

## **Medway policy to enable care and treatments to be safer and more effective through encouraging smokers to quit**

### **QUIT SMOKING FOR BETTER, SAFER CARE**

#### **1. Introduction**

This is a policy for both Medway CCG and Medway Hospital NHS Foundation Trust to support clinicians in encouraging their patients to quit smoking as an adjunct to the treatment of any condition and, as clinically appropriate, in advance of elective surgical procedures. The purpose of this is to reduce the risks, and increase the clinical effectiveness, of treatments of disease and disability.

##### **1.1. Context**

Smoking tobacco is the single greatest cause of preventable death and ill-health<sup>i</sup> and is causally linked to many conditions affecting almost all parts of the body.<sup>ii</sup> It is also a significant cause of avoidable treatment complications, treatment failures and prolonged hospital stays. There is also strong evidence that smokers who have surgery are at higher risk of complications and poorer outcomes.<sup>iii, iv</sup>

#### **2. The purpose of this policy**

Smoking cessation services are provided by Medway Council's public health team in a variety of locations. This policy is intended to make it easier for clinicians of all types to raise the subject of smoking risks and to refer their patients for advice and support in quitting.

Specifically, this policy is intended to enable people to quit smoking:

- as an adjunct to any treatment to increase its clinical effectiveness, as many drugs are adversely affected by chemicals in tobacco smoke and many conditions are aggravated by continued smoking (and continuing smoking in any circumstances increases a person's risk of developing avoidable disease and disability and of premature death); and
- where it is clinically appropriate, sufficiently far in advance to allow a gap of four to six weeks of smoking abstinence prior to elective surgery.

#### **3. What is the evidence for this?**

A summary of evidence-based quantified risks and the general effects of smoking on health and on various treatments and the quantified benefits of quitting, can be found in the appendix. Briefly, there is a plethora of scientific evidence that smoking tobacco, including exposure to second-hand smoke ('passive smoking'), substantially increases the risk of avoidable death from a number of conditions, is causally related to, or aggravates, many conditions which are not necessarily fatal, interferes with the metabolism of many drugs and reduces the effectiveness of a number of treatments and/or counters their effect on the body in other ways, and increases the risk of complications and death from surgery.

i See: <http://www.who.int/mediacentre/factsheets/fs339/en/> (accessed 29 November 2016)

ii Surgeon General. *The Health Consequences of Smoking – 50 years of Progress. A Report of the Surgeon General*. US Department of Health and Human Services. 2014. See: [http://www.cdc.gov/tobacco/data\\_statistics/sgr/50th-anniversary/index.htm](http://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm) (accessed 29 November 2016)

iii Turan A, Mascha EJ, Roberman D, Turner PL, You J et al. Smoking and perioperative outcomes. *Anaesthesiology* 2011; 114: 837-46

iv See: <http://www.rcoa.ac.uk/sites/default/files/Joint-briefing-Smoking-Surgery.pdf> (accessed 4 November 2016)

## 4. Ethical considerations

Normally, four ethical considerations are taken into account when determining the appropriateness of health care services. These are discussed in the following sub-sections.

- 4.1 Respect for personal autonomy – requires that we help people to make their own decisions (for example, by providing important information), and respect those decisions (even when we may believe that a patient’s decision may be inappropriate),<sup>v</sup> noting that this does not require us to provide a clinical service or treatment simply because someone says that they want it when considering the various risks and benefits and availability of resources of all types and other ethical considerations.
- 4.2 Beneficence – emphasises the moral importance of ‘doing good’ to others, entailing doing what is ‘best’ for a patient or group of people,<sup>v, vi</sup> noting that doing good for one person may prevent us from doing good for another (for example, because of the opportunity cost of a clinical intervention and/or its potential complications) and that it is not possible to provide benefit for everybody because resources of all types are limited.
- 4.3 Non-maleficence – requires that we should seek not to harm patients, and, because most treatments carry some risk of doing some harm as well as doing good – and in the context of this policy, a patient continuing to smoke can do harm – all the potential goods and harms and their probabilities must be weighed to decide what, overall, is in a patient’s best interests.<sup>v, vi</sup>
- 4.4 Distributive justice – recognises that time and resources do not allow every patient to have the ‘best possible’ treatment and that decisions must be made about which treatments can be offered within a health care system – this principle of distributive justice emphasises two points:
- people in similar situations should normally have access to similar health care, and
  - when determining what level of health care should be available for one group, we must take into account the effect of such a use of resources on others (that is, the opportunity costs).<sup>v</sup>

In making the ethical consideration of distributive justice, it is necessary to consider the potential impact of denying other people access to services and treatments because of the avoidable increased risks of complications, reduced treatment effectiveness and the need for additional services (such as ITU admission) potentially caused by someone continuing to smoke when receiving treatment.

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v Parker M, Hope T. *Ways of thinking about medical ethics*. In *Ethics*. The Medical Publishing Company Ltd. 2000

vi The question of who should be the judge of what is ‘best’ is often interpreted as focusing on what an objective assessment by a relevant health professional would determine as in the patient’s best interests, with the patient’s own views being considered through the principle of respect for patient autonomy, the two only conflicting when a competent patient chooses a course of action that might be thought of as not in their best interests [Parker M, Hope T. *Ways of thinking about medical ethics*. In *Ethics*. The Medical Publishing Company Ltd. 2000]

## 5. Putting this in to practice

### 5.1 Prior to referral of a smoker for assessment where elective surgery is a treatment option

Clinicians of all types and in all settings making referrals of people who are smokers where elective surgery is a possible treatment option are asked to:

- explain to their patients that being a smoker at the time of surgery will increase the risk of death, cardiac arrest, heart attack, chest infection, sepsis and septic shock, impaired wound healing, treatment failure, other complications, prolonged hospital stay and the risk of hospital readmission, whereas being abstinent for some 4-8 weeks before surgery will significantly reduce these risks;
- provide brief advice on stopping smoking;<sup>vii</sup>
- automatically refer their patients to Medway Council's smoking cessation service unless the patient expressly refuses consent for this;<sup>viii</sup> and
- inform the clinician to whom they are referring their patient that this has been done.

### 5.2 Prior to referral of a smoker for assessment or treatment of any type, or during any type of treatment in any care setting

Clinicians of all types and in all settings making referrals of people who are smokers for assessment or treatment of any condition, or during any type of treatment in any clinical setting are asked to:

- explain to their patients that being a smoker is very likely to aggravate their condition and/or reduce the effectiveness of their treatment as well as increase their risk of developing other conditions;
- provide brief advice on stopping smoking;
- automatically refer their patients to Medway Council's smoking cessation service unless the patient expressly refuses consent for this; and
- inform the clinician to whom they are referring their patient, or who is jointly responsible for the patient's care, that this has been done.

### 5.3 On seeing a referred patient in a consultation following a referral, in a pre-surgery assessment, or as part of an on-going treatment programme

Clinicians of all types and in all settings are asked to check the current smoking status of their patients<sup>ix</sup> and for all those who are current smokers they are asked to:

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vii Brief advice from a clinician is known to motivate people to quit [Raw M, McNeill A, West R. Smoking cessation: evidence-based recommendations for the healthcare system. *Br Med J* 1999; 318:182 and Stead LF, Lancaster T. Physician advice for smoking cessation (Review). The Cochrane Collaboration. 2008], with substantially higher quit rates being achieved through concomitant referral to specialised services

viii Making a referral in this way, such that a person has to actively opt-out of it rather than opt-in, substantially increases uptake whilst preserving people's autonomy. A variety of documents concerning 'nudge' and behavioural change can be found here: <http://www.birmingham.ac.uk/Documents/college-social-sciences/social-policy/hsmc-library/snappy-searches/Nudge.pdf> (accessed 29 November 2016)

ix The most accurate way to do this, subject to the clinician having the appropriate equipment and having been trained in its use, is to check the patient's breath carbon monoxide level

- explain to their patients that being a smoker is very likely to aggravate their condition and/or reduce the effectiveness of their treatment as well as increase their risk of developing other conditions;
- where surgery is being considered, explain to their patients that being a smoker at the time of surgery will increase the risk of death, cardiac arrest, heart attack, chest infection, sepsis and septic shock, impaired wound healing, treatment failure, other complications, prolonged hospital stay and risk of hospital readmission, whereas being abstinent for some 4-8 weeks before surgery will reduce these risks;
- provide brief advice on stopping smoking; and
- unless they are already receiving support to quit smoking, automatically refer their patients to Medway Council's smoking cessation service unless the patient expressly refuses consent for this.

#### 5.4 Dealing with people who decline to quit smoking or who are unable to do so despite one or more attempts supported by an evidence-based service

It can take a smoker many attempts to become permanently abstinent<sup>x</sup> but even stopping for a short time before elective surgery can be of benefit.<sup>xi</sup> However, some people will not be willing to even attempt to quit or may fail to do so (although each period of quitting, even if brief, is a step toward abstinence and should be encouraged). In these circumstances, clinicians are requested to:

- in discussion with their patient, assess the balance of clinical benefits and clinical risks of the proposed treatment in someone who continues to smoke;
- be sure that the patient understands the risks of having the proposed treatment if they continue to smoke and document this fact in their clinical records;
- ensure that the patient's GP/consultant/other relevant clinicians are aware of the patient's decision to go ahead with the proposed treatment despite the increased risks because of their continued smoking; and
- make appropriate arrangements for the patient to have the proposed treatment.

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x Chalton M, Diemert L, Cohen JE, Bondy SJ et al. Estimating the number of quit attempts it takes to quit successfully in a longitudinal cohort of smokers. *Br Med J Open* 2016; 6:e011045  
doi:10.1136/bmjopen-2016-011045

xi Whilst it is best to stop smoking at least 6-8 weeks before planned surgery, doing so later than this may still be beneficial. For example, stopping smoking just four weeks before surgery has been shown in a randomised controlled trial to reduce post-operative complications, [Lindstrom D, Azodi OS, Wladis A, Tennesen H, Linder S et al. Effects of a postoperative smoking cessation intervention on postoperative complications: a randomised trial. *Ann Surg* 2008; 248: 739-45] and stopping smoking at least three weeks before surgery has been shown to reduce the incidence of poor wound healing following plastic surgery procedures. [Michioki K, Masashi N, Hideo T, Seiko H, Yoshihiko K. Determination of the duration of pre-operative smoking cessation to improve wound healing after head and neck surgery. *Anaesthesiology*. 2005; 102: 892-6]

## Appendix: Smoking and the safety and effectiveness of health care

DRAFT 4

**NB This appendix is not yet complete nor, necessarily, in its final format**

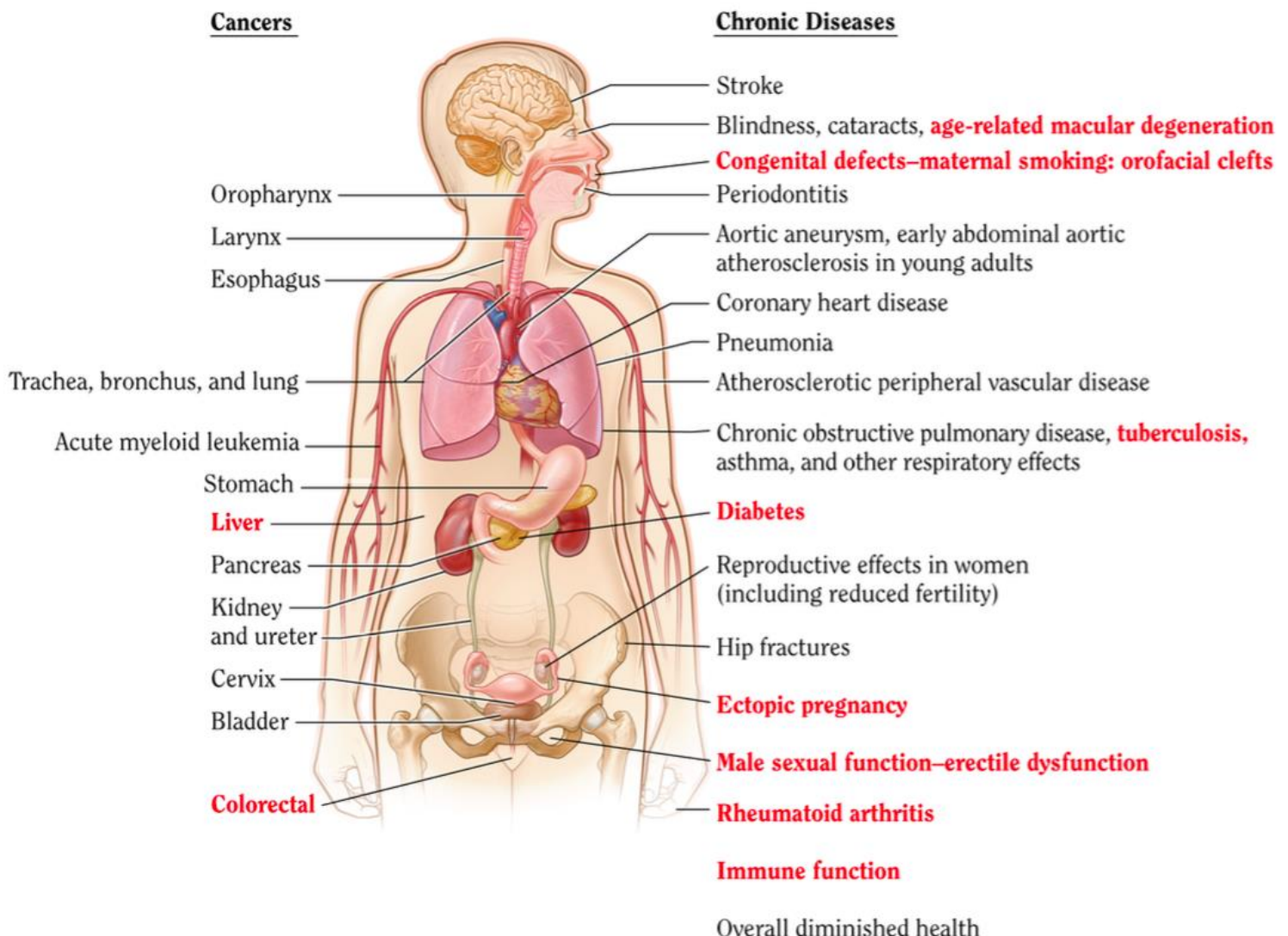
### 1. Introduction

This appendix provides a brief overview of conditions caused or aggravated by smoking and the proportion of deaths and other adverse outcomes that are attributable to smoking. It also provides an overview of the evidence of the impact of smoking on the safety and effectiveness of treatment for a variety of conditions and surgical interventions.

### 1.2. Causal linkage of smoking to disease and death

Smoking is causally linked to a large number of conditions affecting almost all parts of the body, as depicted in Figure 1.

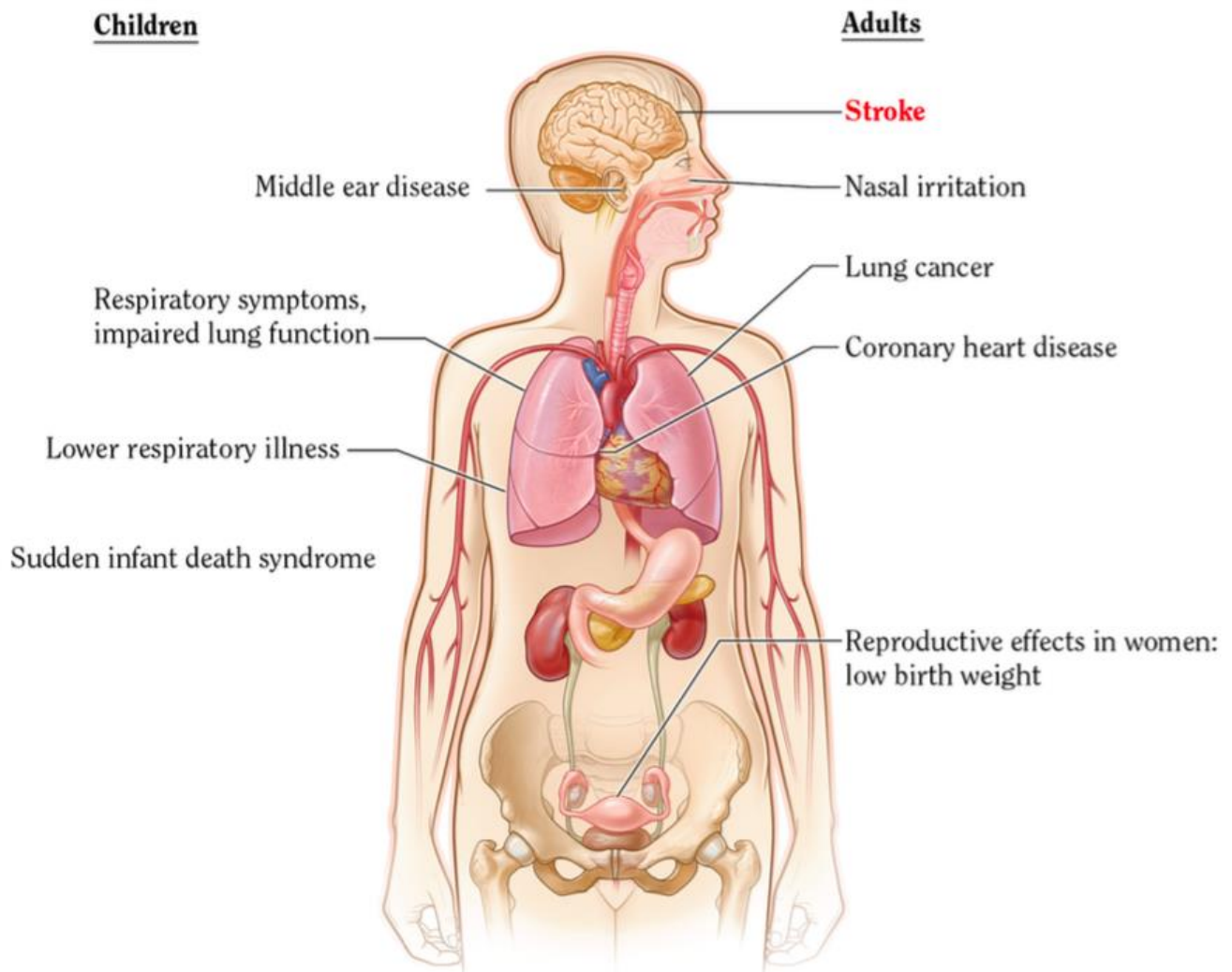
Figure 1: Conditions causally linked to smoking<sup>1</sup>



Note: Conditions highlighted in red are new ones causally linked to smoking identified in the Surgeon General's 2014 report from which this diagram has been taken.

Second-hand smoke (that is, 'passive smoking') is also causally linked to a large number of conditions, as depicted in Figure 2.

**Figure 2: Conditions causally linked to exposure to second-hand smoke<sup>1</sup>**



Note: Conditions highlighted in red are new ones causally linked to smoking identified in the Surgeon General's 2014 report from which this diagram has been taken.

The proportion of deaths in England attributable to smoking for various causes are shown in Table 1.

**Table 1: The proportion of all deaths from specific conditions in England caused by smoking<sup>2</sup>**

Condition	Men (%)	Women (%)
<b>CANCERS</b>		
Lung, trachea, bronchus	86	72
Larynx	80	74
Oesophagus	68	59
Bladder	43	28

Kidney and renal pelvis	33	8
Stomach	24	11
Pancreas	22	24
Myeloid leukaemia	21	9
<b>RESPIRATORY DISEASE</b>		
Chronic obstructive pulmonary disease	83	79
Pneumonia, influenza	23	13
<b>PEPTIC ULCER DISEASE</b>		
Stomach and duodenal ulcer	51	44
<b>CIRCULATORY DISEASES</b>		
Aortic aneurysm	61	54
Atherosclerosis	26	11
Other heart disease	17	10
Ischaemic heart disease	15	10
Other arterial disease	16	17
Cerebrovascular disease	12	6
<b>ALL DEATHS</b>	21	13

Smoking is also causally related to, or aggravates, many conditions which are not necessarily fatal, including:<sup>1,3</sup>

**Heart and circulatory system:** such as Beurger's disease; peripheral vascular disease;

**Respiratory system:** such as asthma, common cold, rhinitis, influenza, tuberculosis;

**Gastrointestinal system:** such as colonic polyps, Crohn's disease, peptic ulcer, gingivitis, periodontitis, bone loss leading to tooth loss, tooth discolouration;

**Musculoskeletal system:** such as injuries to muscles, tendons and joints, neck pain, back pain, osteoarthritis, rheumatoid arthritis;

**Eyes:** such as cataract, macular degeneration, nystagmus, optic neuropathy, fungal eye infections, tobacco amblyopia, diabetic retinopathy, optic neuritis;

**Skin:** such as psoriasis, premature skin ageing;

**Reproductive system:** such as reduced female fertility (30%), premature menopause (average 1.74 years), male impotence, reduced sperm count, reduced sperm motility, reduced ability of sperm to penetrate ovum, increased abnormally-shaped sperm; and

**Other:** such as depression, hearing loss, multiple sclerosis, type 2 diabetes.

Whilst it is unequivocally better not to start smoking, it is never too late to stop (with the possible exception of people who are formally on an end-of-life care pathway): whilst smokers tend to die, on average, ten years younger than non-smokers, stopping smoking leads to gains in life expectancy (stopping at age 60, 50, 40, 30



years gains 3, 6, 9 and 10 years life expectancy, respectively).<sup>4</sup> Quitting at any age will also improve various problems (such as breathlessness and chest infections).

## 2. The impact of smoking on the safety and effectiveness of different treatments

### 2.1 Surgery

#### 2.2.1. *An overview of the risks of being a smoker at the time of surgery*

There is strong evidence that people who continue to smoke when they have surgery are at higher risk of complications and poorer outcomes. In a study of over 600,000 patients, these risks, in comparison to non-smokers, include odds ratios for:<sup>5</sup>

- death: 1.38 (95% CI 1.11–1.72);
- pneumonia: 2.09 (95% CI 1.80–2.43);
- cardiac arrest: 1.57 (95% CI 1.10–2.25);
- myocardial infarction: 1.80 (95% CI 1.11-2,92);
- superficial or deep incisional infections: respectively, 1.30 (95% CI 1.20-1.42) and 1.42 (95% CI 1.21-1.68);
- sepsis: 1.30 (95% CI 1.15-1.46);
- organ space infections: 1.38 (95% CI 1.20-1.60); and
- septic shock: 1.55 (95% CI 1.29-1.87).

And in a joint briefing by the Faculty of Public Health, the Royal College of Surgeons of Edinburgh, the Royal College of Anaesthetists and Action on Smoking in Health,<sup>6</sup> it was identified that, following surgery, smokers:

- have higher risks of lung and heart complications;<sup>7,8,9</sup>
- have higher risks of post-operative infection;<sup>10,11,12</sup>
- have impaired wound healing;<sup>13,14</sup>
- require longer stays in hospital and need higher doses of drugs;<sup>15</sup>
- are more likely to be admitted to an intensive care unit;<sup>16</sup> and
- have an increased risk of emergency readmission to hospital.<sup>15</sup>

Other studies have shown that, for example:

- the effect of smoking on lower limb arterial bypass grafts is to increase the risk of graft failure 3.09-fold (95% CI 2.34-4.08,  $p < 0.00001$ );<sup>17</sup>
- in a prospective trial of 200 patients undergoing tibial osteotomy for knee deformity, the risk ratio for delayed bone healing was 2.7 (95% CI 1.5-4.7) in smokers;<sup>18</sup>
- in patients with tibial fractures, smoking significantly increases the risk of delayed bony union or non union by a factor of 3-18 times that of non-smokers,<sup>19</sup> increases the time to union (32 weeks for smokers, 28 weeks for non-smokers  $p = 0.05$ ),<sup>20</sup> and smokers are more likely to develop osteitis from open tibial fractures (27% in smokers vs 9% in non-smokers  $p = 0.04$ );<sup>21</sup>
- in patients undergoing total hip or total knee replacement, current smokers are more likely than never-smokers to have surgical site infections (odds ratio 1.14 [95% CI 1.16-1.72], pneumonia (odds ratio 1.53 [95% CI 1.10-2.14], stroke (odds



ratio 2.61 [95% CI 1.26-5.41], and one-year mortality (odds ratio 1.63 [95% CI 1.31-2.02]);<sup>22</sup>

- in a nested cohort study of more than 600,000 patients undergoing major surgery, current smokers had an increased risk of postoperative death of 1.17 (95% CI 1.10-1.24);<sup>23</sup>
- postoperative pulmonary complications in patients undergoing thoracotomy are more likely in smokers than in non smokers (19-23% vs 8%, p=0.03), and pneumonia is more likely in smokers than non-smokers (11% vs 3%, p<0.05);<sup>24</sup>
- current smokers are more likely to experience complications in cosmetic procedures such as –
  - breast reduction surgery: smokers are more likely to experience impaired wound healing (p= 0.03);<sup>25</sup> with wound-related complications occurring more often in smokers (35% vs 13% [p,0.001]) with a 2.3 times higher risk of developing complications and a 3.3 times higher risk of developing a wound infection;<sup>26</sup>
  - expander/implant breast reconstruction: smokers are 2.2 times as likely to develop complications as non-smokers (p<0.001), and the five times more likely to experience reconstructive failure (p<0.001);<sup>27</sup>
  - pedicle flap breast reconstruction: smokers are more likely to experience mastectomy flap necrosis than non-smokers (18.9% vs 9% [p=0.005]) and more likely to experience donor site complications (25.6% vs 10% [p=0.001]);<sup>28</sup>
  - facelift surgery: smokers are more likely to experience haematoma formation (p=0.049);<sup>29</sup>
  - muscle flap procedures: smokers are more likely to experience complications (such as partial muscle flap necrosis) than non-smokers (p<0.005) or ex-smokers (p<0.002);<sup>30</sup>
  - abdominoplasty: smokers are more likely to experience wound dehiscence than non-smokers (p<0.01), wound healing problems before discharge (47.9% vs 14.8%);<sup>31</sup>
- current smokers are more likely than non-smokers or ex-smokers following bowel surgery for cancer, diverticular disease or inflammatory bowel disease to experience post-operative morbidity (odds ratio 1.3 [95% CI 1.21-1.40]) or post-operative mortality (odds ratio 1.5 [95% CI 1.11-1.94]);<sup>32</sup>
- current smokers undergoing bariatric surgery are twice as likely to die as non-smokers (odds ratio 2.05 [95% CI 1.67-2.52 p<0.0001]);<sup>33</sup> those who are smokers within one year of gastric bypass surgery are 1.5 times more likely than non-smokers to develop surgery-related problems within one month of surgery (odds ratio 1.457 [95% CI 1.058-2.005]) including venous thromboembolism (odds ratio 6.7 [95% CI 1.9-23.57]);<sup>34</sup>
- smokers undergoing laparotomy are four times more likely to develop an incisional hernia than non-smokers (odds ratio 3.93 [95% CI 1.82-8.49]);<sup>35</sup> and
- smokers are more likely to experience groin hernia recurrence following surgical repair than non-smokers (odds ratio 2.22 [95% CI 1.19-4.15]).<sup>36</sup>

#### *An overview of quitting smoking before surgery*

Quitting smoking 6-8 weeks before surgery has been shown in a randomised controlled trial to reduce the overall complication rate (18% in the intervention group

vs 52% in the control group,  $p=0.0003$ ), with the most significant effects being found in –

- wound-related complications (5% vs 31%  $p=0.001$ ),
- cardiovascular complications (0% vs 10%,  $p=0.08$ ), and
- the need for secondary surgery (4% vs 15%,  $p=0.07$ ).<sup>37</sup>

Further, quitting just four weeks before surgery has been shown in randomised controlled trials to reduce the risk of post-operative complications of all types (21% in the smoking cessation group, 41%,  $p=0.03$ ), with a relative risk reduction of 49%, and the number needed to treat being just 5 (95%CI 3-40).<sup>38</sup>

Other studies of various types have shown, or confirmed, that:

- quitting smoking 3-8 weeks before surgery significantly reduces the risk of serious postoperative complications such as wound infection and cardiopulmonary complications;<sup>39</sup>
- quitting smoking 6-8 weeks before elective knee or hip surgery reduces post-operative complications (18% in quitters vs 52% in smokers, relative risk reduction 65% [95% CI 42-83], number needed to treat 3 [95% CI 2-6]), and reduced wound-related postoperative complications (5% in quitters vs 31% in smokers, relative risk reduction 83% [95% CI 48-95], number needed to treat 4 [95% CI 2-8]);<sup>40</sup>
- quitting smoking before surgery reduces the risk of post-operative complications by 41% (95% CI 15-59,  $p=0.01$ ); with each week of cessation increasing the magnitude of effect by 19%, with at least four weeks' pre-operative smoking abstinence having a statistically significantly larger effect ( $p=0.04$ ); with smoking cessation reducing total complications (relative risk 0.76 [95% CI 0.69-0.87]), wound healing complications (relative risk 0.73 [95% CI 0.61-0.87]), and pulmonary complications (relative risk 0.81 [95% CI 0.70-0.93]);<sup>41</sup> and
- quitting smoking, or at least reducing smoking by 50%, 6-8 weeks before surgery reduces overall post-operative complications (18% in quitters/reducers vs 52% in current smokers,  $p=0.0003$ ) with the greatest benefits being for wound complications (5% vs 31%,  $p=0.001$ ), cardiovascular complications (0% vs 10%,  $p=0.08$ ), and secondary surgery (4% vs 15%,  $p=0.07$ ).<sup>42</sup>

### 2.2.2. *Exploding a myth. Stopping smoking before surgery does **not** increase risks*

In 1989, a prospective study of 192 consecutive patients reported that those who stopped smoking two months or less before surgery had a higher rate of pulmonary complications than those who quit more than two months beforehand although the difference found was not statistically significant.<sup>43</sup> This paper seems to have led to some thinking that quitting smoking before surgery actually increased risks, but this has been shown to be a myth. Various studies and systematic reviews since have shown that:

- quitting smoking within two months of surgery does not increase pulmonary complications;<sup>44,45</sup>
- an initial increase in cough is unlikely to occur among relatively healthy smokers who stop smoking;<sup>46</sup> and
- nicotine withdrawal symptoms do not seem to be a clinically significant problem in the perioperative period for most smokers.<sup>47</sup>

## 2.3. Diabetes

### 2.3.1. *Smoking as a risk factor for diabetes*

Smoking has been shown to be a causative risk factor for type-2 diabetes in a number of studies, for example:

- new smoking quitters and current smokers, in comparison with never-smokers and after adjusting for age, race, gender, education, adiposity, physical activity, lipid levels and blood pressure, have been found to have hazard ratios for diabetes of 1.73 (95% CI 1.19-2.53) and 1.31 (95% CI 1.04-1.65), respectively, with no statistically significant increased risk for former smokers compared with never smokers;<sup>48</sup>
- after controlling for other risk factors, men who smoke 25 or more cigarettes a day have been shown to have a relative risk of developing diabetes of 1.94 (95% CI 1.25-3.03) compared with non-smokers;<sup>49</sup>
- increased smoking rates in both men and women increases the incidence of diabetes, with men smoking two or more packs a day having a 45% higher diabetes rate than never-smoking men, the increased rates being 74% in women, whilst quitting smoking reduces the rate to that of never-smokers after five years in women and ten years in men,<sup>50</sup> and
- increased smoking duration also increases the risk of developing diabetes (odds ratio 2.47 [95% CI 1.03-5.93] for 40 or more years' smoking vs non-smokers).<sup>51</sup>

### 2.3.2. *Smoking in pregnancy and the risk of subsequent diabetes in both mother and offspring*

Not only are smokers more at risk of developing diabetes but there is evidence that maternal smoking in pregnancy increases the risk of both early onset type-2 diabetes and non-diabetic obesity in offspring independent of those offsprings' subsequent smoking habits.<sup>52</sup>

### 2.3.3. *The effect of smoking in diabetes on the complications of diabetes*

Having diabetes nearly doubles mortality from all causes in comparison with those who do not have diabetes (relative risk 1.85 [95% CI 1.79-1.92]).<sup>53</sup> However, amongst those with diabetes, smokers have a still higher risk of death than those who do not smoke (relative risk 1.55 [95% CI 1.46-1.64]) for all-cause mortality and that, compared with never-smokers with diabetes, former smokers with diabetes are at moderately raised risk of all-cause mortality (relative risk 1.19 [95% CI 1.11-1.28]).<sup>54</sup>

### 2.3.4. *The benefits to diabetes control of stopping smoking*

Whilst smoking increases insulin resistance,<sup>55,56</sup> quitting smoking has been shown to reduce it<sup>57</sup> and to improve HbA1C levels in people with diabetes (change -0.70% vs expected 0.0% [p = 0.0001]).<sup>58</sup>

### 2.3.5. *The increased risk of death in people with diabetes who smoke and the benefits of quitting*

Adjusting for gender and for age, the hazard ratio of death from any cause in people with diabetes is 1.28 (95% CI 1.27-1.29),<sup>59</sup> but this increases to 1.48 (95% CI 1.34-1.64) for people with diabetes who smoke and 1.54 (95% CI 1.31-1.82) for coronary heart disease mortality, with an increased risk in both former and current smokers but especially so in current smokers.<sup>60</sup>

In terms of reducing the excess risks of smoking in diabetes in men, benefit only becomes apparent after five years of smoking cessation and becomes similar to that

of never smokers with diabetes after some 20 years and the risks of increased weight that can occur with quitting smoking being outweighed by the benefits of stopping smoking.<sup>61</sup>

In another review of the the excess risk of death in women due to the combination of diabetes and smoking seems to be tobacco dose-related. A prospective 20-year follow-up study of 7,401 women with diabetes, adjusting for age and cardiovascular risk factors, found the following relative risks of death compared to never-smokers with diabetes:

- 1.31 (95% CI 1.11-1.55) for past smokers;
- 1.43 (95% CI 0.96-2.14 – not statistically significant) for current smokers of 1-14 cigarettes/day;
- 1.64 (95% CI 1.24-2.17) for current smokers of 15-34 cigarettes/day; and
- 2.19 (95% CI 1.32-3.65) for current smokers of 35 or more cigarettes/day.<sup>62</sup>

Importantly, the authors of this study found that women with diabetes who had stopped smoking for ten or more years had a relative risk of mortality of 1.11 (0.92-1.35) compared to never-smokers. This difference was not statistically significant suggesting that the excess mortality risk due to smoking was reduced to that of never-smokers, or, at least, was substantially reduced.

#### 2.4. Rheumatoid arthritis

Inflammatory rheumatic diseases are associated with a substantial increase in atherosclerosis, especially in young women, and considerably increase the risk of cardiovascular-related death.<sup>63</sup> In people with rheumatoid arthritis, compared to those who have never smoked, current smokers have nearly twice the risk of dying from any cause (relative risk 1.98 [95% CI 1.56-2.53]), especially circulatory disease and lung cancer, with a decreasing risk with each year of smoking abstinence.<sup>64</sup>

#### 2.5. Respiratory system diseases

Smoking is the major risk factor for the development, aggravation and/or progression of various respiratory diseases including chronic obstructive pulmonary disease (COPD).

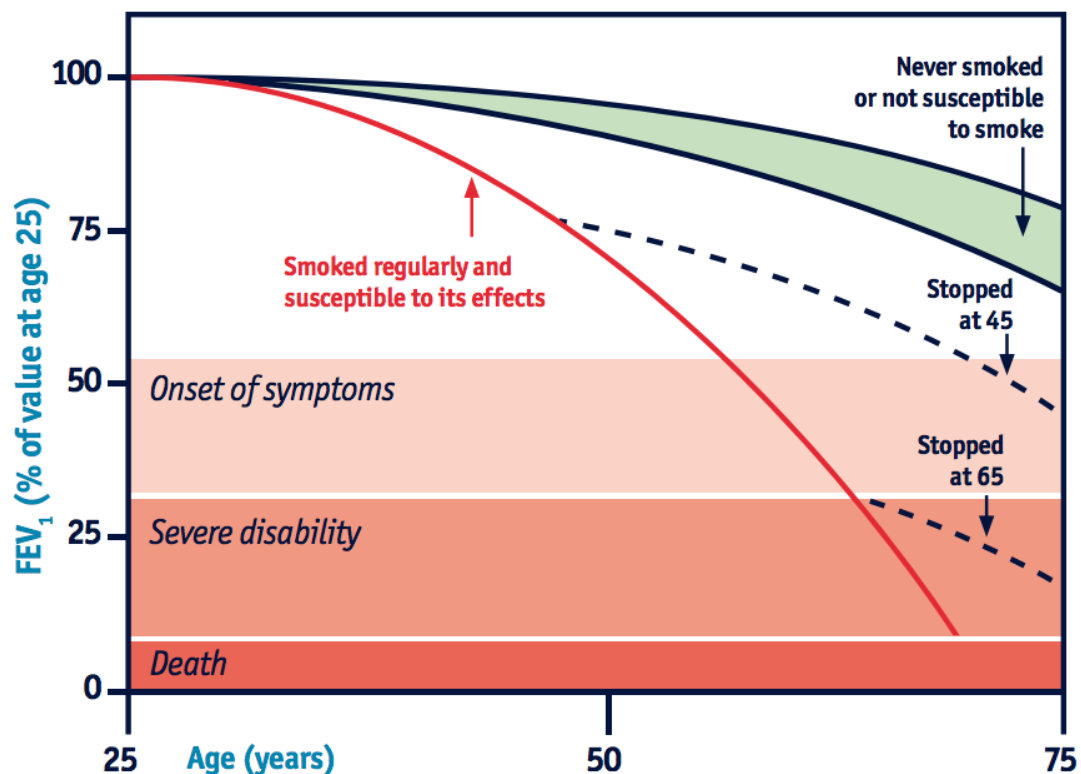
Smoking causes asthma in adults: the risk of developing asthma is statistically significantly higher in smokers (odds ratio 1.33 [95% CI 1.00-1.77]) and in ex-smokers (odds ratio 1.49 [95% CI 1.12-1.97]) compared with never-smokers.<sup>65</sup>

Smoking in people with asthma reduces the effect of short-term treatment with steroids drugs such as theophylline and leads to poorer symptom control,<sup>66,67</sup> whilst non-smokers with asthma have statistically significantly better morning peak expiratory flow rates following inhaled fluticasone than smokers with asthma (prospective, double blind randomised controlled trial).<sup>68</sup>

Smoking cessation in people with asthma improves lung function, symptoms, medication use and asthma-specific quality of life scores,<sup>69,70</sup> and, in one study with no significant differences between former smokers and non-smokers.<sup>71</sup>

Whilst current smokers have age-standardised rates of chronic cough four to five times that of never-smokers (32.3% vs 6.6% in men and 24.6% vs 5.2% in women), chronic cough reduces within a year in quitters and within 2-5 years of stopping, 89-99% of the difference between ex-smokers and never-smokers is accounted for.<sup>72</sup>

Whilst the airways obstruction caused by smoking is irreversible, stopping smoking means that further rates of loss of FEV<sub>1</sub> will revert to that of the normal ageing process, as shown in the diagram below.<sup>73</sup>



The impact of smoking and quitting on FEV<sub>1</sub>

Smoking cessation has been shown to be the most effective way to reduce the decline of respiratory function in people with COPD, halving the rate in quitters,<sup>74</sup> with the greatest effect in those who remain non-smokers.<sup>75</sup> It also reduces exacerbations (hazard ratio 0.78 [95% CI 0.75--0.87]) with the magnitude of benefit increasing with duration of non-smoking (linear trend 0.001 over ten years),<sup>76</sup> and reduces the rate of hospitalisation by 43% (hazard ratio 0.57 [95% CI 0.33-0.99]) in quitters but not in those who simply cut down.<sup>77</sup>

Smoking cessation after diagnosis of early stage lung cancer improves outcomes: continued smoking is associated with a significantly increased risk of all-cause mortality (hazard ratio 2.94 [95% CI 1.15-7.54]) and recurrence (hazard ratio 1.86 [95% CI 1.01-3.41]) in early stage non-small cell lung cancer, and in limited stage small cell cancer, continued smoking significantly increases the risk of all-cause mortality (hazard ratio 1.86 [95% CI 1.33-2.59]), the development of a second primary tumour (hazard ratio 4.31 [95% CI 1.09-16.98]) and recurrence (hazard ratio 1.26 [95% CI 1.06-1.5]).<sup>78</sup>

Cigarette smoking quadruples the risk of developing invasive pneumococcal respiratory disease in active smokers in comparison to non-smokers (odds ratio 4.1 [95% CI 2.4-7.3]) and in passive smokers by more than double (odds ratio 2.5 [95% CI 1.2-2.5]).<sup>79</sup>

Smoking is an independent risk factor for Legionnaire's disease (odds ratio 3.48 [95% CI 2.09-5.79]).<sup>80</sup>

The common cold is more common in smokers than non-smokers (in one study the relative risk was 1.5 (95% CI 1.1-1.8)<sup>81</sup> and in another it was 2.23 (95% CI 1.03-4.82).<sup>82</sup>

Influenza infections are more common in smokers than non-smokers (68.5% vs 47.2%  $p < 0.001$ )<sup>83</sup> and the symptoms are more severe (odds ratio 1.44 [95% CI 1.03-2.01]) and smokers experience a 44% increase in complications.<sup>84</sup>

Adult smokers who develop chickenpox are much more likely to develop pneumonia than non-smokers ( $p = 0.032$ )<sup>85</sup> perhaps by a factor of fifteen.<sup>86</sup>

Studies show that the odds ratio for developing TB in current smokers vs non-smokers is raised: being 1.16 (95% CI 1.27-2.02) and 2.90 (95% CI 2.60-3.30) in ever-smokers vs non-smokers in one study,<sup>87</sup> 2.17 (95% CI 1.29-3.63) in heavy smokers vs non-smokers in another,<sup>88</sup> and 2.6 (95% CI 1.1-5.9) in a third,<sup>89</sup> with the risk of death from TB in smokers being statistically significantly higher.<sup>90,91</sup>

## 2.6. Meningococcal disease

Maternal smoking is the strongest independent risk factor for invasive meningococcal disease in children (up to age 18 years) (odds ratio 3.8 [95% CI 1.6-8.9]).<sup>92</sup> Smokers and those exposed to second-hand smoke are more likely to have nasopharyngeal meningococcal colonisation than non-smokers,<sup>93</sup> active and passive smoking being independent risk factors for such colonisation.<sup>94,95</sup>

## 2.7. Otitis media

Acute ear infections in children at five ears of age are associated with maternal smoking in pregnancy, with an odds ratio of 1.6 (95% CI 1.1-2.5) for mothers smoking 1-9 cigarettes daily, an odds ratio of 2.6 (95% CI 1.6-4.2) for those smoking 10-19 daily and an odds ratio of 3.3 (95% CI 1.9-5.9) for those smoking 20 or more daily during pregnancy.<sup>96</sup>

Recurrent otitis media of sufficient severity to require tympanostomy is more likely to occur in children exposed to second-hand smoke ( $p = 0.04$ ),<sup>97</sup> especially maternal smoking.<sup>98</sup>

## 2.8. Periodontal disease, alveolar bone loss and dental implantation

In smokers, the odds ratios for developing periodontal disease range from 2.79 (95% CI 1.90-4.10) for 1-9 cigarettes daily to 5.88 (95% CI 4.03-8.58) for 31 or more cigarettes daily, with the risk declining with the number of years since quitting from 3.22 (95% CI 2.18-4.76) for 0-2 years to 1.15 (95% CI 0.83-1.60 – not significant) for 11 or more years since quitting.<sup>99</sup> Others have found even higher risks for alveolar bone loss associated with smoking with an odds ratio of 3.25 (95% CI 2.33-4.54) for 'light' smokers and 7.28 (95% CI 5.09-10.31) for 'heavy smokers'.<sup>100</sup>

Stopping smoking does not reverse alveolar bone loss but it does statistically significantly slow its rate.<sup>101,102,103,104</sup> It also improves periodontal healing, which may return to the rate found in non-smokers.<sup>105,106</sup>

Endosseous implants are statistically significantly more likely to fail in smokers in comparison with non-smokers,<sup>107,108</sup> with some finding this occurring in about 31% of instances.<sup>109,110</sup>

## 2.9. Cystic fibrosis

People with cystic fibrosis who are exposure to second-hand smoke have statistically significantly poorer lung function than those with the condition who are not so exposed<sup>111</sup> and affected infants aged 4-12 months have been shown to have decreased growth.<sup>112</sup>

## 2.10. Fertility and in-vitro fertilisation treatment

Male smokers have been found to have lower semen volumes, lower sperm counts, lower sperm density and a smaller proportion of motile sperm than non-smokers<sup>113,114</sup> and this appears to be a dose-related effect.<sup>115</sup> Paternal smoking is also associated with statistically significantly reduced live birth rates (21.1% vs 7.8%).<sup>116</sup>

Meta-analysis has shown an increased risk of infertility in women who smoke compared to those who do not (odds ratio 1.60 [95% CI 1.34-1.91]) and a risk of reduced fecundity in women undergoing IVF who smoke (odds ratio for pregnancy per IVF cycle 0.66 [95% CI 0.49-0.88]).<sup>117</sup> Women who smoke during IVF have been found to have a 50% reduction in implantation rates and on-going pregnancy rates compared to non-smokers, whereas those who quit before IVF treatment have similar rate to non-smokers.<sup>118</sup>

Another study found that where either couple had ever smoked, the relative risk of not achieving a pregnancy with IVF or gamete intra-fallopian transfer in comparison with non-smokers was 2.41 (95% CI 1.07-5.45) and 3.76 (95% CI 1.40-10.03) of not having a live birth.<sup>119</sup>

## 2.11. Smoking during pregnancy

Meta analyses show that in comparison to non-smoking pregnant women, those who smoke during pregnancy are more likely to have:<sup>120</sup>

- placenta praevia (pooled odds ratio 1.58 [95% CI 1.04-2.12]);
- abruptio placenta (odds ratio 1.62 [95% CI 1.46-1.77]);
- ectopic pregnancy (pooled odds ratio 1.77 [95% CI 1.31-2.22]); and
- pre-term premature rupture of the membranes (odds ratio 1.70 [95% CI 1.18-2.25]).

Smoking during pregnancy statistically significantly increases the risks of birth defects with odds ratios for the following defects of:<sup>121</sup>

- cardiovascular/heart defects – 1.09 (95% CI 1.02-1.17);
- musculoskeletal defects – 1.16 (95% CI 1.05-1.27);
- limb reduction defects – 1.26 (95% CI 1.15-1.39);
- missing/extra digits – 1.18 (95% CI 0.99-1.14 – not statistically significant);
- clubfoot – 1.28 (95% CI 1.10-1.47);
- craniostenosis – 1.33 (95% CI 1.03-1.73);
- facial defects – 1.19 (95% CI 1.06-1.36);
- eye defects – 1.25 (95% CI 1.11-1.40);
- orofacial defects – 1.28 (95% CI 1.20-1.36);
- gastrointestinal defects – 1.27 (95% CI 1.18-1.36);



- gastroschisis – 1.50 (95% CI 1.28-1.76);
- anal atresia – 1.20 (95% CI 1.06-1.36);
- hernia – 1.40 (95% CI 1.23-1.59); and
- undescended testes – 1.13 (95% CI 1.02-1.25).

Fetal and infant mortality is increased by maternal smoking compared to non-smokers, by 25% in those smoking less than one pack per day and by 56% in those smoking one or more packs per day.<sup>122</sup>

Compared with babies born to non-smokers, those born to women who smoked during pregnancy have been found to be statistically significantly more likely to:<sup>123</sup>

- be born prematurely, irrespective of daily number of cigarettes smoked;
- be born by caesarean section in women smoking five or more cigarettes daily;
- have, on average, a 250-350g lower birth weight;
- have a lower 5-minute Apgar score and umbilical arterial pH in women smoking more than 20 cigarettes daily; and
- in 50% of those born to women smoking more than 20 cigarettes daily to require admission to a neonatal intensive care unit, and in whom, 70% of all instances of neurological complications occur (such as subependymal haemorrhage, periventricular haemorrhage, porencephalic cysts, intracranial haemorrhage, swallowing disturbance).

Compared with babies born to non-smokers, those born to women who smoked during pregnancy have been found to be statistically significantly more likely to have a smaller:<sup>124</sup>

- birth length;
- head circumference; and
- chest circumference.

## 2.12. Benefits of smoking cessation during pregnancy

A systematic review of trials of smoking cessation during pregnancy showed reductions in the likelihood of:<sup>125</sup>

- low birth weight (relative risk 0.83 [95% CI 0.73-0.95]);
- pre-term birth (relative risk 0.86 [95% CI 0.74-0.98]);

and an increase in mean birth weight of 53.91g (95% CI 10.44g to 95.38g).

Another review has shown that smoking abstinence during early pregnancy reduces the likelihood of:<sup>126</sup>

- ectopic pregnancy (odds ratio 0.56 [95% CI 0.45-0.76]);
- placenta praevia (odds ratio 0.63 [95% CI 0.47-0.96]) and placental abruption (odds ratio 0.63 [95% CI 0.47-0.96]); and
- pre-term premature rupture of the membranes (odds ratio 0.59 [95% CI 0.44-0.98]).

## 2.13. Sudden infant death syndrome

The babies of mothers who smoked in pregnancy have been found to be 1.9 times more likely to die of sudden infant death syndrome (SIDS) (95% CI 1.6-2.3) compared to non-smokers, an effect that has become more pronounced since the recommendation of a supine sleeping position for babies.<sup>127</sup> Another review has found an odds ratio of 4.09 (95% CI 3.28-5.11),<sup>128</sup> and a further one a relative (unadjusted) risk to be nearly 5, with a relative risk of SIDS with paternal smoking of 2.31 (95% CI 2.09-2.59).<sup>129</sup>

## 2.14. Hearing loss and tinnitus

Adjusting for factors such as age and occupational exposure to noise, smokers are more likely to suffer hearing loss than non-smokers (odds ratio 1.69 [95% CI 1.31-2.17]), as are non-smokers who live with smokers (odds ratio 1.94 [95% CI 1.01-3.74]).<sup>130</sup>

The risk of developing tinnitus is independently raised by ever-smoking (hazard ratio 1.40 [95% CI 1.10-1.79]), with an increasing risk with duration of smoking and, adjusting for a variety of factors, a gradual reduction in risk with increasing time after quitting.<sup>131</sup>

## 2.15. Vision loss

Smoking is a dose-related, independent risk factor for ocular damage that can lead to permanent blindness including Graves' ophthalmopathy, age-related macular degeneration, glaucoma and cataract,<sup>132</sup> and is the principal known preventable cause of age-related macular degeneration.<sup>133</sup>

The relative risk of developing age-related macular degeneration in current smokers of 20 or more cigarettes daily, in comparison with never-smokers is 2.46 (96% CI 1.60-3.79).<sup>134</sup>

Smoking is a risk factor for cataract development, and smoking 15 or more cigarettes daily has a rate ratio of 1.42 (95% CI 1.28-1.58) for cataract extraction in comparison with never-smokers after adjustment for age and other risk factors; smoking cessation significantly reduces the risk of cataract extraction with time (p for trend <0.001), with male smokers of 15 or more cigarettes daily having a rate ratio of cataract extraction of 1.13 (95% CI 1.04-1.24) after 20 years abstinence.<sup>135</sup>

**TO BE CONTINUED...**

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