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**Table 1. Summary of barriers and facilitators to implementation of the CURE project pilot, with key quotes (see Wearn, Haste, Haighton, Mallion & Rodrigues, 2020).**

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
<b>Physical Opportunity</b>			
<b>Environmental Context and Resources</b>	Lack of integration with the wider healthcare context (i.e., primary care, community smoking cessation support).	B	'...the variation in support after discharge across Greater Manchester is huge. So, we had to deal with that and that is probably the biggest ongoing challenge that there is'. – P7, management.
	Adequate staffing resources (e.g. project management support, administrative staff, CURE specialist nursing team).	M	...we're only just catching up on [follow-up calls] now and we've had help from an admin person who screens the calls first, see if patients want to be followed up. So that's working quite well at the moment. So, she follows them up. Anybody that wants to be seen by a specialist nurse she refers them on to us. Well it's taken lots of pressure off really as well. -P6, deliverer
	The influence of the hospital/secondary-care delivery environment (e.g. office space and resources, time pressures, access to NRT and pharmacy colleagues, existing data systems).	M	We were in a crowded office with two or three other teams. We had two chairs between five of us. Two computers between five of us. And not a lot of space and you couldn't make phone calls and we were disturbing them, they were disturbing us, and it was just terrible. So, we've got this nice big office now which has now become full. -P6, deliverer.
	Availability of CURE related knowledge and training.	M	There is a CURE level one and two training for anybody that starts with the [core delivery] team. Online training. And then they're also encouraged to access the NCSCT [National Centre for Smoking Cessation] training.... So, on the NCSCT website they're encouraged to become trained up with that. And there is a lot of shadowing that's done.



TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
			When the members of staff first start they go out on the wards, because every single member of the team, they shadow them doing one-to-one work right through the whole process from documentation to chatting with the patients, looking at the whole treatment process. The PGD. It is quite well structured. - P5, deliverer.
	Clear and recognisable branding of the CURE project across hospital setting.	F	It starts at the basics, like a logo, and you start to realise the power just something of a simple logo. It started to build momentum behind it and started to get seen and started getting recognised. – P1, management.
	Flexibility in the core service specification to amend CURE in light of patient need and available resources.	F	Even though we have set clinic times, like we do morning clinics and afternoon clinics, if a patient can't make those, I can say right [when] can you get to the hospital? They say well I can get there for ten. So quite often we'll make an appointment to see them in a Costa coffee or there's a Subway whatever it is – P4, deliverer
<b>Social Opportunity</b>			
<b>Social Influences</b>	Information sharing and social support across CURE nursing team.	F	I introduce certain things myself...within the team, of things that I've done before. So, we do share knowledge as well.... [I send] information over to other colleagues, less experienced colleagues who then get regular updates on that. – P5, deliverer.
	Visibility of, and support from, CURE champions/peer leaders.	F	'[The clinical lead] was an incredibly persuasive individual, and he, for me, not only when he was selling it within the hospital, and certainly within this group, his leadership was incredible.' – P2, management.

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
	Problematic cultural beliefs across the wider healthcare context (i.e., that smoking is a lifestyle choice).	B	...if the person who's making the decision still sees smoking as a lifestyle choice, they won't stump up funding to treat it. And I know that's a really hard thing to say, and I'm not saying it happens anywhere in particular, but as in we do have those challenges as well as personal opinion of people as to whether it's important or not can create challenges. – P7, management.
<b>Reflective Motivation</b>			
<b>Goals</b>	Setting and working towards shared goals (i.e., promoting CURE, adhering to the CURE service specification, identifying and evaluating CURE outcomes).	M	It's quite hard to keep that level [of promotion] up and not let it dwindle, because in a years' time you're going to have a whole new set of junior doctors. And so, you need to do the same thing again. [...]. But that is a challenge, keeping the level of enthusiasm and message up over time. – P1, management.
<b>Professional role and identity</b>	Commitment to patient choice within CURE aligns with professional identity.	F	We do [CURE] on a patient led thing. We give them the guidelines and just offer them support and encouragement. We don't say you've got to stop smoking sort of thing. It's about sowing the seeds and hoping that they'll still somewhere along the line they'll decide that they want to stop smoking – P6, deliverer.
	Acceptance of responsibility for delivering tobacco dependence treatment	M	For a long time, it's been, well, this is someone else's [role], we've never seen it as doctors or prescribing nurses. We've not seen it as our role to be really proactive in smoking.' - P1, management.
<b>Beliefs about consequences</b>	Perceived benefits of CURE implementation (i.e., increased patient engagement with tobacco dependence	F	I do believe in what I'm doing. I mean I had a lot of positive experiences in the past with people changing their life

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
	treatment, improved health related outcomes for patients).		around, so difficult not to believe in it and be enthusiastic about it, you know – P5, deliverer.
<b>Automatic Motivation</b>			
<b>Reinforcement</b>	Reflection on the intrinsic rewards related to CURE involvement and delivery (i.e. positive changes to others' practice, observing health and/or financial benefits for patients)	F	Most [patients] do want to quit. You want to see the benefits of that and yeah, that keeps you going really. And also, when they do manage to quit, we become so pleased. I've had patients that say even whatever they spend buying cigarettes, tobacco, each week they put money in the jar and it's that financial benefits as well. But I think it's the main that their long-term health benefits'. – P4, deliverer.
	Inclusion of incentives for GP engagement	M	Although we put a solution in place to recognise a GPs time, virtually none actually completed it. Or sought it out. Now that might be because we make it too hard, because it's another form to fill in and it's just it's just not worth it. Or is it actually that GPs are doing this, and they were engaged with the process, and the fact we've been out and talked to lots of local GPs...we found that they were really supportive. So, there were times when you need to change medication, so there are times you need to actually talk to the GPs. And any time we've been on the phone to then it's been yeah, fine, no problems, and we've not had any GPs contacting the service saying I'm not prepared to do this'. - P1, management.
<b>Psychological Capability</b>			
<b>Skills</b>	Previous experience and skills supporting smoking cessation and using hospital	M	I suppose through my background and experience I have a way of working with people that's worked for a long time – P5, deliverer.

TDF Domain	Summary of themes within the domain	Barrier (B) /Facilitator (F) / Mixed (M)	Key quotes
<b>Knowledge</b>	based IT systems to support day-to-day delivery. Knowledge of the supporting evidence around secondary-care based smoking cessation treatment.	F	So, reading all the papers on the effectiveness of the drugs that are given for tobacco addiction [was important]. So, all that needed to be done so that we are a voice which is not just passionate but is well educated and informed. – P10, management.

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4 Understanding the implementation of a secondary care tobacco  
5 addiction treatment pathway (The CURE Project) in England: A Strategic  
6 Behavioural Analysis  
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**Table 1. APEASE ratings from pre-workshop survey (total of 36 for 6 scorers).**

<b>Recommendation</b>	<b>A</b>	<b>P</b>	<b>E</b>	<b>A</b>	<b>S</b>	<b>E</b>	<b>TOTAL</b>
<b>Recommendation 1:</b> Plan for different discharge pathways at the set-up of the implementation process (i.e. secondary care, primary care, community services, community pharmacists).	3	3	3	2	4	3	<b>18</b>
<b>Recommendation 2:</b> Ensure adequate staffing is in place from earliest possible stages, particularly in terms of support staff (e.g. admin, IT) to facilitate the day to day smooth running of the intervention and allow nursing staff to focus on supporting patients.	5	4	6	6	6	5	<b>32</b>
<b>Recommendation 3:</b> Engage with external stakeholders and organisations, for example, Local Medical Committees and Medicine Optimisation Services, early in the planning process.	6	4	5	5	5	6	<b>31</b>
<b>Recommendation 4:</b> Provide easily accessible e-learning tools for training to all stakeholders involved in the implementation of the intervention.	6	4	6	6	5	4	<b>31</b>
<b>Recommendation 5:</b> Provide access to a wide range of Nicotine Replacement Therapy (NRT) products, ensuring stock levels are adequate on hospital wards.	4	3	4	5	5	5	<b>26</b>
<b>Recommendation 6:</b> Amend existing data storage systems to allow recording and documenting of patient information and journey through the intervention (e.g. computers programmed with pop up requests for data).	4	4	4	4	6	5	<b>27</b>
<b>Recommendation 7:</b> Provision of adequate funding to facilitate and support implementation of the intervention in secondary care, but also outside of secondary care (i.e. for primary care and community services) in order to develop standardised discharge pathways and integration with external services. For instance, integration with community-based lung health screening vehicle to provide stop smoking advice after CT scans.	2	2	5	4	6	6	<b>25</b>
<b>Recommendation 8:</b> Ensure adequate facilities are available to support delivery, including physical spaces for one-to-one sessions, hospital accessibility for patients (i.e. through parking, public transport) and vaping facilities.	1	1	1	2	5	5	<b>15</b>
<b>Recommendation 9:</b> Implement additional staffing resources and presence in the community, so as to lessen the impact of time pressures in secondary care.	1	0	2	2	4	3	<b>12</b>
<b>Recommendation 10:</b> Ensure high coverage of branding materials in a range of formats i.e. posters, pens, and screensavers to promote awareness of the service.	6	5	5	5	6	4	<b>31</b>
<b>Recommendation 11:</b> Allow enough flexibility in the service specification to facilitate patient engagement and accessibility (e.g. allowing for flexible amounts of follow up support, choice of NRT etc. dependant on patient preference and circumstances).	6	4	5	4	6	5	<b>30</b>
<b>Recommendation 12:</b> Communicate shared goals of the intervention across management and deliverers, so required behaviours can be agreed upon and planned.	6	6	6	6	6	6	<b>36</b>
<b>Recommendation 13:</b> Provide access to a core, but flexible service specification to ensure the intervention is delivered as intended.	6	6	6	6	6	6	<b>36</b>
<b>Recommendation 14:</b> Arrange face-to-face discussions, training and the use of marketing materials to facilitate constant promotion of the intervention to a wide range of healthcare professionals (including new junior doctors).	4	4	5	4	5	4	<b>26</b>

<b>Recommendation 15:</b> Recognise the need to manage competing priorities and implement the intervention within the context of a secondary care setting by providing flexible targets within the context of urgent medical issues.	4	2	4	4	3	3	<b>20</b>
<b>Recommendation 16:</b> From the earliest stages, identify and monitor outcomes that provide evidence of the success of the programme. Plan to disseminate these outcomes to wider stakeholders (e.g. in primary care) to encourage further 'buy-in'.	6	5	6	4	6	6	<b>33</b>
<b>Recommendation 17:</b> Engage in ongoing audit and feedback of outcomes and performance to delivery teams.	5	5	6	6	6	6	<b>34</b>
<b>Recommendation 18:</b> Encourage those involved in the intervention to offer, and support, patient choice in terms of treatment and support options as a part of delivery staff's role.	5	4	5	5	5	5	<b>29</b>
<b>Recommendation 19:</b> Implement a full-time project manager and a clinical lead(s), ensuring they are able to provide constant troubleshooting and peer support in implementing/delivering the intervention.	4	4	6	4	6	4	<b>28</b>
<b>Recommendation 20:</b> Encourage positive social comparison to facilitate a culture change of smoking cessation being everyone's responsibility by, for example, comparing rates of smoking cessation across wards/hospitals and corresponding rates of relevant health outcomes.	5	2	5	5	4	5	<b>26</b>
<b>Recommendation 21:</b> Inform stakeholders when other peers/senior staff approve of engagement with the intervention, so individuals are aware of others' support of the service (e.g. to encourage engagement with meetings).	3	3	4	3	5	4	<b>22</b>
<b>Recommendation 22:</b> Identify champions of the intervention within organisations, informing individuals that their own behaviour may set a good example for others and have positive consequences. This may relate to:  - Clinical/Nurse/Pharmacy champion - Primary Care champion - champions across different hospital wards/departments	5	5	6	5	6	5	<b>32</b>
<b>Recommendation 23:</b> Integrate opportunities for staff to observe peers presenting/discussing the intervention. For example, clinical lead and nursing lead can act as motivators and facilitators of 'buy-in' at both management and delivery staff level.	5	1	5	5	6	5	<b>27</b>
<b>Recommendation 24:</b> Prompt self-praise or intrinsic rewards of involvement, when performing intervention related tasks. For example, prompting staff to reflect on the likely health benefits for patients as a result of the treatment they are providing.	6	5	5	5	5	5	<b>31</b>
<b>Recommendation 25:</b> Provide financial incentive on performance (e.g. when prescribing NRT) for primary care staff supporting service outpatients in the community.	0	0	0	0	2	1	<b>3*</b>
<b>Recommendation 26:</b> Provide additional training on how to use tools associated with intervention delivery (i.e. I.T systems) so staff practice and observe use of these tools to facilitate day to day delivery.	5	5	5	5	6	5	<b>31</b>

\* Missing one participant's rating due to survey error.



## Standards for Reporting Implementation Studies: the StaRI checklist for completion



The StaRI standard should be referenced as: Pinnock H, Barwick M, Carpenter C, Eldridge S, Grandes G, Griffiths CJ, Rycroft-Malone J, Meissner P, Murray E, Patel A, Sheikh A, Taylor SJC for the StaRI Group. Standards for Reporting Implementation Studies ([StaRI statement](#)). *BMJ* 2017;356:i6795

The detailed Explanation and Elaboration document, which provides the rationale and exemplar text for all these items is: Pinnock H, Barwick M, Carpenter C, Eldridge S, Grandes G, Griffiths C, Rycroft-Malone J, Meissner P, Murray E, Patel A, Sheikh A, Taylor S, for the StaRI group. Standards for Reporting Implementation Studies ([StaRI Explanation and Elaboration document](#)). *BMJ Open* 2017 2017;7:e013318

Notes: A key concept of the StaRI standards is the dual strands of describing, on the one hand, the implementation strategy and, on the other, the clinical, healthcare, or public health intervention that is being implemented. These strands are represented as two columns in the checklist.

The primary focus of implementation science is the implementation strategy (column 1) and the expectation is that this will always be completed.	The evidence about the impact of the intervention on the targeted population should always be considered (column 2) and either health outcomes reported or robust evidence cited to support a known beneficial effect of the intervention on the health of individuals or populations.
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The StaRI standards refers to the broad range of study designs employed in implementation science. Authors should refer to other reporting standards for advice on reporting specific methodological features. Conversely, whilst all items are worthy of consideration, not all items will be applicable to, or feasible within every study.

Checklist item	Reported on page #	Implementation Strategy	Reported on page #	Intervention
		“Implementation strategy” refers to how the intervention was implemented		“Intervention” refers to the healthcare or public health intervention that is being implemented.
<b>Title and abstract</b>				
Title	1	1		Identification as an implementation study, and description of the methodology in the title and/or keywords
Abstract	2	2		Identification as an implementation study, including a description of the implementation strategy to be tested, the evidence-based intervention being implemented, and defining the key implementation and health outcomes.
<b>Introduction</b>				
Introduction	3	4		Description of the problem, challenge or deficiency in healthcare or public health that the intervention being implemented aims to address.
Rationale	4	4-6	4	The scientific background and rationale for the implementation strategy (including any underpinning theory/framework/model, how it is expected to achieve its effects and any pilot work).  The scientific background and rationale for the intervention being implemented (including evidence about its effectiveness and how it is expected to achieve its effects).



Aims and objectives	5	7	The aims of the study, differentiating between implementation objectives and any intervention objectives.		
<b>Methods: description</b>					
Design	6	8	The design and key features of the evaluation, (cross referencing to any appropriate methodology reporting standards) and any changes to study protocol, with reasons		
Context	7	8	The context in which the intervention was implemented. (Consider social, economic, policy, healthcare, organisational barriers and facilitators that might influence implementation elsewhere).		
Targeted 'sites'	8	8	The characteristics of the targeted 'site(s)' (e.g locations/personnel/resources etc.) for implementation and any eligibility criteria.	8	The population targeted by the intervention and any eligibility criteria.
Description	9	13	A description of the implementation strategy	13	A description of the intervention
Sub-groups	10	--	Any sub-groups recruited for additional research tasks, and/or nested studies are described		
<b>Methods: evaluation</b>					
Outcomes	11	--	Defined pre-specified primary and other outcome(s) of the implementation strategy, and how they were assessed. Document any pre-determined targets	--	Defined pre-specified primary and other outcome(s) of the intervention (if assessed), and how they were assessed. Document any pre-determined targets
Process evaluation	12	8-13	Process evaluation objectives and outcomes related to the mechanism by which the strategy is expected to work		
Economic evaluation	13	--	Methods for resource use, costs, economic outcomes and analysis for the implementation strategy	--	Methods for resource use, costs, economic outcomes and analysis for the intervention
Sample size	14	--	Rationale for sample sizes (including sample size calculations, budgetary constraints, practical considerations, data saturation, as appropriate)		
Analysis	15	8-13	Methods of analysis (with reasons for that choice)		
Sub-group analyses	16	--	Any a priori sub-group analyses (e.g. between different sites in a multicentre study, different clinical or demographic populations), and sub-groups recruited to specific nested research tasks		

<b>Results</b>					
Characteristics	<b>17</b>	--	Proportion recruited and characteristics of the recipient population for the implementation strategy	--	Proportion recruited and characteristics (if appropriate) of the recipient population for the intervention
Outcomes	<b>18</b>	--	Primary and other outcome(s) of the implementation strategy	--	Primary and other outcome(s) of the Intervention (if assessed)
Process outcomes	<b>19</b>	13-17	Process data related to the implementation strategy mapped to the mechanism by which the strategy is expected to work		
Economic evaluation	<b>20</b>	--	Resource use, costs, economic outcomes and analysis for the implementation strategy	--	Resource use, costs, economic outcomes and analysis for the intervention
Sub-group analyses	<b>21</b>	--	Representativeness and outcomes of subgroups including those recruited to specific research tasks		
Fidelity/adaptation	<b>22</b>	--	Fidelity to implementation strategy as planned and adaptation to suit context and preferences	--	Fidelity to delivering the core components of intervention (where measured)
Contextual changes	<b>23</b>	--	Contextual changes (if any) which may have affected outcomes		
Harms	<b>24</b>	--	All important harms or unintended effects in each group		
<b>Discussion</b>					
Structured discussion	<b>25</b>	18-21	Summary of findings, strengths and limitations, comparisons with other studies, conclusions and implications		
Implications	<b>26</b>	21-22	Discussion of policy, practice and/or research implications of the implementation strategy (specifically including scalability)	--	Discussion of policy, practice and/or research implications of the intervention (specifically including sustainability)
<b>General</b>					
Statements	<b>27</b>	23-24	Include statement(s) on regulatory approvals (including, as appropriate, ethical approval, confidential use of routine data, governance approval), trial/study registration (availability of protocol), funding and conflicts of interest		