

Cessation for smokers seeking treatment and advice from health care professionals in the hospital setting

Author:

Zoe Kopsaftis, School of Medicine, The University of Adelaide, School of Medicine; and the Department of Respiratory Medicine, The Queen Elizabeth Hospital (Basil Hetzel Institute)

Joseph van Agteren, Wellbeing and Resilience Centre, South Australian Health and Medical Research Institute (SAHMRI); and Flinders University, College of Medicine and Public Health

Kristin Carson-Chahhoud, School of Health Sciences, The University of South Australia

Tim O'Loughlin, Carnegie Mellon University Australia

Brian Smith, School of Medicine, The University of Adelaide, School of Medicine; and the Department of Respiratory Medicine, The Queen Elizabeth Hospital (Basil Hetzel Institute)

Author contact:

zoe.kopsaftis@adelaide.edu.au

Abstract

Cigarette smoking costs Australia and New Zealand billions of dollars per year and is the single most preventable risk to health. Though governments have initiated numerous public health policies which have reduced the incidence of smoking, current usage remains around 15 percent. Making further inroads is likely to require augmenting these interventions with action at the individual level. The hospital setting provides a unique opportunity to assess the efficacy of individual attention. The aim of this study is to make an initial assessment of this efficacy by collating the existing evidence of outcomes achieved by health professionals working with individuals in hospital settings. The systematic literature search resulted in 69 studies (72 citations) for evaluation. Results indicated that a multi-component intervention comprised of high intensity counselling with a minimum of one month of post-discharge follow-up in addition to either nicotine replacement therapy or varenicline tartrate is the most effective combination of individual treatments for improving smoking abstinence, particularly for general inpatients. Further, there was an indication that patients admitted to specialist wards (e.g. cardiovascular) would benefit most from high intensity interventions, regardless of the use of adjunct pharmacotherapy. The evidence for a positive effect on sustained quit smoking rates for peri-operative patients is not definite, but as smoking adversely affects surgical success, implementing multicomponent interventions should still be considered. This review found no clear evidence to support implementation of smoking cessation interventions in the emergency department setting. Overall, interventions throughout the review were heterogeneous, making the estimate of a true effect difficult. Furthermore, there were only low numbers of local studies, with the findings of this review relying mostly upon extrapolation from overseas studies. Given the severity of the burden placed on the health system by smoking, there is a need for continuing endeavours by researchers with the support of the government to identify innovative and effective interventions for smokers that can be delivered by health professionals caring for smokers in the hospital setting.

Cigarette smoke is composed of more than four thousand known chemical species with toxic and carcinogenic properties (Colombo et al. 2014). Smokers breathe this aerosolised gas and particulate cocktail

into their bodies, even though it has been identified as the cause of a long list of diseases and cancers affecting the circulatory, respiratory, reproductive, nervous, urinary and digestive systems (Colombo et al. 2014).

Cigarettes' main psychoactive component, nicotine, has strong reinforcing and rewarding properties, and together with the psychological and environmental cues associated with smoking, makes cigarette smoking an extremely addictive behaviour (Balfour 2009; Laviolette and van der Kooy 2008).

Recent estimates indicate a decrease in the prevalence of smoking, from 29.1 percent of Australians and 25 percent of New Zealanders in the 1990s compared to the most recent figures of 12.8 percent and 16.6 percent respectively (Australian Institute of Health and Welfare 2008; Australian Institute of Health and Welfare 2014; Ministry of Health 2014; Ministry of Health 2015). Though these figures appear to be heading in the right direction there are still many who engage in a behaviour which is the greatest preventable cause of morbidity and mortality, accounting for approximately 15,500 and 5,000 Australian and New Zealander deaths per year respectively (Begg et al. 2007; New Zealand Government 2016).

In common with most other countries, Australia and New Zealand have implemented a range of public policy initiatives targeting cigarette use over the past decades. Key examples include prohibiting the advertisement and promotion of cigarette products, followed by mass media public education campaigns and labelling of cigarette packaging with health warnings, and most recently implementing plain packaging requirements (Cotter 2011; Grace 2016; Miller and Scollo 2016). Financial interventions and methods aimed at increasing quit rates have also been introduced in the form of subsidisation of pharmacotherapy, and price and taxation increases, with the cost of purchasing cigarettes in Australia now almost 10 times more expensive than in the 1990s (Purcell et al. 2012). Perhaps the strongest legislation is the ban on smoking in public places, including (but not limited to) workplaces, bars and restaurants, schools, hospitals and other health-care buildings (New Zealand Drug Foundation 2011; Greenhalgh et al. 2016). These broad public policies and legislature initiatives to date have contributed to a drop in smoking rates (Woodruff et al. 1993; Glasgow et al. 1997; Farkas et al. 1999; Farrelly et al. 1999; Albers et al. 2007; Azagba and Sharaf 2013), and as such have demonstrated the viability of continuing to target smoking cessation on a societal level.

Policy interventions have enjoyed considerable success in reducing smoking. However, smoking reduction is not as great in absolute terms as the percentage decline might imply. That is, the decline in absolute number of smokers is now less, for instance due to population growth. Additionally, smoking rates are influenced by fewer young people taking up the habit, as opposed to reducing current smoker rates. These

recalcitrant smokers are less receptive to changing their behaviour, even with the concerted effort of enforcing the tobacco related policies outlined above (Borland et al. 2012; Australian Institute of Health and Welfare 2014). Hence, additional interventions aimed at the level of individual smokers are required to support these larger scale initiatives. The need to engage the healthcare system in this effort has been outlined in a number of policy documents, including Australia's *National Tobacco Strategy 2012-18*, *Framework Convention on Tobacco* and the *National Preventative Health Strategy* (World Health Organization 2005; National Preventative Health Taskforce 2008, Intergovernmental Committee on Drugs 2012). In broad terms these documents outline the need to improve uptake of existing infrastructure (e.g. Quitline), develop systems where health professionals engage with patients around this issue, and provide policy guidelines on brief interventions for health professionals to implement with smokers in their care (World Health Organization 2005; Greenhalgh et al. 2016). The *National Tobacco Strategy 2012-18* (Intergovernmental Committee on Drugs 2012) specifies that as an industry we must:

Improve management of smoking cessation for all patients in health care facilities, particularly for patients on admission to hospital.

There are a number of evidence-based approaches that have been proven to work in the general smoking population, when attempting to address smoking cessation with patients. One can provide face-to-face counselling (Lancaster and Stead 2005) or can refer to a telephone counselling service (Stead et al. 2013), hereafter referred to as a Quitline. Alternatively, there are a number of smoking cessation medications that can assist during a quit attempt, including varenicline tartrate (varenicline) (Ebbert et al. 2010; Cahill et al. 2013), bupropion hydrochloride (bupropion) (Raupach and van Schayck 2011; Cahill et al. 2013) or nicotine replacement therapy (NRT) (Ferguson et al. 2011; Cahill et al. 2013). Combining pharmacotherapy and counselling, hereafter referred to as a multicomponent strategy, is an additional option, which has been shown to increase quit rates from 10 to 25 percent compared to pharmacotherapy alone (Stead and Lancaster 2012). There are also some alternative methods that often get mentioned when discussing smoking cessation, most notably hypnotherapy, for which conclusive evidence is currently lacking (Barnes et al. 2010).

Healthcare institutes' practices and specific organisational policies in relation to smoking cessation are often underutilised, ad hoc, outdated and

variable between institutions, departments, and even individual healthcare practitioners (Freund et al. 2008; Freund et al. 2009; Bartels et al. 2012; George et al. 2012; Ohakim et al. 2015). In the hospital setting, anecdotal and published evidence suggests that clinical practice guidelines for smoking cessation are sub-optimally translated into practice (Fiore et al. 2012; Freund et al. 2009; Regan et al. 2012; Slattery et al. 2016; Smith et al. 2012), despite a growing evidence base underpinning the recommendations. This is a substantial missed opportunity for effective intervention, with almost 300,000 hospitalisations per year in Australia attributable to cigarette smoking (Hurley 2006). Furthermore, hospitalisation presents a unique opportunity to apply individualised approaches as it:

1. provides a reflection period during an inpatient stay for smokers to reconsider lifestyle factors contributing to their illness/admission, a so-called 'teachable moment' (McBride et al. 2003);
2. makes it difficult (although not impossible) to smoke through enforced initiation of abstinence while in a hospital bed, as a result of widespread smoking bans in hospitals (Rigotti et al. 2000; Purcell et al. 2012), allowing patients to focus on the achievement that they have already quit by the time of discharge; and
3. facilitates the initiation of smoking cessation medication under supervision, which allows monitoring of nausea, craving and titration of medication to avoid adverse events.

Hence, in order to provide a current snapshot of effective quit smoking interventions in the hospital setting, the aim of this review is to evaluate the existing evidence for interventions delivered to smokers admitted or presenting to hospital, who are receiving treatment and advice from healthcare professionals.

The compiled evidence will be discussed with a view to underpin practical and achievable recommendations for policy improvement in this area. Given that smoking is a national and international priority area, there is an opportunity to make a significant impact on patient services for smoking cessation by making a change to current practice approaches.

Methods

Study search strategy

A systematic literature search of the Medline, EMBASE, PsycINFO and The Cochrane Library databases was

conducted in November 2016. Publications investigating smoking cessation policy within the hospital setting (for admitted patients and those attending the emergency department) were examined. We used the following free text search terms to identify relevant records: (smoking cessation) AND (pharmacotherapy OR drug therapy OR counselling OR hypnotherapy OR hypnosis OR aversive therapy OR psychotherapy OR smoke-free policy OR bans OR fines OR penalties OR motivation OR goals).

Grey literature were also searched to identify potentially relevant articles through the International Clinical Trials Registry Platform and ClinicalTrials.gov (searched November 2016), using the key words (smoking cessation) AND hospital. Reference lists of publications meeting all the inclusion criteria were also screened for potentially eligible studies.

Study inclusion criteria

In order to determine the most effective smoking cessation interventions delivered by healthcare professionals in the hospital setting, we reviewed evidence from randomised controlled trials with a minimum three-month follow-up. In the case of perioperative interventions, there was no restriction set at the follow-up period. Trial participants were current smokers admitted to a hospital ward or presenting to a hospital emergency department. Healthcare professionals delivering the intervention were defined as doctors, nurses, pharmacists, physiotherapists, and other clinical professionals providing care within the hospital setting. The intervention could also be delivered by researchers in instances where the procedure would, in practice, be provided by a healthcare professional.

Interventions included were:

1. Behavioural interventions: counselling, support groups, self-help, seminars, motivational lectures, web- and mobile phone-based interventions
2. Pharmacological interventions adjunct to counselling: NRT, bupropion and varenicline. These are generally accompanied by at least minimal counselling by health professionals. When minimal counselling was standardised across each study group, this was considered as isolation of the pharmacological intervention effect
3. Multicomponent interventions: pharmacological and non-pharmacological approaches combined as a package intervention

Comparison groups consisted of usual care, minimal intervention (such as a pamphlet or referral back

to regular General Practitioner for follow-up) or co-intervention (where the control group receives some parts of the intervention but not all).

Analysis methods

From the title, abstract or descriptors, two reviewers screened the retrieved citations to identify potentially relevant trials. Data for included studies were then extracted into standardised templates for trial characteristics and outcome variables. Studies not meeting all the inclusion criteria reported above for study design, subject description, and intervention/comparison group characteristics, were excluded from the narrative synthesis of results. In addition, a risk of bias assessment was conducted to assess the quality of the evidence base. This was undertaken using the report by Tooth et al. (2005) and standard Cochrane risk of bias grading criteria. Bias was categorised as 'high risk of bias' when a particular quality procedure did not occur, 'unclear risk of bias' when data were not reported in the article or when criteria were not relevant and 'low risk of bias' when data for a criterion were reported and adequately addressed in the study design. Review Manager Version 5.3 software was used to generate the risk of bias graphs. Outcome variables of interest were:

- Seven-day point-prevalence smoking abstinence: this refers to whether, at a pre-defined time point, an individual has smoked cigarettes/tobacco in the previous seven days.
- Continuous smoking abstinence: relates to cessation of smoking from the initial quit date to a pre-defined time point.

These outcomes are often measured by the participant's self-report, and may be validated through biochemical measures, e.g. cotinine samples obtained via blood, urine or saliva, or carbon monoxide assessed through expired breath or blood specimen (Benowitz et al. 2002; Hughes et al. 2010).

For this review we will report seven-day point-prevalence in the first instance, and where this is not measured we will report 30-day continuous smoking abstinence. These self-reported measures are highly correlated and will lead to the same conclusion (Velicer and Prochaska 2004). Other outcomes which will be discussed in the review are: number and type of adverse events in case of pharmacological interventions; number and type of postoperative complications in case of interventions focusing on surgical patients; and costs associated with each intervention.

While not *direct* smoking cessation measures, these outcomes are clinically relevant and should be taken under advisement when making recommendations for change of practice.

What kind of research is available?

After duplicates were removed, 2768 citations from the electronic search were screened for eligibility. Of these, 62 citations were eligible for evaluation and a further 10 were identified through hand searching included articles and relevant systematic reviews. Tables 1, 2 and 3 are a summary of the characteristics and findings of the 69 studies (72 citations) included for evaluation, separated into the three main types of intervention.

Initially this document aimed to focus on Australia and New Zealand studies, with reference to international studies. However, the comprehensive literature search identified only seven studies undertaken in Australia and none from New Zealand. As such, all relevant studies have been included together for narrative synthesis; studies from North America and Europe being the main contributors to the current evidence base.

Methodological assessment was undertaken for all 72 citations and a visual summary is provided in Figure 1, while individual study quality is presented in Figure 2. Overall, study quality was determined to be average. There were many studies where a low or high risk of bias judgement was precluded due to poor reporting of study methods in the publication; this resulted in a high volume of unclear bias assessments. High risk of bias assessment was predominantly noted in the performance bias domain; this is likely attributable to difficulty blinding participants with behavioural interventions. For pharmacological interventions this was generally well done.

The results below are split for interventions targeting the general inpatient population and patients on cardiac wards. This decision was made because pharmacological interventions are often perceived to be associated with increased risk and caution for cardiac patients; furthermore, there is a substantial body of research targeting this specific patient group. Upon review of the evidence base, cancer patients were not placed in a dedicated subgroup, as it was hypothesised that they predominantly fall within the pre-operative or outpatient group depending on disease status.

In addition, it is important to note that the 'intensity' of behavioural interventions will be discussed below. This refers not necessarily to the quality of the intervention but to the composition of the intervention itself; for example, duration and number of contacts by health care professionals (longer and more

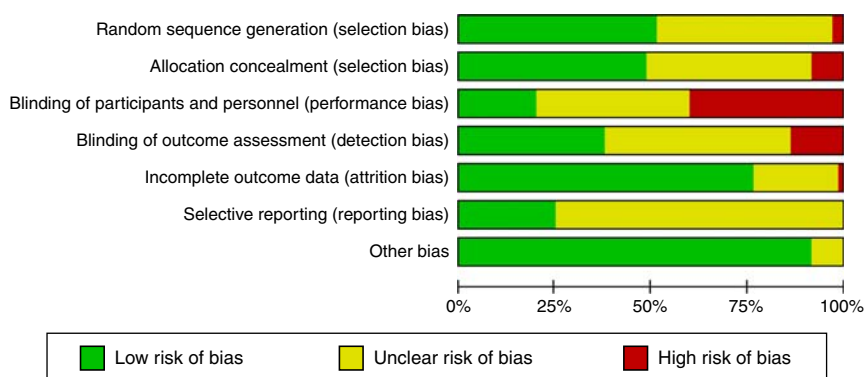


Figure 1: Summary of risk of bias for included studies

equates to a higher intensity). Quality of these interventions is an important factor when considering the results, and may have had a bearing on the relative success or otherwise of the studies included for review. Aspects of the interventions which would facilitate a quality judgement (e.g. delivery of intervention by a specialist or a generalist; training of study personnel to ensure consistent intervention delivery) are reported variably, making it difficult for the authors to rate the intervention quality.

Interventions targeting the general inpatient population

Behavioural interventions

For reasons explained previously, high intensity behavioural interventions are recommended for inpatient smokers to successfully quit their habit. These recommendations are influenced by the results of a Cochrane systematic review and meta-analysis that concluded that high intensity behavioural interventions, being those that consist of a hospital counselling session and a follow-up for at least one month, lead to a significant improvement in quit rates (Rigotti et al. 2012). These recommendations are accurate when behavioural and multicomponent (counselling and access to free pharmacotherapy) interventions are put together, which was the case in the Rigotti et al. (2012) Cochrane review. However, when solely looking at behavioural counselling interventions, specifically split for admitting ward, results point to different conclusions: no clear evidence in favour of either low or high intensity behavioural interventions.

Three studies used lower intensity interventions, and unsurprisingly for such a small pool of evidence, conclusive evidence of effectiveness was lacking. While Meysman et al. (2010) found that a brief

nurse-delivered stage-based intervention using trained nurses was better than a booklet in getting patients to quit, a study by Rigotti et al. (1997) failed to find a significant advantage with a 15-minute bedside counselling session combined with post-discharge counselling over usual care at 6-month follow-up. Similarly, Pederson et al. (1991) did not find any differences when comparing brief quit advice with more intensive counselling consisting of up to eight 15–20 minute sessions while participants were still hospitalised.

Interestingly, studies using higher intensity interventions also showed no significant differences in favour of intervention. De Azevedo et al. (2010) used tailored counselling and up to seven follow-up telephone calls, while Hennrikus et al. (2005) used counselling and up to six follow-up telephone calls, with neither trials showing higher smoking cessation rates compared to brief advice or usual care. Similarly, the study by Smith et al. (2011) did not find significant benefits from a high intensity intervention (bedside counselling, seven telephone follow-ups and minimal intervention package) over minimal intervention. These trials, with a combined sample size of 2228 participants, are only opposed by a small study of 77 participants, which found that an intensive 12-week nurse-delivered relapse management intervention, including eight telephone follow-up calls, showed a 42 percent quit rate compared to 15 percent in the usual care group (Caruthers et al. 2006).

All studies above used either telephone or face-to-face follow-up. Only one study (Harrington et al. 2016) used at a different mode of delivery – a web-based intervention. The intervention focused on quit smoking education and allowed for asynchronous communication with quit smoking counsellors. The authors found that at end of follow-up, results significantly favoured control, 18.5 percent versus 13.8 percent. These results need to be considered in the context of problematic treatment adherence, which may have negatively

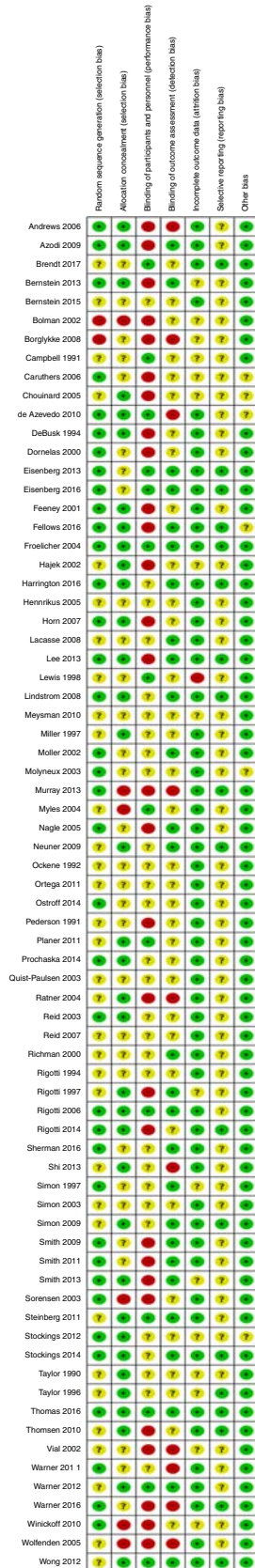


Figure 2: Risk of bias assessment for individual studies

impacted the findings. Treatment adherence problems for web-based and mobile-based interventions in the general population are widely recognised, and can be attributed (among other reasons) to the inexperience of intervention designers in designing engaging solutions (Kelders et al. 2012). This problem will hopefully be solved as the eHealth and mHealth research field matures and interventions become more sophisticated.

Pharmacological interventions adjunct to counselling

Evidence for the effectiveness of bupropion prescribed in the general hospital setting is currently lacking; three trials used bupropion in a cardiac population (see the cardiac section) and two trials targeted pre-operative patients (see pre-operative section). One trial assessed its use in the general population (Simon et al. 2009). The study found no significant improvement in quit rates with bupropion. Interestingly, however, it reported non-significant higher rates of abstinence among the placebo group (31 percent) compared with the bupropion group (15 percent) at six-month follow-up.

The sole study looking at the effect of NRT versus placebo in the hospital setting did not yield significantly higher quit rates when both groups were provided as an adjunct to intensive counselling with five face-to-face follow-up sessions (Campbell et al. 1991). All other NRT studies were either performed in the cardiac or pre-operative setting, or were provided as a multicomponent intervention.

The two studies that tested the use of varenicline in the hospital setting found conflicting results. A well-powered Australian study found that varenicline adjunct to counselling by Quitline significantly increased quit rates to 31.1 percent compared to the 21.4 percent of smoke-free patients treated by Quitline alone (Smith et al. 2013). Alternatively, a much smaller pilot study by Steinberg et al. (2011) found no significant difference between varenicline and placebo adjunct to low intensity counselling. In this trial, only just over half of the participants treated with varenicline were compliant, but those patients who were compliant with the medication showed higher quit rates when treated with varenicline (80 percent versus 56 percent); unfortunately, the study was not sufficiently powered to detect this kind of difference.

Multicomponent interventions

Multicomponent interventions for inpatient smoking cessation are widely encouraged by best-practice

guidelines (Fiore et al. 2000; West et al. 2000; Global Initiative for Chronic Obstructive Lung Disease 2015; Yang et al. 2016). Most studies found in this review evaluated a bedside counselling program combined with NRT and post-discharge telephone and/or outpatient cessation support. Similar to behavioural interventions, counselling can be broken up into high and low intensity. For low intensity interventions, three studies were found that tested the effectiveness of low intensity counselling in addition to provision of NRT, none of which found a significant effect on quit rates (Molyneux et al. 2003; Nagle et al. 2005; Thomas et al. 2016).

The results of eight studies investigating high intensity multicomponent interventions, on the other hand, showed favourable smoking cessation rates. The largest of these studies (Miller et al. 1997), comprising 2024 patients, found that an intervention consisting of counselling, access to an educational video, NRT and one follow-up telephone call was not demonstrably superior to usual care for smoking cessation. However, after increasing the behavioural counselling intensity, by adding three extra follow-up telephone calls and provision of extra face-to-face counselling in the event of relapse, smoking cessation significantly improved by 7 percent over usual care. Similarly, Simon et al. (1997; 2003) conducted two studies evaluating a multicomponent intervention comprised of individual counselling, educational video, provision of three months of NRT, printed resources and five follow-up telephone calls. In the first instance it was compared to a brief pre-discharge counselling session and printed resources and though not significant at six months, abstinence favoured the intervention group by 8 percent, and at 12 months this further improved to 14 percent and became a statistically significant difference (Simon et al. 1997). In the second evaluation, the multicomponent intervention was compared to two months of NRT and a brief counselling session (Simon et al. 2003). Once again results favoured intervention at six months (35 percent vs 21 percent) and 12 months (33 percent vs 20 percent); both differences were statistically significant. This is the first time an identical intervention of this type has been evaluated with reproducible results.

High intensity individually oriented multicomponent interventions may be a resource-intensive exercise, and as such several studies have researched different intervention formats, specifically referring to outpatient services, the use of group-formats, automated telephone counselling, and the use of computers to deliver the interventions.

Simply referring patients to outpatient counselling is not sufficient to maintain high quit rates. Sherman et al. (2016) found that providing patients post-discharge (up to 42 days) counselling via telephone in addition to eight weeks of NRT out-performed a simple referral to Quitline for proactive counselling by almost 10 percent at two months and 5 percent at six months for 30-day point prevalence abstinence.

Delivering inpatient counselling within a group setting is a promising alternative to individual bedside counselling. Borglykke et al. (2008) tested group counselling combined with standard cessation information and provision of NRT compared to standard cessation information alone. Results favoured the multicomponent strategy, where cessation at one-year follow-up was 17 percent superior to control.

Two recent studies investigated the use of innovative technology aimed at automating follow-up counselling and triaging smokers who needed additional human-delivered counselling. Rigotti et al (2014), found significant results when using an automated interactive voice response system to provide follow-up counselling, in addition to free NRT, with superior quit rates of 11 percent higher in the intervention group. They also performed a cost analysis that determined the costs per patient for the intervention were US\$354 for the first 12 months and US\$108 for subsequent years (Rigotti et al. 2014). Fellows et al. (2016) similarly tested an innovative voice recognition intervention in addition to assisted outpatient referrals and a multicomponent inpatient intervention, however, they reported no significant difference in quit smoking rates. Uptake of NRT in the Fellows et al. (2016) trial was considerably lower, which might explain the difference in results. These results indicate that simple voice recognition counselling on its own is not sufficient, but that it proves a promising future research area when tested as a complement to a multicomponent intervention and free NRT.

Only one study assessed the effectiveness of a computer delivered intervention in addition to other familiar components (NRT, print resource, individual counselling and follow-up telephone support) (Prochaska et al. 2014). This multicomponent intervention proved successful compared to usual care, improving smoking abstinence by approximately 10 percent at three-month follow-up. This was sustained at 18-month follow-up with 20 percent of participants reporting smoking abstinence in the intervention group compared to just 7.7 percent in the control. Interestingly, the intervention group also demonstrated decreased risk of hospital readmission. When viewed in combination with the promising results of another web/computer-based intervention, discussed above (Harrington et al. 2016), this is

likely a priority area for further cessation research given its potential for the easy implementation of a standardised program with long-term results.

Summary of smoking cessation treatments for the general inpatient setting

There is insufficient evidence to suggest that the general inpatient population benefits from brief counselling, referral to professional counselling services after discharge or even high intensity behavioural interventions that include telephone follow-up counselling. Furthermore, evidence for the use of pharmacotherapy on its own is inconsistent. The only intervention type that was significantly more effective in increasing quit rates was the use of multicomponent interventions. Specifically, the biggest evidence based interventions involve combining provision of (free) NRT with intensive counselling. Using innovative approaches (automated telephone counselling and computer-delivered interventions) to complement or substitute human-delivered counselling looks promising, but the current evidence base is not strong enough to recommend widespread adoption.

Patients on cardiac wards

Behavioural interventions

Three studies evaluated the effectiveness of low intensity behavioural interventions in patients with a cardiac admission, failing to find sufficient evidence for effectiveness. Neither Bolman et al. (2002) nor Hajek et al. (2002) found superior quit rates for low intensity interventions consisting of brief bedside counselling and other behavioural components (e.g. declaration to commit to quitting). Adding a single one-week follow-up call to an extensive cognitive behavioural intervention was not sufficient in inducing higher quit rates compared to usual care (Rigotti et al. 1994). Quit rates for cardiac patients were, however, higher as compared to the general inpatient setting, despite not being higher than usual care, which does indicate a higher susceptibility to quit smoking for this population.

This notion is further supported by results from studies using higher intensity behavioural interventions. In contrast to the general inpatient population, cardiac patients show significantly higher quit rates of between 39–70 percent as found by five studies. Bedside counselling and education complemented with telephone follow-ups were effective in improving quit rates, with one study finding these results were sustained up to

five years later (Chouinard and Robichaud-Ekstrand, 2005; Dornelas et al. 2000; Feeney et al. 2001; Ockene et al. 1992; Smith and Burgess 2009).

Using a group format as opposed to individual counselling, or targeting smoking cessation as part of a larger cardiac care improvement interventions, are also promising. A bi-weekly group smoking cessation session, combined with telephone follow-up after discharge, resulted in abstinence up to 12 months in 50 percent of patients treated in the group sessions versus 37 percent of patients given no further instruction on how to quit (Quist-Paulsen and Gallefoss 2003). Quit rates of up to 70 percent were found when evaluating a multicomponent intervention focusing on improving case-management of cardiac patients (DeBusk et al. 1994). The intervention assessed smoking and nutritional counselling, the use of lipid-lowering drug therapy and exercise training, and included 12 nurse-initiated telephone follow-ups and 12 patient visits to either the nurse case manager or the laboratory for blood testing.

Pharmacological interventions

Four trials investigated the differences between pharmacotherapy targeting smoking cessation, and placebo as a complement to low intensity counselling. Review of the existing literature demonstrates that there is no definitive evidence to support adding bupropion to counselling for cardiac patients, as two trials failed to find a significant benefit in this population (Eisenberg et al. 2013; Planer et al. 2011). A third trial by Rigotti et al. (2006) only found a significant short-term difference favouring bupropion when looking at a subset of treatment compliant participants; this result was not maintained at one-year follow-up. A further study investigated the use of varenicline as a complement to low intensity counselling, which saw significantly higher rates of non-smokers at the end of the trial – 47.3 percent versus 32.5 percent (Eisenberg et al. 2016).

Multicomponent interventions

Multicomponent interventions for cardiac inpatients were largely led by nurses and included a higher intensity behavioural component. Interventions overall point to increased cessation rates of at least 10 percent up to a period of 3–6 months, but results were in general not sustained at 12 months. Froelicher et al. (2004) found higher point prevalent smoking cessation rates of 10.7 percent at 6 months and overall higher continuous smoking abstinence ($p=0.04$)

for their multicomponent intervention versus brief counselling. Reid et al. (2003) similarly found 11 per cent higher quit smoking rates at 6 months, for an intervention that provided extra follow-up care for those patients who had relapsed. These results were replicated when they tested a similar intervention but used voice response technology to take over the follow-up counselling (Reid et al. 2007).

These results were countered on the one hand by a study with significantly higher quit smoking rates, and on the other hand a study that failed to find results. Taylor et al. (1990) found that a multicomponent intervention over usual care almost doubled smoking cessation rates (61.6 percent vs 32 percent). Conversely, a recent three-arm study (Berndt et al. 2017) comparing usual care to follow-up counselling performed by telephone or follow-up counselling done face-to-face did not find significant between-group differences. However, when the latter split the groups into low socioeconomic status and high socioeconomic status, telephone counselling and face-to-face counselling outperformed usual care.

Summary of smoking cessation treatments for the cardiac setting

High intensity behavioural as well as multicomponent interventions are effective in increasing quit smoking rates for patients with cardiac conditions. While behavioural interventions were heterogeneous in their intervention designs, making it difficult to nominate the exact program which would be most effective, it can be said that any inpatient smoking cessation intervention for cardiac patients should include a behavioural component extending into the post-discharge period. Where possible and appropriate, the provision of free quit smoking medication could be considered as results show overall favourable short to medium term results.

Emergency department patients

There is no clear evidence to support the use of behavioural smoking cessation interventions in the emergency department. The only trial available failed to find a difference between two-minute generic advice and a more intensive intervention, including a self-help workbook and three follow-up telephone calls, when targeting smoking youth aged 14–19 years old. Quit rates were 2.5 percent for the intervention and 2.9 percent for control (Horn et al. 2007).

There appeared to be no difference between provision of a multicomponent intervention with either

low or high intensity behavioural counselling in the emergency department setting. Three trials studied multicomponent interventions including low intensity behavioural support. Bernstein et al. (2013) and Bernstein et al. (2015) tested brief counselling, six weeks of NRT and referral to Quitline (for general smokers) or a single follow-up telephone call (for substance abusers). Though these results were promising at the three-month follow-up, they were not sustained at 12 months. Richman et al. (2000) failed to find even short-term positive results for a similar program compared to an educational pamphlet, with quit rates of 10.9 percent versus 10.4 percent.

Only one emergency department initiated a multi-faceted intervention including a higher-intensity behavioural component, consisting of four follow-up telephone calls (Neuner et al. 2009). Contrary to results of higher-intensity interventions in the general and cardiac inpatient settings, this study demonstrated similar results between groups when compared to usual care: 14.2 percent versus 11.3 percent respectively.

Lack of successful outcomes in the emergency department, even for multi-faceted interventions including a higher-intensity behavioural component, is inconsistent with results seen in other hospital settings. Given the inundation of patients in the emergency department and the need to triage patients according to urgency, as well as costs associated with intervention delivery, this may not be the most suitable opportunity for dedicated smoking cessation interventions.

Peri-operative patients

Providing a personalised letter from a consultant in combination with nurse quit smoking advice and a referral to a stop smoking service improved quit rates pre-operation (18 percent), as opposed to providing a general quit smoking booklet and nurse advice (8 percent) (Andrews et al. 2006). The only other peri-operative behavioural intervention did not detect a difference between brief advice and brief advice plus a carbon monoxide check on the day of surgery (Shi et al. 2013).

Only two pharmacological studies were identified for the peri-operative setting. Myles et al. (2004) did not find bupropion to be more effective than placebo prior to elective surgery in terms of overall abstinence rates at hospital admission and six-month follow-up (this trial started two months before surgery was scheduled and encompassed two face-to-face counselling sessions, as well as weekly telephone

follow-up). Alternatively, a 12-week course of varenicline as part of a perioperative intervention including standardised counselling identified a significant 10 percent improvement in smoking abstinence with varenicline compared to placebo which was sustained up to 12 months (Wong et al. 2012).

Multicomponent interventions that included higher-intensity behavioural support found favourable quit rates for the peri-operative setting overall. Lindström et al. (2008) and Lee et al. (2013) used similar interventions consisting of weekly long counselling sessions, referral to Quitline and free NRT, with both trials finding significantly higher quit rates. The Lindstrom trial found that 33 percent versus 15 percent of smokers had quit at 12-month follow-up, and the Lee trial found 30 percent versus 11 percent had quit at three-month follow-up, for intervention compared to control. A study comparing peri-operative nurse-led telephone, computer and in-person support in conjunction with NRT, found that in the two weeks pre-surgery, abstinence was significantly higher than control (89 percent vs 13 percent), which was maintained in the post-surgery period (92 percent vs 50 percent) (Sørensen and Jørgensen 2003). Furthermore, a multi-modal intervention delivered in person, by telephone and computer as well as free NRT resulted in 73 percent pre-surgical abstinence compared to 56 percent in the usual care group. Though these results diminished after the peri-operative period, the intervention group still out-performed the control group (18 percent vs 5 percent) (Wolfenden et al. 2005).

These favourable results were opposed by two studies that failed to find a significant difference between intervention and control. Ratner et al. (2004) found 20 percent more abstinence within 24 hours of commencing the intervention, but failed to find significant differences beyond the post-operative period. Referral to Quitline in combination with NRT and clinician-driven motivation to use Quitline did not lead to significant differences in abstinence rates at one or three-month follow-up (Warner et al. 2011).

Finally, two studies employed a weaning/scheduled quit program to encourage peri-operative smoking cessation. Adding a scheduled quit date and cigarette weaning program to best practice care (five nurse-led bedside and telephone counselling and NRT) was ineffective; the control group who received best practice care alone demonstrated similar three and six-month abstinence prevalence (approximately 30 percent) (Ostroff et al. 2014). Moller et al. (2002) provided NRT and a consultation session with a nurse, where the participant received a personalised

nicotine substitution schedule and was encouraged to quit smoking entirely, or at least reduce consumption by 50 percent. Though this study did not record smoking abstinence outcomes, it demonstrated a significant improvement in post-surgical complications, particularly wound healing, as well as, a non-significant improvement in the need for second surgery and cardiovascular complications, compared to the control group (Møller et al. 2002).

The evidence for long-term abstinence when targeting peri-operative patients is not clear-cut. Overall, high intensity multicomponent interventions seem to point to sustained quit smoking rates compared to usual care, but more research is still needed. Referring to Quitline and placing patients on a weaning schedule, however, did not lead to significant longer-term quit rates. Overall, higher quit rates were demonstrated in this population as compared to the general inpatient population. While control often comprised basic cessation advice, it also resulted in an increase in abstinence from baseline. This effect is likely attributable to the 'hard deadline' and gravity of impending surgery followed by enforced smoke-free environments during post-operative hospital stays. Although results are not definitive, implementing multicomponent interventions should be considered, due to the adverse effects smoking has on the success of surgical procedures and related potential post-operative complications.

Adverse events related to pharmacological interventions

Out of the 13 pharmacological studies, 11 reported information pertaining to adverse events as part of their investigation. Five studies used bupropion, four used varenicline and four used NRT in forms of gum, lozenges and/or patches. Among the five studies reporting on bupropion, only one reported a significant increase in adverse events between the intervention and comparator population, finding dizziness to be more common among bupropion participants compared to placebo (14 percent vs 1.4 percent; $p = 0.005$) (Planer et al. 2011). Other common adverse events reported among all five studies and across both arms (intervention and placebo) include insomnia, dry mouth, vomiting, sleep disturbance and re-hospitalisation. An increased risk of suicidal thoughts, changes in thinking and behaviour and worsening of depression are known to occur with antidepressants including bupropion. However, none of the five studies evaluated found this to be significantly worse among the bupropion participants.

Among the four studies reporting on varenicline, three found a statistically significant increase in nausea and two reported an increase in abnormal dreams, both among varenicline users. Nausea occurred in 13.9–25 percent of participants on varenicline compared to 1.5–8.6 percent of comparator participants. Other common side effects include insomnia, headache and irritability. A black box warning did exist for varenicline related to possible development of serious neuropsychiatric symptoms including suicidal thoughts, hostility and agitation. However, in December 2016 the US Food and Drug Administration approved dropping the warning due to recent evidence from the EAGLES publication (Evaluating Adverse Events in a Global Smoking Cessation Study) (Anthenelli et al. 2016). This study compared the safety of varenicline, bupropion, NRT and placebo in approximately 8000 smokers with and without psychiatric disorders, finding that varenicline did not increase neuropsychiatric events among those with a history of psychiatric disorders. Although the black box warning has been lifted, the labelling still states that post-marketing studies have reported serious or clinically significant neuropsychiatric adverse events. None of the four studies evaluating varenicline in this review found any significant increase in neuropsychiatric events, cardiovascular events or serious skin reactions between groups.

Among the four NRT studies only two reported information about adverse events and none of these were found to be significantly different between groups. The most common side effects were gastrointestinal such as nausea and vomiting. Of the 35 multicomponent interventions, only six studies reported that an adverse event had occurred. The most common side effects with use of transdermal nicotine patch were skin reactions such as site irritation and erythema, which resolved with discontinuation of the patch. Other common side effects included nausea, headache, sleep disturbances/nightmares and dizziness. However, among studies using a placebo patch as a comparator there was no significant difference between groups in relation to these outcomes (Lewis et al. 1998; Molyneux et al. 2003; Sørensen and Jørgensen 2003). No adverse events were mentioned specifically for other types of nicotine replacement therapy such as gums, lozenges, inhalers, and mists.

Implications for practice

When considering smoking cessation interventions for the inpatient setting, health institutes need to consider intervention and patient type, as patients

admitting to hospital for different reasons may have variable responses to different types of interventions. Patients admitted to a cardiac ward, as opposed to a general ward, showed higher quit rates when they were offered face-to-face counselling, which needs to be followed by either face-to-face or telephone follow-up for at least one month. A simple one-off counselling session, even if it is extensive, is not sufficient to improve cessation rates. The behavioural counselling program can be supplemented with NRT, but it is not necessary as these patients respond to the intervention with or without NRT. This is welcome news, as treatment compliance to smoking cessation pharmacotherapy and enthusiasm for its use in general is often sub-optimal (Ferguson et al. 2011).

When looking at the general inpatient setting, participants do not show higher quit rates when treated solely with a behavioural intervention, regardless of whether there is intensive follow-up or not. This patient group requires the provision of (free) NRT in order for smoking cessation interventions to become effective. Alternatively, patients can be prescribed varenicline, as this medication has been shown to be effective and safe in the hospital population, as well as the general population (Anthenelli et al. 2016; Sterling et al. 2016).

Smoking cessation counselling interventions can successfully be embedded within already existing models of care, specifically by training ward nurses to counsel and provide follow-up. This is a similar conclusion as that found by the Cochrane review on nursing interventions for smoking cessation (Rice et al. 2013). Health institutes should consider making smoking cessation, and counselling on other health related factors, such as alcohol use and exercise, an official part of the health professional's role. They should ensure that the health professional has enough resources, time and training to ensure they are capable to perform these important duties.

There was no evidence to support quit smoking interventions in the emergency department. While smoking cessation should be discussed as part of the 'teachable moment' that is hospitalisation (McBride et al. 2003), health professionals should carefully consider whether the patient is likely to benefit from a quit smoking intervention (based on admitting reason, access to pharmacotherapy, and feasibility of running a high intensity behavioural intervention), or whether it would be more fruitful to address other health problems or behaviours that would be more likely to change. Similarly, healthcare institutions and individual professionals should weigh the costs and available resources of focusing on smoking cessation in this setting in light of the current lack of evidence.

Implications for research

Though there has been substantial research in the field of interventions for inpatient smoking cessation, a definitive conclusion on the exact elements of the most effective approach is lacking. This is largely attributed to heterogeneous interventions and a large proportion of neutral results. Overall, we may infer that interventions including both high intensity behavioural counselling, and either NRT or varenicline have been most effective.

Previously, diagnosis of a chronic condition has been associated with increased smoking cessation. More specifically, patients with cardiac and cancerous disease demonstrate a greater desire and aptitude for quitting (Hermanson et al. 1988; McWhorter et al. 1990; Novotny et al. 1990; Salive et al. 1992). This is consistent with the findings of this review, where interventions were most successful when implemented in cardiac as opposed to general medical, surgical and emergency units. While it may be that health professionals in specialist units (e.g. cardiovascular) place greater emphasis on the benefits of smoking cessation than general medical units (Emmons and Goldstein 1992), future research exploring patients' attitudes toward the importance of quitting in relation to their type of disease may provide the required insight to close the gap.

Surprisingly, there was only limited evidence for more innovative interventions, with only four studies testing the effectiveness of a computer or web-based solution (Wolfenden et al. 2005; Ostroff et al. 2014; Prochaska et al. 2014; Harrington et al. 2016), and no studies testing the use of smartphone apps. While these studies did not favour an electronic intervention as such, issues with adherence were identified. As this field of research evolves, further understanding of effective implementation strategies could unlock the potential of these interventions. As the burden on our health professionals and the demand for cost-effective care increases, developing, testing and implementing innovative tools to track patient progress on vital health behaviour such as smoking cessation becomes increasingly important. Preliminary results from the general population are promising in terms of feasibility, acceptability and smoking abstinence (Bricker et al. 2014; Ubhi et al. 2015). As this technology becomes ingrained in society's daily life, it presents the greatest opportunity for innovative research.

The current evidence base lacks data for the cost-effectiveness of these hospital-based interventions. A high intensity behavioural intervention in combination with provision of NRT was estimated to

cost US\$354 in the first year of implementation and US\$108 for subsequent years (Rigotti et al. 2014). However, when in-person counselling was replaced with a batch of telephone sessions in combination with NRT, there was an estimated cost of approximately US\$75 per patient (Sherman et al. 2016). While this is by no means sufficient evidence of cost-effectiveness to change policy and practice, it does not exclude the hospital as a viable setting for intervention, suggesting that using existing models of care and infrastructure can keep costs low.

The socioeconomic burden of smoking on the health system, a great deal of which can be attributed to hospital use, is disproportionate to the research effort from Australia and New Zealand. Though smoking cessation is a national priority area and policies recommend that hospital and health care professional intervention is necessary, just seven of the included studies were conducted in Australia and none in New Zealand. Of these, only three demonstrated beneficial effects in favour of intervention; a multicomponent computer based intervention (Wolfenden et al. 2005), inpatient prescription of varenicline and bedside facilitation of Quitline contact (Smith et al. 2013), and high intensity behavioural counselling with an extended period of follow-up telephone calls (Feeney et al. 2001). Translational clinical research can be a lengthy and costly process, and within the hospital system this is often investigator-led with costs coming from already restricted operating budgets. Redirecting some governmental funds into a research grant scheme could and should target two important areas for bridging the knowledge-translation gap that currently exists. The first initiative would be a commitment to the development of an evidence-based hospital smoking cessation program, which also takes into account strategies that support the ongoing provision of this intervention beyond the study period. This should be accompanied by a methodologically rigorous and reproducible evaluation, with a commitment to regular review for currency. Secondly, a grant scheme could invite more interest in continued innovation in this area. Despite the existence of a large body of evidence, hospital cessation research needs to continue to evolve and grow to incorporate such emerging approaches as eHealth and mHealth interventions, which could prove invaluable to the cessation effort.

Overall, this review has provided an evidence base predominantly from overseas, which indicates the merits of ward-based intervention for smoking cessation and provision of post-discharge follow-up by health professionals. Though results are not overwhelmingly favourable, given the current state of socioeconomic burden caused by smoking, perhaps

something is better than nothing. However, it is apparent from this review that local and innovative (web and smartphone-based) research is lacking, and would benefit from a more concerted effort by health researchers with support from the government.

References

- Albers, AB, Siegel, M, Cheng, DM, Biener, L and Rigotti, NA 2007. Effect of smoking regulations in local restaurants on smokers' anti-smoking attitudes and quitting behaviours. *Tobacco Control* 16(2): 101–06. doi: 10.1136/tc.2006.017426.
- Andrews, K, Bale, P, Chu, J, Cramer, A and Aveyard, P 2006. A randomized controlled trial to assess the effectiveness of a letter from a consultant surgeon in causing smokers to stop smoking pre-operatively. *Public Health* 120(4): 356–58. doi: 10.1016/j.puhe.2005.10.013.
- Anthenelli, RM, Benowitz, NL, West, R, St Aubin, L, McRae, T, Lawrence, D, Ascher, J, Russ, C, Krishen, A and Evins, AE 2016. Neuropsychiatric safety and efficacy of varenicline, bupropion, and nicotine patch in smokers with and without psychiatric disorders (EA-GLES): a double-blind, randomised, placebo-controlled clinical trial. *The Lancet* 387(10037): 2507–20. doi: 10.1016/S0140-6736(16)30272-0.
- Australian Institute of Health and Welfare 2008. *Australia's Health 2008*. Cat.no.AUS 99. Canberra, available at library.bsl.org.au/jspui/bitstream/1/975/1/Australia's_Health_2008.pdf (accessed 8 March 2017).
- Australian Institute of Health and Welfare 2014. *National Drug Strategy Household Survey Detailed Report 2013*. Drug statistics series. Cat.no.PHE183. Canberra, available at: www.aihw.gov.au/getmedia/dc31e56a-24b8-41e2-908d-fd64c1fad3/16835-12Feb2015.pdf.aspx (accessed 8 March 2017).
- Azagba, S and Sharaf, MF 2013. The effect of graphic cigarette warning labels on smoking behavior: evidence from the Canadian experience. *Nicotine & Tobacco Research* 15(3): 708–17. doi: 10.1093/ntr/nts194.
- Balfour, DJ 2009. *The Neuronal Pathways Mediating the Behavioral and Addictive Properties of Nicotine*. in: Henningfield JE, London ED and Pogun S. (Eds), *Nicotine Psychopharmacology*, Springer, Heidelberg.
- Barnes, J, Dong, CY, McRobbie, H, Walker, N, Mehta, M and Stead, LF 2010. Hypnotherapy for smoking cessation. *Cochrane Database of Systematic Reviews* (10): CD001008. doi: 10.1002/14651858.CD001008.pub2.
- Bartels, C, AbuHaliga, ARY, McGee, H, Morgan, K, McElvaney, NG and Doyle, F 2012. A survey of the prevalence of smoking and smoking cessation advice received by inpatients in a large teaching hospital in Ireland. *Irish Journal of Medical Science* 181(3): 445–49. doi: 10.1007/s11845-011-0792-3.
- Begg, S, Vos, T, Barker, B, Stevenson, C, Stanley, L and Lopez, A 2007. *The Burden of Disease and Injury in Australia 2003*. Australian Institute of Health and Welfare, Canberra.
- Benowitz, NL, Jacob, P, Ahijevych, K, Jarvis, MJ, Hall, S, LeHouezec, J, Hansson, A, Lichtenstein, E, Henningfield, J and Tsoh, J 2002. Biochemical verification of tobacco use and cessation. *Nicotine & Tobacco Research* 4(2): 149–59. doi: 10.1080/14622200210123581.
- Berndt, NL, de Vries, H, Lechner, L, Van Acker, F, Froelicher, ES, Verheugt, F, Mudde, A and Bolman, C 2017. High intensity smoking cessation interventions: Cardiac patients of low socioeconomic status and low intention to quit profit most. *Netherlands Heart Journal* 25(1): 24–32. doi: 10.1007/s12471-016-0906-7.
- Bernstein, SL, Bijur, P, Cooperman, N, Jearld, S, Arnsten, JH, Moadel, A and Gallagher, EJ 2013. Efficacy of an emergency department-based multi-component intervention for smokers with substance use disorders. *Journal of Substance Abuse Treatment* 44(1): 139–42. doi: 10.1016/j.jsat.2012.05.005.
- Bernstein, SL, D'Onofrio, G, Rosner, J, O'Malley, S, Makuch, R, Busch, S, Pantalon, MV and Toll, B 2015. Successful tobacco dependence treatment in low-income emergency department patients: a randomized trial. *Annals of Emergency Medicine* 66(2): 140–47. doi: 10.1016/j.annemergmed.2015.03.030.
- Bolman, C, de Vrie, H and van Breukelen, G 2002. Evaluation of a nurse-managed minimal-contact smoking cessation intervention for cardiac inpatients. *Health Education Research* 17(1): 99–116. doi: 10.1093/her/17.1.99.
- Borglykke, A, Pisinger, C, Jørgensen, T and Ibsen, H 2008. The effectiveness of smoking cessation groups offered to hospitalised patients with symptoms of exacerbations of chronic obstructive pulmonary disease (COPD). *The Clinical Respiratory Journal* 2(3): 158–65. doi: 10.1111/j.1752-699X.2008.00055.x.
- Borland, R, Partos, TR, Yong, HH, Cummings, KM and Hyland, A 2012. How much unsuccessful quitting activity is going on among adult smokers? Data from the International Tobacco Control Four Country cohort survey. *Addiction* 107(3): 673–82. doi: 10.1111/j.1360-0443.2011.03685.x.
- Bricker, JB, Mull, KE, Kientz, JA, Vilardaga, R, Mercer, LD, Akioka, KJ and Heffner, JL 2014. Randomized, controlled pilot trial of a smartphone app for smoking cessation using acceptance and commitment

therapy. *Drug and Alcohol Dependence* 143: 87–94. doi: 10.1016/j.drugalcdep.2014.07.006.

Cahill, K, Stevens, S, Perera, R and Lancaster, T 2013. Pharmacological interventions for smoking cessation: an overview and network meta-analysis. *Cochrane Database of Systematic Reviews* (5): CD009329. doi: 10.1002/14651858.CD009329.pub2.

Campbell, IA, Prescott, RJ and Tjeder-Burton, SM 1991. Smoking cessation in hospital patients given repeated advice plus nicotine or placebo chewing gum. *Respiratory Medicine* 85(2): 155–57.

Caruthers, D, Perkins, K, Sereika, S, Albrecht, S and Dunbar-Jacob, J 2006. Enhancing tobacco abstinence following hospitalization (POS1-59). Society for Research on Nicotine and Tobacco Twelfth Annual Meeting February 15–18, Orlando, Florida.

Chouinard, MC and Robichaud-Ekstrand, S 2005. The effectiveness of a nursing inpatient smoking cessation program in individuals with cardiovascular disease. *Nursing Research* 54(4): 243–54.

Collins, DJ and Lapsley, HM 2008. *The Costs of Tobacco, Alcohol and Illicit Drug Abuse to Australian Society in 2004/05*. Department of Health and Ageing, Canberra.

Colombo, G, Clerici, M, Giustarini, D, Portinaro, NM, Aldini, G, Rossi, R, Milzani, A and Dalle-Donne, I 2014. Pathophysiology of tobacco smoke exposure: recent insights from comparative and redox proteomics. *Mass Spectrometry Reviews* 33(3): 183–218. doi: 10.1002/mas.21392.

Cotter, T 2011. *Mass Media Public Education Campaigns: An Overview*. Tobacco in Australia: Facts and issues, available at: www.tobaccoinaustralia.org.au/chapter-14-social-marketing/14-1-social-marketing-and-public-education-campaign (accessed 8 March 2017).

de Azevedo, RCS, Mauro, MLF, Lima, DD, Gaspar, KC, da Silva, VF and Botega, NJ 2010. General hospital admission as an opportunity for smoking-cessation strategies: a clinical trial in Brazil. *General Hospital Psychiatry* 32(6): 599–606. doi: 10.1016/j.genhosppsych.2010.09.013.

DeBusk, RF, Miller, NH, Superko, HR, Dennis, CA, Thomas, RJ, Lew, HT, Berger, E 3rd, Heller, RS, Rompf, J, Gee, D, Kraemer, HC, Bandura, A, Ghandour, G, Clark, M, Shah, RV, Fisher, L and Taylor, CB 1994. A case-management system for coronary risk factor modification after acute myocardial infarction. *Annals of Internal Medicine* 120(9): 721–29.

Domelas, EA, Sampson, RA, Gray, JF, Waters, D and Thompson, PD 2000. A randomized controlled trial of smoking cessation counseling after myocardial infarction. *Preventive Medicine* 30(4): 261–68. doi: 10.1006/pmed.2000.0644.

Ebbert, JO, Wyatt, KD, Hays, JT, Klee, EW and Hurt, RD 2010. Varenicline for smoking cessation: efficacy, safety, and treatment recommendations. *Patient Preference and Adherence* 4: 355362.

Eisenberg, MJ, Grandi, SM, Gervais, A, O’Loughlin, J, Paradis, G, Rinfret, S, Sarrafzadegan, N, Sharma, S, Lauzon, C, Yadav, R and Pilote, L 2013. Bupropion for smoking cessation in patients hospitalized with acute myocardial infarction: a randomized, placebo-controlled trial. *Journal of the American college of cardiology* 61(5): 524–32. doi: 10.1016/j.jacc.2012.08.1030.

Eisenberg, MJ, Windle, SB, Roy, N, Old, W, Grondin, FR, Bata, I, Iskander, A, Lauzon, C, Srivastava, N, Clarke, A, Cassavar, D, Dion, D, Haught, H, Mehta, SR, Baril, JF, Lambert, C, Madan, M, Abramson, BL and Dehghani, P 2016. Varenicline for Smoking Cessation in Hospitalized Patients With Acute Coronary Syndrome. *Circulation* 133(1): 21–30. doi: 10.1161/CIRCULATIONAHA.115.019634.

Emmons, KM and Goldstein, MG 1992. Smokers who are hospitalized: a window of opportunity for cessation interventions. *Preventive Medicine* 21(2): 262–69.

Farkas, AJ, Gilpin, EA, Distefan, JM and Pierce, JP 1999. The effects of household and workplace smoking restrictions on quitting behaviours. *Tobacco Control* 8(3): 261–65.

Farrelly, MC, Evans, WN and Sfekas, AES 1999. The impact of workplace smoking bans: results from a national survey. *Tobacco Control* 8(3): 272–77.

Feeney, GF, McPherson, A, Connor, J, McAlister, A, Young, R and Garrahy, P 2001. Randomized controlled trial of two cigarette quit programmes in coronary care patients after acute myocardial infarction. *Internal Medicine Journal* 31(8): 470–75.

Fellows, JL, Mularski, RA, Leo, MC, Bentz, CJ, Waiwaiole, LA, Francisco, MC, Funkhouser, K and Stoney, CM 2016. Referring Hospitalized Smokers to Outpatient Quit Services: A Randomized Trial. *American Journal of Preventive Medicine* 51(4): 609–19. doi: 10.1016/j.amepre.2016.06.014.

Ferguson, SG, Shiffman, S and Gitchell, JG 2011. Nicotine replacement therapies: patient safety and persistence. *Patient Related Outcome Measures* 2: 111–17. doi: 10.2147/PROM.S11545.

Fiore, MC, Bailey, WC, Cohen, SJ, Dorfman, SF, Goldstein, MG, Gritz, ER, Heyman, RB, Holbrook, J, Jaen, CR, Kottke, TE, Lando, HA, Mecklenbur, R, Mullen, PD, Nett, LM, Robinson, L, Stitzer, M, Tommasello, AC, Villejo, L and Wewers, ME. *Treating Tobacco Use and Dependence*. Clinical practice guideline, U.S. Department of Health and Human Services, Rockville, 2000.

Fiore, MC, Goplerud, E and Schroeder, SA 2012. The Joint Commission’s New Tobacco Cessation

Measures-Will Hospitals Do the Right Thing? *The New England Journal of Medicine* 366(13): 1172–74. doi: 10.1056/NEJMp1115176.

Freund, M, Campbell, E, Paul, C, McElduff, P, Walsh, RA, Sakrouge, R, Wiggers, J and Knight, J 2008. Smoking care provision in hospitals: a review of prevalence. *Nicotine & Tobacco Research* 10(5), 757–74. doi: 10.1080/14622200802027131.

Freund, M, Campbell, E, Paul, C, Sakrouge, R, McElduff, P, Walsh, RA, Wiggers, J, Knight, J and Girgis, A 2009. Increasing smoking cessation care provision in hospitals: a meta-analysis of intervention effect. *Nicotine & Tobacco Research* 11(6): 650–62. doi: 10.1093/ntr/ntp056.

Freund, M, Campbell, E, Paul, C, Sakrouge, R, Lecathelinais, C, Knight, J, Wiggers, J, Walsh, RA, Jones, T, Girgis, A and Nagle, A 2009. Increasing hospital-wide delivery of smoking cessation care for nicotine-dependent in-patients: a multi-strategic intervention trial. *Addiction* 104(5): 839–49. doi: 10.1111/j.1360-0443.2009.02520.x.

Froelicher, ESS, Miller, NH, Christopherson, DJ, Martin, K, Parker, KM, Amonetti, M, Lin, Z, Sohn, M, Benowitz, N and Taylor, C 2004. High rates of sustained smoking cessation in women hospitalized with cardiovascular disease the women's initiative for non-smoking (WINS). *Circulation* 109(5): 587–93. doi: 10.1161/01.CIR.0000115310.36419.9E.

George, J, Taylor, S, Hong, T, Leung, S and Nguyen, J 2012. A pilot study to investigate the scope for an inpatient smoking cessation programme. *Internal Medicine Journal* 42(5): e80–e83. doi: 10.1111/j.1445-5994.2010.02287.x.

Glasgow, RE, Cummings, KM and Hyland, A 1997. Relationship of worksite smoking policy to changes in employee tobacco use: findings from COMMIT. Community Intervention Trial for Smoking Cessation. *Tobacco Control* 6 (suppl 2): S44.

Global Initiative for Chronic Obstructive Lung Disease 2015. *Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease*. available at: www.goldcopd.org/uploads/users/files/GOLD_Report_2015_Apr2.pdf (accessed 8 March 2017).

Grace, C 2016. *Commonwealth (national) legislation. Tobacco in Australia: Facts and Issues*. available at: www.tobaccoaustralia.org.au/chapter-11-advertising/11-3-commonwealth-legislation (accessed 8 March 2017).

Greenhalgh, E, Stillman, S and Ford, C 2016. *National Policy and Progress in Encouraging and Supporting Cessation. Tobacco in Australia: Facts and Issues*, available at www.tobaccoaustralia.org.au/chapter-7-cessation/7-20-towards-a-national-cessation-strategy (accessed 14 March 2017).

Hajek, P, Taylor, TZ and Mills, P 2002. Brief intervention during hospital admission to help patients to give up smoking after myocardial infarction and bypass surgery: randomised controlled trial. *British Medical Journal* 324(7329): 87–89. doi: 10.1136/bmj.324.7329.87.

Harrington, K, Kim, YI, Chen, M, Ramachandran, R, Pisu, M, Sadasivam, R., Houston, T and Bailey, W 2016. Web-Based Intervention for Transitioning Smokers From Inpatient to Outpatient Care: An RCT. *American Journal of Preventive Medicine* 51(4): 620–29. doi: 10.1016/j.amepre.2016.04.008.

Henrikus, DJ, Lando, HA, McCarty, MC, Klevan, D, Holtan, N, Huebsch, JA, Jestus, S, Pentel, PR, Pine, D, Sullivan, S, Swenson, K and Vessey, J 2005. The TEAM project: the effectiveness of smoking cessation intervention with hospital patients. *Preventive Medicine* 40(3): 249–58. doi: 10.1016/j.jpmed.2004.05.030.

Hermanson, B, Omenn, GS, Kronmal, RA and Gersh, BJ 1988. Beneficial six-year outcome of smoking cessation in older men and women with coronary artery disease. *New England Journal of Medicine* 319(21): 1365–69. doi: 10.1056/NEJM198811243192101.

Horn, K, Dino, G, Hamilton, C and Noerachmanto, N 2007. Efficacy of an emergency department-based motivational teenage smoking intervention. *Preventing Chronic Disease* 4(1): A08.

Hughes, JR, Carpenter, MJ and Naud, S 2010. Do point prevalence and prolonged abstinence measure produce similar results in smoking cessation studies? A systematic review. *Nicotine & Tobacco Research* 12(7): 756–62. doi: 10.1093/ntr/ntq078.

Intergovernmental Committee on Drugs 2012. *National Tobacco Strategy 2012-2018*. Department of Health and Ageing, Canberra.

Hurley, SF 2006. Hospitalisation and costs attributable to tobacco smoking in Australia: 2001–2002. *The Medical Journal of Australia* 184(1): 45.

Kelders, SM, Kok, RN, Ossebaard, HC and Van Gemert-Pijnen, JEW 2012. Persuasive system design does matter: a systematic review of adherence to web-based interventions. *Journal of Medical Internet Research* 14(6): e152, doi: 10.2196/jmir.2104.

Lacasse, Y, Lamontagne, R, Martin, S, Simard, S and Arseneault, M 2008. Randomized trial of a smoking cessation intervention in hospitalized patients. *Nicotine & Tobacco Research* 10(7): 1215–21. doi: 10.1080/14622200801979142.

Lancaster, T and Stead, LF 2005. Individual behavioural counselling for smoking cessation. *Cochrane Database of Systematic Reviews* (3): CD001292. doi: 10.1002/14651858.CD001292.pub3.

- Laviolette, SR and Van Der Kooy, D 2004. The neurobiology of nicotine addiction: bridging the gap from molecules to behaviour. *Nature Reviews Neuroscience* 5(1): 55–65. doi: 10.1038/nrn1298.
- Lee, SM, Landry, J, Jones, PM, Buhrmann, O and Morley-Forster, P 2013. The effectiveness of a perioperative smoking cessation program: a randomized clinical trial. *Anesthesia & Analgesia* 117(3): 605–13. doi: 10.1213/ANE.0b013e318298a6b0.
- Lewis, SF, Piasecki, TM, Fiore, MC, Anderson, JE and Taker, TB 1998. Transdermal nicotine replacement for hospitalized patients: a randomized clinical trial. *Preventive Medicine* 27(2): 296–303. doi: 10.1006/pmed.1998.0266.
- Lindström, D, Azodi, OS, Wladis, A, Tønnesen, H, Linder, S, Nåsell, H, Ponzer, S and Adami, J 2008. Effects of a perioperative smoking cessation intervention on postoperative complications: a randomized trial. *Annals of Surgery* 248(5): 739–45. doi: 10.1097/SLA.0b013e3181889d0d.
- McBride, CM, Emmons, KM and Lipkus, IM 2003. Understanding the potential of teachable moments: the case of smoking cessation. *Health Education Research* 18(2): 156–70. doi: 10.1093/her/18.2.156.
- McWhorter, WP, Boyd, GM and Mattson, ME 1990. Predictors of quitting smoking: the NHANES I followup experience. *Journal of Clinical Epidemiology* 43(12): 1399–405. doi: 10.1016/0895-4356(90)90108-2.
- Meysman, M, Boudrez, H, Nackaerts, K, Dieriks, B, Indemans, R and Vermeire, P 2010. Smoking cessation rates after a nurse-led inpatient smoking cessation intervention. *Journal of Smoking Cessation* 5(1): 69–76. doi: 10.1375/jsc.5.1.69.
- Miller, C and Scollo, M 2016. *The construction and labelling of Australian cigarettes*. Tobacco in Australia: Facts and issues, available at www.tobaccoinaustralia.org.au/chapter-12-tobacco-products/ (accessed 8 March 2017).
- Miller, NH, Smith, PM, DeBusk, RF, Sobel, DS and Taylor, CB 1997. Smoking cessation in hospitalized patients. Results of a randomized trial. *Archives of Internal Medicine* 157(4): 409–15. doi: 10.1001/archinte.1997.00440250059007.
- Ministry of Health 2014. *Tobacco Use 2012/13: New Zealand Health Survey*. Ministry of Health, Wellington.
- Ministry of Health 2015. *Annual Update of Key Results 2014/15: New Zealand Health Survey*, Ministry of Health, Wellington.
- Ministry of Health 2016. *Appendix Background Information: New Zealand's Tobacco Control Programme*, Ministry of Health, Wellington.
- Møller, AM, Villebro, N, Pedersen, T and Tønnesen, H 2002. Effect of preoperative smoking intervention on postoperative complications: a randomised clinical trial. *The Lancet* 359(9301): 114–17. doi: 10.1016/S0140-6736(02)07369-5.
- Molyneux, A, Lewis, S, Leivers, U, Anderton, A, Antoniaki, M, Brackenridge, A, Nilsson, F, McNeill, A, West, R, Moxham, J and Britton, J 2003. Clinical trial comparing nicotine replacement therapy (NRT) plus brief counselling, brief counselling alone, and minimal intervention on smoking cessation in hospital inpatients. *Thorax* 58(6): 484–88. doi: 10.1136/thorax.58.6.484.
- Murray, R, Leonardi-Bee, J, Marsh, J, Jayes, L, Li, J, Parrott, S and Britton, J 2013. Systematic identification and treatment of smokers by hospital based cessation practitioners in a secondary care setting: cluster randomised controlled trial. *British Medical Journal* 347: f4004. doi: 10.1136/bmj.f4004.
- Myles, PS, Leslie, K, Angliss, M, Mezzavia, P and Lee, L 2004. Effectiveness of bupropion as an aid to stopping smoking before elective surgery: a randomised controlled trial. *Anaesthesia* 59(11): 1053–58. doi: 10.1111/j.1365-2044.2004.03943.x.
- Nagle, AL, Hensley, MJ, Schofield, MJ and Koschel, AJ 2005. A randomised controlled trial to evaluate the efficacy of a nurse-provided intervention for hospitalised smokers. *Australian and New Zealand Journal of Public Health* 29(3): 285–91. doi: 10.1111/j.1467-842X.2005.tb00770.x.
- National Preventative Health Taskforce 2008. *Australia: The Healthiest Country by 2020: A Discussion Paper*, Commonwealth of Australia, Canberra.
- Neuner, B, Weiss-Gerlach, E, Miller, P, Martus, P, Hesse, D and Spies, C 2009. Emergency department-initiated tobacco control: a randomised controlled trial in an inner city university hospital. *Tobacco Control* 18(4): 283–93. doi: 10.1136/tc.2008.028753.
- New Zealand Drug Foundation 2011. *Law and penalties*. Tobacco, available at www.drugfoundation.org.nz/tobacco/law-and-penalties (accessed 17 March 2017).
- New Zealand Government 2016. *Tobacco Smoking*. NZ Health Indicators, available at www.stats.govt.nz/browse_for_stats/snapshots-of-nz/nz-social-indicators/Home/Health/tobacco-smoking.aspx (accessed 15 September 2016).
- Novotny, TE, Fiore, MC, Hatziaandreu, EJ, Giovino, GA, Mills, SL and Pierce, JP 1990. Trends in smoking by age and sex, United States, 1974–1987: the implications for disease impact. *Preventive Medicine* 19(5): 552–61. doi: 10.1016/0091-7435(90)90053-M.
- Ockene, J, Kristeller, JL, Goldberg, R, Ockene, I, Merriam, P, Barrett, S, Pekow, P, Hosmer, D and Gianelly, R 1992. Smoking cessation and severity of disease: The

- Coronary Artery Smoking Intervention Study. *Health Psychology* 11(2): 119–26. doi: 10.1037/0278-6133.11.2.119.
- Ohakim, A, Mellon, L, Jafar, B, O'Byrne, C, McElvaney, NG, Cormican, L, McDonnell, R and Doyle, F 2015. Smoking, attitudes to smoking and provision of smoking cessation advice in two teaching hospitals in Ireland: do smoke-free policies matter? *Health Psychology and Behavioral Medicine* 3(1): 142–53. doi: 10.1080/21642850.2015.1026347.
- Ortega, F, Vellisco, A, Márquez, E, López-Campos, JL, Rodríguez, A, de los Ángeles Sánchez, M, Barrot, E and Cejudo, P 2011. Effectiveness of a cognitive orientation program with and without nicotine replacement therapy in stopping smoking in hospitalised patients. *Archivos de Bronconeumología (English Edition)* 47(1): 3–9. doi: 10.1016/j.arbres.2010.07.007.
- Ostroff, JS, Burkhalter, JE, Cinciripini, PM, Li, Y, Shiyko, MP, Lam, CY, Hay, JL, Dhingra, LK, Lord-Bessen, J, Holland, SM and Manna, R 2014. Randomized trial of a presurgical scheduled reduced smoking intervention for patients newly diagnosed with cancer. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association* 33(7): 737–47. doi: 10.1037/a0033186.
- Pederson, LL, Wanklin, JM and Lefcoe, NM 1991. The effects of counseling on smoking cessation among patients hospitalized with chronic obstructive pulmonary disease: a randomized clinical trial. *The International Journal of the Addictions* 26(1): 107–19. doi: 10.3109/10826089109056242.
- Planer, D, Lev, I, Elitzur, Y, Sharon, N, Ouzan, E, Pugatsch, T, Chasid, M, Rom, M and Lotan, C 2011. Bupropion for smoking cessation in patients with acute coronary syndrome. *Archives of Internal Medicine* 171(12): 1055–60. doi: 10.1001/archinternmed.2011.72.
- Prochaska, JJ, Hall, SE, Delucchi, K and Hall, SM 2014. Efficacy of initiating tobacco dependence treatment in inpatient psychiatry: a randomized controlled trial. *American Journal of Public Health* 104(8): 1557–65. doi: 10.2105/AJPH.2013.301403.
- Purcell, K, Scollo, M and Tumini, V 2012. 15.4 Smoking bans in key public areas and environments. *Tobacco in Australia: Facts and Issues*, available at www.tobaccoinaustralia.org.au/chapter-13-taxation (accessed 8 March 2017).
- Quist-Paulsen, P and Gallefoss, F 2003. Randomised controlled trial of smoking cessation intervention after admission for coronary heart disease. *British Medical Journal* 327(7426): 1254. doi: 10.1136/bmj.327.7426.1254.
- Ratner, PA, Johnson, JL, Richardson, CG, Bottorff, JL, Moffat, B, Mackay, M, Fofonoff, D, Kingsbury, K, Miller, C and Budz, B 2004. Efficacy of a smoking-cessation intervention for elective-surgical patients. *Research in Nursing & Health* 27(3): 148–61. doi: 10.1002/nur.20017.
- Raupach, T and van Schayck, CP 2011. Pharmacotherapy for smoking cessation: current advances and research topics. *CNS Drugs* 25(5): 371–82. doi: 10.2165/11590620-000000000-00000.
- Regan, S, Viana, JC, Reyen, M and Rigotti, NA 2012. Prevalence and predictors of smoking by inpatients during a hospital stay. *Archives of Internal Medicine* 172(21): 1670–74. doi: 10.1001/2013.jamainternmed.300.
- Reid, R, Pipe, A, Higginson, L, Johnson, K, D'Angelo, MS, Cooke, D and Dafoe, W 2003. Stepped care approach to smoking cessation in patients hospitalized for coronary artery disease. *Journal of Cardiopulmonary Rehabilitation* 23(3): 176–82. doi: 10.1097/00008483-200305000-00003.
- Reid, RD, Pipe, AL, Quinlan, B and Oda, J 2007. Interactive voice response telephony to promote smoking cessation in patients with heart disease: a pilot study. *Patient Education and Counseling* 66(3): 319–26. doi: 10.1016/j.pec.2007.01.005.
- Rice, VH, Hartmann-Boyce, J and Stead, LF 2013. Nursing interventions for smoking cessation. *Cochrane Database of Systematic Reviews* 8: CD001188. doi: 10.1002/14651858.CD001188.pub4.
- Richman, PB, Dinowitz, S, Nashed, AH, Eskin, B, Sylvan, E, Allegra, C, Allegra, J and Mandell, M 2000. The emergency department as a potential site for smoking cessation intervention: a randomized, controlled trial. *Academic Emergency Medicine: Official Journal of the Society for Academic Emergency Medicine* 7(4): 348–53. doi: 10.1111/j.1553-2712.2000.tb02235.x.
- Rigotti, NA, Arnsten, JH, McKool, KM, Wood-Reid, KM, Pasternak, RC and Singer, DE 1997. Efficacy of a smoking cessation program for hospital patients. *Archives of Internal Medicine* 157(22): 2653–60. doi: 10.1001/archinte.1997.00440430135016.
- Rigotti, NA, Arnsten, JH, McKool, KM, Wood-Reid, KM, Pasternak, RC and Singer, DE 2000. Smoking by patients in a smoke-free hospital: prevalence, predictors, and implications. *Preventive Medicine* 31(2): 159–66. doi: 10.1006/pmed.2000.0695.
- Rigotti, NA, Clair, C, Munafò, MR and Stead, LF 2012. Interventions for smoking cessation in hospitalised patients. *Cochrane Database of Systematic Reviews* (5): CD001837. doi: 10.1002/14651858.CD001837.pub3.
- Rigotti, NA, McKool, KM and Shiffman, S 1994. Predictors of smoking cessation after coronary artery bypass graft surgery. Results of a randomized trial with 5-Year

follow-up, *Annals of Internal Medicine* 120(4): 287–93. doi: 10.7326/0003-4819-120-4-199402150-00005.

Rigotti, NA, Regan, S, Levy, DE, Japuntich, S, Chang, Y, Park, ER, Viana, JC, Kelley, JH, Reyen, M and Singer, DE 2014. Sustained care intervention and postdischarge smoking cessation among hospitalized adults: a randomized clinical trial. *JAMA* 312(7): 719–28. doi: 10.1001/jama.2014.9237.

Rigotti, NA, Thorndike, AN, Regan, S, McKool, K, Pasternak, RC, Chang, Y, Swartz, S, Torres-Finerty, N, Emmons, KM and Singer, DE 2006. Bupropion for smokers hospitalized with acute cardiovascular disease. *The American Journal of Medicine* 119(12): 1080–87. doi: 10.1016/j.amjmed.2006.04.024.

Sadr Azodi, O, Lindström, D, Adami, J, Tønnesen, H, Nåsell, H, Gilljam, H and Wladis, A 2009. The efficacy of a smoking cessation programme in patients undergoing elective surgery—a randomised clinical trial. *Anaesthesia* 64(3): 259–65. doi: 10.1111/j.1365-2044.2008.05758.x.

Salive, ME, Conroni-Huntley, J, LaCroix, AZ, Ostfeld, AM, Wallace, RB and Hennekens, CH 1992. Predictors of smoking cessation and relapse in older adults. *American Journal of Public Health* 82(9): 1268–71.

Scollo, M and Bayly, M 2016. Revenue from tobacco taxes in Australia. *Tobacco in Australia: Facts and Issues*. available at www.tobaccoinAustralia.org.au/chapter-13-taxation/13-6-revenue-from-tobacco-taxes-in-australia (accessed 11 April 2017).

Scollo, M and Winstanley, MH 2016. *Tobacco in Australia: Facts and Issues*. available at www.TobaccoInAustralia.org.au (accessed 8 March 2017).

Sherman, SE, Link, AR, Rogers, ES, Krebs, P, Ladapo, JA, Shelley, DR, Fang, Y, Wang, B and Grossman, E 2016. Smoking-Cessation Interventions for Urban Hospital Patients: A Randomized Comparative Effectiveness Trial. *American Journal of Preventive Medicine* 51(4): 566–77. doi: 10.1016/j.amepre.2016.06.023.

Shi, Y, Ehlers, S, Hinds, R, Baumgartner, A and Warner, DO 2013. Monitoring of exhaled carbon monoxide to promote preoperative smoking abstinence. *Health Psychology* 32(6): 714, doi: 10.1037/a0029504.

Simon, JA, Carmody, TP, Hudes, ES, Snyder, E and Murray, J 2003. Intensive smoking cessation counseling versus minimal counseling among hospitalized smokers treated with transdermal nicotine replacement: a randomized trial. *The American Journal of Medicine* 114(7): 555–62. doi: 10.1037/a0029504.

Simon, JA, Duncan, C, Huggins, J, Solkowitz, S and Carmody, TP 2009. Sustained-release bupropion for hospital-based smoking cessation: a randomized trial. *Nicotine & Tobacco Research: Official Journal*

of the Society for Research on Nicotine and Tobacco 11(6): 663–69. doi: 10.1016/S0002-9343(03)00081-0.

Simon, JA, Solkowitz, SN, Carmody, TP and Browner, WS 1997. Smoking cessation after surgery. A randomized trial. *Archives of Internal Medicine* 157(12): 1371–76. doi: 10.1093/ntr/ntp047.

Slattery, C, Freund, M, Gillham, K, Knight, J, Wolfenden, L, Bisquera, A and Wiggers, J 2016. Increasing smoking cessation care across a network of hospitals: an implementation study. *Implementation Science: IS* 11: 28, doi: 10.1186/s13012-016-0390-x.

Smith, BJ, Carson, KV, Brinn, MP, Labiszewski, NA, Peters, MJ, Fitridge, R, Koblar, SA, Jannes, J, Veale, AJ, Goldsworthy, SJ, Litt, J, Edwards, D and Esterman, AJ 2013. Smoking Termination Opportunity for in Patients (STOP): superiority of a course of varenicline tartrate plus counselling over counselling alone for smoking cessation: a 12-month randomised controlled trial for inpatients. *Thorax* 68(5): 485–86. doi: 10.1136/thoraxjnl-2012-202484.

Smith, PM and Burgess, E 2009. Smoking cessation initiated during hospital stay for patients with coronary artery disease: a randomized controlled trial. *CMAJ: Canadian Medical Association Journal = Journal de l'Association Medicale Canadienne* 180(13): 1297–303. doi: 10.1503/cmaj.080862.

Smith, PM, Corso, L, Brown, KS and Cameron, R 2011. Nurse case-managed tobacco cessation interventions for general hospital patients: Results of a randomized clinical trial. *CJNR (Canadian Journal of Nursing Research)* 43(1): 98–117.

Smith, PM, Sellick, SM and Spadoni, MM 2012. Tobacco cessation Clinical Practice Guideline use by rural and urban hospital nurses: a pre-implementation needs assessment. *BMC Nursing* 11: 6, doi: 10.1186/1472-6955-11-6.

Sørensen, LT and Jørgensen, T 2003. Short-term pre-operative smoking cessation intervention does not affect postoperative complications in colorectal surgery: a randomized clinical trial. *Colorectal Disease* 5(4): 347–52. doi: 10.1046/j.1463-1318.2003.00450.x.

Stead, LF, Hartmann-Boyce, J, Perera, R and Lancaster, T 2013. Telephone counselling for smoking cessation. *Cochrane Database of Systematic Reviews* (8): CD002850. doi: 10.1002/14651858.CD002850.pub3.

Stead, LF and Lancaster, T 2012. Combined pharmacotherapy and behavioural interventions for smoking cessation. *Cochrane Database of Systematic Reviews*. (10): CD008286. doi: 10.1002/14651858.CD008286.pub2.

Steinberg, MB, Randall, J, Greenhaus, S, Schmelzer, AC, Richardson, DL and Carson, JL 2011. Tobacco dependence treatment for hospitalized smokers: a

randomized, controlled, pilot trial using varenicline. *Addictive Behaviors* 36(12): 1127–32. doi: 10.1016/j.addbeh.2011.07.002.

Sterling, LH, Windle, SB, Filion, KB, Touma, L and Eisenberg, MJ 2016. Varenicline and adverse cardiovascular events: A systematic review and meta-analysis of randomized controlled trials. *Journal of the American Heart Association* 5(2): e002849, doi: 10.1161/JAHA.115.002849.

Stockings, E, Clancy, R, Bowman, J, Terry, M and Wye, P 2012. A randomised controlled trial linking mental health inpatients to community smoking cessation supports: Preliminary findings and discussion. *HNE Handover: For Nurses and Midwives* 5(1): 12–17.

Stockings, EA, Bowman, JA, Baker, AL, Terry, M, Clancy, R, Wye, PM, Knight, J, Moore, LH, Adams, MF, Colyvas, K and Wiggers, JH 2014. Impact of a post-discharge smoking cessation intervention for smokers admitted to a smoke-free inpatient psychiatric hospital: a randomised controlled trial. *Nicotine & Tobacco Research* 16(11): 1417–28. doi: 10.1093/ntr/ntu097.

Taylor, CB, Miller, NH, Killen, JD and DeBusk, RF 1990. Smoking cessation after acute myocardial infarction: effects of a nurse-managed intervention. *Annals of Internal Medicine* 113(2): 118–23. doi: 10.7326/0003-4819-113-2-118.

Taylor, CB, Miller, NH, S. Herman, Smith, PM, Sobel, D, Fisher, L and DeBusk, RF 1996. A nurse-managed smoking cessation program for hospitalized smokers. *American Journal of Public Health* 86(11): 1557–60. doi: 10.2105/AJPH.86.11.1557.

Thomas, D, Abramson, MJ, Bonevski, B, Taylor, S, Poole, SG, Paul, E, Weeks, GR, Dooley, MJ and George, J 2016. Integrating smoking cessation into routine care in hospitals—a randomized controlled trial. *Addiction* 111(4): 714–23. doi: 10.1111/add.13239.

Thomsen, T, Tønnesen, H, Okholm, M, Kroman, N, Maibom, A, Sauerberg, ML and Møller, AM 2010. Brief smoking cessation intervention in relation to breast cancer surgery: a randomized controlled trial. *Nicotine & Tobacco Research* 12(11): 1118–24. doi: 10.1093/ntr/ntq158.

Tooth, L, Ware, R, Bain, C, Prudie, DM and Dobson, A 2005. Quality of reporting of observational longitudinal research. *American Journal of Epidemiology* 161(3). doi: 10.1093/aje/kwi042.

Ubhi, HK, Michie, S, Kotz, D, Wong, WC and West, R 2015. A mobile app to aid smoking cessation: preliminary evaluation of SmokeFree28. *Journal of Medical Internet Research* 17(1): e17. doi: 10.2196/jmir.3479.

Velicer, WF and Prochaska, JO 2004. A comparison of four self-report smoking cessation outcome measures. *Addictive Behaviors* 29(1): 51–60. doi: 10.1016/S0306-4603(03)00084-4.

Vial, RJ, Jones, TE, Ruffin, RE and Gilbert, AL 2002. Smoking cessation program using nicotine patches linking hospital to the community. *Journal of Pharmacy Practice and Research* 32(1): 57–62. doi: 10.1002/jppr200232157.

Warner, DO and Kadimpati, S 2012. Nicotine lozenges to promote brief preoperative abstinence from smoking: pilot study. *Clinical Health Promotion* 2(3): 85–88.

Warner, DO, Klesges, RC, Dale, LC, Offord, KP, Schroeder, DR, Shi, Y, Vickers, KS and Danielson, DR 2011. Clinician-delivered intervention to facilitate tobacco quitline use by surgical patients. *The Journal of the American Society of Anesthesiologists* 114(4): 847–55. doi: 10.1097/ALN.0b013e31820d868d.

Warner, DO, Nolan, MB, Kadimpati, S, Burke, MV, Hanson, AC and Schroeder, DR 2016. Quitline tobacco interventions in hospitalized patients: a randomized trial. *American Journal of Preventive Medicine* 51(4): 473–84. doi: 10.1016/j.amepre.2016.03.005.

West, R, McNeill, A and Raw, M 2000. Smoking cessation guidelines for health professionals: an update. *Thorax* 55(12): 987–99. doi: 10.1136/thorax.55.12.987.

Winickoff, JP, Healey, EA, Regan, S, Park, ER, Cole, C, Friebely, J and Rigotti, NA 2010. Using the postpartum hospital stay to address mothers' and fathers' smoking: the NEWS study. *Pediatrics* 125(3): 518–25. doi: 10.1542/peds.2009-0356.

Wolfenden, L, Wiggers, J, Knight, J, Campbell, E, Rissel, C, Kerridge, R, Spigelman, AD and Moore, K 2005. A programme for reducing smoking in pre-operative surgical patients: randomised controlled trial. *Anaesthesia* 60(2): 172–79. doi: 10.1111/j.1365-2044.2004.04070.x.

Wong, J, Abrishami, A, Yang, Y, Zaki, A, Friedman, Z, Selby, P, Chapman, KR and Chung, F 2012. A Perioperative Smoking Cessation Intervention with Varenicline A Double-blind, Randomized, Placebo-controlled Trial. *The Journal of the American Society of Anesthesiologists* 117(4): 755–64. doi: 10.1097/ALN.0b013e3182698b42.

Woodruff, TJ, Rosbrook, B, Pierce, J and Glantz, SA 1993. Lower levels of cigarette consumption found in smoke-free workplaces in California. *Archives of Internal Medicine* 153(12): 1485–93. doi: 10.1001/archinte.1993.00410120065009.

World Health Organization 2005. *WHO Framework Convention on Tobacco Control*. Geneva.

Yang, I, Dabscheck, E, George, J, Jenkins, S, McDonald, C, McDonald, V, Smith, B and Zwar, N 2016. *The COPD-X Plan: Australian and New Zealand Guidelines for the Management of Chronic Obstructive Pulmonary Disease 2016*. Lung Foundation Australia and Thoracic Society of Australia, and New Zealand.

Appendix 1: Descriptive summary of exclusively behavioural intervention

Table 1. Interventions that compare two behavioural solutions to smoking cessation: none of the participants of either group had free access to pharmacotherapy

Study reference	Participants and sample size	Setting description	Intervention	Control	Short summary of findings	Plain language conclusion
Andrews, Bale et al. 2006	Elective surgery patients <ul style="list-style-type: none"> • Consultant advice letter $n=51$ • General booklet $n=51$ 	Single site: General hospital; UK	Individualised letter from consultant general with advice to stop smoking, nurse advice and referral to stop smoking service Model used: not stated	General quit smoking booklet + nurse advice	18% in the intervention compared to 8% in the control group quit smoking before surgery commenced	An individualised letter can contribute to higher quit smoking rates before planned surgery
Bolman, de Vries et al. 2002	Inpatients with cardiovascular disease <ul style="list-style-type: none"> • Intervention $n=388$ • Usual care $n=401$ 	Multi-site: 5 received intervention, 6 received control; Netherlands	Initiated during hospital admission and continued after discharge: consisted of stop-smoking advice from cardiologist, short-bedside consultation with a nurse including assessments of readiness to change, additional nurse-led consultations, provision of self-help materials and after care by cardiologist Model: health counselling model	Usual care consisting out of occasional attention to smoking cessation during check-up	Self-reported 7-day point-prevalence data at 3 months indicate a significant small intervention effect (OR=1.4). No significant effect for continuous abstinence was found	Intensive behavioural intervention can lead to small improvements in smoking cessation rates
Caruthers, Perkins et al. 2006	Hospitalised smokers; <ul style="list-style-type: none"> • Intervention $n=40$ • Usual care $n=40$ 	Multi-site; three hospitals; USA	12-week nurse delivered relapse management intervention (8 telephone interventions over 11 weeks) Model: Self-efficacy Theory	Enhanced usual care: promotional message + manual for tobacco dependence by the Centre for Disease Control	At 24 weeks, 42% of intervention subjects and 15% of usual care showed 7 day point prevalent smoking cessation (biochemically validated), $p=0.004$	An 11 week intensive intervention can increase cessation rates
Chouinard and Robichaud-Ekstrand 2005	Inpatients with cardiovascular disease <ul style="list-style-type: none"> • Counselling + follow-up $n=56$ • Counselling $n=56$ • Brief advice $n=56$ 	Single site: Cardiology unit of regional tertiary hospital; Canada	1 hour inpatient counselling session either with or without telephone follow-up (6 calls) Model: Transtheoretical Model	General smoking cessation advice	Higher validated self-report 7-day point prevalent smoking cessation at 6 months ($p=0.05$), but not continuous ($p=0.21$), with higher point prevalence rates for those receiving follow-up 41.5% versus those who did not 30.2%	Especially inpatient counselling + intensive follow-up seems to improve cessation rates.
de Azevedo, Mauro et al. 2010	Inpatient general hospital admissions <ul style="list-style-type: none"> • High intensity $n=132$ • Low intensity $n=141$ 	Single site: public university hospital; Brazil	30-minute tailored motivational interview with trained counsellor tailored to patient needs plus seven routine telephone calls after hospital discharge Models used: motivational interviewing	Low-intensity intervention consisted of 15-minute general counselling	Low and high intensity sessions produced comparable self-reported 7-day point prevalent abstinence rates, 41.7% versus 44.9%, $p=0.03$	No difference in single session low or high intensity intervention
DeBusk, Miller et al. 1994	Patients admitted following acute myocardial infarction; <ul style="list-style-type: none"> • Intervention $n=131$ • Brief advice $n=121$ 	Multi-site: 5 Kaiser Permanente Medical Centres in San Francisco Bay area; USA	Intervention focused on multiple risk factors including smoking, nutrition and exercise delivered in hospital. Brief bedside counselling by physician combined with relapse prevention intervention ran by nurses. Telephone follow-up after two days, a week and at monthly intervals was provided. Model used: relapse prevention	Brief smoking cessation counselling by physician	Cotinine confirmed point-prevalent smoking cessation rate was significantly higher for the intervention arm (70%) compared to control (53%), $p=0.03$ at 12 months	Bedside counselling combined with follow-up leads to significantly higher cessation rates at 12 month follow-up

Dornelas, Sampson et al. 2000	Inpatients with myocardial infarction; <ul style="list-style-type: none"> • Intervention $n=54$ • Minimal care $n=46$ 	Single site: Hartford Hospital cardiology ward; USA	20 Minutes of bedside cessation counselling by a trained psychologist followed by seven brief telephone calls over 6 months post-discharge Model: motivational interviewing, relapse prevention, transtheoretical model and social-cognitive	Minimal care: a verbal and written recommendation to watch an on-line patient education video	7-day point prevalent smoking cessation rates were 70% for intervention compared to 40% for control at 12 month follow-up, $p<0.005$. Cessation rates at 6 months also favoured the intervention condition over control (73% versus 46%, $p<0.05$)	Bedside counselling with follow-up can improve cessation rates up until 12 months
Feeney, McPherson et al. 2001	Inpatients following acute myocardial infarction; <ul style="list-style-type: none"> • Intervention $n=96$ • Control $n=102$ 	Single site: coronary care unit in a Queensland Hospital; Australia	Intervention program consisted of the Stanford Heart Attack Staying Free program: The program included an exercise-based manual, assessment of confidence to quit (patients with low confidence were counselled on coping skills) and weekly telephone follow-up for the first month, and follow-up at 2, 3, 6 and 12 months. Model used: not mentioned	Usual care patients received verbal and printed advice about tobacco cessation and watched an educational video during the coronary care unit stay and were reviewed by an alcohol and drug assessment nurse; The nurse continued to follow-up at 3, 6 and 12 month intervals as outpatients	Analysis shows that of patients who joined the Stanford heart attack staying free and showed up at the 1 month follow-up 39% were abstinent (as validated by cotinine array) at 12 months compared to 2% of patients receiving usual care ($p<0.001$)	The Stanford heart attack program produced superior results compared to usual hospital care
Hajek, Taylor et al. 2002	Inpatients with cardiac event (myocardial infarction or coronary bypass surgery). <ul style="list-style-type: none"> • Intervention $n=274$ • Brief verbal advice $n=266$ 	Multi-site: 17 hospitals; UK	Brief verbal advice and access to British Heart foundation booklet as well as 20-30 minute session of CO reading, booklet on smoking and cardiac recovery, a quiz, a buddy, declaration of commitment to quit and a sticker in patient file Model: no model mentioned	Brief verbal advice + British Heart foundation booklet	No difference in continuous abstinence ($p=0.84$), 59% vs 60%, or point prevalent abstinence, 60% vs 60% ($p=0.91$) at 6 weeks, nor at twelve months, 41% vs 37% ($p=0.40$) for continuous and 43% versus 39% ($p=0.35$) for point prevalent, control vs intervention respectively	Single brief behavioural intervention is not enough to promote abstinence. Adherence to intervention components was relatively low
Harrington, Kim et al. 2016	All patient care areas (psychiatric, maternity and ICU were excluded). <ul style="list-style-type: none"> • Intervention $n=748$ • Control $n=740$ 	Single site: University Hospital; USA	Usual care and access to quit smoking web intervention using education and asynchronous communication with a Quit advisor Models used: Social-cognitive theory and Transtheoretical model	Usual care: one-pager and verbal message (2-3 minutes) by untrained hospital staff	There was no difference in 30-day point prevalence abstinence ($p=0.55$), 25.4% vs 26.8% at 6 month follow-up. Continuous abstinence was significantly higher for control, 18.5% vs 13.8%, $p=0.020$. Costs were \$53,802 for intervention and \$3,875 for control	Web-based smoking cessation treatment not better than usual care. May be due to adherence problems
Hennrikus, Lando et al. 2005	General medical patients (psychiatric, maternity and substance users were excluded). <ul style="list-style-type: none"> • Advice (A) $n=703$ • Advice + counselling(AC) $n=696$ • Usual care (UC) $n=696$ 	Multi-site: 4 hospitals (2 public, 2 private); USA	Advice only group: Usual care and a sticker was placed in the patient's case notes and their health professionals were frequently reminded of the project via newsletters, incentives etc. Advice + counselling group: usual care, brief provider advice and extended bedside counselling at hospital + 3-6 follow-up telephone calls Model: motivational interviewing, relapse prevention, transtheoretical model and social-cognitive	Usual care: two smoking cessation manuals and a directory of quit smoking programs and resources	At 12 month self-reported 7-day abstinence was higher in the AC group (19.8%) compared to UC (15%) and A (15.2%). However, adjusting for cotinine readings, there was no difference between AC (9.9%), A (10.0%) and modified usual care (8.8%) Quit rates were higher in this with smoking-related conditions	No increase in cotinine validated abstinence rates between three conditions (although self-report did go up for intensive condition)

Cessation for smokers seeking treatment and advice from health care professionals in the hospital setting

Horn, Dino et al. 2007	Smokers aged 14 - 19 <ul style="list-style-type: none"> • Intervention $n=41$, • Brief advice $n=34$ 	Single site: Suburban, university affiliated ED; USA	Motivational tobacco intervention: 15-30 min face-to-face patient-tailored intervention, stage-matched self-help workbook, handwritten postcard, 3 follow-up telephone calls at 1, 3 and 6 months Models used: client-centred therapy, social cognitive theory, and cognitive behavioural therapy, motivational interviewing	Brief advice (BA): 2 min generic advice, referral to health line. One follow-up telephone call.	No difference in point prevalent abstinence. For intervention (2.5%) or control (2.9%), $p=0.55$. There was no significant difference in reduction either	No difference in responders between brief advice and motivational tobacco intervention
Meysman, Boudrez et al. 2010	Surgery patients from orthopaedics, traumatology, ENT, head and neck and neurosurgery <ul style="list-style-type: none"> • Intervention $n=178$ • Booklet $n=180$ 	Multi-site: 4 university hospitals; Belgium	Nurse delivered stage based intervention using the 5 A's Model: Transtheoretical model	Booklet with quit smoking information	Self-reported continuous abstinence at 6 months was 15.7% for the intervention versus 8% for control, $p=0.02$	Significantly more self-reported abstinence at 6 month follow-up for stage based intervention compared to a booklet
Ockene, Kristeller et al. 1992	Inpatients with cardiovascular disease <ul style="list-style-type: none"> • Intervention $n=132$ • Advice only $n=135$ 	Multi-site: 3 Cardiac catheterisation laboratories of general hospitals; USA	10 minute quit smoking advice + 30 min inpatient counselling + outpatient telephone follow-up (3-4 sessions). There was also a possibility to return for outpatient face-to-face counselling Model: cognitive and behavioural self-management strategies	Advice only: 10 minute advice session	While validated 7-day point prevalent quit rates were higher for patients receiving the intervention (57%) versus control (48%) at 12 months, this results did not reach significance, $p = .06$, OR = 1.4. These results were maintained at 5 year follow-up. Patients with more significant disease responded better	No significant results for multicomponent intervention versus advice only when using validated tools
Pederson, Wanklin et al. 1991	COPD inpatients <ul style="list-style-type: none"> • Intervention $n=37$ • Control $n=37$ 	Single site: Chest unit of a 600-bed teaching ward; Canada	Self-help manual and advice to quit smoking with 3 to 8 15-20 minute counselling sessions while in hospital. Model: authors developed own approach	Advice to quit smoking	There were no significant differences in self-reported smoking cessation at 3 or 6 months, with 33% quitting successfully for intervention at 6 month versus 21.4% for control.	Intensive intervention including booklet and counselling with follow-up did not lead to significantly higher quit rates, however results may be caused by low sample size
Quist-Paulsen and Gallefoss 2003	Inpatients with cardiovascular disease <ul style="list-style-type: none"> • Intervention $n=118$ • No intervention $n=122$ 	Single site: general hospital; Norway.	Quit smoking group sessions 2x per week during inpatient stay. Follow-up telephone calls at day 2, 14, 21 and at 3 months and five month. At 6 weeks outpatient consultation was provided Models: relapse prevention and fear arousal	No specific instructions on how to quit smoking	Higher proportion of quitters for the intervention (50%) versus control (37%), $p=0.05$, as determined via validated point prevalence abstinence	Higher proportion of quitters when patients received counselling and follow-up telephone calls versus control
Rigotti, McKool et al. 1994	Patients scheduled for coronary artery bypass surgery <ul style="list-style-type: none"> • Intervention $n=44$ • Usual care $n=43$ 	Single site: cardiac surgery hospital unit; USA	Commenced approximately 4 days post-surgery. Cognitive and behavioural techniques via three counselling sessions incorporating video and a written manual + follow-up telephone counselling one week post-discharge from a nurse. Models used: cognitive behavioural theory	Usual post-surgical care: group lecture that included a brief message not to continue smoking	No significant difference between self-reported continuous abstinence rates at any time during 5.5 year follow-up ($p>.62$). Difference in self-reported 7-day abstinence rate was also non-significant ($p>.52$). Cotinine validation was obtained for 94% of those reporting continuous abstinence for one year and 5.5 years, difference between groups remained non-significant ($p>.52$)	Cognitive-behavioural intervention with one week follow-up was not superior to usual care for patients in hospital following cardiac surgery

Rigotti, Amsten et al. 1997	Patients admitted to hospital who had smoked one or more cigarettes in the previous month <ul style="list-style-type: none"> • Intervention $n=325$ • Usual care $n=325$ 	Single site: teaching hospital; USA	Bedside counselling session, written self-help resources for in-hospital and at-home use, case note prompt for physician to provide cessation advice and 3 post-discharge telephone counselling Models used: motivational interviewing + cognitive behavioural counselling + relapse prevention techniques	Usual hospital care: not further described	At one month follow-up self-reported seven day abstinence rate was higher for the intervention group compared to control (28.9% vs 18.9%, $p=0.003$). This result was not sustained at six-month follow-up, which was verified by saliva cotinine assay (intervention 17.3% vs control 14.0%, $p=0.26$).	Cognitive behavioural intervention was superior to usual care at one month but not at 6 months in improving smoking cessation for hospitalised patients
Shi, Ehlers et al. 2013	Preoperative surgery patients <ul style="list-style-type: none"> • Intervention $n=82$ • Control $n=87$ 	Single site: Mayo Clinic; USA	Brief advice and a check of smoking status via carbon monoxide monitoring at day of surgery, and why it is important to stay smoke free	Brief advice	No difference in carbon monoxide levels at day of surgery between the two groups, $p=0.67$	Informing surgery patients that their carbon monoxide will be measured at the day of surgery does not lead to differences in smoking behaviour
Smith and Burgess 2009	Patients hospitalised for myocardial infarction or coronary artery bypass graft, with minimum hospital admission of 36 hours <ul style="list-style-type: none"> • Intervention $n=137$ • Control $n=139$ 	Single-site: 4 cardiac units in large hospital; Canada	Patients received the minimal intervention and 45-60 minute nurse delivered bedside education and counselling session combined with take home resources (video, audio tape, workbook) followed by 7 telephone counselling session post discharge at 2, 7, 14, 21, 30, 45 and 60 days post-discharge Models used: relapse prevention model	Minimal intervention: personalised quit advice based on medical condition, review of 2 written pamphlets delivered by nurse and allocation of a prompt in case notes for physician to deliver standard scripted quit message at bedside during admission	Self-reported 7 day point prevalence abstinence was significantly higher for intervention versus control at all time-points. Quit rates were very high: 3 months, 76% vs 61%, $p=0.009$; 6 months 67% vs 49%, $p=0.003$; and 12 months, 62% vs 46%, $p=0.007$. Quit rates were lower at 12-month when verified by a proxy, but remained significant.	Intensive intervention increased odds of quitting smoking in cardiac patients
Smith, Corso et al. 2011	General hospital patients hospitalised for a minimum of 36 hours <ul style="list-style-type: none"> • Intensive intervention $n=309$ • Minimal intervention $n=334$ 	Multi-site: 3 hospitals; Canada	Patients received the minimal intervention and 45-60 minute nurse delivered bedside education and counselling session combined with take home resources (video, audio tape, workbook) followed by 7 telephone counselling session post discharge at 2, 7, 14, 21, 30, 45 and 60 days post-discharge Models used: relapse prevention model	Minimal intervention: personalised quit advice based on medical condition, review of 2 written pamphlets delivered by nurse and allocation of a prompt in case notes for physician to deliver standard scripted quit message at bedside during admission	There were no significant differences at 6 or 12 months between the two groups. At 12 months validated point prevalent smoking abstinence was 28% for the intensive versus 24% for the minimal intervention	There were no significant differences for low intensity versus high intensity in the general population
Winickoff, Healey et al. 2010	Postpartum parents admitted to the maternity ward following birth of a child Counselling intervention $n=48$ Usual care $n=53$	One hospital, USA	Parents received a 15-minute face-to-face counselling session tailored for parental smokers and an offer to be enrolled in a Quitline service, as well as letters faxed to the family's relevant paediatrician, General Practitioner and obstetrician recommending appropriate strategies and ongoing support following discharge Based on the 5As approach to cessation	Usual care: no contact relating to smoking cessation	Self-reported 7-day point prevalence for the intervention group was 31% at baseline and to 25% at 3-month follow-up versus 38% at baseline and 23% at 3-month follow-up in the control group (effect size=9.4%, ns). Self-reported 24-hour quit attempts were significantly higher in the intervention group compared to control (64% vs 18%, $p=0.005$)	Enrolling parents into a smoking cessation program during postpartum hospital admission appears to stimulate quit attempts within the day, though this success does not appear to translate to sustained cessation

Abbreviations: nicotine replacement therapy=NRT, Odds Ratio=OR

Table 2. Combination interventions – Description of pharmacological interventions in adjunct to counselling

Study reference	Participants and sample size	Setting description	Intervention	Comparison	Findings narrative	Conclusion
Campbell, Prescott et al. 1991	Inpatients with smoking-related diseases <ul style="list-style-type: none"> • Gum + counselling, <i>n</i>=107 • Placebo + counselling, <i>n</i>=105 	Single site: general hospital; UK	Smoking cessation advice + nicotine gum (2 mg) + outpatient follow-up with a research assistant at 2, 3 and 5 weeks, 3 and 6 months where further advice and gum was provided; Stronger gum offered for up to 3-months for individuals still smoking (4 mg or placebo)	Smoking cessation advice + placebo gum + outpatient follow-up with a research assistant at 2, 3 and 5 weeks, 3 and 6 months where further advice and gum was provided	No difference in validated self-reported continuous smoking abstinence between both groups (20%). Abstinence was higher for cardiac patients compared to other (32% vs 13% for lung). Gum adherence was relatively low	No difference in continuous abstinence for NRT gum versus placebo when combined with counselling
Eisenberg, Grandi et al. 2013	Inpatients with acute myocardial infarction; <ul style="list-style-type: none"> • Bupropion + counselling <i>n</i>=192 • Placebo + counselling <i>n</i>=200 	Multi-site: 38 collaborating centres across 7 countries (USA, Canada, India, Pakistan, Iran, Tunisia and Bangladesh)	Low-intensity counselling and bupropion hydrochloride (Zyban) 150 mg daily for 3 days, 150 mg twice daily for the remainder of the 9 week treatment period	Placebo group received matching placebo administered with the same schedule and low intensity counselling	At 12 months follow-up point prevalence abstinence rates were 37.2% for bupropion group and 32.0% for the placebo group (<i>p</i> =0.33)	No difference between bupropion and placebo at 12 months follow-up
Eisenberg, Windle et al. 2016	Hospitalised patients with acute coronary syndrome; <ul style="list-style-type: none"> • Varenicline + counselling <i>n</i>=151 • Placebo + counselling <i>n</i>=151 	Multi-site: 40 clinical centres across Canada and USA	Intervention consisted low intensity counselling and access to varenicline for 12 weeks	Placebo patients received the same treatment schedule over 12 weeks	Participants treated with varenicline showed higher point-prevalence quit smoking rates at 24 weeks than control (47.3% versus 32.5%, <i>p</i> =0.01), results that were not found for continuous abstinence (35.8% versus 25.8%, <i>p</i> =0.08)	Varenicline and minimal counselling can result in higher quit rates
Myles, Leslie et al. 2004	Preoperative patients undergoing elective surgery <ul style="list-style-type: none"> • Bupropion + brief counselling <i>n</i>=24 • Placebo + brief counselling <i>n</i>=23 	Multi-site: two teaching hospitals; Australia	7 Week supply of bupropion that would last until surgery, as well as brief counselling, telephone follow-up 2-4 days after their quit day and a quit smoking booklet	Placebo patients received the same treatment schedule as the active ingredient group	No differences in quit smoking rates at time of hospital admission, but a significant reduction was shown for intervention versus control, <i>p</i> =0.05. 6 Months after surgery, no differences were found between the two groups (13% versus 5%, <i>p</i> =0.61)	Providing bupropion before surgery can reduce cigarette intake but not quit smoking rates
Ortega, Vellisco et al. 2011	Internal medicine patients <ul style="list-style-type: none"> • NRT + high intensity counselling <i>n</i>=924, • High intensity counselling <i>n</i>=919 	General hospital in Seville, Spain	Cognitive-behavioural counselling (30-45 minutes) every 3 days until release from hospital. After release, patients could choose to do face-to-face follow-up or telephone-follow-up at 1 week, two weeks, month 1,2,3,6, 12. NRT: patches or chewing gum for maximum 12 weeks free of charge	Cognitive behavioural counselling similar to the intervention group	33% of participants treated with NRT continued to smoke compared to 21% of participants who did not have access to NRT as adjunct to counselling, <i>p</i> =0.002. Participants who chose to have outpatient face-to-face follow-up compared to telephone follow-up showed higher quit rates in the NRT group, 39% versus 30%, <i>p</i> =0.03	Adding NRT to high intensity CBT-based smoking cessation program increases cessation rates

Planer, Lev et al. 2011	Adults hospitalised for acute coronary syndrome (including unstable angina and MI) <ul style="list-style-type: none"> • Bupropion + counselling $n=74$ • Placebo + counselling $n=75$ 	Single-site: 2 campuses of a medical centre; Israel	Bupropion 150 mg once a day for 3 days, followed by twice a day for 2 month. 15 minute of motivational support was given during hospitalisation. Face-to-face counselling was provided at month 1 and 2. Weekly telephone contact was performed for two months, followed by monthly telephone follow-ups. Total time was 100 minutes of counselling for the first two months and 100 minutes for the remainder of the year	Placebo once a day for 3 days, followed by twice a day for 2 month. Similar counselling was provided to the placebo group as the active drug group	The overall continuous (self-reported) smoking abstinence rate at 1 year was 31% in the bupropion group and 33% in the placebo group ($p=0.86$). There were furthermore no differences at 3 and 6 months	Bupropion compared to placebo did not lead to higher abstinence rates as an adjunct to intensive counselling
Rigotti, Thorndike et al. 2006	Patients hospitalised for acute cardiovascular disease. <ul style="list-style-type: none"> • Bupropion + counselling $n=124$ • Placebo + counselling $n=124$ 	Multi-site: 5 hospitals; USA	Sustained release bupropion (150 mg) + multicomponent cognitive-behavioural cessation counselling program (12 weeks duration). Treatment commenced during hospital admission	Placebo patients received the same treatment schedule as the active ingredient group	There was no difference in validated seven day point-prevalence abstinence rates at the end of the 12 week treatment period, $p=0.08$ (bupropion 37.1% vs placebo 26.8%), or, one year follow-up, $p=0.49$ (bupropion 25.0% vs placebo 21.3%). Cessation rates were significantly higher in the bupropion group compared to placebo for those who were compliant with medication at twelve weeks ($p=0.04$). This effect was not sustained at one year follow-up ($p=0.23$)	Bupropion may be effective in the short but not long term in increasing quit rates among patients hospitalised with cardiovascular disease
Simon, Duncan et al. 2009	Patients hospitalised for minimum 24 hours and any known patients scheduled for elective admission. <ul style="list-style-type: none"> • Bupropion + counselling $n=41$ • Placebo + counselling $n=42$ 	Single site: veterans affairs hospital; USA	A 7 week course of sustained release bupropion in combination with a behavioural counselling session + 5 follow-up telephone calls post discharge at 1 and 3 weeks, and then monthly for the first 3 months following enrolment into the study	Placebo patients received the same treatment schedule as the active ingredient group	There was no difference in self-reported 7 day point prevalence abstinence at 6 months between intervention and control (29% vs 41%, $p=0.36$), with similar results found by cotinine validation (15% vs 24%, $p=0.41$)	Results found non-significantly higher quit rates for control
Smith, Carson et al. 2013	Smokers admitted to hospital for smoking related illness <ul style="list-style-type: none"> • Varenicline + counselling $n=196$ • Counselling alone $n=196$ 	Multi-site, respiratory, vascular, cardiology and neurology wards; Australia	Varenicline tartrate titrated from 0.5mg daily to 1mg twice daily + Quitline counselling	Quitline only	Self-reported continuous abstinence at 12-month follow-up significantly favoured varenicline + Quitline compared to Quitline only (31.1% vs 21.4%, relative risk 1.45; 95%CI 1.03-2.04, $p=0.03$)	Initiating a course of varenicline tartrate and facilitating Quitline contact during hospital admission improves smoking abstinence for up to a year
Steinberg, Randall et al. 2011	General inpatients <ul style="list-style-type: none"> • Varenicline + counselling $n=40$ • Placebo + counselling $n=39$ 	Single site: university-based hospital; USA	Participants received access to varenicline in hospital and 8 weeks after discharge. They also received low intensity counselling consisting of a 5 to 10 min behavioural intervention and 15 minute long follow-ups during inpatient stay	Placebo patients received the same treatment schedule as the intervention group, as well as the same behavioural counselling	Though not significant, 7 day point abstinence confirmed by expired CO favoured control over intervention at: 4weeks (38% vs 35%); 12 weeks (33% vs 30%) and 24 weeks (31% vs 23%), all, $p>.05$	Pilot study, no significant differences between varenicline and placebo

Cessation for smokers seeking treatment and advice from health care professionals in the hospital setting

Thomsen, Tønnesen et al. 2010	Breast cancer patients scheduled for surgery • NRT + counselling n=58 • Usual care n=62	Multi-site: breast surgery departments; Denmark	Intervention started 3-7 days prior to surgery and continued for 10 days after. It included a single face-to-face counselling session (45-90 minutes), NRT was offered free for the preoperative period and encouragement to remain abstinent for 2 days prior and 10 days following surgery	Routine preoperative advice: inconsistent or no advice regarding risks of smoking in relation to surgery	Self-reported continuous abstinence from 2 days pre to 10 days post-surgery was in favour of the intervention group compared to control; 28% vs 11% (relative risk 2.49; 95%CI 4-37). This difference was not noticeable at 12-month follow-up (13% vs 9%)	45-90 minute one-on-one counselling and the offer of free NRT improved smoking abstinence for the immediate pre and post-operative period, but not long-term
Warner and Kadimpati 2012	Smokers scheduled for elective surgery • Active lozenge+ counselling n=22 • Placebo lozenge + counselling n=24	One hospital; USA	Active 2-4milligram nicotine lozenge in addition to brief cessation counselling. Patients received a supply of 16 lozenges for the pre-surgical admission period (approximately 1 day)	Placebo labelled 2-4milligram lozenge in addition to brief cessation counselling. Patients received a supply of 16 lozenges for the pre-surgical admission period (approximately 1 day)	Pre-operative self-reported abstinence was not different between active and placebo lozenge groups; 73% vs 54% respectively, $p=0.23$	This pilot study indicates that a nicotine lozenge is no more effective than placebo when combined with pre-operative counselling
Wong, Abrishami et al. 2012	Preoperative patients undergoing elective surgery • Varenicline + counselling n=151 • Placebo + counselling n=135	Two hospitals; Canada	Intervention: Varenicline plus 15-minutes of standardised counselling by research coordinators with the first counselling session occurring in the preoperative clinic; varenicline was taken exactly 1 week prior to target quit date and continued for 12 weeks	Placebo tablets for 12 weeks, with initiation 1 week prior to the quit date plus 15-minutes of standardised counselling by research coordinators with the first counselling session occurring in the preoperative clinic	Self-reported 7-day point-prevalence data at 12 months for varenicline versus placebo was 36.4% versus 25.2% (relative risk 1.45; 95%CI 1.01-2.07; $p=0.04$), which was also significant in favour of varenicline at 3 and 6 months follow-up	Varenicline successfully improved long-term (12-month) quit attempts among preoperative surgical patients compared with an identical placebo

Abbreviations: nicotine replacement therapy=NRT, Odds Ratio=OR. In general pharmacotherapy driven interventions do not occur without at least minimal counselling. The following interventions test for the difference between pharmacotherapy versus placebo, but both groups had access to some sort of counselling

Table 3: Descriptive summary of multicomponent interventions

Study reference	Participants and sample size	Setting description	Intervention	Comparison	Findings narrative	Conclusion
Lindström et al. 2008 Azodi et al. 2009	Hip or knee arthroplasty, inguinal or umbilical primary hernia repair or laparoscopic cholecystectomy patients • Intervention $n=55$ • Control $n=62$	Multi-site: university hospitals; Sweden	Intervention started 4 weeks prior to hospitalisation and lasted 4 weeks after. It included weekly face-to-face or telephone meetings, referral to Quitline, free NRT	Brief or no smoking cessation information	Validated up until 3 weeks after surgery shows 36% of intervention participants and 2% of control participants being continuously abstinent, $p<0.001$. 12 months point-prevalent (non-validated) self-reported smoking cessation rates were 33% versus 15% respectively, $p=0.03$	A multicomponent approach starting prior to hospital admission can reduce smoking cessation rates short-term and long-term
Berndt et al. 2017	Inpatients with coronary heart disease: • Usual care $n=245$ • Telephone counselling + NRT $n=223$ • Face-to-face counselling + NRT $n=157$	Multi-site: 8 cardiac wards (8 hospitals); The Netherlands	Both counselling groups included an inpatient and outpatient phase (using the Ask-Advise-Refer strategy: assess smoking behaviour, advice to quit, refer to outpatient cessation counselling; Counselling was tailored for the patient's willingness to quit and was based on Transtheoretical model NRT patches were provided for 8 weeks for both groups Telephone-counselling: provided by the Dutch Expert Centre for Tobacco Control lasting at least 15 minutes per call; Face-to-face: provided by cardiac nurses qualified as smoking cessation counsellors lasting 30-45 minutes	General quit smoking brochure + assessment of smoking behaviour and provision of quit advice by a cardiologist or ward nurse	There were no overall significant differences in continuous quit rates between the three groups ($p=0.17$) at 12 months. Splitting the results for low SES vs high SES showed that there was no difference between the three interventions for high SES, but that patients with low SES had higher quit rates when using face-to-face and telephone counselling compared to usual care, specifically when they have low to moderate intention to quit	More intensive behavioural approach is effective for low SES, but does not lead to higher quit rates for high SES patients
Bernstein et al. 2013	Emergency department smokers with substance use disorders; • Enhanced care $n=48$ • Usual care $n=40$	Single site: urban academic hospital emergency department; USA	Enhanced care consisting of quit smoking brochure, 10-15 minute brief motivational interviewing session, 6 weeks of nicotine patches and a telephone follow-up at 48-72 hours after ED discharge	Brochure describing the health risks of smoking and contact information for a cessation programs in the area	No difference in 30-day continuous abstinence at 3 month follow-up, but biochemically validated 7-day point-prevalent abstinence was higher for enhanced care (14.6%) compared to usual care (0%; $p=0.015$)	Enhanced care including NRT can lead to increased quit rates at 3 month follow-up
Bernstein et al. 2015	Emergency department smokers • Enhanced care $n=386$ • Usual care $n=388$	Single site: urban hospital emergency department; USA	Enhanced care consisting of quit smoking brochure, 10-15 minute brief motivational interviewing session, referral to Quitline, 6 weeks of nicotine patches and a telephone follow-up at 72 hours after ED discharge	Brochure describing the health risks of smoking and contact information for a cessation programs in the area	Significant difference in biochemically validated 7-day point-prevalence at 3 months follow-up between intervention (12.2%) and control (4.9%). No significant differences at 1 year follow-up.	Enhanced care including NRT can lead to increased quit rates at 3 month follow-up

Cessation for smokers seeking treatment and advice from health care professionals in the hospital setting

Borglykke et al. 2008	Inpatients with exacerbations of COPD <ul style="list-style-type: none"> • Group treatment $n=121$ • Usual care $n=102$ 	Single site: university hospital; Denmark	Standard information on smoking cessation + smoking cessation group treatment consisting of weekly 2-hour sessions over 5 weeks based on materials developed by the Danish Cancer Society and others;. Participant spouses offered participation for supportive effect; complimentary NRT was provided when needed	Standard information on smoking cessation	Self-reported point prevalence smoking cessation (biochemically validated in 84%) at 1 year was higher for intervention (30%) versus UC (13%)	Group training + NRT can increase smoking cessation rates at 1 year
Fellows et al. 2016	Hospitalised adult smokers; <ul style="list-style-type: none"> • Intervention $n=597$ • Control $n=301$ 	Multi-site: 3 large community hospitals; USA	Intervention included intensive bedside tobacco use assessment, cessation counselling and proactive assisted referrals to a tobacco treatment specialist consult service for available outpatient counselling programs and medications. Patients received NRT as part of discharge medication and access to an Interactive voice recognition intervention that provided four follow-up calls over 7 weeks.	Usual care included intensive bedside tobacco use assessment and cessation counselling (15 minute), printed and verbal	There was no difference in self-reported 30-day abstinence for the intervention group (18%) versus to control group (17%), $p=0.569$, with similar results for continuous abstinence 13% and 14% for usual care at 6 months follow-up	Assisted referral and access to an interactive voice recognition follow-up system did not lead to an increase in smoking cessation rates compared to usual care
Froelicher et al. 2004	Women hospitalised with cardiovascular disease; <ul style="list-style-type: none"> • Intervention $n=142$ • Usual care $n=135$ 	Multi-site: 10 San Francisco Bay area hospitals; USA	Usual care + a nurse-managed cognitive behavioural relapse-prevention intervention at bedside (30-45 minutes) during hospital admission, with telephone contact at intervals post discharge up to 5 times). Counselling included multimedia aids such as educational videos and stress and relaxation audiotapes along with an American Heart Association workbook and videotape on smoking cessation relapse and prevention Note: Subjects in both arms had access to NRT	Usual care: brief counselling by physician, a quit smoking pamphlet and a list of smoking cessation classes. Note: Subjects in both arms had access to NRT	At 6 months follow-up 7 day point prevalence was 51.5% in the intervention group and 40.8% for usual care, with no further significant difference between groups observed for 12 and 24 month follow-up periods. Overall the intervention group showed higher continuous abstinence compared to control, $p=0.04$	Overall high rates of smoking cessation in both groups, but higher rates of continuous abstinence for the more intensive intervention
Lacasse et al. 2008	Cardiac, respiratory and general patients with anticipated duration of >36 hours hospitalisation. <ul style="list-style-type: none"> • Intervention $n=99$ • Control $n=97$ 	Single site: tertiary hospital; Canada	Strong quit smoking message, self-help motivational quitting material, cessation counselling based on self-efficacy theory (between 10-20 minutes), use of NRT patches and 4 follow-up telephone calls of about 10 minutes	No cessation advice	No significant differences in point prevalence abstinence between groups at 6 month follow-up, 32.2% for intervention versus 30.0% for control, or 12month follow-up, 30.3% for control and 27.8% for control. NRT was only provided to 18 people	A medium intense intervention with follow-up until 1 month does not lead to higher smoking cessation rates

Lee et al. 2013	Adult surgery patients • Intervention $n=84$ • Standard care $n=84$	Single site: ambulatory and short-stay (<3 days) surgical facility; Canada	Brief counselling, smoking cessation brochures, referral to Quitline, 6 week supply of NRT (transdermal patches). The intervention started 3 weeks before hospitalisation	Standard care: inconsistent smoking cessation advice up to health professionals	At 30 days self-reported abstinence (7-day point prevalence) was 11% in control versus 28.6% in the intervention group, $p=0.008$. By starting the trial before the hospitalisation, self-reported abstinence before surgery (validated by carbon monoxide array) was 6% in control versus 14.3% for the intervention, $p=0.03$	Pre-operative multicomponent smoking cessation intervention leads to peri-operative smoking cessation and 30-day self-reported abstinence
Lewis et al. 1998	All smoking adult inpatients • Counselling + NRT patch $n=62$ • Counselling + placebo patch $n=62$ • Minimal care $n=61$	Single site: university teaching hospital; USA	Counselling + NRT: minimal care and access to patches (3 week 21 mg and 3 week 11 mg) followed by telephone counselling on 4 occasions Counselling + placebo (CPP): minimal care, 6 weeks placebo patches, followed by telephone counselling on 4 occasions Counselling was based on CBT and motivational interviewing	Minimal care: brief 2-3 minute motivational message + self-help booklet	7 day point prevalent cessation + carbon monoxide validation at 6 months did not find a difference between either condition, 4.9% for minimal care, 6.5% for the placebo group and 9.7% for the patch group, $p=0.57$. Those admitted with respiratory diseases had highest quit rate (46%)	Patches did not lead to higher quit rates at 6 months compared to placebo or minimal intervention, but this might be the result of a lack of power
Miller et al. 1997	All smoking inpatients (excluding patients of obstetrical or psychiatric wards) • Intensive intervention $n=540$ • Minimal Intervention $n=460$ • Usual care $n=942$	Multi-site: 4 medical centres; USA	Minimal intervention: 30 minute counselling based on social learning and relapse prevention therapy + 16 minute video and access to NRT when necessary. One follow-up call at 2 days was planned. Intensive care: same as above but with 4 follow-up calls. If relapse occurred, patients could have another 30 minute counselling session	Usual care received 1 to 2 minute counselling provided by the physician, a standard booklet on smoking cessation and the option to do outpatients for co-payment	Self-reported smoking cessation + cotinine validation showed that at 12 months 27% of participants in the intensive intervention, 22% of the minimal intervention and 20% of the usual care group were abstinent, $p=0.02$. The difference was only significant between intensive and usual care, $p=0.009$. Patients who used NRT had lower cessation rates than those without, which is possibly linked to nicotine dependence	Significantly more smokers quit when treated with intensive compared to usual care, but not with minimal care
Moller et al. 2002	primary elective hip or knee alloplasty patients • Intervention $n=56$ • Control $n=52$	Multi-site: three university hospitals; Sweden	Intervention that started 4 weeks prior to surgery. Patients had option to quit cold turkey or reduce intake to at least 50%. NRT was provided free of charge and patients were counselled on side-effects, withdrawal symptoms and weight gain	Standard care	Smoking cessation results not described	Smoking cessation results not described
Molyneux et al. 2003	Medical and surgical patients: Usual care $n=92$ • Counselling alone $n=91$ • Counselling + NRT $n=91$	Single site: metropolitan hospital; UK	Counselling alone: 20 minute counselling by physician or nurse + leaflet. Patients were advised on NRT Counselling + NRT: Counselling as described above + access to a 6 week course of NRT (patch, gum, inhalator, lozenge or nasal spray)	Usual Care: no additional intervention	Continuous validated abstinence rates at 12 months for NRT plus counselling, counselling alone and usual care were 11%, 4%, and 8%, respectively ($p=0.25$), and for validated point abstinence 17%, 6% and 8% ($p=0.03$)	No significant difference in continuous, but a result in point-prevalent abstinence for counselling + NRT compared to usual care and counselling alone

Murray et al. 2013	Self-reported smokers within 4 weeks of admission • Intervention $n=264$ • Control $n=229$	Single site: 18 medical wards of large teaching hospital; UK	Brief advice, standard written information, daily counselling and dual NRT when possible (patch + fast acting product). If contraindicated, varenicline or bupropion was used. Counselling was based on motivational interviewing. Upon discharge patients were offered access to quit smoking service	Usual care: advice given based on discretion of doctors or other HP	Continuous abstinence and carbon monoxide validation at 4 weeks: 38% for intervention versus 17% for control, adjusted odds ratio 2.10 (95% confidence interval 0.96 to 4.61)	No significant results for smoking cessation rates at 4 weeks for delivery of evidence based cessation support by hospital based cessation practitioners
Nagle et al. 2005	All patients excluding patients in accident and emergency, day surgery and dialysis, transplant and intensive care units • Counselling + NRT $n=711$, • Minimal care $n=711$	Single site: metropolitan tertiary teaching hospital in Hunter region, Australia.	Two brief counselling sessions executed by nurses, delivery of patient booklets and depending on nicotine dependency an offer for NRT	No intervention: minimal contact about smoking cessation	Validated self-report 24 hour point prevalence with cotinine and carbon monoxide validation. Did not find a difference at 12 month (19.5% vs. 21.9%) nor was there a difference for continuous abstinence (11.7% vs. 13.9%) at 12 months	Brief nurse-led counselling without a follow-up does not improve smoking cessation rates compared to a minimal intervention
Neuner et al. 2009	Emergency department patients • Intervention $n=515$ • Control $n=529$	Single site: emergency department in Berlin; Germany	Patients received an on-site counselling (1-3 minutes) session and up to 4 telephone booster calls. Counselling was based on motivation to quit. Free NRT was provided on site	Usual care: not described	7-day abstinence at 12 months showed no significant difference for patients in the intervention group (14.2%) versus patients in the control group (11.3%), $p=0.15$	ED initiated brief counselling and access to NRT did not lead to higher quit rates at 12 month follow-up
Ostroff et al. 2014	Cancer patients scheduled for surgery • Intervention $n=37$ • Control $n=37$	Single site: cancer centre; USA	The intervention focused on scheduled reduced smoking before surgery. It contained best practice care (see control column) and pre-surgical tapering using a computer program (Quitpal)	Best practice: telephone and bedside counselling by trained nurse (based on motivational interviewing). 5 sessions + NRT were offered (not obligatory)	There were no significant differences in 7-day point prevalent abstinence at 3 month and 6 month follow-up (36% versus 34%, $p=0.88$, and 32% versus 32%, $p=1.0$, respectively)	No difference between best-practice and best-practice + pre-surgical reduction tool using a computer
Prochaska et al. 2014	Inpatient psychiatric patients (locked ward with smoking ban) • Counselling + NRT $n=113$ • Usual care $n=111$	Single site: Psychiatric ward; USA	Intervention based on Transtheoretical model (TTM). 10 week NRT provision + computer-based TTM intervention with tailored reports, stage-based tailored print material, 15-30 minute counselling session. Follow-up at 3 and 6 month repeated the computer intervention	Usual care: not described	The 7-day point prevalence (verified by CO testing and collateral reports) was 13.9% vs 3.2% at month 3, 14.4% vs 6.5% at month 6, 19.4% vs 10.9% at month 12 and 20.0% vs 7.7% at month 18, with an OR of 3.15, $p=0.018$ for month 18. Retention to the intervention was over 80%	A computerised motivationally tailored intervention reduces smoking cessation rates in psychiatric patients up to 18 months
Ratner et al. 2004	Elective surgery patients • Counselling + NRT $n=117$ • Usual care $n=120$	Single site: teaching hospital; Canada	Pre-operative intervention containing NRT and counselling, emergency kit and a telephone hotline number. Further counselling was provided during admissions and telephone follow-up (up to 9 times) occurred after discharge	No intervention	Significantly higher numbers of 24 hour point prevalent abstinent smokers in intervention group (73%) versus control (53%), $p=0.003$. There were no differences found at 6 month and 12 month follow-up after surgery	Reduction in pre-operative smoking can be achieved by multi-modal intervention

Reid et al. 2003	<p>Patients with coronary artery disease</p> <ul style="list-style-type: none"> • NRT + counselling $n=126$ • Minimal intervention $n=128$ 	<p>Single site: tertiary cardiac facility; Canada</p>	<p>Patients would receive brief individual counselling (5-10 minutes), a self-help booklet and a referral to the primary care physician. Patients were called 4 weeks after discharge to provide positive reinforcement. If smoking had started nurse counselling commenced: three 20 minute face-to-face sessions + NRT 4 weeks 10mg 16 hour patches and 2 weeks 5mg/16 hour patches</p>	<p>Patients would receive brief individual counselling (5-10 minutes), a self-help booklet and a referral to the primary care physician</p>	<p>The point-prevalent self-reported abstinence rate in the stepped-care group at 3 month follow-up was 53% in the stepped care group and 42% in the control group, $p=0.05$. This significant difference did not maintain at 12 months, 39% vs 36%, $P=0.36$</p>	<p>Stepped care only resulted in a significant difference at 3 months, but not at 12 month, compared to minimal intervention</p>
Reid et al. 2007	<p>Cardiac patients</p> <ul style="list-style-type: none"> • Intervention $n=50$ • Control $n=49$ 	<p>Single site: University of Ottawa Heart Institute; Canada</p>	<p>Standard bedside counselling + access to NRT. + Interactive voice response technology: calls at days 3, 14 and 30 day post-discharge. If chance of relapse was found, the patient was flagged and a nurse specialist would provide counsellor-led telephone sessions (3x 20 minutes over 8-weeks)</p>	<p>Usual care: Standard bedside counselling and access to NRT. No further treatment, but participants were able to join outpatient program or use other resources</p>	<p>At 1 year follow-up 46% in the intervention group ($n=23$) versus 34.7% ($n=17$) were abstinent according to self-reported 7 day point-prevalence, $OR=1.6$, $p=0.25$. At 12 weeks follow-up, 42% versus 35% were abstinent</p>	<p>The trial did not find significant differences between the two groups, but suffered from low power as it was a pilot trial</p>
Richman et al. 2000	<p>Adult smokers presenting to ED</p> <ul style="list-style-type: none"> • Intervention $n=78$ • Control $n=74$ 	<p>Single site: emergency department; USA</p>	<p>Two page "Stop Smoking" pamphlet, a comprehensive information package on the use of NRT, standardised scripted counselling by physician incl. written and verbal referral to in-house smoking cessation program (motivational interviewing + education sessions + opportunity to commence NRT) and advice that joining this program is more cost effective than their smoking habit</p>	<p>Two page "Stop Smoking" pamphlet</p>	<p>There were no differences in self-reported three month smoking abstinence for intervention (10.9%) versus control (10.4%), $p=1.0$. None of the intervention group participants contacted or attended the in-house smoking cessation program during the study period.</p>	<p>Physician counselling and referral to a hospital based smoking cessation program had no effect on quit rates or program attendance at three-month follow-up.</p>
Rigotti et al. 2014	<p>Patients admitted to hospital who had already received smoking cessation counselling during hospital stay</p> <ul style="list-style-type: none"> • Intervention $n=198$ • Control $n=199$ 	<p>Single site: general hospital; USA</p>	<p>Inpatient cessation services (counselling + access to NRT). At discharge: pharmacotherapy supplied for up to 90 days as discussed by patient and counsellor during inpatient stay, 5 automated interactive voice response telephone calls at 2, 14, 30, 60 and 90 days post discharge (providing support and advice and encouraged them to request counsellor contact if low confidence)</p>	<p>Inpatient cessation services (counselling + access to NRT). At discharge they received Standard care: post-discharge pharmacotherapy recommendation and advice to contact a Quitline</p>	<p>Validated 7-day abstinence at 6 months was significantly greater for the intervention group compared to control (26% vs 15%, $p<.009$). Self-reported continuous abstinence 6 months was also significantly improved (27% vs 16%, $p=0.007$). The costs per patient for the intervention were 354USD for the first 12 months and 108USD for subsequent years</p>	<p>An intervention of free pharmacotherapy for 90 days and follow-up via automated telephone call significantly improved smoking cessation for inpatients planning to quit</p>

Cessation for smokers seeking treatment and advice from health care professionals in the hospital setting

Sherman et al. 2016	Adults admitted to a hospital ward, emergency department or intensive care unit • Intervention $n=805$ • Quitline $n=814$	multi-site: 2 public hospitals; USA	Seven sessions of telephone counselling taking place at 2, 3, 5, 9, 16, 32 and 42 days post-discharge. Cognitive and behavioural approach to supporting participant's chosen quit date and prevent any possible relapse. Eight weeks of NRT provided Models used: motivational interviewing + problem solving therapy + CBT	Quitline operators instructed to contact participants via telephone to conduct 15-20 minute counselling session and one follow-up call	Self-reported abstinence rates at two month follow-up favoured intervention vs control (18.9% vs 13.6%, RR 1.39, 95%CI 1.11-1.74) and again at 6 month follow-up (25.8% vs 20.5%, RR=1.25, 95% CI 1.05,1.50). The mean cost per participant was 17.84USD for control and 76.62USD for intervention	Intensive telephone counselling leads to higher quit rates than a single Quitline contact
Simon et al. 1997	Patients undergoing non-cardiac surgery. • Intervention $n=168$ • Control $n=156$	Single-site: veterans affairs hospital; USA	Individual counselling session prior to discharge (30-60min) incl. education and advice, behavioural self-management techniques, educational video, an offer of 3 months NRT, written self-help resources and 5 follow-up telephone calls	A 10 min pre-discharge counselling session and provision of written self-help resources	6 month self-reported 7 day abstinence favoured intervention over control, though not significant (22% vs 14%, $p=0.06$). The difference between intervention and control became significant at 12 months (27% vs 13%, $p<.01$). Cotinine validated 7 day abstinence at 12 months was also significantly in favour of intervention compared to control (15% vs 8% , $p=0.04$)	A multicomponent discharge intervention offered to hospital inpatients significantly improved smoking abstinence compared to minimal intervention
Simon et al. 2003	General inpatients (patients with psychiatric or terminal illness were excluded). • Intervention $n=102$ • Control $n=107$	Single-site: veterans affairs hospital; USA	Individual counselling session prior to discharge (30-60min) incl. education and advice, behavioural self-management techniques, educational video, an offer of 2 months NRT, written self-help resources and 5 follow-up telephone calls	Minimal care: 2 months NRT appropriate dose for pre admission cigarette use and a 10 minute counselling session	6 month self-reported 7 day abstinence significantly favoured intervention over control (35% versus 21%, $p=0.02$). The difference for this outcome remained significant at 12 months (33% versus 20%, RR 1.7 95%CI 1.1-2.7, $p=0.03$). Cotinine validated 7 day abstinence at 12 months was not significant with those lost to follow-up considered smokers (29% versus 20%, $p=0.07$)	Higher rates of quitters for more intensive behavioural counselling compared to minimal care
Sørensen and Jørgensen 2003	Pre- and post-operative patients undergoing colorectal surgery • Intervention $n=27$ • Control $n=30$	One hospital; Denmark	Intervention: initiated 2-3 weeks pre-operatively with pre- and post-operative support by project nurse (telephone call, outpatient or home visit the day after expected smoking cessation) and NRT (Nicorette patch, gum, resoriblet, inhaler or nasal spray at least daily with no upper limit for use) until 24hours before surgery Model: None reported	Maintenance of daily smoking habits, where smoking was allowed in single room studies	Self-reported continuous abstinence data at 15 days (pre-operative period) indicate a significant intervention effect compared to control (89% vs 13% abstinent; $p<0.05$). In the post-operative period 92% vs 50% were abstinent respectively ($p<0.05$)	Pre and post-operative smoking cessation advice with NRT can improve smoking cessation rates short-term

Stockings et al. 2012 Stockings et al. 2014	Mental health inpatients in a smoke free ward • Intervention $n=104$ • Control $n=101$	single-site: psychiatric ward; Australia	Standard care (see control column) as well as written self-help resources, a 10-15 minute motivational interview, 2 week supply of NRT on discharge, bi-weekly telephone follow-up for 4 months, additional 12 week supply of NRT, referral to Quitline, referral to community run cessation groups	Standard care(should have included):assessment of smoking status and nicotine dependence on admission, brief quit advice, NRT during admission and 3 days post-discharge, post-discharge smoking care plan	At end of follow-up (6 months) there was no difference between intervention and control, 7.7% versus 5.9%, but significantly more patients in the intervention (11.5%) versus the control (2%) group had 7-day point prevalence abstinence	Lack of strong evidence to support sustained smoking cessation in psychiatric inpatients using a multicomponent intervention.
Taylor et al. 1990	Patients hospitalised with myocardial • Intervention $n=86$ • Control $n=87$	Multi-site: 4 Kaiser Foundation hospital; USA	Nurse-managed intervention consisting out of an educational counselling session, written educational resource, audiotapes (assisted with progressive muscle relaxation), counselling on how to avoid high-risk relapse situations. If unable to quit follow-up outpatient appointment with nurse and if strong withdrawal symptoms free NRT was provided. Included telephone follow-up calls at 2 and 3 weeks and then monthly for 4 months following discharge	usual care: no specific quit instructions	At 12 month follow-up carbon monoxide validated smoking cessation rates significantly favoured intervention compared to control (61.6% versus 32%, $p=0.001$)	Nurse led intervention initiated in patients hospitalised for myocardial infarction improves 12 month cessation rates
Taylor et al. 1996	General hospital inpatients • Intervention, $n=315$ • Control $n=313$	Multi-site: 4 Kaiser Foundation hospital; USA	Multicomponent intervention including a standardised message from physician, one hour meeting with nurse during inpatient stay, 16 minute video, workbook, audiotape, counselling on high-risk relapse situations and offer of NRT if significant withdrawal symptoms or high nicotine dependence was established. Telephone follow-up was provided at 2 days, 1 week, 3 weeks 90 days post-discharge	Usual care: standardised message from physician + written self-help resource	Self-reported 7 day point prevalent cessation significantly favoured intervention compared to control at all time-points including 12 month follow-up (36% versus 28%, $p=0.022$). Following either cotinine or proxy confirmation, 12 months 7 day abstinence remained significantly in favour of intervention compared to control (31% vs 21%, $p=0.006$)	A nurse coordinated intervention can improve smoking cessation for hospitalised patients
Thomas et al. 2016	All adult smokers were eligible regardless of the ward they were admitted to • Intervention $n=300$ • Control $n=300$	multi-site: three tertiary hospitals; Australia	System change approach: pharmacist led behavioural counselling based on 5A's, pharmacotherapy was encouraged and offered free during hospital admission and at least 1 week after, access to educational resources and referral to a specialised cessation services. If interested patients were referred to Quitline and provided ongoing support post-discharge (communication with GP and community pharmacy)	Usual care: pharmacotherapy was available to all patients during hospital stay (not always offered systematically)+ brief counselling variably offered + NRT patches available to those eligible and interested	No difference in carbon monoxide verified sustained abstinence at 6 months between intervention (11.6%) and control (12.6%), OR 0.91, 95%CI 0.55-1.50) nor at 12 months, 11.6% versus 11.2%	Multicomponent intervention led by pharmacists did not appear affective in improving smoking cessation rates

Vial et al. 2002	<p>Adult smokers admitted to medical or surgical wards</p> <ul style="list-style-type: none"> • Hospital-based program $n=35$ • Community pharmacy-based program $n=34$ • Minimal intervention $n=33$ 	One hospital; Australia	<p>All intervention participants received a 30-45 minute consultation with the hospital pharmacist and were commenced on nicotine patches (half price) following counselling for appropriate use. And referred to either a Hospital-based program or Community pharmacy-based program one week later. Weekly counselling sessions post-discharge and provision of discounted patches continued for 16 weeks.</p>	<p>Minimal intervention: provided with commercially available quit resources and cessation advice including strategies and behavioural approaches</p>	<p>Self-reported continuous abstinence was not different between the three groups at 3, 6 and 12 months. This was the same for self-reported 7-day point prevalence at 3 and 6 months, at 12 months there was a significant difference between hospital (38%), community pharmacy (24%) and minimal intervention arms (4.6%) ($p=0.031$)</p>	<p>Counselling in addition to nicotine patches was equally as effective when provided in the hospital or community pharmacy setting and superior to minimal intervention</p>
Warner et al. 2011	<p>Pre-operative patients undergoing elective surgery</p> <ul style="list-style-type: none"> • Intervention $n=149$ • Control $n=151$ 	One hospital; USA	<p>Intervention: clinician-delivered intervention to facilitate Quitline use provided by the Mayo Clinic Tobacco Quitline using a dedicated toll-free number with an initial session post-recruitment with a Quitline counsellor for approximately 45-minutes and up to eight subsequent proactive sessions combined with four weeks of free NRT with optional four more weeks of NRT if patient still engaged in quitting Model: 5A approach (Ask, Assess, Advise, Assist and Arrange)</p>	<p>Brief (approximately 5 minute) intervention based on the 5A approach including a brochure with the number for Quitline</p>	<p>Self-reported 7-day point-prevalence data at 3 months showed no difference between groups with 25.8% compared to 26.8% abstinence in the control and Quitline groups respectively; Continuous abstinence was also not significant and neither were 7-day point prevalence of continuous abstinence rates at 1 month</p>	<p>No difference was observed between the Quitline facilitated group and the group receiving the information brochure that included the Quitline number</p>
Warner et al. 2016	<p>Hospitalised smokers</p> <ul style="list-style-type: none"> • Quitline assistance $n=300$ • Brief advice only $n=300$ 	Two hospitals; USA	<p>Quitline facilitation intervention including cessation advice and Quitline information to facilitate use of the service. An information brochure and wallet sized card were also provided. At the participant's discretion a call to Quitline was made for them to arrange for an initial counselling call and enrol them in relevant services. NRT was also offered during inpatient stay and for two weeks following discharge Model: Social Cognitive Therapy</p>	<p>Brief intervention including brief assistance and advice in using a brochure targeting cessation and including the Quitline number, though use of the number was not actively encouraged. NRT was also offered during inpatient stay and two weeks following discharge</p>	<p>7-day point-prevalence abstinence were not statistically difference between intervention and control groups at 7 days (33% vs 36%, $p=0.49$), 30 days (31% vs 31%, $p=1.0$) or 6 months (24% vs 24%, $p=1.0$)</p>	<p>Facilitating Quitline utilisation did not improve self-reported smoking abstinence compared to providing brief general advice and resourced</p>

Wolfenden et al. 2005	Pre-operative patients undergoing surgery <ul style="list-style-type: none"> • Intervention $n=124$ • Control $n=86$ 	One hospital; Australia	Intervention: tailored counselling on cessation delivered by computer (17 minutes), print material to prompt advice by cessation nurse and anaesthetic staff, computer assisted technology to deliver counselling following attendance at the clinic and before admission (telephone counselling), patients smoking >10 cigarettes per day received free NRT (1-2 weeks) with NRT available during post-operative admission Model: None reported	Usual care consisted of clinic staff who had the opportunity to provide advice on quitting and to prescribe pre- and post-operative NRT at their discretion	Self-reported continuous abstinence at 3 months showed that intervention subjects, when compared with usual care participants, were more likely to report abstinence before surgery (73% vs 56%; OR2.2) and 3 months after attendance (18% vs 5% OR=3.9) respectively	Tailored counselling sessions delivered in person, over telephone and via a computer provided superior treatment efficacy compared to usual care for pre- and post-operative surgical patients
-----------------------	---	-------------------------	---	---	---	--

Abbreviations: nicotine replacement therapy=NRT, Odds Ratio=OR