



Mini-Symposium: Interventions to Prevent Respiratory Disease

Reducing tobacco smoking and smoke exposure to prevent preterm birth and its complications

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EDUCATIONAL AIMS

THE READER WILL BE ABLE TO DISCUSS:

- Aspects of the relationship of tobacco smoking during pregnancy and second-hand smoke exposure with preterm birth and its complications
- The effectiveness of interventions aimed at preventing tobacco smoking and its harmful effects during pregnancy
- The effectiveness of interventions to reduce pre- and postnatal smoke exposure in relation to preterm birth and its complications

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SUMMARY

Tobacco smoking and smoke exposure during pregnancy are associated with a range of adverse health outcomes, including preterm birth. Also, children born preterm have a higher risk of complications including bronchopulmonary dysplasia and asthma when their mothers smoked during pregnancy.

Smoking cessation in early pregnancy can help reduce the adverse impact on offspring health. Counselling interventions are effective in promoting smoking cessation and reducing the incidence of preterm birth. Peer support and incentive-based approaches are likely to be of additional benefit, whereas the effectiveness of pharmacological interventions, including nicotine replacement therapy, has not definitely been established. Smoke-free legislation can help reduce smoke exposure as well as maternal smoking rates at a population level, and is associated with a reduction in preterm birth.

Helping future mothers to stop smoking and protect their children from second hand smoke exposure must be a key priority for health care workers and policy makers alike.

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INTRODUCTION

Tobacco smoking and second-hand smoke (SHS) exposure during pregnancy are associated with a considerable burden of

adverse perinatal and child health outcomes [1,2]. Among these is preterm birth, currently the leading cause of death in children worldwide and responsible for considerable morbidity among survivors [3,4]. This review will first map out the global burden of mortality and morbidity resulting from tobacco smoking and preterm birth. We will then outline how smoking and SHS exposure are linked to preterm birth and its complications, with particular attention to complications affecting the lungs. Finally we will highlight various approaches to reduce the impact of tobacco smoking and SHS exposure on preterm birth and its complications.

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Global burden of tobacco smoking and SHS exposure

Prevalence and consequences of smoking

Every year, approximately six million people die because of tobacco use, making it the primary preventable cause of mortality worldwide [5,6]. Tobacco use is causally linked to many diseases, including different types of cancer, cardiovascular diseases and chronic obstructive pulmonary disease (COPD) [1,6]. Between 1980 and 2012, the worldwide smoking prevalence decreased from 41% to 31% among men and from 11% to 6% among women [5]. However due to population growth the absolute number of daily smokers increased from 721 million to 967 million during that period [5]. Important variation exists in smoking prevalence across countries with, for example, very high prevalence among men in Russia and Indonesia (both >50%) and among women in Greece and Bulgaria (both >25%) [5].

Prevalence and consequences of SHS exposure

Tobacco is not only harmful to the health of its users; it also affects the health of non-smokers through exposure to SHS [1]. SHS exposure was estimated to have caused 603 000 deaths and 10.9 million disability adjusted life years (DALYs) worldwide in 2004 [7]. SHS exposure is highest in children (40%), compared to men (33%) and women (35%) [7]. Over 25% of the lives and over 60% of the health life years estimated to be lost due to SHS exposure each year are among children [7]. This is likely an underestimation of tobacco's true impact on early-life health as it is solely based on the well-recognised impact of SHS on respiratory tract infections and asthma in childhood [8]. Many children are however in addition affected by antenatal smoke exposure, either via active maternal smoking or maternal SHS exposure, putting them at risk of a range of adverse perinatal and long-term outcomes [1,2,6].

Smoking and SHS exposure during pregnancy

The prevalence of antenatal smoke exposure varies by country according to its social, cultural, and ethnic background. In high-income countries, an estimated 10–20% of women smoke during pregnancy, with high percentages in the United Kingdom (14–20%) and the United States (US; 15–18%) [9]. Smoking during pregnancy is much less common in low- and middle-income countries, with an overall prevalence of 1.3% (range 0–15%) estimated from 2001–2012 Demographic and Health Survey data from 54 countries [10]. Of concern, however, is that in some of these countries up to 75% of pregnant women are exposed to SHS [11].

Multiple epidemiologic studies and meta-analyses have demonstrated maternal smoking during pregnancy to be associated with severe adverse pregnancy outcomes, including: stillbirth [12], congenital anomalies [13], low birth weight [1], preterm birth [14], and neonatal mortality [1]. Children whose mothers smoked during pregnancy are furthermore at increased risk of sudden infant death syndrome (SIDS) [15], respiratory tract infections [16], recurrent wheezing [17], asthma [18], overweight and obesity [19], cognitive delay [20], and behavioural problems [20]. There is increasing evidence that maternal smoking also increases the offspring's risk of taking up smoking themselves later on [21]. Although SHS exposure during pregnancy is generally less strongly associated with adverse paediatric health outcomes than is active smoking, it has been linked to increased risks of low birth weight and childhood asthma [22,23].

Epidemiology of preterm birth and its complications

Incidence of preterm birth

In 2010, an estimated 14.9 million babies were born preterm worldwide [8]. Over 60% of all preterm births were

in Sub-Saharan Africa and South Asia [8]. Although in developed countries the overall preterm birth rate is relatively low at 8.6% compared to the global rate of 11.1%, the US ranks among the top 10 countries contributing to the global number of preterm births, with 12.0% of babies being born preterm [8]. Preterm birth is thus a global public health problem, which is likely to escalate given that only three out of 184 countries experienced a reduction in preterm birth rate between 1990 and 2010 [8].

Mortality attributable to preterm birth

Annually, approximately one million deaths are directly attributable to preterm birth [4,24]. Although low- and middle-income countries contribute the majority of preterm-birth related deaths, several high-income countries are among those with the highest percentage of deaths being directly attributable to preterm birth [4]. Variation is influenced by many factors including the level of care available and provided, ethnic and socioeconomic background of the population, and ethical considerations regarding resuscitation of babies born at the edge of viability, and end-of-life decisions.

Complications of preterm birth

When healthy, the uterus provides the optimal environment for the developing fetus. Preterm birth however removes a baby from this environment during a critical phase of development, putting it at risk of many adverse outcomes [3]. For almost all outcomes the risk is highly gestational age-dependent, with the highest prevalence seen among the most preterm infants. Common pathological processes underlying preterm birth, including intrauterine inflammation and infection, pre-eclampsia, and intrauterine growth restriction, have distinct effects on specific organs, further modulating these risks.

Respiratory complications

The introduction of antenatal corticosteroids and postnatal surfactant therapy has allowed for increased survival after preterm birth and thereby for respiratory complications to shift towards much more immature babies. Respiratory distress remains a common early sign of very preterm birth. Despite a general shift away from aggressive ventilator strategies, an important proportion of extremely preterm infants go on to develop chronic lung disease of prematurity, bronchopulmonary dysplasia (BPD). BPD likely represents the severe end of a spectrum of prematurity-related respiratory complications, and is associated with sustained airway obstruction and wheezing symptoms [25]. Especially during the first years, children born preterm are at increased risk of re-hospitalisation, often due to respiratory problems and in particular bronchiolitis [26]. Prematurity-associated respiratory problems may extend well into later life [3], with increased risks for childhood asthma [27,28], and chronic obstructive pulmonary disease (COPD) [29]. Even children born near-term are increasingly recognised to be at risk for adverse pulmonary outcomes and as a group are the primary contributors to the overall burden of prematurity-associated respiratory problems [27].

Other complications

Common severe non-respiratory neonatal complications following preterm birth include: sepsis, necrotising enterocolitis (NEC), intraventricular haemorrhage (IVH), periventricular leukomalacia (PVL), and retinopathy of prematurity (ROP). In the long term, developmental impairments, including motor disturbances and cognitive and communicative deficits, and behavioural problems are commonly seen.

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