Adult lung cancer in southern Africa: epidemiology and aetiology

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Introduction

Cancer is a leading cause of mortality worldwide,[1] with lung cancer being the leading cause of cancer-related mortality globally. In developed countries national data are collected and collated into large databases detailing the incidence of all cancers; the incidence of lung cancer is then compared with other cancers in order to gauge its overall incidence. Lung cancer in the UK is an increasing problem, and is now the second most common cause of death with an overall incidence of 41.4 per 100 000.[2] However in southern Africa lung cancer is less common and comprehensive data are lacking.[3] In southern Africa the incidence of lung cancer and its mortality rate remain low in comparison with other cancers and respiratory diseases,[4] with a rate of lung cancer in South Africa of 5.8 per 100 000, compared with 32.7 per 100 000 for oesophageal cancer.[5] Due to the increasing availability of cigarettes, the lack of anti-smoking campaigns, urbanisation, and changes in lifestyle, the incidence of lung cancer is likely to be on the rise.[6]

This article aims to review current literature on the burden and causes of lung cancer in southern Africa and highlight areas that may require intervention or further research.

Methodology

Material gathered for this review was initially taken from a search on the website 'Pubmed'. The search criteria included countries and their pre-independence name, in the Southern African Development Community (SADC).

Twenty-four papers were reviewed and included in this review. References from these papers were used to gather relevant information from the World Health Organization (WHO) and similar organisations.

Discussion

Socio-cultural factors

Smoking

Smoking is well known to be strongly associated with lung cancer and is the leading contributory factor. Smoking is more prevalent in men; in adults aged ≥15 years; 43.7–52% of men smoked compared with 11.1–17% of women.[7,8] The lower prevalence of smoking in women is due to lower social acceptability of women smoking in southern African cultures.[7] Overall, nearly 9% of all deaths are attributable to smoking, with 49% of deaths occurring in the economically productive age group of 35–69 years.[7] Worryingly, one study showed a 46% prevalence of smoking among pregnant black women; resulting in conditions such as low birth weight. Another study in South Africa has shown that the odds ratio (OR) of lung cancer that is attributable to tobacco smoking for men and women was 4.79; this is comparable with chronic obstructive pulmonary disease (COPD), which had an OR of 2.53.[8] The OR of developing lung cancer in male light smokers (defined as <15 g/day) was 9.8 and in heavy smokers (defined as ≥15 g/day) was 12.0; current female smokers have an OR of 5.8.[9]

The greater male smoking prevalence[8] results in a significant male predominance in lung cancer, with 70% of lung cancer in Cape Town diagnosed over a 1-year period being in men.[10] Between 1993 and 1995 lung cancer accounted for 8.7% and 2.8%, for men and women respectively, of all cancers in Africa. As such, rates of lung cancer in South Africa are substantially higher in men (see Figure 1).[11] Also concerning is the prevalence of smoking in adolescence, with 27.1% of boys and 10.5% of girls aged 11–17 years smoking in 2001.[12]

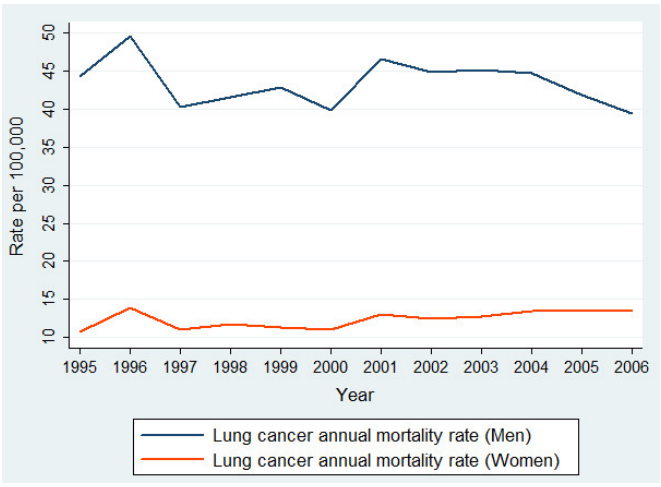

Figure 1 Trends in age-standardised mortality rates (per 100 000) for lung cancer in South Africa from 1995 to 2006, by gender[11]

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Occupational factors

Occupational factors contribute to the development of lung cancer. A study in South Africa focused on amphibole miners. The study concerned their exposure to two amphibole rocks: amosite and crocidolite, both of which are forms of asbestos. Prolonged inhalation of these thin fibrous crystals can cause a variety of respiratory illness. In the cohort of 7317, 17% (1225) died, with only 56 attributable to lung cancer and 30 to mesothelioma.[13] The study concluded that crocidolite was more toxic than amosite, with a standard mortality ratio (SMR) of 1.38 for amosite and 2.03 for crocidolite exposure.

Silica is a well-known carcinogen. The link between silicosis (lung fibrosis secondary to silica exposure) and the risk of lung cancer is well known.[14,15] There is however dispute as to whether silica exposure, in the absence of silicosis, increases the risk of lung cancer; this risk is likely to be increased by other factors such as smoking and exposure to other carcinogens such as radon.[16] Dust exposure in the mines also contributes to the risk of lung cancer, chronic obstructive pulmonary disease (COPD) and ischaemic heart disease (IHD); all of which give similar SMRs to asbestos exposure, with that of lung cancer at 139.8%.[17] The main risk factor associated with COPD and lung cancer was smoking (86% of white South African miners smoke cigarettes), however dust inhalation was noted to increase the risk of COPD but not the risk of lung cancer.[17] Exposure to other carcinogens in the workplace may also increase the risk of lung cancer.[14,18] The above studies describe an association between silica, dust exposure, and lung cancer; some other studies have shown no such association.[18] It is possible that differing conclusions are due to the lack control in many studies for smoking and radon exposure, which are significant confounding factors.

Infectious agents

The high prevalence of HIV/AIDS in Africa is well known. Kaposi's sarcoma and non-Hodgkin's lymphoma are designated AIDS-defining cancers; their risk is increased >10 000 and 50–600 times respectively in those with AIDS. The risk of lung cancer is increased four times and as such is designated a non-AIDS-defining cancer.[19] Tobacco smoking cannot entirely account for this increased risk; especially in young adults where lung cancer is less likely to develop in such a short time therefore other co-factors, namely co-infection, are also responsible.[20]

In Africa the need to effectively manage and treat HIV/AIDS is a pressing issue. This is highlighted by the concerning 14% increase in drug-resistant mutations in southern Africa between January 2001 and July 2011.[21] A consequence of improved HIV/AIDS treatment could be a decrease in the incidence of AIDS- and non-AIDS-defining cancers, such as lung cancer.

Living conditions

Foods

A study conducted, through dietary surveys in South Africa in 2000, showed that 80% of adults (aged ≥15 years old) consumed less than the recommended 400 g of fruit, per day, therefore low fruit and vegetable intake affects 11.1 million males and 12.5 million females.[22] Previous literature reviews have reported a consistent protective effect of fruit and vegetable intake on the development of lung cancer among other diseases.[23–25] The study had shown that the disability adjusted life years (DALYs) regarding lung cancer, attributable to low fruit and vegetable intake, were 7.8% for men and 4.7% for women of the total DALYs (97 482 in men, 79 436 in women). This represents 11 352 DALYs in both sexes due to lung cancer.[22]

Indoor air pollution

A large proportion of Africa uses solid fuels (coal or biomass) for cooking or heating, with an estimated 18% of South Africa's population using solid fuels.[26] A South African study showed that lung cancer was attributable to the use of these fuels; representing 497 DALYs in total in the adult population; overall only 0.8% of all DALYs in this study were attributable to solid fuel use.[27] Lung cancer represents a very low percentage of DALYs compared to COPD in adults (>30 years of age) and acute respiratory infections, such as pneumonia, in children (<5 years old). In general, due to domestic duties, women and children are more affected by indoor air pollution than men. This study was adjusted for the effects attributable to air pollution from solid fuel use without the use of tobacco smoking; exposure to both is likely to work synergistically to promote the development of lung cancer and COPD.

Outdoor air pollutants

Man-made pollution is a complex mixture of toxic substances including sulphur dioxide and oxides of nitrogen, which are mainly produced by motor vehicles as well as the use of industrial fossil fuels. Domestic use of wood, coal, and paraffin in underdeveloped rural areas also contributes to outdoor air pollution.

A study was conducted in a range of areas in South Africa to gauge the amount of 'years of life lost' (YLLs) attributable to outdoor pollution. Some 8.5% of the total YLLs were attributed to lung cancer with the rest being a result of acute respiratory infections in children and cardiopulmonary mortality in adults.[28]

Outdoor asbestos exposure has an effect on the risk of developing lung cancer. In areas with moderate asbestos pollution, homes near main asbestos transportation routes, a 2.5-fold increase in the relative risk of developing lung cancer was noted. In heavily asbestos polluted areas, homes near asbestos mines, there is a 2.8-fold increase in the relative risk in men, and a 5.4-fold increase in

females.[9] Asbestos is however not completely accountable since other factors such as smoking and indoor pollution more contribute significantly to the elevated risk.

Strengths and weaknesses

A strength of this review is that a thorough search method was used for study identification using pre-defined selection criteria. Weaknesses of this review are that a single reviewer was involved which can lead to a risk of publication selection bias; in addition, some publications may not have been available online leading to a risk of selection bias. Notably, this was a narrative review rather than a full systematic review.

Conclusion

In southern Africa, while the incidence and mortality rates are currently relatively low, the increasing use of tobacco has yet to show its full effect. When equivalent smoking rates occurred in the UK, the incidence of cancer was 80–100 per 100 000,[29] worryingly less than that of southern Africa at present. Five-year survival rates for lung cancer are low; 14% in one part of southern Africa[30] compared with 17.1% in the UK.[31] To prevent rates of lung cancer in southern Africa increasing to those currently seen in developed countries, research and preventative measures in many areas need to be urgently addressed with high quality studies to explore the relationship between HIV and the risk of lung cancer needed along with public health initiatives to:

- *Reduce outdoor air pollution* by promotion of public transport and regulation of the industrial pollutant emission;
- *Reduce indoor air pollution* by promotion of the use of cleaner household fuels and improved cooking stoves and household ventilation;
- *Reduce tobacco use* by higher taxes on cigarettes, increased education on the consequences of smoking, banning aggressive tobacco company marketing techniques, no smoking permitted in public areas, and increased smoking cessation advice and services;
- *Reduce occupational exposure* by improved occupational health and increased government regulation on the exposure to carcinogens in the workplace.

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