

## **A transition in health status from childhood to adulthood and associated lifestyle risk factors: a 13-year interval follow-up study in South Africa**

Maria A. Oosthuizen<sup>a\*</sup>, Champak C. Jinabhai<sup>b</sup>, Aletta P.S. Terblanche<sup>c</sup> and Piet J. Becker<sup>c,d</sup>

<sup>a</sup>*CSIR-Natural Resources and the Environment, Pretoria;* <sup>b</sup>*University of KwaZulu Natal, Congella;* <sup>c</sup>*Medical Research Council, Pretoria;* <sup>d</sup>*Division of Epidemiology, University of Pretoria, Pretoria, South Africa*

South Africa is a developing country that also has developed aspects and as a result, has to cope with issues related to both worlds. There has been a definite change in the global patterns of diseases from a situation dominated by infectious diseases to a predominance of non-communicable diseases where the risk factors are largely associated with lifestyle. Results from a follow-up study were used to investigate a transition in health status of the study sample. Questionnaires were used in this historical cohort study, which reviews the health status and lifestyle aspects of young adults who participated as children in the Vaal Triangle Air Pollution Health Study (VAPS) during 1990. In general, the study sample had a higher prevalence of chronic diseases compared to the general South African population. Findings indicate that the transition in health status recorded elsewhere in the world can be demonstrated in this South African group.

**Keywords:** air; epidemiology; health; questionnaire; risk

### **Introduction**

South Africa is a developing country that also has several of the features that characterize developed countries – and therefore has to cope with problems that are related to the developing world and the developed world. The past 100 years has witnessed a definite change in the patterns of diseases, both globally and in South Africa. The epidemiology transition in South Africa was mostly from infectious diseases, of which many have been eliminated (such as smallpox) or reduced (such as meningococcus), to non-communicable diseases (such as cancer, diabetes and heart disease), where the risk factors are largely associated with lifestyle (World Health Organization [WHO] 2002). However, there are infectious diseases, such as cholera and tuberculosis (TB), which are still present in low and middle-income countries (including South Africa) and these are mainly associated with poverty (WHO 2002). According to the South African Yearbook (2003/2004), the most common communicable diseases currently in South Africa are TB, malaria, measles and sexually-transmitted diseases.

South African studies have shown that, although the more affluent areas of South Africa were further ahead in the epidemiological transition, the poor areas also suffer a

---

\*Corresponding author. Email: roosthui@csir.co.za

substantial burden of premature death due to diseases such as stroke, chronic obstructive lung diseases, asthma, epilepsy, oesophageal cancer and cervical cancer (Medical Research Council [MRC]2001/2002).

Other studies have shown that there has also been a transition in *mortality* risk from mainly infectious diseases, perinatal and maternal causes in less developed countries, to diseases of the circulatory system and an increase in cancer in more developed countries (Eaton 2003). However, in South Africa, the mortality profile for 2000 reflects a quadruple burden of disease, where HIV/AIDS, chronic diseases, poverty-related conditions and injuries all contributed substantially. After HIV/AIDS (which contributed 30%), the leading causes of death were cardiovascular diseases (17%), infectious diseases (10%), malignant neoplasms (8%) and injuries (12%) (Bradshaw et al. 2003).

The transition from a situation dominated by infectious diseases to one characterized by non-communicable diseases is mainly associated with changes in lifestyle, with urbanization, increased stress, increased living standards and the 'Western' diet (MRC 2001/2002). This risk transition was one of the aspects investigated in a follow-up study conducted on a specific cohort of individuals whose health status was recorded when they were children. The focus of this paper is on the lifestyle risk factors that could influence such a transition in health status.

## Method

Reliable demographic information for the 1686 individuals who participated as 10-year-old children in the Vaal Triangle Air Pollution Health Study (VAPS) during 1990 was used to obtain the study sample for 2003. The original VAPS was a multidisciplinary longitudinal study which involved 14,053 children. The aim of VAPS was to study the exposure and effects of outdoor as well as indoor air pollution on the health of children (between the ages of 8 and 12), living in the Vaal Triangle. This area was and still is perceived as a polluted area because all main sources of ambient (outdoor) air pollution are represented in the Vaal Triangle. These sources include coal burning (from power stations, some industries and residential areas), industrial processes (including petrochemical and metallurgical industries) as well as motor vehicles.

It was decided to focus on children who were 10-years-old at the time VAPS started, because at the age of 10, most children do not yet smoke actively and they are still developing physiologically. A total of 404 of the individuals who participated in the original study could be located in 2003 and 184 of these responded positively to a request to participate in this study. The latter group of respondents constituted the final study sample.

This study reviewed amongst others, the health status and lifestyle aspects of these young adults through self-administered postal questionnaires that had been approved previously by an ethics committee. Between September 2003 and February 2004, data were collected on demographics, socio-economic status, house characteristics, and sources of indoor pollution, smoking habits, and health status from each individual who gave informed consent. Additional data were also collected on types of physical activity, dietary intake and alcohol use.

The collected data were summarized by means of frequencies, percentages and cross-tabulations. Data fields that were not completed in the questionnaires were treated as missing data in the data analyses. At a univariate level, the data from 1990 were compared with the 2003 data by employing McNemer's test for symmetry. For 2003 outcome variables were tested for association with risk/environmental factors using Pearson's Chi-square test or, when applicable, Fisher's exact test. The crude (unadjusted) odds ratios

(ORs) along with their 95% confidence intervals (CI) were also calculated. Following the within 2003 analyses, demographic/risk/environmental factors that were 'significantly associated with outcome' at a 0.20 level of significance were studied in a multivariate way using logistic regression.

## **Results and discussion**

### ***Demographic and descriptive statistics of the study sample***

The majority (63%) of the participants still reside in the same area that they lived in during 1990. Sixty percent (110/184) of the study sample is female and 40% (74/184) male. Afrikaans is the predominant home language of 89% (163/184) of the study sample, while 10% (19/184) reported that they use English and a further 1% (2/184) reported their home language as 'other'. As far as education is concerned, most (98%) of the respondents have at least completed grade 12 at school. Thirty-six percent of the respondents have a degree or diploma and 18% have a postgraduate qualification.

### ***Living conditions of the study sample***

Sixty-nine percent (121/175) of the respondents indicated that they live in single-family houses that are not attached to other houses while 13% (23/175) live in flats (apartments). The majority (93% or 170/182) of the respondents relies on municipal water for domestic use; electricity is used by 97% (176/182) of the households for cooking purposes.

### ***Indoor pollution sources***

Seventy percent of respondents live in houses where pets are allowed inside. This is an increase compared to the 66% recorded in 1990. Thirty-four percent reported mould growing inside the house. During the 1990 survey this figure was 14%. It is believed that this increase is due to the increased popularity of showers. Another factor that could have an effect on indoor air pollution (besides pets and mould inside the house) is tobacco smoking. There was a 7% decrease in the prevalence of smoking inside houses since 1990, when 40% of households reported having smokers who smoke inside the house.

### ***Lifestyle of the study sample***

#### ***Sport***

As far as general activities are concerned, walking was found to be the most popular, with 56% (92/165) of respondents participating in this form of exercise. Group sport such as soccer, rugby and netball are played by 9% (14/160) of respondents. The WHO believes that physical inactivity is the cause of about 15% of some cancers, diabetes and heart disease (WHO 2002).

#### ***Eating and drinking habits***

The respondents reported that chicken and/or fish are more popular than red meat, with 97% (176/182) of respondents eating chicken on a regular (at least once a week) basis, while 88% (160/181) have red meat on a regular basis. Processed food is consumed on a regular basis by 44% (78/177) of respondents, fruit by 84% (153/182) and vegetables by

93% (172/184). As far as fried food is concerned, it is evident that 97% (178/184) of respondents regularly use oil to fry food. Sixty-seven percent (123/184) of respondents consumes alcohol, the majority (85% or 109/128) of them less than seven drinks per week. In 1998, the prevalence of alcohol consumption in South Africa amongst men aged between 15 and 24 years was 23% and 9% amongst women for the same age group (South African Demographic and Health Survey [SADHS]1998). The prevalence of alcohol consumption amongst the study sample is higher than for South Africa when considering the same age group.

### *Smoking habits*

Twenty-seven percent (46/168) of respondents are currently smoking, while 12% (20/168) stopped smoking and 61% (102/168) never smoked. The 1998 prevalence of smoking in South Africa amongst men aged between 15 and 24 was 24%, whilst it was 6% amongst women for the same age (SADHS 1998), giving an overall of 15%. The prevalence of smoking amongst the study sample is higher than for the average South African in the same age group.

### *Health status*

Forty-four percent (81/183) of respondents felt that their health status compared excellently with other South Africans of the same age group, 55% (100/183) felt it compared well, while 1% (2/183) felt they have a poor health status compared to others of the same age group.

Only 6% (10/161) of respondents were absent from work or activities for one or more days during the 2 weeks preceding completion of the questionnaire. In 1990, 8% (14/161) were absent from school for one or more days before completion of the questionnaire.

Sixty-six percent (100/179) of respondents were absent for some time from their work or activities during the 12 months before completion of the questionnaire. Eighty one percent of these were absent for 1 – 5 days only.

The main reasons for absenteeism in 2003 were given as flu (44%) and lower respiratory illnesses (15%) such as bronchitis, pneumonia and asthma. In comparison, influenza develops in up to 20% of Americans each year (Fauci et al. 2005).

Gastro-intestinal disorders accounted for 12% of the study sample's absenteeism rate. Eight percent were absent as a result of sinusitis and the rest were absent due to illnesses that varied from migraine (3%), surgery (3%), accidents (1%), kidney stones (0.8%) and hangovers (0.8%).

The reasons for absenteeism during 1990 followed the same trend, with flu (44%), lower respiratory illnesses (17%) and gastro-intestinal disorders (12%) mentioned as the main ailments causing absenteeism.

### *Respiratory illnesses*

The adulthood (2003) respiratory health status of the individuals was compared to their childhood (1990) respiratory health status. Statistically significant increases were found in the upper respiratory illnesses sinusitis ( $p = <0.001$ ) and hay fever ( $p = <0.001$ ), as well as in the lower respiratory illnesses pneumonia ( $p = 0.008$ ) and asthma ( $p = 0.034$ ). Univariate analysis performed on the data identified preliminary lifestyle risk factors. There was a statistically significant relationship between the prevalence of pneumonia and

the consumption of more than seven drinks per week. This phenomenon was further investigated using logistic regression.

#### *Upper respiratory illnesses (URI)*

Although not statistically significant, elevated crude odds ratios (ORs) were found for some lifestyle factors associated with URI. The risk of contracting earache is 1.5 times higher for 'ever-smokers' (individuals who have at some stage smoked two or more cigarettes per day) than for 'never-smokers' (never smoked more than one cigarette per day). Individuals who are overweight have a 1.7 times higher risk of having sinusitis than individuals who are either underweight or have normal weight. Working in an environment where they have been exposed to chemicals for more than a year increases an individual's risk of suffering from hay fever 1.6-fold.

#### *Lower respiratory illnesses (LRI)*

Elevated crude odds ratios (ORs) were also found for some lifestyle factors associated with LRI. The risk of contracting pneumonia is 3.4 times higher for an ever-smoker and three times higher for an individual living in a house where people are smoking.

An overweight person has a 1.8 times higher risk for contracting pneumonia; someone that has worked in a dusty environment for at least a year has a three times higher risk; and someone who was exposed to chemicals in the working environment for at least a year has a 2.4 times higher risk. The risk of contracting pneumonia was 10.8 times higher for an individual consuming more than seven drinks per week.

Two lifestyle risk factors were found to be associated with bronchitis, i.e. being overweight (2.2 times higher risk) and living in a house where people smoke (1.5 times higher risk).

For asthma, five lifestyle risk factors had an elevated OR. The factor with the highest risk (3.3 times) was the habit of consuming more than seven drinks per week. Being an ever-smoker was associated with a three times higher risk, and being overweight with a 2.2 times higher risk. This confirms the Tucson study's finding of an association between overweight and asthma (Taussig et al. 2003), as well as the finding by Huovinen et al. (2003) that there is an association between obesity and adult onset of asthma. Working for more than a year in an environment exposed to chemicals was associated with a 1.7 times higher risk and having mould growing inside the house was associated with a 1.9 times higher risk for asthma.

#### *Multivariate analysis*

The relatively small number of positive responses resulted in wide confidence intervals. Although several potential confounders were evaluated, the possibility that the results were confounded by unmeasured variables cannot be ruled out. Following stepwise logistic regression, the only lifestyle risk factor identified for URI, was being overweight (OR 2.17 [1.03; 4.61];  $p = 0.04$ ) in the case of sinusitis.

Lifestyle risk factors identified for LRI, were as follows:

For pneumonia:

- Living in a house where smoking is allowed (OR 10.74; 95% CI 1.06; 108.00).
- Consuming more than seven drinks per week (OR 11.76; 95% CI 1.61; 85.90).

When adjusted for ever-smoking, the OR of consuming more than seven drinks per week decreased to 8.43. Being an ever-smoker thus *seems* to have *some* influence but the large adjusted OR of 8.43 indicates that other factors brought about by drinking that have been overlooked, may play a role. It is believed that other lifestyle factors may also play a role. For example, that these individuals do not follow a balanced diet which might have an influence on their immune system and make them more vulnerable to infections.

For asthma:

Having an allergy (OR 10.89 [2.32; 50.97];  $p = 0.002$ ).

- Mould in the house was found to be a confounding factor for having an allergy, since the OR for having an allergy decreased from 10.89 – 7.43 when ‘mould in the house’ was taken into account.
- Being an ever-smoker was found to be a *risk factor* but not a confounding factor (OR 4.25 [0.99; 18.14];  $p = 0.05$ ).

#### *Non-communicable diseases*

It is estimated that non-communicable diseases are responsible for about 60% of deaths worldwide (WHO 2002). In 2000, non-communicable diseases had already accounted for 37% of deaths in South Africa (communicable other than HIV/AIDS, maternal, perinatal and nutritional causes accounted for 21% of deaths) (Bradshaw et al. 2003).

#### *Cancer*

Death due to cancer is a risk that is increasing in both developed and developing countries. The WHO has estimated that cancer rates worldwide will double by 2020 (Eaton 2003). Again, unhealthy lifestyles and smoking are seen as the main causes, with the increase in the number of elderly people as a contributing factor (Eaton 2003). The most recent (1995) data on the lifetime risk of cancer in South Africa shows that it ranges from 1 in 3 for white males and 1 in 4 for white females, to 1 in 6 for Asian males and 1 in 11 for black females (Sitas et al. 1998). None of the respondents in the current study had ever been diagnosed with cancer (same as in 1990). The prevalence for the South African population in the same age group (15 – 24 years of age) was also indicated as 0 (SADHS 1998).

#### *Hypertension*

Eleven percent (19/178) of respondents reported having had high blood pressure. This figure is much higher than the figure for South Africa. In comparison, the prevalence of high blood pressure (hypertension) amongst individuals between 15 and 24 years of age in the South African population, is 0.2% for men and 3.8% for women (SADHS 1998) (overall 2%). When logistic regression was applied to data from the current study, the only lifestyle risk factor found to be marginally significantly associated with hypertension, was being overweight (OR 3.16 [0.86; 11.55];  $p = 0.08$ ).

#### *Cholesterol*

Ten percent (18/176) of respondents reported having had high cholesterol. The prevalence of lipaemia amongst individuals between 15 and 24 years of age in the South African population is 0.2% for men and 0.5% for women (SADHS 1998) (overall 3.5%). When

logistic regression was applied, being overweight was again the only lifestyle risk factor marginally significantly associated with high cholesterol (OR 3.03 [0.94; 9.73];  $p = 0.06$ ).

### *Painful joints*

Eighteen percent (32/176) of respondents reported having painful joints (gout/arthritis). A review of publications on studies in different parts of the world highlighted an increase in the prevalence and severity of gout, with a simultaneous decrease in age at onset of the disease (25% of patients in a Chinese study experienced gout before the age of 30). It is believed that dietary habits play a major role in this trend (Pascual and Pedraz 2004). When applying logistic regression in the current study, only one lifestyle risk factor was found to be statistically significantly linked to having painful joints, namely the habit of regularly consuming food fried in oil (OR 3.33 [0.99; 11.15];  $p = 0.05$ ). Although not statistically significant, three factors were suggestive of being protective of painful joints, namely regular (at least three times a week) participation in physical activities (OR 0.44 [0.18; 1.05];  $p = 0.06$ ), regular consumption of fruit (OR 0.74 [0.17; 3.23];  $p = 0.67$ ), and the regular consumption of vegetables (OR 0.45 [0.05; 4.4];  $p = 0.49$ ).

### *Diabetes*

One percent (2/173) of the respondents reported being diabetic. The prevalence of diabetes for the South African population between 15 and 24 years of age is 0.1% for men and 0.5% for women (SADHS 1998) (overall 0.3%), thus lower than the prevalence reported for this study sample. The prevalence of type 2 diabetes has increased worldwide and even children are now at risk. Being overweight and a lack of exercise are considered to be important risk factors (Rizvi 2004) which again refers to lifestyle. In South Africa it has been found that as rural black communities migrate to urban areas, the incidence of diabetes (type 2; maturity onset) increased (MRC 2001/2002). This increase could be attributed to a change in lifestyle.

### *Overweight*

Thirty-one percent (56/182) of the study respondents considered themselves to be overweight. According to the South African demographic and health study (1998), 20% of women and 8% of men (overall 14%) between 15 and 24 years of age are overweight (according to WHO standards). The results indicate that, although perceptive, there is a possibility that the prevalence of being overweight was higher for these study respondents than for the average South African between 15 and 24 years of age. As discussed previously, being overweight was found to be a risk factor for having respiratory illnesses, hypertension and high cholesterol.

### **Conclusion**

Although the individuals in this study spent their developing years in an area where air pollution is a concern, the focus of this paper is on lifestyle risk factors that could have influenced the transition in their health status. The findings of the study indicate that the transition in health status that has been recorded elsewhere in the world can also be demonstrated in this specific South African group. In general, the respondents of the current study had a higher prevalence of chronic diseases compared to the general South

African population, considering the same age group. One of the reasons could be their lifestyle, since with reference to the top ten risks to health globally (WHO 2002), the study sample has a higher prevalence than the general population of South Africa of at least five of these, namely: high blood pressure, tobacco consumption, alcohol consumption, high cholesterol and being overweight.

This finding ties in with a WHO report where it was mentioned that chronic diseases will be the world's leading cause of disability by 2020. The report also states that although mostly preventable or at least manageable through behavioural changes, primary healthcare in developing countries is not sufficiently equipped to deal with the situation (Whelan 2002). As a developing country, South Africa should take cognizance of this fact.

### **Acknowledgements**

The original study was funded by the CSIR (formerly known as Council for Scientific and Industrial Research), ESKOM (Electricity Supply Commission) and the National Association for Clean Air (NACA).

### **References**

- Bradshaw D, Groenewald P, Laubcher R, Nannan N, Nojilana B, Norman R, Pieterse D, Schneider M. 2003. Initial burden of disease estimates for South Africa, 2000. South African Medical Research Council Report. ISBN 1-919809-64-3.
- Eaton L. 2003. World cancer rates set to double by 2020. *BMJ*. 326(7392):728a.
- Fauci AS, Touchette NA, Folkers GK. 2005. Emerging infectious diseases: A 10-year perspective from the National Institute of Allergy and Infectious Diseases. *Emerging Infect Dis*. 11(4):519–525.
- Huovinen E, Kaprio J, Koskenvuo M. 2003. Factors associated to lifestyle and risk of Adult Onset Asthma. *Respir Med*. 97(3):273–280.
- Medical Research Council (MRC). 2001/2002. Annual Report; [cited 2003 May 06]. Available from: <http://www.mrc.ac.za/annualreport/annual.html>.
- Pascual E, Pedraz T. 2004. Gout Curr Opin Rheumatol [serial online]; [cited 2004 May 27]. Available from: <http://www.medscape.com/viewarticle/475056?src=mp>.
- Rizvi AA. 2004. Type 2 Diabetes: Epidemiologic trends, evolving pathogenic concepts, and recent changes in therapeutic approach. *South Med J*. 97(11):1079–1087.
- Sitas F, Madhoo J, Wessie J. 1998. Incidence of histologically diagnosed cancer in South Africa, 1993 – 1995. National Cancer Registry, S.A Institute for Medical Research.
- South African Demographic and Health Survey (SADHS). 1998. ISBN 0-621-31456-X: xii, 169, 171, 172, 196, 197, 201, 212, 213, 223, 227, 231, 234, 239, 241, 245, 247; [cited 2003 Oct 28]. Available from: <http://www.doh.gov.za/search/index.html>.
- South Africa Yearbook. 2003/2004. [cited 2004 May 13]. Available from: <http://www.gcis.gov.za/docs/publications/yearbook.htm>: 389 – 395.
- Taussig LM, Wright AL, Holberg CJ, Halonen M, Morgan WJ, Martinez FD. 2003. Tucson children's respiratory study: 1980 to present. *J Allergy Clin Immunol*. 111(4):661–675.
- Whelan J. 2002. WHO calls for countries to shift from acute to chronic care. *BMJ*. 324(7348):1237.
- World Health Organization (WHO). 2002. The World Health Report 2002: Reducing risks, promoting healthy life; [cited 2003 Apr 16]. Available from: <http://www.who.int/whr/2002/en/>.

Copyright of International Journal of Environmental Health Research is the property of Taylor & Francis Ltd and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.