Epidemiology of Respiratory Disease in Malawi

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Introduction

The epidemiology of respiratory disease in rural Malawi is largely unknown. Published studies have concentrated on the most prevalent diseases causing admission to hospital in urban areas. An important exception to this rule is the large body of published literature on tuberculosis in children and adults. The purpose of this article is to review what is known about infectious and non-infectious respiratory disease in children and adults, and to highlight the important questions that require new studies to provide answers. In each section, infectious and non-infectious respiratory disease will be considered in turn as illustrated in Table 1. Published literature was searched using Pubmed searches of the term "Malawi" (269 hits), "Africa and lung"(697 hits), and by consultation with local specialists. Grey literature was sought through the Documentation Center of the Ministry of Health, the UN Resource Center, the College of Medicine "Malawiana collection" and by contacting the Health Management Information Unit of the Ministry of Health.

Distribution of disease

Distribution of Infectious Respiratory Disease in Children

Acute Respiratory Infection

Acute respiratory infection (ARI) includes upper and lower respiratory tract infections and the incidence and prevalence of ARI are therefore dependent on definition. Upper respiratory tract infections are far more common than pneumonia (or lower respiratory tract infections) but almost all ARI-related mortality is due to pneumonia. A cohort study of infants in rural Malawi found an average of 1.1 episodes of ARI per year with a peak incidence in infants aged 1-3 months and during the cool season.[1] The incidence is likely to be higher in infants living in urban areas. Ministry of Health data given in Table 2 report case rates in under-fives for all ARI combined. A higher number of pneumonia cases was reported from February to April but numbers of reported cases of pneumonia when based on clinical criteria alone are likely to be affected by the clinical overlap with malaria.[2]

Pneumonia among hospitalized children in Malawi has been studied recently in the context of the Malawi Child Lung Health Project which ran from 2000 to 2004 as a joint project between International Union Against Tuberculosis and Lung Disease (IUATLD) and the Ministry of Health.[3] Around 4 000 cases of *severe* or *very severe* pneumonia were treated annually in 24 of the 25 government hospitals in Malawi. The importance of case definition is emphasized by the discrepancy with the much higher incidence rates as reported in the 2005 Health Management Information Service (HMIS) bulletin which included *non-severe* as well as *severe* pneumonia. Between July 2004 and June 2005, 624,000 new pneumonia cases were diagnosed in children under five years old in government and CHAM (Christian Health Association of Malawi) hospitals, representing 298 cases/1000 population [Health Management Information Bulletin. Annual Report. Ministry of Health and Population, Lilongwe, 2005]. This may still be an underestimate as the 2000 Demographic Health Survey found that 7.1% of children presented to a health facility for treatment when the child had ARI as defined by a history of cough and fast breathing in the two weeks before the survey, which is equivalent to 1850 cases/1000 per year.

Tuberculosis

Tuberculosis (TB) among children in Malawi has been described.[4] In 1998, there were 2739 cases of TB registered in children (11.9% of the national reported cases). The estimated rates of TB in children were 78/100,000 in children under one year, 83/100 000 in children aged 1 to 4 years and 33/100 000 in those aged 5-14 years. In this study, central hospitals and mission hospitals reported higher rates of childhood TB than district hospitals. There is no contact tracing of adult cases of TB in most of Malawi, but the rates of childhood TB estimated in this study were thought to be accurate as they are consistent with rates measured in other parts of Africa, and have increased from previous estimates from the pre-HIV era.[5]

HIV related infections

Pneumonia is the most common cause of morbidity and mortality in HIV-infected children.[6] HIV infection of children alters the pattern of respiratory illness.[6,7,8] HIV causes increased bacterial pneumonia and tuberculosis, but also *Pneumocystis* pneumonia (PcP) and a chronic lung disease, probably of infective origin, known as lymphocytic interstitial pneumonitis (LIP).[9,10] The incidence and severity of bacterial pneumonia in HIV infected children in Africa are known to be greater than in non-HIV infected children[11] but exact figures are not known in Malawi. In a cohort study in Blantyre from birth until 3 years, the frequency of cough and pneumonia was significantly higher in HIV-infected children compared to non HIV-infected children.[12]

Distribution of Infectious Respiratory Disease in Adults

Tuberculosis

The Malawi National Tuberculosis Programme (NTP) has collected data for many years and documented an increase in the total number of cases as the burden of HIV has increased. There were 28,234 cases of tuberculosis treated in 2003 and 7716 (27%) were sputum smear-positive. Using tuberculin test reactivity in unvaccinated 6 year olds to estimate the annual risk of infection and population statistics, the NTP has estimated that these figures represent 46% of tuberculosis cases in Malawi and a incident rate of 81/100 000 per year. Many of the remainder will be treated outside the 44 hospitals registering cases, mostly in small private hospitals and clinics.

TB cases show a peak incident age of 25-34 years, and no gender difference. Increases in the prevalence of HIV have increased the incidence of TB cases; the percentage of cases of TB attributable to HIV has risen from 17% to 57% in Karonga, with the increase in women occurring at a younger age (15-29 yrs) than in men (30-44 yrs).[13]

Pneumonia

Respiratory tract infections and fever have been described as the most common cause of admission to hospital in Malawi even in the pre-HIV era.[14,15] In Botswana in 1997, pneumonia caused 8.3% of in-patient deaths (TB caused 15.7%).[16] Six hundred cases of acute pneumonia are now admitted to the adult medical wards of Queen Elizabeth Central Hospital (QECH), Blantyre, each year in a unit that admits approximately 10,000 patients per year but there has been no detailed diagnostic study of the aetiology of these infections.

HIV related infections including empyema

A recent cohort study of 660 HIV-infected Malawian adults following strict diagnostic criteria reported incidence rates of 3.8 per 100 person years of observation (pyo) for confirmed bacterial pneumonia; 16.5 per 100 pyo for probable bacterial pneumonia; 12.1 per 100 pyo for pulmonary TB and 0.6 per 100 pyo for confirmed PcP.[17]

The seroprevalence of HIV infection among hospital inpatients at QECH, Blantyre is 70% on medical wards and 45% on surgical wards. Pneumonia cases have an HIV seroprevalence of approximately 75%, but cases with pneumococcal bacteraemia have an HIV seroprevalence of 5%.[18] In studies of 352 patients with a presumptive diagnosis of sputum negative tuberculosis, 17 cases of PCP were diagnosed by bronchoscopy and BAL.[19] Non-typhoidal *Salmonella* (NTS) infections are common in patients presenting with cough, but this is thought to be due to dual infections with NTS and a typical respiratory pathogen such as *Streptococcus pneumoniae* in patients with late HIV.[20] Approximately 20 cases of empyema are seen in the central hospitals per year – most are HIV positive.

Bronchitis

There has been no survey of bronchitis in Malawi but cases have been reported.[u] In South Africa, the national incidence of bronchitis defined as chronic productive cough is 2.3% in men and 2.8% in women.[v]

Distribution of non infectious respiratory disease in children

HIV related tumours

Kaposi's sarcoma (KS) is the most common HIV related malignancy in Malawian children (EM Molyneux, personal communication). Pulmonary KS does occur in children and is usually associated with palatal KS and bloody pleural effusion. Pulmonary lymphoma is rare.

Asthma

Asthma is treated in a small number of children in the central hospitals in Malawi, but is an uncommon disease (approx 0.6% of cases admitted to hospital). It is likely to be more common in children from relatively wealthy, urban-based families[23,w], and in Malawi these children will present to private practitioners. Misdiagnosis has been

appreciated as a problem in other parts of Africa. [25]

Cystic fibrosis

There has not been a confirmed case of cystic fibrosis in Malawi.

Distribution of non infectious respiratory disease in adults

HIV related tumours (Kaposi's sarcoma)

Atypical African Kaposi's sarcoma is associated with AIDS.[z] The incidence of pulmonary Kaposi's sarcoma in Malawi could be estimated by the association of palatal KS in patients with either blood stained pleural effusion or progressive pulmonary symptoms unresponsive to antibiotics and TB treatment but no such study has been reported. Kaposi's sarcoma remains the most common malignancy diagnosed in medical wards in Malawi. A recent cohort study of HIV-infected adults in Blantyre found an incidence rate of 5 cases of KS per 100 pyo.[17] In a Zimbabwean series of 48 pulmonary KS cases, second diagnoses (eg concurrent TB) were uncommon and prognosis was poor.[27]

Chronic obstructive pulmonary disease

The global burden of disease caused by chronic obstructive lung disease secondary to cigarette smoking is well known, but is not yet a significant problem in Malawi. The burden of COPD caused by indoor air pollution due to cooking with smoky fuel is becoming appreciated globally and is likely to be a significant problem among women in Malawi. There has been no detailed survey in Malawi, but a study in Nigeria showed an association of COPD with biomass fuel use in women.[28]

In a recent study of 128 volunteer adults carrying out FEV1 assessments in Blantyre, the mean percent predicted FEV1 among women was 72% compared to 86% in men. The presence of a low percent predicted FEV1 was associated with female gender, biomass fuel use, tuberculosis and HIV status but not cigarette smoking (Gordon SB, unpublished data).

Cor pulmonale

Cor pulmonale is common in late middle aged women presenting as medical outpatients. There has been no study of the association of this presentation with biomass fuel use. Heart failure secondary to lung disease has been reported in Nigeria.[29]

Tobacco related disease

Tobacco is the most important cash crop in Malawi. Local consumption of tobacco is by inhalation of snuff, and by smoking in cigarettes. Cigarette smoking in women is unusual, and in men rarely exceeds 5 cigarettes per day. The burden of disease attributable to tobacco use has not been assessed. COPD is likely to be associated with biomass fuel use and a history of tuberculosis. Bronchial carcinoma is seen but is unusual due to the relatively small number of smokers and the low life expectancy among Malawians.

Asthma

Severe asthma is an uncommon presentation to hospital.[21] In Botswana, asthma and COPD caused 0.7% of inpatient deaths where tuberculosis (15.6) and pneumonia (8.3%) were common.

1. TB is the only respiratory disease for which there are good incidence and prevalence data in Malawi
2. Pneumonia is a major cause of hospital admission and death in children
3. The burden of disease due to pneumonia in adults is high but the causes are unknown
4. Pneumonia and TB are the most common causes of morbidity and mortality in HIV-infected adults and children
5. The burden of disease due to COPD is likely to be highly due to biomass fuel use and tuberculosis

Occupational lung disease

The important industries in Malawi where occupational lung disease might be expected are the cotton industry, including dyeing of cloth, the tobacco industry, fishing, small bakeries and the processing of tea and coffee. There are no published data from these industries.

Malawians have traditionally travelled within the region to find work in the mines of South Africa. It is likely that occupational lung disease will have occurred in these migrant workers[30,31], but no data regarding the burden of this disease are available.

Sarcoid, pulmonary fibrosis

There are no published data on the incidence of inflammatory or fibrosing lung disease in Malawi. In the current HIV epidemic, chronic lung disease almost always occurs in the context of HIV infection and is presumed to be due to chronic infection.

Distribution of determinants for respiratory disease

Determinants of Respiratory Disease in Children

The important determinants of respiratory disease in children are often common to the major diseases described above and often inter-linked. These determinants, which can either increase or decrease the incidence of disease, are divided into biological, behavioural and social categories. Biological determinants include malnutrition, age, HIV infection, Vitamin A deficiency and concomitant viral infections. Behavioural determinants include vaccination status, biomass fuel use, alcohol abuse and cigarette smoking. Social determinants include crowding and the number of siblings.

Biological determinants of respiratory disease in children

Young age is a major factor that increases the incidence, severity and mortality associated with pneumonia in childhood. Low birth weight, protein-energy malnutrition and micronutrient (vitamin A & zinc) deficiency are also important determinants of incidence and severity of ARI and are common. Around one-third of babies are born with low birth weight (<2.5 kg) and 21% of children were recorded as underweight in HMIS figures from 2003 (regional range 8-68%).

Viral infections are common and increase mucosal inflammation and increase the incidence of bacterial pneumonia. The reduction in viral infective episodes following the pneumococcal conjugate vaccine trial in South Africa has been used to illustrate the role of secondary bacterial infection in exacerbating the symptoms of primary viral infection.[32]

HIV infection is an important determinant of pneumonia and of non-infectious pulmonary disease such as LIP and pulmonary KS. The overall HIV seroprevalence in paediatric admissions at QECH in Blantyre is 18.9%[33] but over 50% for acute and chronic pneumonia.[8,10] The vast majority of children infected with HIV are infected by vertical transmission; on average 20% of women attending antenatal clinic are HIV infected countrywide.[34] Vertical transmission of HIV can be reduced using peri-partum anti-retroviral therapy[35] and single-agent nevirapine is now offered to mothers delivering in hospital in Malawi. The major risk factors for development of HIV related infections are falling CD4 count and rising viral load.[36] Malnutrition is an additional risk factor for severe infections in HIV infected children.

Breast feeding is protective against ARI in childhood but does increase the risk of vertical transmission of HIV. The current recommendation in Malawi is that women should breast feed exclusively if possible, regardless of HIV status.

Biological determinants of respiratory disease in adults

The biological determinants of respiratory disease in adults are similar to those in children with young age being replaced by old age and chronic disease. The traditional risks for pneumonia and tuberculosis of poverty, advanced age, and malnutrition have been overtaken in Malawi by HIV which is now the single most important risk factor for disease and has caused the incidence of TB to rise despite an effective NTP.[13,37] French has estimated that the proportion of bacterial pneumonia attributable to HIV in sub-Saharan Africa is approximately 73% based on community acquired pneumonia (CAP) rates in HIV infected and uninfected cohorts in the region.[38] The incidence of bacterial pneumonia in patients on treatment for TB is much higher in HIV infected than non-HIV-infected patients and so the incidence of dual infections has increased.[39] In addition, a study in Kenya has shown that 8% of community acquired pneumonia in adults is due to TB.[40] The major risk factor for bronchitis in South Africa is a history of tuberculosis.[41]

HIV infection is also a determinant of non-infectious respiratory disease. KS is associated with advanced HIV disease and co-infection with Human Herpes Virus 8 (HHV-8). HHV-8 viraemia is common in HIV clinic attendees[42], and associated with high anti-HHV-8 IgG[43] in southern Africa, but no study of risk factors has been reported in Malawi. Lymphoma is also associated with HIV infection, but no study has been carried out in Malawi.[44]

Biological determinants of respiratory disease that are important elsewhere in the world such as very advanced age, nursing home residence, chronic diseases (liver or renal failure, diabetes) and steroid use are not significant in Malawi.

Behavioural determinants of respiratory disease in children

Good vaccination coverage has been associated with a reduction in ARI-related deaths in Malawian children especially of measles and pertussis and now possibly bacterial pneumonia due to Haemophilus influenzae as well. Biomass fuel use has been shown to be associated with increased ARI in children in Zimbabwe[45] and coal

smoke exposure is associated with bronchitis in China.[46] This has not been described in Malawi but conditions are similar and the effect is likely to be the same. Maternal cigarette smoking is extremely rare in Malawi, and cigarette smoking in men is relatively light, so this is not likely to be a current risk factor for ARI in Malawian children.

Behavioural determinants of respiratory disease in adults

The behavioural determinants of respiratory disease that are likely to be important in Malawian adults are alcohol abuse, cigarette smoking, and the use of biomass fuel. Studies of these determinants have not yet been published.

Male gender is associated with tobacco use in Malawi (as in South Africa[47]) and knowledge about health risks are limited in either gender.[48] Since the prevalence of tobacco-related disease is not known, the importance of this observation remains in question. There is substantial variation in genetic susceptibility to tobacco-related disease, particularly COPD and bronchial cancer, in populations where tobacco use is heavy.[49] It is likely that migrant worker effects contribute to the burden of tobacco related disease in Malawi by the known synergistic effect of asbestosis.[50,51]

In unpublished data, the use of biomass fuel for cooking was associated with lower FEV1 values in women and with respiratory symptoms (Gordon, 2004). Cigarette smoking in men, and smoky cooking fuel in women are significantly associated with chronic cough in southern Africa therefore bronchitis is likely to be a significant but unrecognised problem in Malawi.[52] Further, clinicians in Malawi report that severe heart failure in late middle-aged women with lung disease (cor pulmonale) is a common presentation and suspect that this relates to the use of biomass fuel (J Kumwenda, personal communication).

Social determinants of respiratory disease in children

Crowding and the number of siblings in a family (more siblings present an increased risk) are associated with ARI and TB in children world-wide. Improved housing has been shown to improve children's health in northern Malawi.[53] Exposure to an index case is a major risk factor for TB, and active contact tracing found nine times more TB cases than passive contact tracing in Malawi. The current resource-constrained lack of active contact tracing is therefore a risk factor for tuberculosis in Malawian children.[54] Children are at particular risk of TB when the household contact is female (especially the mother) and sputum smear-positive (SM Graham, personal communication).

The major risk factors for the development of asthma in children are being studied in other parts of Africa where wheezing is common.[55,56,57] Factors associated with urban living, such as lack of domestic animals, cooking with kerosene and increased exposure to house dust mite seem to be important. These findings make it unlikely that there will be a dramatic increase in the prevalence of childhood asthma in Malawi in the near future.

Social determinants of respiratory disease in adults

Special risk groups for tuberculosis in Malawi include prisoners[58], prison employees, health care personnel and ex-miners.[bg] Groups at special risk of bacterial pneumonia are migrant workers in the South African mines but this risk is incurred at the mining barracks and not in Malawi. Occupational exposures in cement factories, bakeries, fish processing plants and other industries may be an under-appreciated problem but the major industry in Malawi is the tobacco industry. Dust-related symptoms are likely as have been shown elsewhere.[60] Workers in the tobacco industry are exposed to high dust levels in drying flues and when stacking the dried leaf. This results in a restrictive lung defect independent of cigarette smoking.[61] In addition, a large number of tobacco workers in Zimbabwe smoke unprocessed leaf and are at increased risk of bronchial carcinoma.[62] The same is likely to be true in Malawi. Symptoms of occupational asthma were reported in the cotton industry in Malawi but with the decline of this industry these have become rare. Asthma in adults is rare in Malawi and likely to remain so due to the environmental constraints outlined above.

1. Age and nutritional status are important determinants for respiratory disease
2. HIV infection is now the major risk factor associated with infectious and non-infectious respiratory disease in children and adults in Malawi
3. Biomass fuel use is an under recognised threat to respiratory heath, particularly in women, and should be further investigated
4. Childhood immunization is important in preventing infectious causes of severe pneumonia

Impact of the disease

Health impact of infectious Respiratory Disease in

Children

Acute Respiratory Infection

Respiratory disease is estimated to cause 20% of deaths in children under 5 in Africa[63], where many countries still report an under-5 mortality of between 10 and 20% of all births.[64] The Malawi Child Lung Health Project found that case-fatality rates for children hospitalized with severe pneumonia prior to implementation of the project ranged from 8 to 29% in district hospitals. The majority of deaths are due to bacterial pneumonia, PcP and TB.[65]

Tuberculosis

Tuberculosis is under-diagnosed in children[66] but outcomes are poor even in those in whom treatment is initiated. Only 45% of children completed treatment with 17% dying, 13% defaulting and 21% lost to follow-up. Outcome was worst in younger children, and children with sputum negative TB. Approximately 1200 children die per year of TB in Malawi.[4]

HIV related infections

Children with HIV are at greater risk of recurrent disease and death. The majority of children in Malawi infected with HIV die by 3 years of age and pneumonia is the main cause of death.[7] A study of severe pneumonia at QECH found an overall case-fatality rate of 22% and was significantly higher for HIV-infected children (30%) compared to HIV-uninfected children (9%).[10]

Health impact of Infectious Respiratory Disease in Adults

Tuberculosis

TB cases have approximately a 20% mortality before the end of treatment, with figures being worse for sputum negative and extra-pulmonary infection. In a study of ambulatory TB therapy, 33% of patients died by 12 months, with death associated with older age, HIV infection and parenchymal lung disease.[67] The NTP estimates that the registered cases of TB (28,000 per year) are 45% of the actual cases. If 20% die during treatment, this equates to 12,500 deaths per year attributable to TB. If one third of cases die by 12 months, this equates to approximately 20,000 deaths per year. The loss of income and daily function in tuberculosis patients is dramatic and has recently been described by Mann and colleagues (publication pending).

Pneumonia

Approximately 600 cases of pneumonia are admitted to QECH, Blantyre, each year and the case fatality rate in this group is 19%. French has estimated that the number of cases of adult pneumonia in Malawi is approximately 51,000 per year. The mortality due to community acquired pneumonia (CAP) in Malawi may approximate to 10,000 deaths per year, of which 70% will be HIV associated.

HIV related infections

Cohorts of HIV infected adults not receiving anti-retroviral therapy have a mortality rate per year of up to 25%.[17,68] Most of this mortality relates to death from HIV associated infections. Cohort and hospital-based cross-sectional studies have found that the predominant bacterial infections in HIV-infected Malawian adults are NTS and *S. pneumoniae*.[17,69]

Bronchitis

The health impact of bronchitis in Malawi probably results in many days taken off work, but no data are available.

Non infectious respiratory disease in children

HIV related tumours

Pulmonary KS is rapidly fatal.

Asthma

Rare cause of death but individual morbidity considerable because of limited treatment options.

Non infectious respiratory disease in adults

HIV related tumours (Kaposi's sarcoma)

A case series from southern Africa found that median survival for KS even with chemotherapy was only 70 days.[27]

Chronic obstructive pulmonary disease

The burden and severity of this disease in Malawi is not known.

Cor pulmonale

The burden and severity of this disease in Malawi is not known, but untreated survival in severe heart failure is typically less than 6 months.

Tobacco related disease

There are no relevant data from Malawi.

Asthma

The health impact of asthma in affected persons will be severe, as very little inhaled therapy is available and so guideline directed control[70] of symptoms is impossible.

Occupational lung disease

1. The burden of respiratory infection in Malawi is huge:
   a. about 12500 adults and 1200 children die each year from TB
   b. Pneumonia is estimated to cause 20% of all under five mortality
2. The health impact of respiratory disease due to biomass fuel use and tobacco is not known

No data.

Effective interventions

Interventions, like determinants, can be divided into biological, behavioural and social categories.

Biological interventions to improve respiratory health in children

The need for improved nutrition of Malawian children is self-evident and beyond the remit of this chapter. Education and improved antenatal care of mothers to reduce the high proportion of low birth-weight babies would also be effective. Vitamin A is routinely given at 6 months of age in Malawi and community-based studies in Tanzania and elsewhere found that this is protective against measles-related mortality. Therapeutic doses of vitamin A are very effective in reducing pneumonia-related death in children with measles[71] but only 20% of the expected number of vitamin A doses were given in 2003 (HMIS Bulletin Dec 2003). Zinc may also have a role in reducing pneumonia-related deaths.[72]

Vaccination is an effective intervention for many infectious diseases including causes of pneumonia and the current WHO Extended Programme of Immunisation (EPI) in Malawi includes BCG, diphtheria, pertussis, tetanus, measles and more recently (since 2002) Haemophilus influenzae type b (Hib) conjugate vaccine. Preliminary findings form the 2004 Demographic Health Survey found that 64% of children received all vaccinations – 91% received BCG and 78% received measles. A conjugate vaccine was effective against 9 capsular types of Streptococcus pneumoniae[73] in South Africa, but this vaccine is prohibitively expensive for Malawi, and the serotype coverage is not ideal anyway.[74] Nevertheless, there is no prospect of a better vaccine in the next 10 years, and the effect of herd immunity in the USA was twice that of the direct vaccination effect. The Pneumo-Accelerated Development and Introduction Programme (Pneumo ADIP: www.preventpneumo.org) www. programme sponsored by the Global Alliance for Vaccines and Immunisation (GAVI:www.vaccinealliance.org) is therefore giving consideration to the implementation of pneumococcal conjugate vaccines in the least wealthy nations.

BCG vaccination reduces severe disease due to tuberculosis and is preventive against leprosy[75], but can cause disease in HIV infected children.[76] The benefit of providing isoniazid preventive therapy to young well childhood contacts of cases of smear-positive TB is potentially large but uncertain.[54,77]

Reduction of maternal and perinatal HIV infection is possible, and has the potential to dramatically reduce HIV related lung disease by halving the number of HIV infected children (see AIDS chapter). ART became freely available under the National AIDS Commission managed ART programme in 2004 to treat a limited number of HIV infected children. ART reduces infections and prolongs survival in HIV infected children. Cotrimoxazole prophylaxis given to all HIV-exposed infants is effective in preventing PcP infection and a recent study in Zambian children over 1 year old found that it improved survival, reduced hospitalizations and pneumonia-related deaths.[78] Cotrimoxazole prophylaxis is now recommended in HIV infected children in Malawi in line with WHO recommendations based on the Zambian study (http://www.who.int/3by5/en). EPI immunizations are usually effective in HIV-infected children albeit with reduced efficacy compared to HIV-uninfected children.

Biological interventions to improve respiratory health in adults

The NTP in Malawi will not be effective unless TB control is combined with an ART strategy.[13,79,80] There is likely negligible benefit of neonatal BCG preventing adult disease. *M.vaccae* has been tested as an adjuvant treatment in Karonga District and Zambia without benefit.[81] Prevention of pneumonia in adults by vaccination is not yet an achievable goal. The 23-valent pneumococcal polysaccharide vaccine is effective in preventing invasive pneumococcal disease in western populations but did not help HIV infected Ugandan adults.[68] There is a

possibility that the herd effect of the 7-valent conjugate vaccine would reduce the burden of adult pneumonia but this has not yet been tested in an area of high HIV seroprevalence.

Isoniazid preventive therapy[82] and cotrimoxazole prophylaxis have both been shown to reduce infections in HIV infected adults.[83,84] In Malawi, cotrimoxazole prophylaxis has been shown to reduce mortality in HIV-infected tuberculosis patients in Karonga and Thyolo districts.[85] Cotrimoxazole prophylaxis is now being rolled out as part of the HIV/TB care package in Malawi but supply will present a major challenge.

ART is effective in reversing some cutaneous Kaposi's sarcoma and there are reports of some successful palliation of peripheral KS with single agent vincristine but in pulmonary KS this success is unusual.

Behavioural interventions to improve respiratory health in children

An intervention study showing an alternative to biomass fuel use that resulted in less ARI or respiratory symptoms in children has not yet been achieved in Malawi. Studies in India[86] and Guatemala[87,88] are ongoing but regional differences will be critical in determining if interventions will be effective.

Behavioural interventions to improve respiratory health in adults

Cessation of cigarette smoking and good management of intercurrent infections can reduce the rate of deterioration of COPD induced by cigarette smoking. It is not clear if reduced exposure to biomass fuel smoke will have any beneficial effect – it is more likely that prevention of damage will be the primary benefit.

Social interventions to improve respiratory health in children

The Malawi Child Lung Health Project tested the hypothesis that treatment outcomes in ARI could be improved by education of health givers and by the reliable provision of antibiotics. The study was successful reducing pneumonia case-fatality rates by as much as 40% in district hospitals and much of the success was due to provision of oxygen and antibiotics. The Project will report in 2006 and is now including CHAM hospitals.

The widespread implementation of contact tracing[54] might reduce the health burden of tuberculosis in children in Malawi[89] but would require a substantial increase in public awareness and would need to be supported by increased accuracy of diagnosis of tuberculosis in children.[90] These approaches are not currently available in Malawi due to resource limitations.

Social interventions to improve respiratory health in adults

Smoke related health effects are dose-dependent and partially reversible on removal of the exposure. Prevention or alleviation of bronchitis in Malawi can only follow identification of the problem and specific risk factors. If biomass fuel use was shown to have a significant health impact in Malawi, the abundant provision of hydro-electric power might improve health and increase forest resources at the same time.

Removal of provoking agents and effective therapy give good control of asthma symptoms and avoid deaths. Asthma is not high enough on the burden of disease list to be given much resource at present. Adequate management of heart failure relieves symptoms and domiciliary oxygen prolong life in cor pulmonale. ACE inhibitors and other effective drugs are a limited resource in Malawi where even basic hospital resources cannot be sustained and domiciliary oxygen is unrealistic. Fortunately, the prevalence of cor pulmonale is low.

Advocacy to change political will, legislation and taxation can alter tobacco production and consumption. Unless these changes are implemented in Malawi, a legacy of tobacco related disease is likely. Even if Malawian tobacco production is reduced, legislation must be put in place to protect Malawians from the predatory marketing practices of the cigarette manufacturers that have caused controversy in the USA and Turkey. The announcement in February 2005 that Malawi will not ratify the Framework Convention on Tobacco Control (FCTC) is a step in the wrong direction.

Occupational health is currently a luxury of developed countries. South Africa is leading the way in southern Africa[91] in investigating workplace conditions and legislating to protect workers and provide compensation for industrial injury.[92] In Malawi, such bureaucratic efficiency and legislative completeness are some way off.

Conclusion and research priorities

Malawi has a very large burden of infectious respiratory disease. The common causes of hospital admission and

Table 1 Classification of respiratory disease burden in Malawi

Infectious Respiratory Disease	Children	TB ARI including pneumonia HIV related infections
	Adults	TB Pneumonia HIV related infections
Non Infectious Respiratory Disease	Children	Asthma Cystic fibrosis
	Adults	HIV related tumours (KS) COPD Cor pulmonale Tobacco related disease Asthma

death are bacterial pneumonia and TB. At least 70% of adults with severe respiratory disease and many of the children are HIV infected. HIV infection significantly increases incidence and mortality of pneumonia and TB. Malawi also has an unknown burden of non-infectious respiratory disease due to biomass fuel use and the tobacco industry.

The research priorities in infectious disease are to design effective implementation strategies for the existing effective health interventions. There are available preventive measures that could markedly reduce the burden of disease which include immunisation with bacterial conjugate vaccines, prevention of HIV infection and mother-to-child transmission, cotrimoxazole prophylaxis and isoniazid preventive therapy. The challenges are effective implementation and lack of resources. The research priorities in non-infectious disease are to define the health effects of biomass fuel use and the tobacco industry.

1. There are highly effective interventions to prevent and treat respiratory infections in both HIV infected and non-HIV infected children and adults
2. A reduction of HIV prevalence would have a major impact on reducing pneumonia-related mortality for adults and children
3. There are effecive interventions for noninfectious respiratory disease, Their implementation in Malawi is constrained by lack of data regarding incidence, prevalence and risk factors.

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Table 2. Incidence of ARI in children from MOH records.

Year	Case rate / 100,000 (U5)	Case rate/ 100,000 (over 5)	Case rate /100,000 (total)
76	58,725	16,591	24,934
77	63,883	17,168	26,418
78	66,339	32,799	39,417
79	69,163	29,210	37,131
80	68,897	35,557	42,197
81	74,970	37,308	44,841
82	76,687	40,572	47,824
83	76,660	40,318	47,628
84 (incomplete information)	64,437	20,225	29,126

Table 3. Reported cases of tuberculosis by year from NTP data

TB Case Notifications – 1994 to 2003

Year	Total	Smpos(%)[1*] new PTB[4‡]	Smneg(%)[2▯] new PTB	EPTB(%) new	Smpos(%) PTB relapse	Other (%)[3□]
1994	19496	5988(31)	8958(46)	4046(21)	504(2)	-
1995	19155	6295(33)	7054(37)	5255(27)	551(3)	-
1996	20630	6703(32)	8070(39)	5328(26)	529(3)	-
1997	20676	7587(37)	7481(36)	5101(25)	507(2)	-
1998	22674	8765(39)	8311(37)	4993(22)	605(2)	-
1999	24396	8132(33)	10013(41)	5583(23)	668(3)	-
2000	24846	8267(33)	8799 (35)	5723(23)	758(3)	1299(6)
2001	27672	8309(30)	10763(39)	6145(22)	877(3)	1578(6)
2002	26532	7687(29)	10660(40)	5377(20)	872(3)	1936(8)
2003	28234	7716(27)	11246(40)	5829(21)	1050(4)	2393(8)

1 * Smpos = sputum smear positive

2 ▯ Smneg = sputum smear negative

3 □ other = all recurrent TB cases not included as smear positive relapse

4 ‡ PTB = pulmonary TB

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