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How can hospitals change practice to better implement smoking cessation interventions? A systematic review

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Additional supporting information may be found online in the Supporting Information section at the end of the article.

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Abstract: Smoking cessation reduces the risk of death, improves recovery, and reduces the risk of hospital readmission. Evidence and policy support hospital admission as an ideal time to deliver smoking-cessation interventions. However, this is not well implemented in practice. In this systematic review, the authors summarize the literature on smoking-cessation implementation strategies and evaluate their success to guide the implementation of best-practice smoking interventions into hospital settings. The CINAHL Complete, Embase, MEDLINE Complete, and PsycInfo databases were searched using terms associated with the following topics: *smoking cessation, hospitals, and implementation*. In total, 14,287 original records were identified and screened, resulting in 63 eligible articles from 56 studies. Data were extracted on the study characteristics, implementation strategies, and implementation outcomes. Implementation outcomes were guided by Proctor and colleagues' framework and included acceptability, adoption, appropriateness, cost, feasibility, fidelity, penetration, and sustainability. The findings demonstrate that studies predominantly focused on the training of staff to achieve implementation. Brief implementation approaches using a small number of implementation strategies were less successful and poorly sustained compared with well resourced and multicomponent approaches. Although brief implementation approaches may be viewed as advantageous because they are less resource-intensive, their capacity to change practice in a sustained way lacks evidence. Attempts to change clinician behavior or introduce new models of care are challenging in a short time frame, and implementation efforts should be designed for long-term success. There is a need to embrace strategic, well planned implementation approaches to embed smoking-cessation interventions into hospitals and to reap and sustain the benefits for people who smoke.

Keywords: hospitals, implementation, implementation outcomes, implementation science, implementation strategies, smoking policy, tobacco control

Introduction

Smoking cessation remains a global public health priority, and smoking cessation is the most effective way for regular smokers to improve their long-term health.¹ Smoking cessation also delivers short-term benefits in relation to recovery from surgery and illness and a reduced risk of hospital readmission.^{2,3} Despite the substantial burden that smoking places on hospitals, smoking-cessation treatment is not systematically embedded in the health care system.^{4–6} Although hospitals have implemented smoke-free policies to protect people from the adverse effects of second-hand smoke,^{7,8} policies aimed at increasing sustained smoking cessation among patients are less common.⁴

A hospital admission is an ideal time to deliver smoking-cessation interventions.⁹ The most effective treatment model is for clinicians to provide brief advice on stopping smoking that proactively links patients to best-practice cessation treatment (see Table 1).^{1,10–14} Brief advice models include the *5As* (ask, advise,

TABLE 1. Three Key Elements of Best-Practice Smoking-Cessation Treatment to Initiate During Hospitalization^a

BRIEF ADVICE (TANG 2014, ¹⁰ STEAD 2013 ¹¹)	STOP SMOKING PHARMACOTHERAPY (DHHS 2020, ¹ RIGOTTI 2020 ¹²)	MULTISESSION BEHAVIORAL COUNSELLING (DHHS 2020, ¹ MATKIN 2019, ¹³ STEAD 2017 ¹⁴)
Ask about smoking: <i>Do you smoke tobacco (or anything else)?</i>	Combination nicotine-replacement therapy	Counseling by phone (eg, quitline) or face to face
Advise benefits of quitting and how it might interact with the presenting condition, eg: <i>Stopping smoking can improve cancer treatment outcomes. There are effective stop smoking treatments that I'd like to help you access.</i>	Varenicline, bupropion	Stop-smoking clinic
Act/refer: Provide prescription for pharmacotherapy plus opt-out referral for multisession behavioral counseling		Group-based programs

Abbreviation: DHHS, US Department of Health and Human Services.

^aCenters for Disease Control and Prevention (CDC) tools for clinicians and tobacco cessation change package are available online (cdc.gov/tobacco/basic_information/for-health-care-providers/clinical-tools/index.html).

assess, assist, arrange) endorsed by the World Health Organization¹⁵ or the 3As (ask, advise, act/refer).¹⁶ Best-practice treatment combines multisession behavioral counseling (eg, quitline, hospital cessation clinic) with pharmacotherapy (eg, combination nicotine-replacement therapy, varenicline, bupropion).^{1,17} The latest Cochrane meta-analysis for hospitalized patients found that intensive counseling interventions that began during the hospital stay and continued with supportive contacts for at least one month after discharge increased smoking-cessation rates after discharge (risk ratio, 1.37; 95% confidence interval, 1.27-1.48; 25 trials).¹⁸ No statistically significant benefit was found for less intensive counseling interventions. Adding nicotine-replacement therapy to an intensive counseling intervention increased smoking-cessation rates compared with intensive counseling alone (risk ratio, 1.54; 95% confidence interval, 1.34-1.79; 6 trials). The effect of these interventions was independent of the patient's admitting diagnosis and was found in rehabilitation settings as well as acute care hospitals.¹⁸ This work demonstrates that, although interventions can be effective, failure is often because of an inability to deliver adequate help before discharge and the under-utilization of efficacious tobacco-dependence treatments. Policy also supports the delivery of smoking advice within hospital settings.¹⁹ Whereas research to date has focused on the efficacy and effectiveness of smoking-cessation interventions in health settings,^{3,20,21} there is a lack of guidance on optimal ways to embed smoking interventions in routine care.¹⁹

Implementation science addresses a gap between scientific discoveries and their translation into practice.²² Evidence indicates that efficacious interventions are inadequately implemented, and it has been suggested that it takes 17 years for 14% of original research to translate to patient benefit.²³ Therefore, it is necessary to consider how interventions with proven efficacy, such as smoking cessation in

hospital settings, can be implemented.²⁴ Implementation refers to the processes that facilitate the integration of evidence-based interventions into usual practice within a setting.²⁵ Evidence-based smoking-cessation interventions, including, but not limited to, the 5As, can be integrated into the usual clinical practice of health professionals using implementation strategies. Implementation strategies are defined as the methods or techniques applied to enhance the adoption and sustainability of a new practice, providing the *how to* of changing practice.²⁶ Examples of implementation strategies include: education, quality monitoring systems, practice champions, reminders, revising professional roles, and obtaining formal commitments.²⁷ The success of implementation strategies can be evaluated through implementation outcomes, including acceptability, which are distinct from clinical or service outcomes. These include adoption, appropriateness, costs, feasibility, fidelity, penetration, and sustainability.²⁸ It is important to distinguish between the intervention (eg, the 5As), implementation strategies (eg, staff education, reminders, or policies), and implementation outcomes (evaluation of whether implementation strategies have been successful). Given the lack of synthesized evidence and guidelines about smoking-cessation implementation strategies used in hospital settings and the health and cost benefits of improving uptake of smoking-cessation interventions in hospital settings, an exploration into optimal strategies to implement smoking-cessation interventions is warranted.

The objectives of this review are to report a systematic review that: 1) describes the implementation strategies used to deliver evidence-based smoking-cessation interventions in hospital settings and 2) evaluates the success of implementation strategies against implementation outcomes. The findings will provide guidance on optimal strategies for embedding smoking-cessation interventions into hospital settings.

TABLE 2. Implementation Outcomes, Definitions, and Their Operationalization for This Review

OUTCOME	DEFINITION ^a	OPERATIONALIZATION IN THIS REVIEW
Acceptability	The perception among implementation stakeholders that a given treatment, service, practice, or innovation is agreeable, palatable, or satisfactory	Patient and staff comfort and satisfaction with smoking-cessation interventions
Adoption	The intention, initial decision, or action to try or use an innovation or evidence-based practice	Evidence of staff asking patients about tobacco use, advising them to quit, assessing their willingness to quit, assisting them to quit (including referrals), and arranging follow-up during the first 12 mo of implementation ^b
Appropriateness	The perceived fit, relevance, or compatibility of the innovation or evidence-based practice for a given practice setting, provider, or consumer and/or the perceived fit of the innovation to address a particular issue or problem	Perceptions of the suitability of smoking-cessation interventions for use within hospital settings
Cost	The cost impact of an implementation effort	The total cost of the implementation (including intervention costs), preferably presented in a manner that enables the calculation of costs per smoker/patient for comparative purposes
Feasibility	The extent to which a new treatment or an innovation can be successfully used or carried out within a given agency or setting	Evidence that smoking-cessation interventions could be used with the resources available to staff in their hospitals
Fidelity	The degree to which an intervention was implemented as it was prescribed in the original protocol or as it was intended by the program developers	Evidence that smoking-cessation interventions were being used as the developers had envisaged
Penetration	The integration of a practice within a service setting and its subsystems	Evidence of staff asking patients about tobacco use, advising them to quit, assessing their willingness to quit, assisting them to quit (including referrals), and arranging follow-up after the first 12 mo of implementation ^b
Sustainability	The extent to which a newly implemented treatment is maintained or institutionalized within a service setting's ongoing, stable operations	Evidence that ongoing funding had been secured and that the intervention was embedded in hospital systems

^aAdapted from Proctor et al 2011.²⁸

^bTwelve months was chosen because it represents an annual cycle within a hospital.

Methods

The protocol for this review has been registered with the International Prospective Register of Systematic Reviews (PROSPERO CRD42021207422). This report complies with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement²⁹ and the SWiM (Synthesis Without Meta-Analysis) guidelines.³⁰

Search Strategy

Studies were identified using the following databases: CINAHL Complete, Embase, MEDLINE Complete, and PsycInfo. The terms used in the search represented 3 topics: smoking cessation, hospital settings, and implementation (for the full search strategy, see Supporting Methods). The search was limited to peer-reviewed articles published in the English language from 2010 onward to reflect modern implementation science frameworks, recent hospital models and policy drivers (eg, National Health Service guidance³¹), and evidence that restricted smoking behaviors in hospitals resulted in better health outcomes.^{32,33} The search was conducted on May 28, 2020. The reference lists of articles that met the inclusion criteria were scanned for additional publications that could be candidates for inclusion in the review.

Selection Criteria

The inclusion criteria for studies were: 1) the research was focused on the initiation of smoking-cessation interventions with patients receiving care within hospital settings, 2) the implementation strategy—defined as the plan of action to implement an intervention into practice—was reported and described, and 3) at least one implementation outcome was reported. Table 2 presents an overview of implementation outcomes, definitions, and their operationalization for this review based on Proctor and colleagues' implementation outcomes.²⁸ Studies were excluded if the implementation strategies were not named and/or described.

Study selection

Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia) was applied to support the screening and eligibility assessment processes. Three researchers (A.U., V.W., and a senior research fellow) performed the screening and eligibility assessments in a blinded, standardized manner. Publications were screened based on title and abstract, with 2 reviewers reading the full texts of included articles to determine eligibility for inclusion in the review. Disagreements between reviewers were resolved through discussion. All disagreements were discussed until concordance was reached.

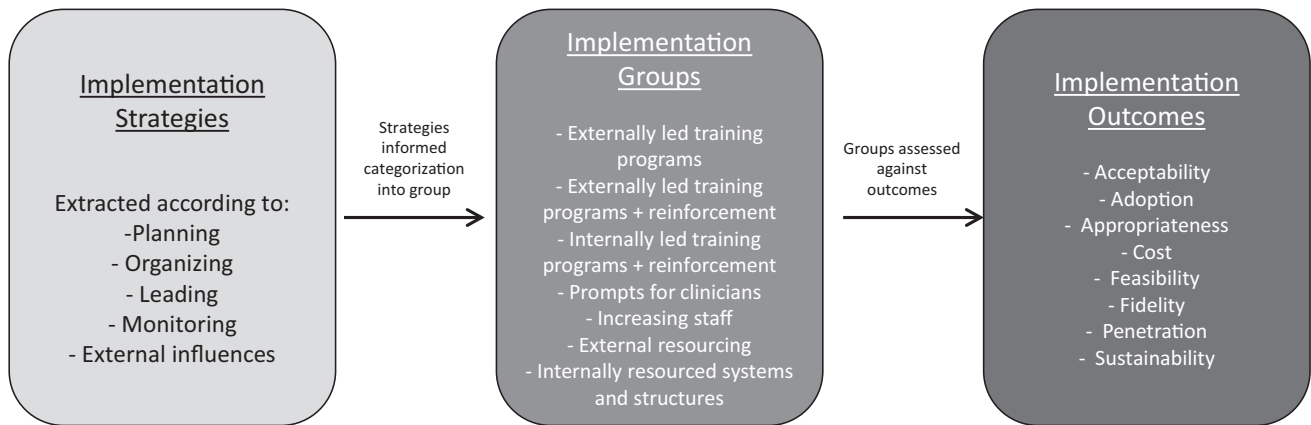


FIGURE 1. Overview of the Current Review.

Data extraction

Microsoft Excel software was used for data extraction. The following information was extracted from each included study: 1) country, 2) study design, 3) control condition, 4) study duration (length of implementation and follow-up), 5) setting, 6) number of sites, 7) study dates, 8) interventions, 9) implementers, 10) implementation strategies (coded against 4 managerial functions [planning, organizing, leading, and monitoring³⁴] plus external influences) and engagement of frontline staff (staff and volunteers engaged, duration and frequency of engagement), and 11) implementation outcomes (acceptability, adoption, appropriateness, cost, feasibility, fidelity, penetration, and sustainability). All implementation outcomes were assessed because they all contribute information about implementation success. Two researchers (A.U. and a senior research fellow) independently extracted the data. Disagreements between reviewers were resolved through discussion until consensus was reached.

Data analysis

Given the heterogeneity of implementation outcomes, a meta-analysis was not appropriate.³⁰ A thematic analysis was conducted on the implementation strategies to describe the types of strategies used. The thematic synthesis process involved: 1) coding text from included articles, 2) developing descriptive themes from these codes, and 3) generating analytical themes.³⁵

Studies were then categorized based on similar implementation strategies, resulting in the generation of 7 different implementation groups: 1) externally led, one-off training programs; 2) externally led, one-off training programs with reinforcement (eg, reminders, promotional material); 3) internally led training programs with reinforcement; 4) prompts for clinicians in charts or electronic medical records with training or notification; 5) increasing staff dedicated to smoking-cessation interventions; 6) external resourcing for smoking-cessation interventions; and 7) internally resourced development of systems and structures.

These groups were developed by the data extraction team (A.U. and a senior research fellow) based on similarities between study implementation strategies and are presented in the order of increasing implementation intensity. Each study was categorized to one group. These groups were assessed against implementation outcomes. An overview of the key components of this review, including the implementation strategies, implementation groups, and implementation outcomes, are presented in Figure 1.

According to the SWiM guidelines, the criterion used to prioritize results was study design, with studies that had a comparison group prioritized.³⁰

Results

The search of electronic databases yielded 21,039 records, of which 6753 were duplicates (see Fig. 2). Of the remaining 14,287 records, 168 publications were retained after title and abstract screening, of which 62 met the inclusion criteria after full-text eligibility assessment. An additional study was identified from scanning the reference lists of included articles, resulting in 63 eligible articles describing 56 original studies.

Overview of Studies

Table 3 presents an overview of each study.^{36–98} A summary of the characteristics of the 56 studies is presented in Table 4. Most studies were conducted in the United States ($n = 30$; 54%), using before-after study designs ($n = 37$; 66%) and without control conditions ($n = 50$; 89%). Almost one-third incorporated qualitative methods, including individual interviews ($n = 14$; 25%), focus groups ($n = 2$; 4%), and naturalistic observations ($n = 1$; 2%). Most studies were conducted at a single site (33 of 56); and the length of implementation and follow-up, on average, was >1 year (mean \pm SD, 1.36 \pm 1.35 years), ranging from 31 days to 8 years. Studies were conducted in a range of settings, including oncology (10 of 56 studies), psychiatry (6 of 56 studies), and general settings (6 of 56 studies). The most commonly

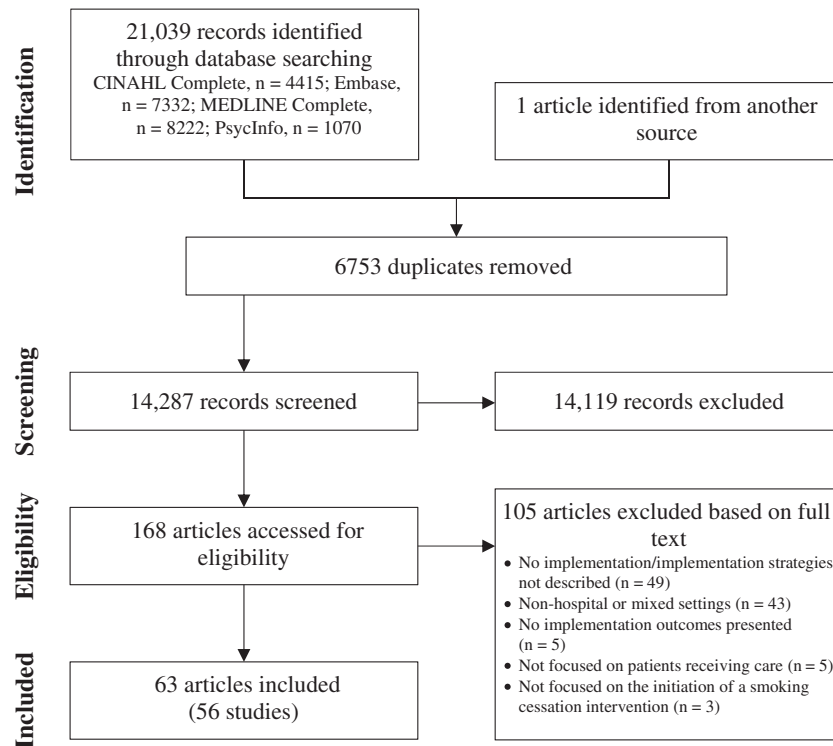


FIGURE 2. Identification and Selection of Studies for the Systematic Review.

implemented smoking-cessation interventions were the 5As (17 of 56 studies) and the 3As (7 of 56 studies).

Implementation Strategies

Table 5 summarizes the implementation strategies identified across studies, presented as planning, organizing, leading, monitoring, and external influences. Supporting Table 1 presents the extracted implementation strategy data. Planning strategies involved establishing goals and creating courses of action to achieve them. They were identified in almost two-thirds of studies ($n = 35$; 63%), with the most common being stakeholder consultation/engagement ($n = 14$; 25%), executive/senior leadership buy-in/support ($n = 10$; 18%), internal environment/practices/needs review ($n = 10$; 18%), and intervention pilot ($n = 10$; 18%). Organizing strategies included modification of structures, allocation of resources (including staff), and delegation of tasks to achieve goals. These are reported in 45% of the studies ($n = 25$), with the most frequently mentioned being upskilling/certification of key staff ($n = 7$; 13%) and additional staff appointments ($n = 6$; 11%). Leading strategies included encouraging and enabling people to take effective action and were reported in all studies ($n = 56$; 100%), with staff/volunteer training/development present in almost all studies ($n = 54$; 96%). Monitoring strategies included evaluation of the execution of the plan and adjusting to ensure goals were achieved, which were identified in over one-half of the studies ($n = 32$; 57%), with auditing/data collection ($n = 29$; 52%) and feedback

being the most common. External influences were identified in many studies ($n = 40$; 71%), with academics the most common ($n = 28$; 50%).

Implementation Outcomes by Implementation Group

Each study was categorized into one of 7 groups based on implementation strategies. Table 6 presents an overview of the groups, listing the implementation strategy for each group and subsequently providing a breakdown of each implementation outcome (acceptability, adoption, appropriateness, cost, feasibility, fidelity, penetration, and sustainability).^{31,36,37,39-52,56,58,60-62,64-71,73,75,76,82,86-89,91,92,94-96} A more comprehensive list of implementation outcomes for all included studies is presented in Supporting Table 2. A summary of results is presented below:

1. *Externally, led one-off training programs* were characterized by brief training (one-off, typically less than an hour) with no planning, organizing, or monitoring of implementation strategies. This group consisted of 10 studies^{42,53,58,60,74,78,80,84-86} with an average follow-up period of 0.6 years. All studies described adoption outcomes, with minimal descriptions of other implementation outcomes. Although some studies showed improvements for adoption, these were often short-term. Across these studies, evidence for appropriateness, feasibility, and fidelity was lacking. Only one study

TABLE 3. Overview of All Included Studies, n = 53

STUDY	COUNTRY	SETTING	DESIGN	STUDY DATES	LENGTH OF IMPLEMENTATION AND FOLLOW-UP
Abelmutti 2019 ³⁶	Canada	Large comprehensive cancer center	Noncomparative study	April 2016 to March 2018	2 y
Balmford 2014 ³⁷	Germany	Comprehensive cancer center within a large university medical center	Noncomparative study	April 2009 to July 2012	3.25 y
Bell 2018 ³⁸	England	8 NHS hospital trusts and 12 local authorities commissioning smoking-cessation services	Interrupted time series (without a comparison group)	November 2012 to July 2013	≥8 mo for each trust
Bernstein 2017, ³⁹ 2019 ⁴⁰ , Grau 2019 ⁴¹	United States	2 Hospitals in a single city	Cluster randomized controlled trial with individual interviews	August 2013 to February 2016	2 y, 8 mo
Bialous 2017 ⁴²	Czech Republic & Poland	Several hospitals	Before-after study	July 2014 to February 2015	~4 mo for each country
Bickerstaffe 2014 ⁴³	England	Hospital	Before-after study	Not reported	Not reported
Blok 2019 ⁴⁴	United States	4 Hospital units from 2 sites within the same network	Before-after study with individual interviews	May 2016 to July 2017	60 wk
Bowden 2010 ⁴⁵	Australia	2 Major birthing hospitals	Before-after study with individual interviews	July 2004 to March 2006	18 mo
Bruce 2018 ⁴⁶	United States	Cancer center	Noncomparative study	2014-2017	3 y
Campbell 2016, ⁴⁷ 2017 ⁴⁸	England	2 Antenatal clinics within a NHS Foundation Trust	Before-after study with individual interviews	May 2012 to October 2013	Not reported
Campbell 2019 ⁴⁹	England	2 Antenatal ultrasound scan departments within a NHS Trust	Before-after study with individual interviews	September 2012 to May 2014	9 mo
Castaldelli-Maia 2017 ⁵⁰	Brazil	17 Psychosocial care centers	Noncomparative study	Not reported	12 mo
Duffy 2015 ⁵¹	United States	VA hospital	Noncomparative study with individual interviews and observations	June 2012 to March 2013	≥9 mo
Duffy 2010 ⁵²	United States	General medical units at 3 VA sites	Nonrandomized comparative trial	July 2007 to June 2009	Not reported
Duffy 2016 ⁵³	United States	Inpatient units of 5 hospitals within Trinity Health	Controlled before-after study with individual interviews	October 2011 to ~November 2013	Not reported
Evans 2017, ⁵⁴ 2019 ⁵⁵	Canada	14 Regional cancer centers	Noncomparative study	2012-2019	8 y
Evison 2020 ⁵⁶	England	900-Bed major acute teaching hospital	Noncomparative study	October 2018 to August 2019	9 mo
Finegan 2018 ⁵⁷	Canada	Postanesthesia care unit within a research and teaching hospital	Before-after study	August 2015 to ~2017	18 mo
Fore 2014 ⁵⁸	United States	VA Medical Center	Noncomparative study	2007 to ~2009	19 mo
Gali 2020 ⁵⁹	United States	14 Clinics within a comprehensive cancer center	Before-after study	January 2018 to February 2020	1 y, 2 mo
Gonzalez 2018 ⁶⁰	United States	Emergency department of a private hospital	Before-after study	Not reported	6 wk
Hughes 2018 ⁶¹	United States	Acute care facility	Before-after study	Not reported	Not reported
Jose 2020 ⁶²	United States	3 Outpatient surgical practices within an academic medical center	Controlled before-after study with focus group interviews	June 2015 to July 2016	13 mo

TABLE 3. (Continued)

STUDY	COUNTRY	SETTING	DESIGN	STUDY DATES	LENGTH OF IMPLEMENTATION AND FOLLOW-UP
Karn 2016 ⁶³	United States	3 Health care systems (2 urban, 1 rural)	Before-after study	July 2010 to June 2012	12 mo, 6 wk
Katz 2013 ⁶⁴	United States	2 General medicine units of a single university-affiliated VA hospital	Before-after study with individual interviews	Not reported	12-5 mo
Katz 2014, ⁶⁵ 2016 ⁶⁶	United States	9 Medicine units within 4 academic VA hospitals	Before-after study with individual interviews	May 2009 to December 2012	12-17 mo per hospital
Katz 2012, ⁶⁷ 2013, ⁶⁸ 2014 ⁶⁹	United States	2 Emergency departments of a university hospital and a large community teaching hospital	Before-after study with individual interviews	August 2008 to August 2010	Hospital 1, 3.5 mo; hospital 2, 7.5 mo
Kisule 2010 ⁷⁰	United States	335-Bed university-affiliated medical center	Before-after study	September 2008 to March 2009	4 mo
Lappin 2020 ⁷¹	Australia	Acute inpatient mental health unit	Before-after study	December 2017 to June 2018	3 mo
Liu 2010 ⁷²	United States	Major tertiary care referral site with an average daily census of 308 inpatients	Before-after study	2004-2009	4 y
Malone 2019 ⁷³	Australia	35-Bed acute care inpatient ward of a large public teaching hospital	Before-after study with focus group and individual interviews	October 2015 to April 2016	2 mo
Martinez 2018 ⁷⁴	Bolivia, Guatemala, Paraguay	3 Public hospitals (2 oncology and 1 respiratory)	Before-after study	September 2015 to September 2016	12 mo
Matten 2011 ⁷⁵	United States	500-Bed community hospital	Before-after study	January 2007 to March 2009	15 mo
Mbata 2019 ⁷⁶	United States	28-Bed mood disorder unit of a psychiatric teaching hospital	Before-after study	Not reported	8 wk
Meyer 2020 ⁷⁷	United States	Cancer hospital	Before-after study	January 2018 to June 2019	4 mo
Muladore 2018 ⁷⁸	United States	24-Bed psychiatric inpatient unit in a medium-sized community hospital	Before-after study	January to March 2018	31 d
Nolan 2019 ⁷⁹	United States	Outpatient breast clinic	Before-after study with individual interviews	January 2012 to August 2017	Not reported
Preechawong 2011 ⁸⁰	Thailand	3 Hospitals involved in the smoke-free hospital campaign	Before-after study	2007	Not reported
Ramsey 2020 ⁸¹	United States	21 Major clinics at a cancer center	Before-after study	January to October 2018	6 mo
Raupach 2014 ⁸²	Germany	Cardiology wards of a medical center	Before-after study with individual interviews	February to July 2011	3 mo
Reid 2010 ⁸³	Canada	9 Hospitals, ranging in size from small rural community hospitals to large urban academic teaching centers	Before-after study with individual interviews	2006 to ~2009	≥ 18 mo for each hospital unit
Sarna 2016 ⁸⁴	China	8 Hospitals in 2 cities	Before-after study	2012-2013	8 mo
Sarna 2014 ⁸⁵	Czech Republic	8 Hospitals	Before-after study	Not reported	Not reported
Sarna 2012 ⁸⁶	United States	30 General medical-surgical hospitals across 3 states	Cluster randomized controlled trial	Not reported	Not reported
Saxony 2017 ⁸⁷	New Zealand	Surgical departments within 2 large hospitals	Noncomparative study	January 2012 to March 2014	2.25 y
Simeison & HackbARTH 2018 ⁸⁸	United States	Emergency department of a large suburban hospital	Before-after study	2015 to May 2016	6 mo

TABLE 3. (Continued)

STUDY	COUNTRY	SETTING	DESIGN	STUDY DATES	LENGTH OF IMPLEMENTATION AND FOLLOW-UP
Singer 2019 ⁸⁹	United States	Radiation oncology in an academic center in an urban location	Before-after study	December 2014 to June 2016	12 mo
Sisler 2017 ⁹⁰	United States	Neurosurgery inpatient services within a large academic medical center	Before-after study	April 2014 to December 2016	2 y
Slattery 2016 ⁹¹	Australia	37 General hospitals (outcome data from 8 of them)	Interrupted time series (without a comparison group)	2005-2009	3 y
Taylor 2020 ⁹²	United States	6 Inpatient units within a large hospital	Before-after study	February 2006 to February 2007	Not reported
Taylor 2020 ⁸³	United States	Comprehensive cancer center	Noncomparative study	Not reported	15 mo
Vega & Stolare 2010 ⁹⁴	New Zealand	290-Bed district general hospital	Before-after study	2006-2008	18 mo
Vick 2015 ⁹⁵	United States	Inpatient units within a 200-bed acute care VA medical center	Before-after study	October 2009 to March 2010	Not reported
Webb & Wilson 2017 ⁹⁶	Australia	Public teaching hospital	Controlled before-after study	July 2014 to September 2015	3 mo
Wye 2017 ⁹⁷	Australia	2 Inpatient adult psychiatric facilities (100-bed and 125-bed)	Interrupted time series (without a comparison group)	June 2009 to December 2010	14 mo
Ziedonis 2012 ⁹⁸	China	A hospital-based mental health center with inpatient units (for 300 patients) and outpatient services	Before-after study	April 2010 to November 2011	19 mo

Abbreviations: NHS, National Health Service; VA, Veterans Affairs.

TABLE 4. Characteristics of Included Studies

CHARACTERISTIC	NO. OF STUDIES (%)
Country	
United States	30 (54)
Australia	6 (11)
England	5 (9)
Canada	4 (7)
Other	11 (20)
Study design	
Cluster randomized controlled trial	2 (4)
Nonrandomized comparative trial	1 (2)
Controlled before-after study	3 (5)
Interrupted time series, ie, without a comparison group	3 (5)
Before-after study	37 (66)
Noncomparative study	10 (18)
Control condition	
No control	50 (89)
No intervention control, ie, usual care	5 (9)
Low intensity control	1 (2)
No. of sites	
Single	33 (59)
Multiple	23 (41)
Setting	
Oncology	10 (18)
Multiple	10 (18)
General	6 (11)
Psychiatry	6 (11)
Surgery	5 (9)
Maternity	4 (7)
Hospital wide	4 (7)
Other	4 (7)
Not reported	7 (13)
Smoking intervention	
5As	17 (30)
3As	7 (13)
Tobacco Tactics	5 (9)
Nicotine-replacement therapy	3 (5)
Opt-out referral	3 (5)
Tobacco treatment specialist providing care	3 (5)
Other	18 (32)

Abbreviations: 3As, ask, advise, and act (refer/help); 5As, ask, advise, assess, assist, and arrange.

measured sustainability, with results indicating reduced sustainability over time. Across outcomes, externally led, one-off training programs showed limited potential for implementation into usual practice.

2. *Externally led, one-off training programs with reinforcement* studies (n = 10^{44,49-51,61,64-66,73,76,82}) evaluated training programs supplemented by other implementation strategies, such as reminders, supervision, feedback, or other reinforcement. Studies in this category had an average study period of 0.8 years. Authors reported on more implementation outcomes than the previous category: the most common outcomes were adoption (8 studies), appropriateness (6 studies) acceptability (4 studies), and feasibility (4 studies). There was limited evidence for successful implementation across outcomes, with poor acceptability, appropriateness, feasibility, fidelity, and penetration. Adoption showed modest improvements, and sustainability was lacking. Overall, these studies had limited implementation success in the context of shorter study periods and poor sustainability.
3. *Internally led training programs with reinforcement* (7 studies^{43,62,70,75,89,91,94}) consisted of education programs with reinforcement and internal leadership, with an average study period of 1.2 years. Most studies (6 of 7) had planning strategies (eg, stakeholder consultation⁴³ or internal endorsement⁹¹), and most had monitoring strategies (eg, feedback⁸⁹). These studies most commonly reported on adoption (4 studies) and penetration (4 studies). Overall, internally led training programs with reinforcement may have more potential for adoption and penetration than externally led training programs (with and without reinforcement), although evidence for outcomes appropriateness and feasibility was lacking.
4. *Prompts for clinicians in charts or electronic medical records with training or notification* (6 studies^{36,39-41,67-69,88,95,96}) had an average study period of 1.4 years. Adoption was most commonly assessed (in 5 studies). Overall, prompts for clinicians showed some potential for adoption, although studies that demonstrated improvements still found that the majority of patients did not receive smoking-cessation interventions. Therefore, implementation strategies involving prompts are insufficient to result in routine delivery of smoking-cessation interventions, and evidence is lacking across other outcomes.
5. *Increasing staff dedicated to smoking-cessation interventions* (10 studies)^{37,46-48,52,56,57,71,87,92,97} had an average study period of 1.7 years. These studies had dedicated staff to deliver smoking-cessation interventions, and the most common outcomes assessed were cost (5 studies), penetration (8 studies), and sustainability (4 studies). For these studies, adoption and acceptability were evident. Evidence for appropriateness was lacking, and feasibility was mixed. Success was achieved for the longer term implementation outcomes (penetration and sustainability). Findings indicated that smoking-cessation interventions were adopted

TABLE 5. Implementation Strategies Identified in Included Studies, n = 56

ACTIVITY	NO. OF STUDIES (%)
Planning ^a	
Strategies in relation to establishing goals and creating courses of action to achieve them	
No planning activities identified	21 (38)
Stakeholder consultation/engagement	14 (25)
Executive/senior leadership buy-in/support	10 (18)
Internal environment/practices/needs review	10 (18)
Intervention pilot	10 (18)
Implementation team, multidisciplinary	9 (16)
Phased implementation/roll-out	6 (11)
Steering group guidance, including executives	6 (11)
Adoption of an implementation method ^b	5 (9)
Executive/senior-level leadership of the project	5 (9)
Scientific/external evidence review	3 (5)
Frontline staff buy-in	3 (5)
Implementation tailored to setting	3 (5)
Intervention changed based on implementation experiences	2 (4)
Training in an implementation method ^b	2 (4)
Trial of implementation strategies	2 (4)
Target setting	1 (2)
Organizing ^a	
Modifying structures, allocating resources including staff, delegating tasks to achieve goals established during planning	
No organizing activities identified	31 (55)
Upskilling/certification of key staff ^c	7 (13)
Additional staff appointments	6 (11)
Delegation of new tasks to existing staff	5 (9)
Appointment of smoking-cessation champions	5 (9)
Designating nurse facilitators, liaising between nurses and study team	4 (7)
Volunteer recruitment	3 (5)
Dedication of existing staff time to new roles	3 (5)
Formation of new smoking-cessation services/teams	2 (4)
Academic team coordinating intervention	2 (4)
Purchase equipment, CO monitors	2 (4)
Supply of pharmacotherapy	1 (2)
Leading ^a	
Encouraging and enabling people to take effective action	
Staff/volunteer training/development	54 (96)
Development/distribution of information/promotional material ^d	16 (29)
Use of reminder systems ^e	14 (25)
Adaptation/leveraging of electronic record system	13 (23)
Communication with staff about the implementation	9 (16)
Redeveloping assessment, treatment, and referral practices	9 (16)
Development/adaptation of paper-based forms/systems	5 (9)
Receiving implementation support; eg, external advice/mentoring	5 (9)
Information sessions for patients and carer groups	2 (4)
Leaders, eg, nurse champions, acting as change agents	2 (4)

TABLE 5. (Continued)

ACTIVITY	NO. OF STUDIES (%)
Financial incentives/penalties	2 (4)
Negotiations with management	1 (2)
Media engagement	1 (2)
Monitoring ^a	
Evaluating the execution of the plan and making adjustments to ensure goals are achieved	
Audit/data collection	29 (52)
No monitoring activities identified	24 (43)
Providing feedback	18 (32)
Supervision	5 (9)
External influences ^a	
Organizations and individuals external to the organization exerting an influence on the intervention	
Academics	28 (50)
No external influences identified	17 (30)
Government funding	8 (14)
Government, national/local/cancer-focused agencies	7 (13)
External trainers, nonacademic	6 (11)
Smoking-cessation experts, nonacademic	2 (4)
Commercial businesses; eg, EMR/EHR software vendors	2 (4)
Cancer organization (project leadership)	1 (2)
External nongovernment funding; eg, charitable/commercial sources	1 (2)
Changes within a smoking-cessation service	1 (2)
Media advertising campaign on smoking cessation	1 (2)

Abbreviations: CO, carbon monoxide; EMR/HER, electronic medical/health record.

^aNumbers sum to >56 and percentages sum to >100% because multiple activities were being identified in some studies.

^bFor example, plan-do-study-act cycles and Lean Six Sigma quality-improvement strategy.

^cFor example, tobacco treatment specialist training and train-the-trainer.

^dThis includes material on smoking cessation and services for patients and staff (eg, posters, flyers).

^eFor example, systems may include cue cards, tent cards, posters, and electronic record system changes.

and acceptable when there were dedicated personnel to deliver smoking interventions; however, the implementation success of these studies is contingent on the continued employment of these dedicated staff and associated costs.

6. *External resourcing for smoking-cessation interventions* included 9 studies with multifaceted and complex strategies and a focus on external support and partners, with an average study period of 1.8 years.^{38,45,54,55,59,63,77,81,83,93}

These studies had extensive coordination and organization of strategies that were externally led or had extensive external influence. All outcomes were assessed across these studies. Acceptability was evident, and adoption showed some improvements. For appropriateness, feasibility, and fidelity, the evidence was mixed. Penetration was achieved for these studies, and evidence for sustainability was mixed. These results suggest that external resourcing of programs may have some capacity to achieve longer term implementation outcomes, especially penetration. Importantly, this evidence was in the context of longer study periods.

7. *Internally resourced development of systems and structures* used a broad range of implementation strategies, consisting of 4 studies that all had strategies, from planning, organizing, leading, and monitoring.^{72,79,90,98}

These studies had a longer study period, averaging 2.5 years, and were conducted in single sites with an emphasis on internal leadership and significant follow-up periods. Studies that consisted of internally resourced development of systems and structures had a longer term follow-up period and more of a focus on longer term implementation outcomes (sustainability and penetration). There was evidence that these outcomes had been achieved, along with acceptability and adoption, although there were areas for improvement in fidelity and feasibility.

Discussion

This study aimed to examine implementation strategies for embedding smoking-cessation interventions in hospitals.

TABLE 6. Description of Implementation Groups

IMPLEMENTATION GROUP (NO. OF STUDIES)	DESCRIPTION OF IMPLEMENTATION STRATEGIES	IMPLEMENTATION OUTCOME (NO. OF STUDIES)	SUMMARY
1. Externally led, one-off training programs (10)	Implementation strategy was solely related to training and predominantly involved academics providing training for nurses on smoking-cessation interventions; one-off engagement of frontline staff lasted 30-60 min in the majority of studies.	Adoption (10)	Limited evidence for increased adoption of smoking-cessation strategies: One study that had a control group showed no difference for the 5As (Sarna 2012 ⁸⁶), whereas others showed minimal improvements (eg, improved <i>asking</i> from 67% to 78% [Bialous 2017 ⁴²] or improved <i>assisting</i> 17% to 21% of the time) (Gonzalez 2018 ⁶⁰). The most promising adoption result was an 86% delivery of smoking-cessation services at 15 mo; however, there were no baseline data (Fore 2014 ⁵⁸).
		Appropriateness (2)	Mixed evidence, with one study showing that nurses felt smoking-cessation support was important (NHS 2010 ³¹), whereas another found that most nurses (75%) reported barriers to implementation, such as lack of interest from patients (Fore 2014 ⁵⁸).
		Feasibility (1)	There was limited evidence because nurses described a lack of time (Fore 2014 ⁵⁸).
		Fidelity (1)	One study demonstrated moderate compliance with an online webinar, however, it had a low response rate (Sarna 2012 ⁸⁶).
		Penetration (1)	Varying penetration; eg, brochures provided (73%) versus shown DVD (2%)
		Sustainability (1)	Found that use of the study was reducing over time (NHS 2010 ³¹)
		Acceptability (4)	There was evidence that these interventions were not acceptable, with 3 of the 4 studies identifying disruption to the therapeutic relationship (Malone 2019 ⁷³) and resistance from patients (Katz 2014, ⁶⁵ 2016 ⁶⁶) or staff (Castaldelli-Maia 2017 ⁵⁰). Conversely, one paper reported that patients were comfortable discussing smoking (Duffy 2015 ⁵¹).
2. Externally led, one-off training programs with reinforcement (10)	Most studies involved academics providing training to health care professionals, including nurses. Several forms of reinforcement supported this training, including reminder systems, promotional material, adaptations of electronic record systems, providing feedback, and supervision. All studies involved leading activities; there was also evidence of planning, organizing, and monitoring activities. All studies engaged frontline staff or volunteers, sometimes with additional support/supervision as needed. Engagement typically lasted ≤60 min.	Adoption (8)	There was limited evidence, with improvements to the delivery of smoking interventions being either unsuccessful (Hughes 2018 ⁶¹), modest (Blok 2019, ⁴⁴ Duffy 2015 ⁵¹ ; Katz 2013, ⁶⁴ 2014, ⁶⁵ 2016 ⁶⁶), or mixed (Malone 2019, ⁷³ Raupach 2014 ⁸²).
		Appropriateness (6)	There were concerns about suitability or ambivalence from staff (Campbell 2019 ⁴⁹ ; Castaldelli-Maia 2017 ⁵⁰ ; Katz 2013, ⁶⁴ 2014, ⁶⁵ 2016 ⁶⁶ ; Malone 2019 ⁷³ ; Raupach 2014 ⁸²); eg, concerns that smoking-cessation discussions would duplicate efforts of primary health staff (Castaldelli-Maia 2017 ⁵⁰) or noting tensions with other priorities (Malone 2019 ⁷³).
		Cost (2)	One study counted resources only and did not include staff time (Blok 2019 ⁴⁴), and the other study calculated costs per quitter at \$147USD (including costs associated with volunteer time) (Duffy 2010 ⁵¹).
		Feasibility (4)	Poor evidence of feasibility; 2 studies showed insufficient staff time (Katz 2014, ⁶⁵ 2016 ⁶⁶ ; Raupach 2014 ⁸²), one had limited feasibility because of extensive patient exclusion criteria (Mbata 2019 ⁷⁶), and the other was inconclusive (Katz 2018 ⁶⁴).
		Fidelity (3)	Adherence to the intervention was shown in one study (Duffy 2010 ⁵¹); and 2 other studies noted selective implementation and skills (Katz 2014, ⁶⁵ 2016 ⁶⁶ ; Raupach 2014 ⁸²).

TABLE 6. (Continued)

IMPLEMENTATION GROUP (NO. OF STUDIES)	DESCRIPTION OF IMPLEMENTATION STRATEGIES	IMPLEMENTATION OUTCOME (NO. OF STUDIES)	SUMMARY
3. Internally-led, one-off training programs with reinforcement (7)	These studies engaged nurses, physicians, and other health care staff in training. Reinforcement mainly took the form of providing feedback. Most studies included leading activities, planning, and monitoring; principally auditing/data collection. Engagement of frontline staff varied between one-off to ongoing.	Penetration (1)	Penetration was demonstrated through reporting of the booked appointments (n = 6613) and the number of opt-in forms distributed for the smoking intervention (n = 1800; 27%) (Campbell 2019 ⁴⁹).
		Sustainability (2)	Sustainability was low, with one study showing that the intervention was discontinued (Duffy 2015 ⁵¹) and the other showed reduced sustainability of the intervention (Blok 2019 ⁴⁴).
		Adoption (4)	Adoption was modest (Jose 2020, ⁶² Kisuule 2010, ⁷⁰ Matten 2011 ⁷³); eg, an increase in asking about smoking from 51% to 80% (Jose 2020 ⁶²) or an increase in documentation of tobacco-dependence counselling in progress notes from 36% to 44%; and nicotine-replacement therapy dosing increased from 26% to 64% (Kisuule 2020 ⁷⁰). One study noted a substantial improvement in the number of nicotine-replacement therapy units used, from 768 in the year before implementation to 1418 12 mo later (Vega & Stolare 2010 ⁹⁴).
		Appropriateness (1)	One study found that nurses often did not regard smoking-cessation interventions as their responsibility; similarly, for feasibility, staff noted insufficient time (Jose 2020 ⁶²).
		Cost (2)	One study calculated intervention (nicotine-replacement therapy) costs (Vega & Stolare 2010 ⁹⁴), and the other provided a financial incentive to 13 residents (Singer 2019 ⁸⁹).
		Feasibility (1)	One study stated that staff reported insufficient time to deliver intervention (Jose 2020 ⁶²).
		Penetration (4)	Three studies showed that the intervention was still integrated after 12 mo (Bickerstaffe 2013, ⁴³ Jose 2020, ⁶² Slattery 2016 ⁹¹). One article indicated that penetration reduced over time (from 76% to 52%), potentially because of a financial incentive already being provided to radiation oncology residents (Saxony 2017 ⁸⁹).
4. Prompts for clinicians in charts or electronic medical records (EMRs) with training/notification (6)	Prompts to perform smoking-cessation interventions were inserted in patient charts or EMR. Implementation was by academics or internal staff. In addition to leading activities, monitoring activities were common, especially auditing/data and providing feedback. Engagement of staff—mainly nurses and physicians—was generally undertaken using one-off training. Engagement varied (from ≤30 min up to >60 min to ≤2 h)	Sustainability (1)	One study demonstrated ongoing implementation efforts with new workflows being developed (Saxony 2017 ⁸⁹).
		Acceptability (1), appropriateness (1), feasibility (1)	One study assessed these outcomes with qualitative data, showing staff believed that smoking-cessation counselling was not practical and met with resistance from patients; staff also expressed ambivalence toward the implementation of the smoking-cessation guidelines and indicated delivery could be difficult in some settings, such as an emergency department (acceptability, appropriateness, and feasibility) (Katz 2012, ⁶⁷ 2013, ⁶⁸ 2014 ⁶⁹).
		Adoption (5)	A 2-y cluster RCT (Bernstein 2017, ³⁹ 2019 ⁴⁰ ; Grau 2019 ⁴¹) showed improved delivery of smoking cessation in several areas (eg, referrals to quitline: 29% in the intervention arm and 0% in the control arm). Another controlled before-after study found that advice to quit increased in the charts of patients who underwent elective surgery (from 1.8% to 18.7%), and no change was evident in the charts of those who underwent non-elective surgery but did not receive the intervention (Webb & Wilson 2017 ⁹⁶). Other studies found mixed or minimal success for adoption (Katz 2012, ⁶⁷ 2013, ⁶⁸ 2014 ⁶⁹), lacked baseline data (Simerson & Hackbarth 2018 ⁸⁸), or demonstrated modest improvements (Vick 2013 ⁹⁵).
		Fidelity (1)	One study reported that it was not clear whether the protocol was being implemented as specified (poor fidelity) (Simerson & Hackbarth 2018 ⁸⁸).

TABLE 6. (Continued)

IMPLEMENTATION GROUP (NO. OF STUDIES)	DESCRIPTION OF IMPLEMENTATION STRATEGIES	IMPLEMENTATION OUTCOME (NO. OF STUDIES)	SUMMARY
5. Increasing staff dedicated to smoking-cessation interventions (10)	Predominant strategy was to employ additional staff or dedicate existing staff time to undertake smoking cessation interventions. All studies involved planning, organizing, and leading activities, with one-half also using monitoring activities. In some, interventions were piloted and implementation was rolled out in stages. Adapting electronic record systems to facilitate the delivery of interventions, the development of promotional material, and the redevelopment of assessment, treatment, and referral was also common. External influences included government funding. Staff and volunteers were engaged with training and, in one-half of the studies, training was ongoing.	Penetration (1)	One study found solid uptake, with 62% of 13,617 new patients screened for smoking (Abdelmutti 2019 ³⁶).
		Sustainability (1)	One 2-y study revealed that a more sustained strategy was needed, and the researchers were developing e-learning modules to try to improve maintenance over time (Abdelmutti 2019 ³⁶).
		Acceptability (1)	One study found that the intervention was well received (Campbell 2016, ⁴⁷ 2017 ⁴⁸).
		Adoption (3)	There were moderate increases; eg, self-report of smoking-cessation practices increased from 57% to 86% (Duffy 2010 ⁵²); and 72% of tobacco users were visited by volunteers as required (Taylor 2020 ⁹²).
		Appropriateness (1)	One study was unable to demonstrate that the intervention was appropriate, with staff reporting barriers and a lack of interest from patients (Duffy 2010 ⁵²).
		Cost (5)	Cost considerations included additional staff but often not the whole implementation effort (Balmford 2014, ³⁷ Bruce 2018, ⁴⁶ Evison 2020, ⁵⁶ Lappin 2020, ⁷¹ Saxony 2017 ⁸⁷).
		Feasibility (3)	Results for feasibility were mixed: One study found referrals were easier than expected (Campbell 2016, ⁴⁷ 2017 ⁴⁸), another noted insufficient time (Duffy 2010 ⁵²), and another found resource limitations (Taylor 2020 ⁹²).
		Penetration (8)	There was evidence of penetration; eg, screening for tobacco use increased over an 18-mo period (from 50% to 89%) (Saxony 2017 ⁸⁷); 92% of people were screened and 96% were given advice to quit (Evison 2020 ⁵⁶).
		Sustainability (4)	Two studies appeared to have achieved this with ongoing, dedicated staff (Bruce 2018, ⁴⁶ Saxony 2017 ⁸⁷); 2 other studies revealed that implementation efforts were ongoing (Balmford 2014, ³⁷ Saxony 2017 ⁸⁷).
		6. External resourcing for smoking-cessation interventions (9)	Provision of funding or in-kind support, principally from government, for hospitals to implement smoking-cessation interventions: Implementation was by internal staff, external academics, cancer organizations or hospitals. Most involved planning, organizing, leading, and monitoring activities. Planning involved steering group guidance, executive/senior leadership support, and multidisciplinary implementation team, as well as stakeholder engagement. One-half of the studies involved monitoring and auditing/data collection. A wide range of staff received training, which was often ongoing.

TABLE 6. (Continued)

IMPLEMENTATION GROUP (NO. OF STUDIES)	DESCRIPTION OF IMPLEMENTATION STRATEGIES	IMPLEMENTATION OUTCOME (NO. OF STUDIES)	SUMMARY
7. Internally resourced development of systems and structures (4)	Internally funded/supported strategies aimed to make significant changes to existing systems and structures: Most studies involved planning, multidisciplinary implementation teams, internal environment/practices/needs reviews, and stakeholder engagement. Organizing most commonly involved delegating new tasks to existing staff and upskilling/certification of key staff. Leading activities included training, developing/adapting paper-based forms/systems, and redeveloping assessment, treatment, and referral practices. All implementations involved auditing/data collection. Staff engagement focused on physicians and nurses.	Adoption (4)	One study showed evidence of adoption with an increase in referrals to smoking services (incident rate ratio = 2.47) (Bell 2018 ³⁸); the others showed some improvements, eg, an increase in medication prescription from 3% to 17% (Ramsey 2020 ⁸¹) or an increase in new patient referrals to tobacco services by 100% (Meyer 2020 ⁷⁷).
		Appropriateness (1)	In one study, clinicians reported that smoking cessation may not be suitable for advanced disease (Evans 2017, ⁵⁴ 2019 ⁵⁵).
		Cost (3)	Costs for additional staff to implement were estimated for 2 studies (Bowden 2019, ⁴⁵ Gali 2020 ⁵⁹), whereas another study assessed full costs (training of staff, investments in equipment and consumables, changes to workload) at £572,009 per NHS trust over a 5-y period (Bell 2018 ³⁸).
		Feasibility (3)	Feasibility outcomes were mixed. In one study, clinicians thought the intervention was well integrated into their work (Bowden 2019 ⁴⁵); one study identified clinician concern about workload, incomplete data, and difficulties in motivation (Bowden 2019 ⁴⁵); and another study had extensive eligibility criteria, restricting the number of smokers who could receive the intervention (Taylor 2020 ⁹³).
		Fidelity (2)	There was mixed support for fidelity, with one study reporting adherence (Karn 2016 ⁶³) but another noting variability in practices (Evans 2017, ⁵⁴ 2019 ⁵⁵).
		Penetration (6)	One study with 8-y follow-up found that most centers achieved a target of 75% screening for smoking status (Evans 2017, ⁵⁴ 2019 ⁵⁵), and another study had 1254 patients referred to the quitline, compared with just 7 before implementation (Karn 2016 ⁶³). Other penetration outcomes were relatively strong; eg, 70% of patients assessed (Taylor 2020 ⁹³) or 65% of current smokers received advice (Bowden 2019 ⁴⁵).
		Sustainability (5)	Results were mixed, with 2 studies noting that the intervention was reducing at 90 d (Meyer 2020 ⁷⁷) and 4 mo (Bell 2018 ³⁸), whereas 2 studies appeared to have secured funding to support the implementation (Bowden 2010 ⁴⁵ ; Evans 2017, ⁵⁴ 2019 ⁵⁵), and one noted continuation and expansion of the program (Gali 2020 ⁵⁹).
		Acceptability (2)	There was evidence for acceptability, with patients satisfied with the intervention (Sisler 2017 ⁹⁰), and another study reported that patients were not surprised about smoking discussions (Nolan 2019 ⁷⁹).
		Adoption (1)	One study reported there appeared to be an increase in assessment of nicotine dependence (Ziedonis 2012 ⁹⁸).
		Feasibility (1)	One study found that a reasonable proportion of patients (45 of 209) did not receive the smoking intervention for reasons that included cognitive impairment, not speaking English, or refusal (Sisler 2017 ⁹⁰).

TABLE 6. (Continued)

IMPLEMENTATION GROUP (NO. OF STUDIES)	DESCRIPTION OF IMPLEMENTATION STRATEGIES	IMPLEMENTATION OUTCOME (NO. OF STUDIES)	SUMMARY
		Fidelity (1)	One study found a lack of knowledge of, or forgetting, processes by clinical staff, suggesting poor fidelity (Nolan 2019 ⁷³).
		Penetration (3)	There was evidence of successful penetration: One study found substantial increases in documentation of tobacco status from 1% up to 80%-90% over a 3-y period (Liu 2010 ⁷²); whereas authors of 2 other studies reported solid increases in uptake in the longer term (eg, referrals increased from 32% to 62% and follow-up phone calls increased from 1.5 to 31 per mo) (Taylor 2020 ⁹⁰) or an increase in consultation attendance from 41% to 75% (Nolan 2019 ⁷³).
		Sustainability (3)	There was evidence of sustainability: One study reported putting structures in place to sustain implementation efforts (Ziedonis 2012 ⁹⁸), another noted ongoing implementation efforts (Taylor 2020 ⁹⁰), and another study appeared to have ongoing funding (Liu 2010 ⁷²).

Abbreviations: 5As, ask, advise, assess, assist, and arrange; NHS, National Health Service; RCT, randomized controlled trial; USD, US dollars.

^aIn some instances, multiple articles are cited that represent a single study. Implementation *strategies* across studies are presented in Supporting Table 1, and implementation *outcomes* across studies are presented in Supporting Table 2.

Although various implementation outcomes were assessed for different studies using various implementation strategies, this review has generated key recommendations for implementing smoking cessation in hospital settings through the establishment of 7 study categories.

For this review, we identified various implementation strategies to describe a range of study groups, which were then evaluated against several implementation outcomes. This approach allowed us to evaluate a large group of studies, many of which used similar approaches. There was substantial heterogeneity in the way implementation outcomes were operationalized. For each implementation outcome, especially adoption, it was common for several indicators to be collected (eg, whether patients were asked, advised, assessed, assisted, or arranged for follow-up) over different time points, with data collected from medical record review, clinicians, or patients. In addition, the methods used for collecting data varied, and qualitative approaches included interviews, focus groups, or other sources,⁶⁴⁻⁶⁶ with different methods used for different implementation outcomes.

The first aim, describing the implementation strategies used to deliver smoking-cessation interventions in hospital settings, indicated that studies predominantly focused on training of staff, with fewer studies reporting on planning strategies, such as stakeholder engagement; organizing strategies, such as appointing or delegating staff; and monitoring strategies, such as supervision or feedback. The majority of studies did not report organizing activities (modifying structures; allocating resources, including staff; delegating tasks to achieve goals).

Implementation strategies informed the categorization of 7 types of implementation groups. Implementation in the 3 resource-intensive groups were of longer duration and placed greater attention on assessing and reporting the longer term implementation outcomes of penetration and sustainability (ie, strategies that increase staff time dedicated to smoking-cessation interventions, external resourcing for smoking-cessation interventions, and internally resourced development of systems and structures). Generally, all 4 types of implementation strategies (planning, organizing, leading, and monitoring) were used in these studies (Table 5). These resource-intensive programs were more likely to involve steering group guidance (including executives), executive/senior leadership buy-in/support, implementation teams, stakeholder consultation/engagement, and intervention pilots compared with less resource-intensive groups (ie, those focused on training programs or the use of prompts). The results also show the success of internally driven programs because these programs represent a genuine priority for the health services rather than being involved as a study site. Furthermore, the findings suggest that having dedicated staff to support both intervention delivery and implementation may lead to better implementation.

The studies that described settings in which fewer implementation strategies were delivered reported short-term outcomes and less evidence about how implementation success was assessed. The weight of evidence suggests that these programs encountered issues with acceptability, appropriateness, feasibility, and sustainability. The extent to which the hospitals were engaged in the implementation

efforts was unclear. For briefer implementation efforts, adoption data suggest that there were poor levels of uptake during implementation, and sustainability was not assessed. The findings of this review lead us to recommend that future study designs adopt longer follow-up periods to explore and evaluate the sustainability of smoking-cessation interventions.

Findings from this review demonstrate that brief education by itself is insufficient for successful implementation. Rather, implementation efforts should be planned and resourced and should include a variety of implementation strategies (see Table 5). Planning strategies, including a needs review, executive support, steering group development or senior leadership, and others, are important to commence implementation efforts. Although brief education efforts may be easy to deliver, by themselves, they appear to be unlikely to contribute to long-term successes in changing health professionals' practices regarding the delivery of smoking cessation. We argue that embedding smoking care successfully provides good return on investment through successful prevention,^{2,99,100} and these results are especially relevant, with smoking cessation being a noted priority for health services during the COVID-19 pandemic.¹⁰¹ Consequently, investing in implementation strategies that extend beyond brief education, such as stakeholder engagement or audit and feedback, is very likely to be worthwhile.

This review also demonstrates that the implementation of new models of care and change of practice in hospital settings is challenging. Ongoing implementation efforts were necessary for many studies. Even in studies that were extremely well resourced, implementation was often incomplete. This suggests that cessation programs in hospitals must have clearly articulated evaluation plans in which implementation outcomes are defined and measures are specified at the outset, to enable sufficient follow-up to assess penetration and sustainability. A systematic review on the barriers to implementation in hospital settings suggests that system, staff, and intervention barriers¹⁰² should also be considered to achieve effective implementation. Qualitative data can contribute to understanding the patient and clinician experience of the intervention.¹⁰³ Along with implementation outcomes, we would advocate for improvements in the reporting of intervention effectiveness and cost effectiveness in publications about the implementation of smoking-cessation programs. As smoking cessation interventions become more widespread in hospitals, it will be necessary to routinely collect data to monitor the effectiveness of these programs through consistent reporting of clinical outcomes (eg, measuring quit rates) alongside implementation outcomes. Cost is a key factor in identifying which interventions should be implemented.¹⁰⁴ A recent cost-analysis study outlines substantial

economic and health benefits when patients undergoing a surgical procedure quit smoking.¹⁰⁵ Similarly, a recent systematic review that sought to explore the reported costs of tobacco-control interventions in clinical settings showed that few studies report on interventions costs when assessing intervention effectiveness, with even fewer considering the costs associated with planning and implementation of the intervention.¹⁰⁶ Those authors note that the costs of implementation strategies and adaptations in real-world settings are yet to be quantified.¹⁰⁶ Finally, it is important to acknowledge that higher level policy and structural changes, such as whether the Joint Commission's tobacco-cessation measures are mandated or tied to payment, exert considerable influence on the sustainability of practice change.^{1,107}

This review has several limitations. Because of the number of included publications, we did not contact authors for further information; rather, we relied on the reporting of implementation strategies and outcomes in the included reports. Potentially, authors did not fully report implementation strategies, especially across stages of planning (eg, start-up meetings or stakeholder engagement). We argue that these implementation strategies are important and should be reported within publications. The synthesis drew upon a range of outcome measures and various approaches to measuring these outcome measures.³⁰ Findings were reported against the outcomes published by Proctor et al, although studies often did not define their outcomes according to these criteria. Consolidating these various implementation outcomes meant that only a narrative synthesis of findings was possible. In addition, the focus of this review was studies that had clearly reported implementation strategies and implementation outcomes. However, we note that this focus may mean the exclusion of articles in the literature that report on outcomes such as feasibility and acceptability of smoking-cessation interventions in health settings but do not describe the details of how implementation strategies were selected and tested in real-world settings.^{108,109}

Despite limitations, this review has evaluated a large body of diverse literature to generate recommendations about how to embed smoking-cessation care in hospital settings. A strength is the operationalization of a widely used framework²⁶ and the process of drawing similarities between implementation approaches based on extensive data extraction to manage and review a large number of studies.

Conclusions

The burden of smoking is significant, and addressing this in hospitals is a priority. The current review indicates that training of staff is the predominant approach to achieve this. However, to embed smoking-cessation interventions in hospitals, complex and multistrategic implementation approaches capable of driving system changes must

be embraced. Although brief implementation efforts may be viewed as advantageous because they are less resource-intensive, their capacity to change practice in a sustained way is questionable. Attempts to change clinician behavior or to introduce new models of care are challenging in a short time frame; we recommend planning, resourcing, and investing in a multistrategic approach both before and during implementation to drive successful implementation. It is important to

assess implementation efforts for long-term success. These findings highlight the complexity and difficulty in changing behavior and practice; these are challenges that must be addressed to ensure that health professionals deliver care based on the best available evidence. ■

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