CHEST

SmokeHaz

Systematic Reviews and Meta-analyses of the Effects of Smoking on Respiratory Health

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BACKGROUND: Smoking tobacco increases the risk of respiratory disease in adults and children, but communicating the magnitude of these effects in a scientific manner that is accessible and usable by the public and policymakers presents a challenge. We have therefore summarized scientific data on the impact of smoking on respiratory diseases to provide the content for a unique resource, SmokeHaz.

METHODS: We conducted systematic reviews and meta-analyses of longitudinal studies (published to 2013) identified from electronic databases, gray literature, and experts. Random effect meta-analyses were used to pool the findings.

RESULTS: We included 216 articles. Among adult smokers, we confirmed substantially increased risks of lung cancer (risk ratio (RR), 10.92; 95% CI, 8.28-14.40; 34 studies), COPD (RR, 4.01; 95% CI, 3.18-5.05; 22 studies), and asthma (RR, 1.61; 95% CI, 1.07-2.42; eight studies). Exposure to passive smoke significantly increased the risk of lung cancer in adult nonsmokers and increased the risks of asthma, wheeze, lower respiratory infections, and reduced lung function in children. Smoking significantly increased the risk of sleep apnea and asthma exacerbations in adult and pregnant populations, and active and passive smoking increased the risk of tuberculosis.

CONCLUSIONS: These findings have been translated into easily digestible content and published on the SmokeHaz website. CHEST 2016; 150(1):164-179

KEY WORDS: health risks; lung diseases; meta-analysis; passive smoking; policymakers; public awareness; respiratory diseases; smoking; systematic review

ABBREVIATIONS: FRC = functional residual capacity; LRTI = lower respiratory tract infection; RR = risk ratio

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Tobacco smoking is the leading cause of preventable death in the European Union, responsible for nearly 700,000 deaths every year. Approximately 50% of smokers die prematurely, resulting in the loss of an average of 14 years of life.[1] An estimated further 13 million people in the European Union are living in poor health with chronic diseases as a result of smoking. Many forms of cancer and cardiovascular and respiratory diseases are linked to tobacco use, which causes more problems than alcohol, drugs, high blood pressure, excess weight, or high cholesterol. Passive smoking is a significant health hazard to children and nonsmoking adults, being responsible for causing excess cases of sudden infant death syndrome, asthma, middle ear infections, and meningitis.[2] Therefore, preventing smoking remains a key health priority. Because smoking prevention requires population-level policy measures and individual treatment interventions,[3] it is important that accurate data on the effects of tobacco use on health are readily available to policymakers, policy advocates, and the general public.

In this respect, one major difficulty is that the available evidence on smoking and health is extensive, disparate, and at times conflicting. Therefore, it is particularly important that the evidence base is regularly captured, through systematic review, and synthesized to provide easily understandable and accurate summary estimates of effects.

This article reports on the findings of the SmokeHaz project, which summarizes the harms of smoking on respiratory health in a freely accessible online resource for policymakers, researchers, students, health care professionals, and the public.[4] SmokeHaz is a collaborative project between the UK Centre for Tobacco and Alcohol Studies, the European Respiratory Society, and the European Lung Foundation. In this project, all of the available worldwide literature up to 2013 has been used to update a series of systematic reviews and meta-analyses on associations between tobacco smoking and a range of respiratory health outcomes. This article presents the detailed scientific data for validation by independent peer review and is designed to promote and strengthen public awareness of tobacco control issues as requested in Article 12 of the World Health Organization's *Framework Convention on Tobacco Control*.[3]

Methods

Inclusion Criteria

We included longitudinal, cohort, or nested case-control studies that assessed the effect of active or passive tobacco smoking on the risk of developing respiratory diseases. Outcomes of interest included lung cancer, COPD, asthma and wheeze, asthma exacerbations, or sleep apnea or tuberculosis in adults and asthma and wheeze, asthma exacerbations, lung function, sleep apnea, or lower respiratory tract infection (LRTI) in children. Where possible we used biochemically verified measures of smoking, for example exhaled carbon monoxide or saliva cotinine levels, in preference to self-reported smoking status. Active smoking was defined as ever smoker, current smoker, or ex- or former smoker; passive smoking was defined as being in contact with secondhand smoke from any source: domestic, occupational, or other sources. Studies assessing levels of exposure to smoke based on cigarette consumption (pack years defined as number of packs smoked per day multiplied by number of years smoked, duration of smoking, or the number of cigarettes smoked per day) were also included. For passive smoking, we included studies which assessed effects either in non- or never smokers or where the effect of active smoking was adjusted for in the statistical analyses. In addition to adult populations, studies focusing on in utero, infants, children, and adolescents were also included. Where insufficient studies were identified for particular outcomes, we extended our searches to include studies reporting disease-specific mortality. Studies which only looked at passive smoke exposure relating to cooking fuels and those looking at active or passive smoking from illegal substances were excluded. To ensure the strictest independence of the science as far as possible within the limits of disclosed knowledge, we omitted any primary studies with declared or identifiable involvement of the tobacco industry.

Search Strategy

Comprehensive literature searches in MEDLINE, Embase, and Web of Science were conducted from 1985 to 2013 (precise end dates varied for each health outcome), with no language restrictions imposed. We also searched conference proceedings from major international tobacco control conferences and a range of websites hosted by relevant professional societies. Contact with experts in the field was made to identify further relevant published or unpublished research. References lists of all included studies were screened to identify further potentially eligible studies.

Study Selection and Data Extraction

Titles, abstracts, and full-text articles identified from the searches were screened by one reviewer (L. J.) to select relevant articles. A second reviewer (J. L.-B.) independently screened a minimum of 10% of titles and abstracts and 30% of full-text articles. Two authors (L. J. and J. L.-B.) independently extracted data from included studies using previously piloted data extraction forms and independently assessed the quality of the included studies using the Newcastle-Ottawa Scale[5] for primary studies and the Assessment of Multiple Systematic Reviews Scale for existing systematic reviews.[6] A Newcastle-Ottawa Scale score of ≥ 7 indicated high quality in the

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