DECLARATION

I hereby declare that the whole thesis, unless specifically indicated to the contrary in the text, is my own original work and has not been submitted for a degree at any other university.

UMESH GANGARAM LALLOO

1992

RESPIRATORY HEALTH SURVEY IN AN INDIAN SOUTH AFRICAN COMMUNITY: DISTRIBUTION AND DETERMINANTS OF SYMPTOMS, DISEASES AND LUNG FUNCTION

SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF MEDICINE
IN THE
FACULTY OF MEDICINE
UNIVERSITY OF NATAL, 1992

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1992

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THE STATISTICAL ANALYSES HAVE BEEN

DONE IN CONSULTATION WITH

MISS ELEANOR GOUWS, DR PIET BEKKER AND

DR G REINACH OF THE INSTITUTE FOR

BIOSTATISTICS OF THE SOUTH AFRICAN

MEDICAL RESEARCH COUNCIL.

THIS WORK IS DEDICATED TO:

THE PEOPLE OF LENASIA WHO HAVE A TREMENDOUS SENSE OF SOCIAL RESPONSIBILITY

MY DAUGHTER, SEEMA AND WIFE, RAZIYA WHO ENDURED ITS COMPILATION WITH ME

MY MOTHER

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ACKNOWLEDGEMENTS

In the writing of these acknowledgements I was almost tempted to reference what I had to say because it has been said many times before by those who have endured the preparation of a thesis. I will say them again because this work represents the combined efforts of a number of people who have contributed directly or indirectly, by just being there. I was indeed fortunate to have so many wonderful, helpful and brilliant people around me.

This study was supported by a research grant from the Richard Ward Fund of the University of the Witwatersrand, the S A Medical Research Council and the Faculty of Medicine of the University of Natal. I was also employed as a senior research fellow in the Department of Community Health of the University of Witwatersrand, also funded by the Richard Ward Fund, during the conduct of the survey in the 1985.

I am eternally grateful to the people of Lenasia, including the volunteer interviewers, supervisors and the respondents in the study who were just great. Without their support this work would have been impossible, given the time and financial constraints within which the data was collected.

I find it especially difficult to adequately express my appreciation to Dr Nicky Padayachee, my co-investigator, who in his very special and dedicated way showed me the way forward. He taught me how to relate

to the community. I also owe him a pair of shoes to replace the ones he wore out when he trudged the streets of Lenasia with me checking out the residential stands and counting the flats.

I was very fortunate to have Professor Margaret Becklake and Professor Y K Seedat as my supervisors. Professor Seedat was my mentor from the first time I encountered him as my tutor in internal medicine in my fourth year of undergraduate study in 1977. He has been involved in my career and academic development since that time. I regard him as one of the great teachers in medicine and am indeed privileged to be in his department and to have him as my supervisor. He surprised me because of his remarkable patience in waiting for me to complete my thesis. Either he knew I would finish it or he hoped that I would. I hope it was the former. Professor Margaret Becklake kindled my interest in respiratory epidemiology and was responsible for the development of the project from its inception to its completion. She possesses an incisive mind, a remarkable ability to teach and abundant patience. She is my mentor, teacher and friend. She was a guiding light for me and made this project possible.

I have to make special mention of Eleanor Gouws, the biostatistician in Durban, who was of tremendous help with the statistical analyses. She was always a source of encouragement, whenever I was ready to throw in the towel because some aspect was difficult. Although I met Dr Piet

Bekker, the consultant statistician, only a few times he became a friend and went out of his way to assist me.

My colleagues at the Epidemiology Unit of the National Centre for Occupational Health in Johannesburg, where I was based during the planning and execution of the study, were all of great help and assisted with every aspect of the study. Professor Tony Davies, the director of the Centre and a truly lateral thinker, also gave me tremendous support. Dr MA Seedat, my colleague and friend, deserves special mention because of his unselfish help and contribution to my academic career. There are many other colleagues in the Department of Medicine, like Ayesha Motala, Vinod Gathiram, Elvis Irusen, Bilkish Cassim and Girish Mody who were always there for me.

My daughter, Seema, a bundle of joy who, although only three years old, did not miss an opportunity to help me at the computer. Somehow, I think she understood when she could not get my undivided attention because of my preoccupation with the thesis. My wife, Raziya always believed in me and was very patient.

Last but not least I have to say a big thank you to Previna Ramhorry who provided five star secretarial assistance in the compilation of this thesis. I am also grateful to the Department of Medicine for allowing me sabbatical leave to analyse the data and for use of its facilities in the preparation of this work.

SUMMARY

A cross-sectional epidemiologic survey of the respiratory health status was conducted in the adult (15 years and older) Indian South African population resident in Lenasia, Johannesburg to study the distribution and determinants of respiratory symptoms, disease and lung function level. A slightly modified self-administered version of a standardised respiratory health questionnaire and a wedge spirometer was used. There were a high proportion of current smokers among men. Although women smoked less than men in other communities they nevertheless smoked on average more heavily than other Indian South African women. Indian men and women who smoked had a high prevalence of respiratory symptoms. The women also demonstrated an increased susceptibility to the effects of cigarette smoking when compared with women in other communities. Indians in this study had spirometric lung function levels that were lower than that recorded in recent studies in Blacks and Whites in South Africa. Respiratory symptoms, disease and lung function level were examined in a multiple logistic regression model which contained all the potential determinants recorded in the present study. Voluntary tobacco smoking, recent chest illnesses and any kind of heart trouble was associated with a significant risk for having most of the respiratory symptoms and diseases in men and women. In addition exposure to dust in the work environment, little or no exercise, ≤Std.8 education a history of any kind of chest trouble and respiratory trouble before the age of 16 years was associated with an increased risk for

having respiratory symptoms in men in this model. An increased risk for respiratory symptoms was demonstrated in women only with age. Age and standing height were the most important determinants of lung function level in men and women in the regression model. Dust exposure in the work environment was associated with a significantly lower lung function level in men. Alcohol consumption and a history of whooping cough was also independently associated with a lower lung function level in men but were of borderline significance. In women involuntary/passive tobacco smoke exposure and respiratory trouble before the age of 16 years were associated with a lower lung function level. Women who spent most of their lives in a rural area and those who had a university education had a higher lung function level. The deleterious effects of smoking on lung function were minimal in this study possibly because lung function was performed only in subjects in the 18-45 year age category. A "healthy smoker" effect was demonstrated in men. Men who ever smoked and were without cardiorespiratory symptoms had significantly higher lung function levels compared to men who never smoked and were without symptoms.

CHAPTER 1

INTRODUCTION

1.1 GENERAL MISSION STATEMENT

Epidemiologic i.e. community based studies of the respiratory health of populations and specific subgroups like occupational groupings are important for numerous reasons. They establish the extent of respiratory disorders and their distribution and often also their determinants. The result of these studies provide proof for hypotheses on the causation of respiratory disease and also serve to generate new hypotheses. The latter is often achieved by comparison with other populations, so that environmental influences on the health status of a given population can be better understood. The results of these studies allow health care providers to set priorities in health planning and to define risk factors which may be modifiable and thus be able to prevent disease at an early stage. The study of the pattern of respiratory diseases is facilitated by the availability of standardised questionnaires, lung function technology which can be applied in the field with relative ease, and chest radiography in special situations.

The majority of the studies on respiratory health in South Africa have been workforce based and have been conducted in Black subjects, the main aims of which were to examine the effects of particular environmental and occupational exposures. These included studies on

exposure to mine dust (Zwi and Becklake, 1958), asbestos (Myers *et al*, 1985), foundry dust (Myers *et al*, 1989), grain dust (Fonn, 1989) and cotton dust (White, 1989). Few studies have included women. The applicability of the findings in these studies to the general population is questionable. There are no studies of respiratory health in Indian South Africans so that, except for mortality and morbidity data, very little is known about their respiratory health. Studies of other chronic degenerative diseases like diabetes mellitus, hypertension and ischaemic diseases indicate that this population suffers a greater burden of these conditions compared to indigenous Indian populations in India (Omar *et al*, 1985; Seedat *et al*, 1978).

Controversy also still exists about ethnic variation in lung function and in the distribution of respiratory diseases and their determinants. This problem was highlighted in South Africa where race was emphasised as a result of the apartheid system of government. Myers (1984) argues that what has been attributed to racial variation in lung function is a consequence of socio-environmental differences. Davies and Becklake (1985) recommended that further studies on respiratory health in South Africa were needed to address this issue. An opportunity exists in South Africa for community based studies of the respiratory health status in the different population groups as a result of the Group Areas Act of the apartheid system of government which enforced residential racial segregation.

The primary objective of this study was to describe the respiratory health status of a South African Indian population. The specific objectives were to examine the distribution and determinants of symptoms, and of lung function level. This will provide an information base using standardised methodology so that comparison with national and international studies is possible. The need for such studies was stressed recently at an international joint consultative meeting of the World Health Organisation (WHO) and the International Union Against Tuberculosis and Lung Disease (IUATLD) on chronic airways disease (Murray, 1989), a meeting at which priorities for future research were set and these included the need for carefully collected national data on respiratory health status using standard methods. Although the present study is retrospective in relation to this meeting, the report which emanated from the consultation sets this study in context. The methods used in the present study also conformed to the standardised methods called for.

A secondary objective of this study related to the development of reference values for lung function in the Indian population of South Africa. These may be of value for assessment of functional impairment in the clinical and occupational health context. There are no specific reference values for spirometry in this group. Currently employed prediction values are based on regression equations derived from

studies in white populations which are discounted by approximately 10-13% because of racial differences (Cotes, 1978). It is intended that this study will form part of a national effort as recommended by Davies and Becklake (1984) to gather data in the different population groups to address the issue of racial difference in lung function.

Ideally information on the health status of a population, including respiratory status should be derived from community based studies so as to avoid selection biases inherent in special subgroups. In occupational groups these biases included the "healthy" worker effect (only those in good health can hold down a job particularly if it is physically demanding) as well as the "survivor" effect (active workforces do not include the sick, the aged and the lame), both of which result in underestimation of ill health indicators (Hernberg, 1983; Carpenter, 1987). To date there is no community based study on respiratory health in South African Blacks or Indians and only one in South African Whites (Wicht *et al*, 1977).

The overall goal of the present study was to address the issues regarding the distribution and determinants of respiratory health indicators in the Indian population group and contribute to the national and international database by utilising standardised methodology. The findings may also be used to define priorities for public health action

and future research, in the same way as was achieved with studies in the South African Indian community on chronic degenerative conditions such as ischaemic heart disease, hypertension and diabetes mellitus, all of which have been targeted for public health and preventive measures.

1.2 DEFINITION OF TERMS USED IN THIS THESIS

1.2.1 RACE/ETHNICITY: Race and ethnicity are used as interchangeable terms in this report. According to Polednak (1989) races are considered "natural units or populations that undergo evolutionary change. These groups differ slightly in gene frequencies and share some more or less distinct biological characteristics". Ethnic groups are regarded as culturally distinct, although the two concepts overlap. The term "ethnic group" is recommended by the United Nations as a more comprehensive term and "race" is not recommended (Montagu, 1960). However from a biological anthropologist's point of view "racial" may be useful because biological traits predominate in some groups and may therefore help distinguish geographic groups (Polednak, 1989)

1.2.2 INDIANS: The term Indian will be used to refer to people of Aryan and Dravidian origin from India (Meer, 1969). The National

Department of Statistics and Health in South Africa classifies them as Asians and this may create confusion because "Asian" is often used to describe people who originate from the East excluding India (Polednak, 1989).

1.2.3 BLACKS: In the South African context Blacks are the indigenous people of Negroid origin. The term "Blacks" will be used in this context in this thesis. The South African apartheid government classified them as "bantu". This latter term is considered derogatory by them and hence is not currently in common usage although the older literature refers to it. All people not of European origin were classified as "non-white" or "non-European" in South Africa.

9. COPD: Chronic airways obstruction (CAO) develops in relation to many risk factors, and as a result of several pathogenetic mechanisms described independently by numerous workers and came in consequence to be known by different terms. the term "chronic obstructive lung disease" (COLD) was introduced to avoid semantic confusion. Subsequently "chronic obstructive pulmonary disease" (COPD) came into use as a non-committal term to describe patients with CAO who had a wide range of clinical and pathological features (Burrows, 1990). This was supported by the demonstration by Hogg *et al* (1968) that disease in the small airways was an important cause of airways obstuction even in the presence of concomitant emphysema. Asthma is still specifically excluded from the definition of COPD by most

investigators (Burrows, 1990). The term COPD is used in the context of Burrow's definition in this study.

CHAPTER 2

BACKGROUND

2.1 HEALTH STATUS OF INDIANS IN SOUTH AFRICA

2.1.1 HISTORICAL PERSPECTIVE

There were approximately 884 000 Indians (often referred to as Asians) in South Africa according to the 1985 national census report (Central Statistical Services, 1985). Today, with few exceptions, the Indian South African community comprises individuals who were born in this country (Kuper *et al*, 1968). They have their origins in India and are the descendants of the indentured labourers who were brought to South Africa between 1860 and 1911 by the British colonialists to develop the sugar belt of the province of Natal. These labourers were also accompanied by "free" or "passenger" Indians who came to establish businesses (Meer, 1969). Many of the labourers chose to stay in this country once their contract expired. Some moved to the other provinces like the Transvaal and the Cape, whilst the majority remained in Natal. They established themselves initially as labourers and traders.

The history of the Indians in South Africa is characterised by one of tremendous political repression by the British colonialists and later by the Afrikaner government which came into power in 1948. As a result they developed an intense desire to succeed economically in order to

gain a sense of independence and self subsistence. Mahatma Gandhi, who came to South Africa in 1893 as a lawyer, pioneered the struggle of the Indian South African (Meer, 1969). Today, Indians have established themselves as a significant economic force in this country. Simkins and Hindson (1979) showed that the Indian workforce in South Africa had an equal distribution of white and blue collar workers. They also constitute one of the largest Indian populations in any country outside the Indian subcontinent.

As already mentioned the different population groups in South Africa have tended to maintain their ethnic and cultural identity. The apartheid laws of South Africa contributed to this by restricting racial intermixture (Prohibition of Mixed Marriages Act No 15 of 1949) and forcing people to reside within their own areas (Group Areas Act No. 41 of 1950). It was therefore feasible to set up community based surveys to study the health status of each group and they have been shown to have distinctive health profiles (Rip *et al*, 1987).

2.1.2 GENERAL HEALTH PROFILE

The general health status indicators in the Indians in relation to the other population groups in South Africa are summarised in Table 2.1 (Health

trends in South Africa, 1989). It can be seen that Indians have a profile that is between that of whites and coloureds. In addition, other studies in Indian South African communities focussed on specific system disorders, for instance, cardiovascular and metabolic disorders. Several studies have shown the prevalence of diabetes mellitus in Indian South Africans (Campbell, 1963; Marine *et al*, 1969 and Omar *et al*, 1985) to be higher than that in indigenous Indian populations in India. This phenomenon is also noted in other migrant Indian populations studied (West, 1978; Zimmet, 1982). Similarly, higher prevalences of hypertension and ischaemic heart disease have also been recorded in South African Indians (Seedat *et al*, 1978; Sewdarsen and Jialal, 1986; Seedat *et al*, 1990).

Table 2.1

HEALTH STATUS INDICATORS IN INDIANS COMPARED TO WHITES COLOUREDS AND BLACKS IN SOUTH AFRICA IN 1985

	INDIANS	WHITES	BLACKS[1]	COLOUREDS
LIFE EXPECTANCY (YRS)[2] AT BIRTH	67	71	62	61
INFANT MORTALITY RATE (PER 1000 LIVE BIRTHS)	16.1	9.3	61	40.7
BIRTH RATE (PER 1000 POPULATION)	22.5	16.3	39.1	27.6
GENERAL MORTALITY RATE (PER 1000 POPULATION)	5.5	7.6	8.3	7.7
DISEASE SPECIFIC MORTALITY RATE (PER 100 000 POPULATION)				
1. PNEUMONIA & BRONCHITIS	18	40	37	54
2. LUNG CANCER	6.9	29.0	5.0	23.1
3. ISCHAEMIC HEART DISEASE	110	178	4	60
4. HYPERTENSIVE DISEASE	26	14	9	19
TUBERCULOSIS NOTIFICATION RATES (PER 100 000 POPULATION)	80	15	211	429
NUTRITIONAL DEFICIENCIES (PER 1000 000 POPULATION)	0.5	0.3	6.9	6.1

SOURCE : HEALTH TRENDS IN SOUTH AFRICA (1989) PRETORIA, SOUTH AFRICA

1 FIGURES FOR BLACKS UNRELIABLE BECAUSE OF UNDER-REGISTRATION

2 LIFE EXPECTANCY IN SOUTH ASIA 53 YRS, AND EAST ASIA 67 YRS.

Further information on the health profile of Indians in South Africa is obtained from national morbidity and mortality statistics which, though limited by their inaccuracies in diagnosis and registration, nevertheless provide a reasonable idea of disease profiles (Wyndham and Irwig, 1979; Mann, 1982). They provide a crude overall picture which may stimulate epidemiological enquiry. For instance, Mayet (1982) studied the pattern of diseases in a hospital based population of Indians admitted to the R K Khan hospital (a large state hospital for Indians in Durban) over a 10 year period ending in July, 1980. Cerebrovascular disorders and ischaemic heart disease (IHD) accounted for 50% of the 1717 deaths that occurred in the 31 101 admissions during the study period. Chronic degenerative diseases like diabetes mellitus, IHD and hypertension accounted for 36% of all admissions, a pattern that is similar to that seen in western populations and much higher when compared to Blacks in Durban (Adams, 1979). Acute respiratory infections and other infectious diseases like tuberculosis accounted for a much smaller proportion of the admissions (4,5%). There is no comparative data for Indians in the rest of the country.

Wyndham (1984) reviewed the national mortality statistics for whites, Indians and coloureds between 1968 and 1977. He found that the Indians had a mortality rate which was also between that of coloureds and whites. All 3 groups showed a decline in deaths from infectious diseases during the 10 year period. A subsequent study by (Rip *et al*,

1987) based on mortality data between 1978 and 1982 showed a higher mortality for cardiovascular disorders among whites and Indians. Indian males and coloureds of both sexes showed increases in overall mortality rates during this 5 year period.

2.1.3 RESPIRATORY HEALTH STATUS OF INDIAN SOUTH AFRICANS

Information regarding the respiratory health status of Indians is limited. An impression of the overall status may be obtained from morbidity and mortality statistics from the prevalence of respiratory symptoms and from lung function levels. Mayet (1982) found that respiratory disorders accounted for 15% of all admissions and 11,2% of deaths in her report of Indian patients admitted to a hospital over a 10 year period. Chronic obstructive airways diseases were responsible for 31% of these deaths. Amongst respiratory deaths, asthma accounted for 17%, acute respiratory infections such as pneumonia for 26%, and pulmonary tuberculosis for 18%. Once again there was no comparative data for Indians in the rest of the country.

Epstein *et al* (1987) examined the national mortality statistics for respiratory diseases in whites, coloureds and Indians in South Africa

between 1978 and 1982. They found that, in general, Indians had a mortality rate for respiratory diseases that was between that of coloureds and whites, similar to the pattern found with the health status indicators and overall mortality rates(see Table 2.1). Indian women had the lowest mortality rate for lung cancer, a not unexpected finding because they had the lowest prevalence of smoking in a national survey (Van der Burgh, 1979). The mortality rates for COPD rose during the 5 year period in all 3 groups, except in Indian females. National vital statistics may also underestimate considerably the true mortality from COPD. For instance, Mitchell *et al* (1971) concluded COPD was underdiagnosed on death certicifates on the basis of an autopsy study in 2 teaching hospitals in the United States.

There is, to date, only one reported community based study on respiratory health in South Africa. This was conducted in a white community resident in the western Cape (Wicht *et al*, 1977). Although it was limited by a poor response rate of 42.4% it provided useful insight into respiratory disorders in that community. The other published studies on respiratory health in South Africa have been confined to subgroups, particularly worker populations. As already indicated, these studies have limited applicability to general communities on the one hand because of biases such as the "healthy" worker effect (Hernberg, 1983) and on the other hand because of bias due to the ill health effect

of certain occupational exposures. There are no epidemiological respiratory health studies, including within any occupational subgroups, in Indian populations in South Africa.

2.2 RESPIRATORY HEALTH STATUS OF INDIANS ELSEWHERE

There is a paucity of studies on the respiratory health of Indians in India and other countries. Early studies in India (Viswanathan and Singh, 1977; Thiruvengadam, 1977) conducted in urban and rural populations of Delhi and the urban population of Madras city respectively, revealed a much lower prevalence of chronic bronchitis than in Western communities. For instance, the prevalence of asthma was found to be 2,4% in a questionnaire survey in Patna, India (Viswanathan *et al*, 1969) and 3,3% in the Maldives (Wolstenholme, 1979) which was lower than the average 4% for western populations (Cookson, 1987). By contrast, Pandey (1984) in a study in a rural Indian community in Nepal found an 18,3% crude prevalence rate of chronic bronchitis. This was much higher than in other third world countries. The rate of chronic bronchitis was similar in men and women and was attributed to domestic smoke pollution (Pandey, 1984). Miller and Ashcroft (1971) undertook a survey of a migrant Indian population (from India) resident

in 2 villages in Guyana in South America. Comparison with the black population living in the same villages revealed that chronic bronchitis was much more prevalent and more severe in the Indians at comparable levels of smoking. The reason for this finding was unclear and not explained by occupational and domestic exposures. No other published data on respiratory symptoms and illnesses in Indians was encountered.

There are however, several studies on the lung function in healthy Indians in India (Bhattacharya and Banerjee, 1966; Jain and Ramiah, 1969; Cotes and Malhotra, 1975; Udwadia *et al*, 1986), Nepal (Bangham and Veale, 1976), Pakistan (Ayub *et al*, 1987), the United Kingdom (Malik *et al*, 1972) and Guyana (Miller *et al*, 1970). All these studies indicate that the spirometric values in Indians are lower than in whites and about equal to that in blacks. However, differences were noted in relation to altitude and in migrant Indian populations, raising the possibility of environmental influences. No comparative data is available for Indian South Africans.

2.3 DETERMINANTS OF RESPIRATORY HEALTH STATUS IN POPULATIONS

The respiratory health status of a population is determined by numerous factors. These may be divided into environmental and host factors. For

the purposes of the present study socio-environmental (SE) factors are considered separately. The term socio-environment is used to describe collectively the social, environmental and economic factors which relate to social status/class (Steinberg and Becklake, 1986) and are discussed further below. In addition size is obviously a very important determinant of lung function level and accounts for approximately 30% of between individual variation (Becklake, 1986). Size must therefore be taken into account when assessing the effects of environmental factors on the lung function level. Standing height is usually used for this purpose, with or without sitting height and weight.

2.3.1 ENVIRONMENTAL FACTORS

2.3.1.1 EXPOSURE TO TOBACCO SMOKE:

Over 4 decades of extensive experimental, toxicologic and epidemiologic research has established beyond any doubt that active tobacco smoking is a major determinant of chronic respiratory symptoms and COPD in populations (Fielding, 1985; United States Surgeon General's report, 1984). With the changing pattern of respiratory diseases as a result of improved social circumstances and decrease in infections in developed countries, smoking has emerged as the single most important preventable factor in COPD and lung cancer.

It accounted for between 80-90% of of the estimated 60 000 deaths from COPD in the United States in 1983 (Fielding, 1985; United States Surgeon-General's Report, 1984). A comprehensive smoking history is therefore mandatory in any study of respiratory health, be it for epidemiologic purposes to determine the effects of other agents or to determine reference values for lung function or for a clinical evaluation of the individual patient. Not all smokers will develop smoking related respiratory diseases and the rate of progression is variable (Fletcher and Peto, 1977). Thus individual susceptibility appears to play an important role in determining the outcome as do other environmental influences .

In recent years, epidemiologic research has focussed on the effects of exposure to environmental tobacco smoke or passive smoking. Tobacco smoke in the environment is derived from 2 main sources: "mainstream" smoke exhaled by a smoker and "sidestream" smoke arising from the burning end of the cigarette (Sterling *et al*, 1982). Increased respiratory symptoms and illnesses have been documented in children and adults exposed to environmental tobacco smoke (Weiss *et al*, 1983), although the evidence is not as strong as it is for active smoking. Since the seminal paper by Hirayama (1981), several studies have demonstrated an increased risk for lung cancer in passive smokers. Once again the evidence is considered inconclusive because of methodological flaws in many of the studies (Fielding, 1985).

2.3.1.2 OCCUPATIONAL EXPOSURES:

Exposure to dusts and fumes in the workplace has been causally linked to the development of several respiratory diseases. Examples of these include interstitial lung diseases due to silica and asbestos exposure and occupational asthma: over 200 agents encountered in the workplace have been identified as asthmagenic (Chen Yeung in Murray, 1989). Common examples are isocyanates and bacterial enzymes (Cotes and Steel, 1987). The evidence for causality with many of these exposures is established beyond any doubt. These disorders are limited to specific worker populations and usually not difficult to identify. Due to the increase in incidence in COPD with the consequent increase in morbidity and mortality, epidemiologic interest has focussed recently on the role of inhaled agents other than smoking in its aetiology (Becklake, 1985; Speizer, 1989).

Improved statistical and epidemiological techniques have provided substantial evidence for the role of inhaled agents other than tobacco smoke in the pathogenesis of COPD. Becklake (1989) argues that occupational exposures to dusts alone or in combination with fumes and chemicals, should no longer be considered putative, but established factors in the development of COPD. This conclusion was based on evidence obtained from community based, workforce based and pathologic and mortality studies. As with smoking, the effects are dose

related to exposure. As with smoking, host factors appear to be important since given comparable exposure, only a certain proportion of individuals show ill health effects.

2.3.1.3 EXPOSURE TO POLLUTANTS FROM COMBUSTION OF FUELS:

Combustion of fuels like wood, gas and coal indoors may expose the inhabitants to a variety of pollutants like NO2, NO, CO, SO2, volatile organic compounds and particulate matter such as soots, oils and carbon (Samet, 1990). Increased respiratory symptoms, reduced lung function level, increased respiratory infections and exacerbation of chronic respiratory diseases are some of the likely effects of exposure to these pollutants. Pandey (1984) attributed the high prevalence of chronic bronchitis in non-smoking rural Nepalese women to domestic smoke exposure. This must play an important role in determining the respiratory health status in developing communities and is potentially a confounding variable in the association of SE factors with respiratory health.

2.3.1.4 BIOLOGIC AGENTS:

Exposure to a variety of biologic agents may also produce respiratory disease through either immune or infective mechanisms (Samet, 1990). Indoor allergens include house dust mites, moulds, home dampress, animal dander and bacteria (Dales *et al*, 1991; Dales *et al*, 1991). Their presence is related to a number of factors including ventilation conditions, relative humidity, temperature and hygiene of the indoor environment, all factors which may be reflected in SE factors. Asthma and hypersensitivity pneumonitis are the chief effects of these exposures. The relationship of these agents to respiratory symptoms and lung function is seldom reported in community based studies because these measurements are difficult to carry out and impractical for researchers in large surveys. The unusually high prevalence of chronic respiratory disease in the Pacific island Polynesians, unexplained by their smoking habits may be due to exposure to windblown coral dust (Brown *et al*, 1978).

2.3.2 HOST FACTORS

2.3.2.1 AGE:

Many studies report that respiratory symptoms increase with age. In addition all indices of lung function show a progressive decline with increasing age. The vital capacity, for example, increases until the age

of 23-27 years and then, in most studies, plateaus, before starting a progressive decline. Individuals who are free of respiratory disease will show a decline in FEV1 of approximately 20-30 ml/year (Cotes, 1979). The decline in lung function with age is aggravated by the effects of environmental exposures like smoking. However, there is no data to identify age as independent from other established or putative risk factors for chronic respiratory diseases (Speizer and Tager, 1979). This is because duration of exposure to risk factors are closely linked to age. Fletcher and Peto (1977) demonstrated that age will determine at which point in time chronic respiratory disease may manifest as disability.

2.3.2.2 GENDER:

For the same height, men have larger lungs than women (Cotes, 1979). The spirometric indices of boys are about 8% larger than that of girls of the same height before puberty and this difference is accentuated in adolescence. With ageing, the lung volumes of men appear to deteriorate to a greater extent than lung volumes of women and this may be due to the greater burden of environmental exposures in men (Cotes, 1979).

Age specific mortality trends suggest an excess of deaths from chronic respiratory diseases in males over females, but this may be due to lack of standardisation for smoking and occupational exposures (Speizer and Tager, 1979). Tager and Speizer (1976) found mucus hypersecretion to be commoner in males after standardisation for smoking. This observation was not confirmed in the Tucson, community based, epidemiologic study of respiratory health (Leibowitz and Burrows, 1977).

2.3.2.3 GENETIC FACTORS:

There is epidemiologic evidence to suggest that genetic factors have a role to play in the aetiology of COPD. Alpha 1 antitrypsin deficiency was the first genetic abnormality to be positively identified as a risk factor for COPD (Eriksson, 1965). Whilst the homozygous state has been definitely associated with the development of emphysema, the evidence implicating the intermediate deficiency states has not been as convincingly identified (Shigeoka *et al*, 1976; Klayton *et al,* 1975; Morse *et al*, 1977). In addition, relatives of persons with mucus hypersecretion with and without COLD had an excess risk of developing the condition when compared to relatives of those without mucus hypersecretion (Speizer and Tager, 1979).

Alpha 1 antitrypsin deficiency only accounts for a small proportion of COPD observed in a community. There may be other anti-protease deficiencies and genetic factors which are as yet unidentified. In addition, Lewitter et al (1984) were able to demonstrate genetic influences on the level of lung function in longitudinal studies of nuclear families using the technique of path analysis.

2.3.2.4 RACE:

Blacks appear to be less susceptible to COPD than their white counterparts. Sluis-Cremer (1980) found that South African Black miners had fewer respiratory symptoms and less loss of lung function than their white counterparts at comparable levels of smoking. Similar black/white differences were noted in several studies in other parts of the world (Coates *et al*, 1965; Densen *et al*, 1967; Massaro et al, 1965; Cookson and Mataka, 1978). Indians, by contrast, may have a similar susceptibility to COPD as whites (Cotes, 1979). Miller and Ashcroft (1971) found that the migrant Indian poulation of Guyana were more susceptible to chronic bronchitis than their black counterparts. There is no comparative data for Indian/ White differences in susceptibility. Racial differences have been noted in the prevalence of alpha 1 antitrypsin deficiency: for instance this is rare in some African populations but common in the United States and Europe (Summers, 1978).

There also appear to be racial differences in asthma prevalences throughout the world (Holland, 1987). These observed biological differences may be explained in part by SE factors as was the case in the United States health survey in 1986 (Polednak, 1989).

There is a considerable body of evidence in the literature indicating that the size of the lungs and lung function levels differ considerably between people of different ethnic groups. This is even the case after standardisation for standing height; standardizing to sitting height reduces but does not eliminate ethnic differences (Cotes, 1979). People of Negroid origin tend to have smaller lungs for a given height than those of Caucasian origin. Indians appear to have values in between these two ethnic groups (Cotes, 1979). The implications of the ethnic variation is not entirely clear and remain a source of controversy in relation to reference standards for lung function values and assessment of functional disability (Meyers, 1985).

2.3.2.5 CHILDHOOD RESPIRATORY ILLNESS:

Childhood respiratory illnesses are also thought to be important risk factors for the development of COPD in adulthood. Burrows *et al* (1977) reported that persons with mucus hypersecretion and COPD were more

likely to have reported significant respiratory illness in childhood. Prospective studies of children into adulthood are required to prove the association. The mechanisms also need to be elucidated. However, these associations may in part be due to preferential recall bias in that sick adults may be more likely to recall childhood respiratory illnesses (Burrows, 1990).

2.3.3 SOCIO-ENVIRONMENTAL (SE) FACTORS:

SE factors are almost certainly important determinants of chronic respiratory disease and of lung function level. Social class gradients in the prevalence of respiratory disorders were demonstrated in early British studies (Goodman *et al*, 1953; Holland *et al*, 1969) and later confirmed in the United States (Higgins *et al*, 1977). The belief is that a lower SE status predisposes an individual to a greater burden of respiratory illnesses which adversely affects lung function, particularly during childhood when most of the increase in lung size occurs (Reid, 1984). Further, a lower SE status results in a lower nutritional level and exposes individuals to greater levels of exposure in the domestic (pollutants from fuel combustion and poor ventilation) and work environment (dusts and fumes). The other school of thought is that ethnic variation is a biological characteristic of population. Steinberg

and Becklake (1986) provide evidence in the literature to support the former hypothesis. Speizer and Tager (1979) contend that as measurement techniques for some of the risk factors more directly associated with disease improves, social class may no longer be as important a risk factor. It is the author's contention that SE factors must, in the meanwhile, remain a proxy for these as yet unidentifiable or unmeasurable risk factors. Steinberg and Becklake (1986) reviewed 6 studies involving over 11 000 adults resident in the United States, Denmark and France and found that the FEV_1 was related to social class and/or one of a number of factors relating to social class including education, area of residence and housing status. They conclude that it is important to account for SE status in comparisons of lung function between populations to assess the role of other environmental factors like occupational exposures.

A major difficulty in evaluating the role of SE factors is the lack of SE status indicators that are applicable to different populations. Nikon and Pearn (1980) believe that SE indicators are country specific and this hampers between population comparisons. However, comparisons within populations should be possible if suitable SE indicators are developed and studies are designed to ensure adequate social class representation.

SE factors may explain some of the ethnic variation in lung function in a country such as South Africa. As already indicated this issue was raised by Myers (1984) in relation to the ethnic variation and differential prediction values for lung function in the ethnic groups in South Africa. He argued that because Blacks have a lower SE status, they are predisposed to a greater burden of childhood respiratory illnesses and noxious environmental and domestic exposures resulting in lower lung function values. As already indicated, Davies and Becklake (1984) therefore urged research into the respiratory health status of different population groups in this country which should record and take into account socioeconomic factors as determinants of respiratory health status. However, cross-sectional studies provide only weak evidence of causality and this hypothesis needs to be tested in studies of respiratory health in South Africa.

2.4 COMMUNITY BASED SURVEYS OF RESPIRATORY HEALTH STATUS

2.4.1 COMMUNITY BASED STUDIES VS STUDIES OF SPECIAL SUBGROUPS:

In South Africa, as already indicated, the majority of epidemiologic studies on respiratory health have been conducted in specific population groups, particularly occupational groups. The objective of these studies has usually been to study morbidity in occupational cohorts in relation to type of occupation, to identify specific occupational hazards, to generate hypotheses on cause-effect relationships, and to evaluate interventions. Such studies have the advantage of focussing a defined population which is easily accessible for sampling and can usually be studied in working hours. Compared to community based surveys usually achieve very good response rates and deal with cohorts which are often readily available for longitudinal study. Detailed measurement of the environmental exposure is also possible thus facilitating examination of dose response-relationships. Also, as already pointed out, the findings in these subgroups are not readily applicable to the community and are subject to several biases, the most important of which is the "healthy' worker effect (Carpenter, 1987) which is likely to lead to an underestimation of any ill health burden

attributable to the workplace, as well as providing a health profile likely to be better than that of the community in general.

Community based studies are difficult to execute because of the complexities in sampling; they are also often expensive and labour intensive, and the response rates may be suboptimal. They have the advantage of being representative of different SE groups and thus they provide the opportunity for examining interactions with a variety of other risk factors. A broad approach to categorisation of exposure is also possible in community based studies (Becklake, 1989). These studies also usually provide an overview of the health status of a population and furnish useful reference standards to assess the effects of exposures in sub-groupings.

As discussed earlier there are few community based projects determining the health status of different communities in South Africa (Wicht *et al*, 1977; Hoffman *et al*, 1988). The earliest project was that of Kark (1952), which was abandoned because of lack of community support. Many of the so-called community based projects in this country tend to have a clinic centred approach and are of limited applicability as a description of the health status of the community served by the clinic. In general, there are few research projects on the determinants of health in South African communities.

2.4.2 METHODS OF MEASUREMENT OF RESPIRATORY HEALTH STATUS IN EPIDEMIOLOGIC STUDIES:

2.4.2.1 QUESTIONNAIRE:

Several standardised respiratory health questionnaires have been developed for use in epidemiologic studies and this has simplified data collection and comparisons between studies. The first such questionnaire was devised by the British Medical Research Council (MRC) in 1960 in recognition of the need for uniform methods and terminology in data collection on respiratory health (MRC Committee on the aetiology of chronic bronchitis, 1960). The questionnaire was revised in 1966 and 1976. The ATS formally adopted this questionnaire in 1968 and in 1978 Ferris (1978) subsequently devised a more comprehensive version which accommodated the deficiencies in the British MRC questionnaire. Both questionnaires have been validated and are recommended for use in respiratory surveys (Samet, 1978; Ferris, 1978). Both have been widely used in epidemiologic studies.

An added advantage of both the revised MRC and the ATS questionnaires is that they can be interviewer administered or self-completed. Fletcher and Tinker (l961) compared the two modes of administration of the MRC questionnaire and found a close correlation

with the responses, although 25% of the respondents did not complete the entire questionnaire when self-completed. A good response was also achieved with a mailed questionnaire (Siemialijchi, 1979). Familiarity with repeated administration and the influence of the season in which the questionnaire was administered did not appear to result in significant bias (Samet, 1978). Samet states that any bias resulting from modification of the questionnaire is potentially controllable.

2.4.2.2 LUNG FUNCTION:

Pulmonary function tests (PFT) are an integral component of most respiratory epidemiologic surveys. They provide a functional assessment of the respiratory health of an individual. Furthermore, functional abnormalities have been correlated with various respiratory disorders like COPD and restrictive lung disorders. Tests like simple spirometry are relatively easily performed in the community, and even in the home of the respondents in a survey. In recognition of the importance of PFT's in surveys and in clinical studies, both the American Thoracic Society (Ferris, 1978) and the European Community for Coal and Steel (Quanjer, 1983) published guidelines for the collection of PFT data in a standardised manner. This has facilitated comparisons within and between studies and permitted valid longitudinal comparisons. The

American Thoracic Society (ATS) also laid down minimal requirements for epidemiologic studies (Ferris, 1978).

2.4.2.3 CHEST RADIOGRAPHY:

The chest radiograph is an essential component of the clinical evaluation of the respiratory system in an individual patient for certain respiratory conditions, in particular for interstitial disease such as the pneumoconioses. Standardised procedures for the recording and reporting of chest radiographs for the pneumoconioses have been established by the International Labour Organisation, Geneva (1980). The American Thoracic Society has extended this to include reporting of other pulmonary diseases like COPD (Ferris, 1978).

Chest radiography also poses several problems in epidemiologcal surveys. It requires specialised apparatus and personnel which cannot be readily transported to the field and processing of the films require stable environmental conditions. The fear of radiation hazards may reduce community acceptability of such a survey. Anatomic information from a radiograph does not contribute towards the diagnosis of bronchitis and asthma and lacks sensitivity in subjects with COPD (Simon, 1959).

Chest radiography is not recommended as the primary method of detection for the following conditions : tuberculosis, interstitial lung diseases, lung cancer or cor pulmonale in community based population surveys in which the subjects have been selected in a random fashion from the general population. This is because the prevalence of these conditions is so low as to question its justification for its routine use on the grounds of cost and radiation hazard (Ferris, 1978; U.S. Department of Health, Education and Welfare, 1973). Chest radiography should be reserved for selected populations like screening asbestos exposed workers for asbestos related disorders and high risk groups for tuberculosis. Controversy also exists as to whether chest radiography is superior to the recording of symptoms as a primary screening method for tuberculosis in high risk groups (Lalloo and Meths, 1991).

2.5 CONCLUSION AND RATIONALE FOR THE PRESENT STUDY:

Many factors influence the respiratory health status of a population. The increase in morbidity and mortality attributed to COPD has stimulated extensive research into these factors in the last 2 decades. Considerable epidemiologic data has accumulated for most of these, and has improved our understanding of the aetiologies and natural history of chronic lung disease, although the data is still inconclusive for several factors such as SE status and involuntary smoking, and in the

view of many, occupational factors. A number of studies have reported ethnic/racial differences in susceptibility to various respiratory diseases, both acute and chronic, and in lung function levels for a given height.

In South Africa attention has been focussed on ethnic differences because of the apartheid system of government which enforced racial segregation. The apartheid system also resulted in a SE gradient between the race groups, with the Blacks being the most disadvantaged. It is not surprising therefore that the relationship between ethnicity and lung function level is a source of considerable controversy in this country. For this reason, information on the contribution of SE factors to variation in lung function level needs to be examined, including the role of childhood illness. To this end Davies and Becklake (1984) recommended epidemiologic studies within the different race groups to investigate the determinants of respiratory health status and lung function level, which could contribute quantitative information on SE effects. Community based studies are preferable to studies in specific subgroups in order to avoid the selection biases inherent in the latter.

The availability of a standardised and validated respiratory health questionnaire and lung function technology facilitates studies on respiratory health and between population comparisons. Likewise, the location of the different race groups in geographically distinct residential areas and lack of significant racial intermixture in South Africa facilitates the conduct of community based studies, within ethnic/racial groupings. The present study was developed to describe the respiratory health status of an Indian South African community in terms of the distribution and determinants of respiratory symptoms illness and lung function level.

In the South African context, the information was collected to facilitate comparison of respiratory health status in this community with that of other South African race/ethnic groups. Note that the present study did not directly address the issue of the extent to which race/ethnic differences in lung function are attributable to SE factors. However, by quantifying the contribution of SE factors to lung function level within a South African race/ethnic group, it was anticipated that useful information would be provided which is pertinent to that issue.

In the international context, the study methods used were chosen to maximise the comparability of the data gathered in this community with data in other Indian and non-Indian communities in other parts of the world.

CHAPTER 3

OBJECTIVES, STUDY DESIGN AND DEFINITIONS

3.1 OBJECTIVES:

The socio-political situation in South Africa provided an opportunity for studies of race/ethnic groups. The South African Indian community was considered an ideal community for a respiratory health survey because of a)the high literacy rate, b)lack of racial intermixture, c)anticipated adequate representation of the social class strata, d)availability of population data to predict sample size, and e)accessibility to survey. Studies on chronic cardiovascular and degenerative diseases reveal that the migrant Indians in South Africa have a higher prevalence of these disorders compared to their counterparts in India. There is also an indication that a similar situation may pertain regarding respiratory diseases in migrant Indians (Cotes, 1979; Miller and Ashcroft, 1971) and warrants further research.

This thesis describes the results of a respiratory health survey in the Indian community resident in the suburb of Lenasia, an Indian residential area of the city of Johannesburg, situated 35km from the centre of the city.

The overall goal of the study was to examine the determinants of respiratory health status in adults in this community. The specific objectives were to:

1) determine the relationship of respiratory health status to environmental, host and SE factors.
2) describe lung function in a subsample of the study population in relation to stature taking into account other relevant factors such as age, sex, smoking and to assess the contribution of SE factors to between individual variation in lung function level.

3.2 DEFINITIONS:

For the purpose of this study, the terms underlined in the statement of objectives were defined as follows:

RESPIRATORY HEALTH STATUS was defined in terms of symptoms and reported illness from questionnaire information supplied by the study subjects.

LUNG FUNCTION was defined in terms of spirometric measurements.

ENVIRONMENTAL and HOST FACTORS were defined in terms of questionnaire information regarding the household (supplied by the head of the household) and questionnaire information supplied by the respondent.

SOCIO-ENVIRONMENTAL (SE) FACTORS were defined using the same sources of information, with focus on job category, income, education and

household characteristics, as a measure of the individual's (or the household's) socio-economic status.

3.3 STUDY DESIGN

To achieve these objectives a community based cross sectional survey was carried out in the Indian community of Lenasia, Transvaal. A two stage sampling frame was used to respond to the objectives outlined above. In the first stage, a random sample of stands was selected from each of the 11 residential extensions of the suburb and all adults living in the stands selected were asked to complete a respiratory symptom questionnaire. This provided the information necessary to answer the first objective. In a second stage, all adults of a specified age range who completed the questionnaire were asked to attend a clinic to undergo pulmonary function tests. This data yielded the information necessary to answer the second objective.

CHAPTER 4

STUDY POPULATION

4.1 THE SUBURB OF LENASIA:

Lenasia is an Indian residential area of the city of Johannesburg proclaimed under the Group Areas Act (No.41 of 1950) of the Republic of South Africa and was developed in the 1960's. Lenasia is situated approximately 35 kilometres from the centre of the city, and was developed within the framework of 13 extensions. In general houses were built by the city council and community development board of the government to cater for families of different socio-economic categories, so that each extension tended to have a different housing status. The socio-economic stratification has not been uniformly maintained because of the social class mobility of the residents with consequent upgrading of the council provided homes. Vacant plots were available in many of the extensions and sold to those who could afford to build their own homes. Flats or apartment blocks were limited to two extensions (extensions 1 and 9). Most of the residents of Lenasia were former residents of areas in and around Johannesburg and were displaced as a result of the Group Areas Act. The township developed its own infrastructure such as schools, parks, community centres, places of worship and businesses. Most of the people commute to work to the city and its surrounding industrial areas.

Johannesburg and its suburbs are situated 1750m above sea level. It enjoys a warm dry climate with an average annual rainfall of 750 millimetres. The mean temperature in summer is 20^0C and the mean winter temperature is 10^0C.

Demographic data on the population of Lenasia was available from the national census of 1980 and from a recently completed survey of the aged in Lenasia (Padayachee, 1986). This facilitated sample size calculation which was possible with reasonable accuracy.

4.2 SAMPLE SIZE CALCULATION:

For the purpose of sample size calculation, asthma was taken as the disease of interest with the lowest prevalence. Based on published data (Cochrane and Rees, 1989) and in discussion with the Lenasia Medical Circle (an organisation of health professionals of Lenasia) the prevalence of asthma in adults in Lenasia was estimated to be between 3-5%. Using the formula of Cochrane (1977) it was calculated that 1912 adults will be required to establish the prevalence of this condition at 4% with a standard error of 0,85 with a 95% confidence limit. With this level of precision, it would be possible to detect a 50% increase in this condition compared to most published data ie. a prevalence of 6% or higher. Assuming a 75% response rate, 2114 subjects would be required

to achieve an adequate sample size. The sampling procedure for lung function tests is described in section 5.2.

4.3 SAMPLING PROCEDURE:

As indicated above a stratified, random sampling technique was used, first within extensions to sample stands and secondly within households to sample age groups. These two stages of sampling are now described.

Lenasia is zoned into 13 extensions, numbered 1-12 with extension 10 subdivided into A and B. Extension 12 (named Daxina) was recently zoned and was in the process of development during the planning phase of the survey, so it was therefore excluded from the sampling frame. The town planning department provided maps of the stands in Lenasia and indicated which ones were developed. This data was verified by comparison with the study of the aged completed in 1985 (Padayachee, 1986) and personal checks of the areas were carried out by the co-ordinators of the project. The numbers of all developed residential stand numbers were then entered into an IBM computer for each extension separately. Flats/apartments were considered as a discrete extension for sampling because flat dwellers may have

distinctive SE characteristics. Each flat was assigned a number and entered into the sampling frame. A total of 9544 developed residential stands and flats were identified (see Figure 4.1). It was estimated from the 1980 census data and Padayachee's (1985) study of the aged that 668 (7%) developed stands (including flats) were required to provide the approximately 2114 sample of adults. A 7% random sample of the stands stratified by extension was obtained. In addition, for every sampled stand an alternative number was generated if a stand required replacement according to the protocol (refer to section 4.5). The sampling frame is diagramatically illustrated in Figure 4.1. The sampled plots were then indicated on the map provided by the town planning department with coloured map pins to check the adequacy of sampling and to assign areas to the interviewers and this is illustrated in Figure 4.2.

FIGURE 4.1

LENASIA RESPIRATORY HEALTH SURVEY - 1985

DIAGRAMMATIC REPRESENTATION OF SAMPLING FRAME

1	2	3	4	5
6	7	8	9	10A
	10B	11	FLATS	

EXTENSIONS IN LENASIA

FLATS/APARTMENTS WERE SAMPLED SEPARATELY

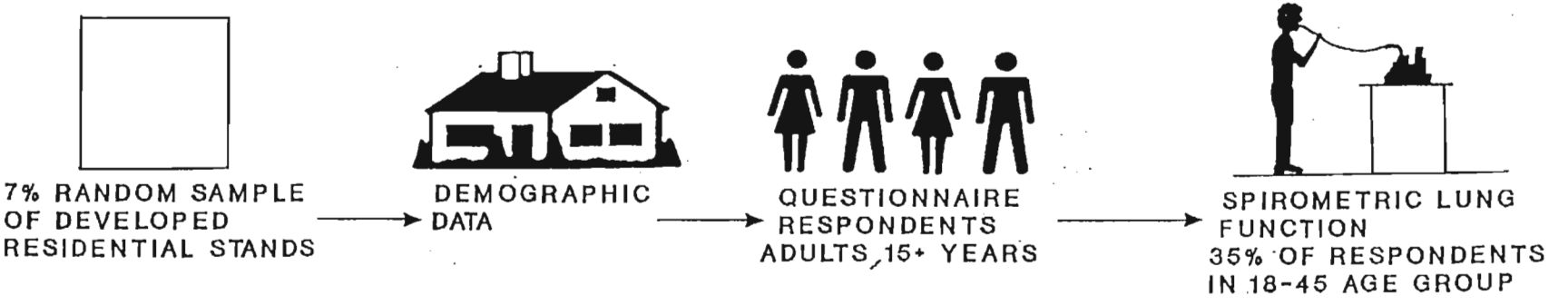
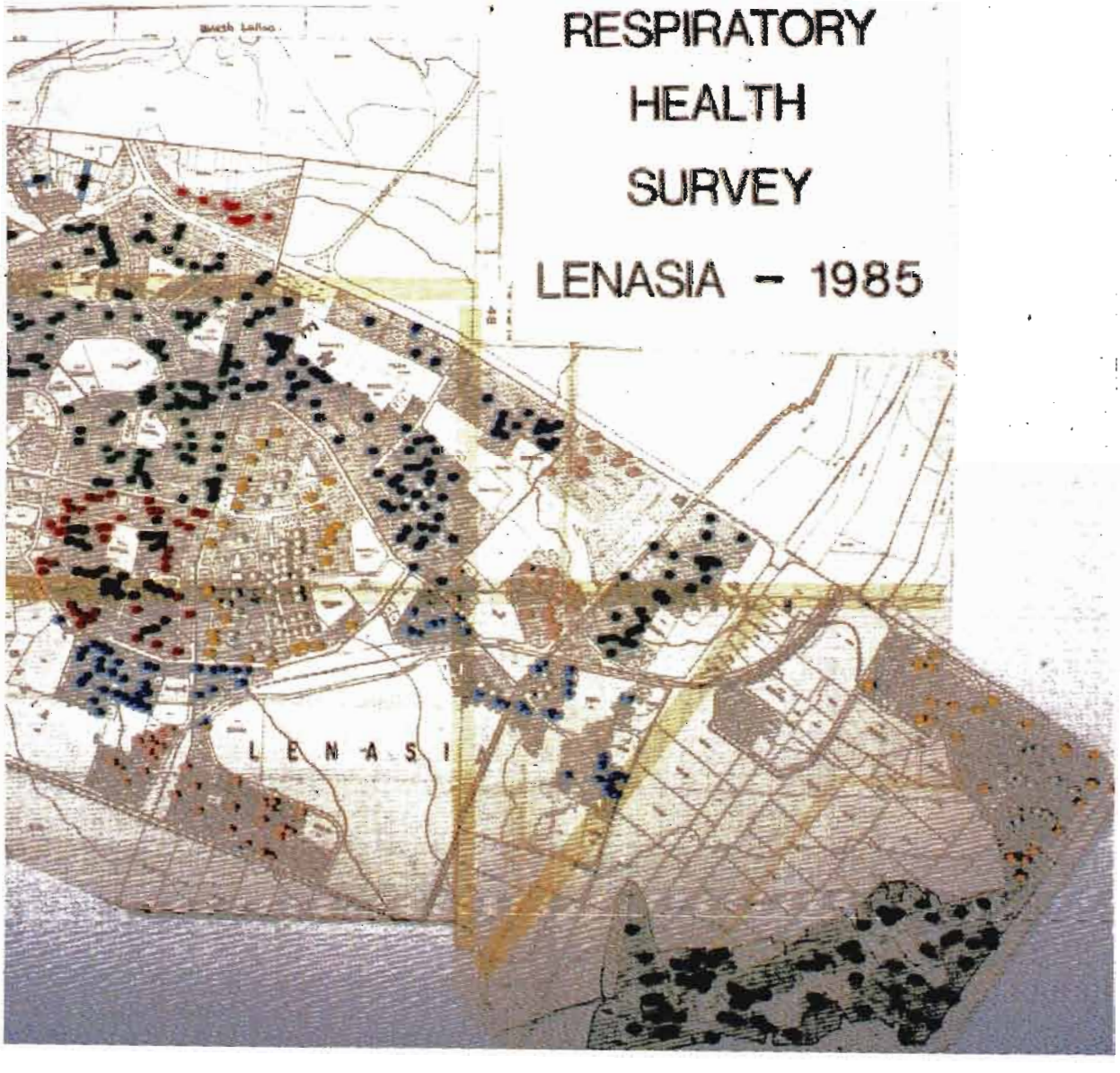


FIGURE 4.2

TOWN PLANNING MAP OF LENASIA INDICATING SAMPLED RESIDENTIAL STANDS



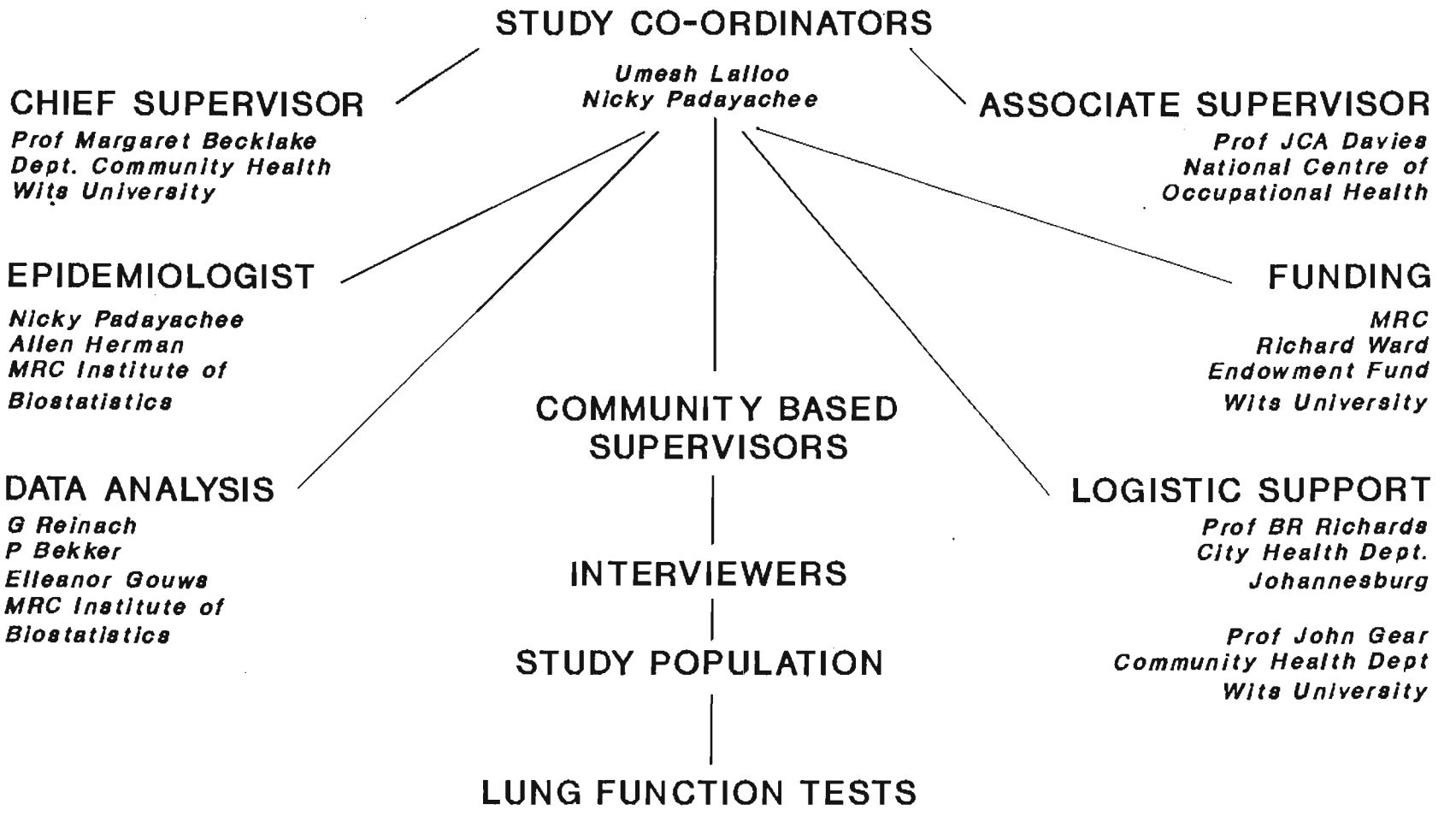
1. EACH MAP PIN REPRESENTS 1 STAND
2. EXTENSIONS ARE REPRESENTED BY DIFFERENT COLOURS
3. FLATS ARE NOT SHOWN

4.4 ORGANISATIONAL STRUCTURE OF SURVEY AND COMMUNITY PARTICIPATION:

A study of this magnitude required the input of a number of lay and professional organisations and many, many individuals. In order to ensure the success of the project, the approval of the community was sought. This was achieved by presenting the protocol for the study to a meeting of the community where the findings of an already completed study of the aged (Padayachee, 1986) was presented. In addition, consent for the study was obtained from the Johannesburg Indian Social Welfare Association (JISWA) which has the support of the community, the Johannesburg City Health Department, and the Lenasia Medical Circle which represented the health professionals of Lenasia. Prior approval for the study was also obtained from the ethics committee of University of the Witwatersrand, Medical School. The outline of the organisational structure of the project is presented in Figure 4.3.

FIGURE 4.3

LENASIA RESPIRATORY HEALTH SURVEY - 1985
ORGANISATIONAL STRUCTURE



The project was then publicised in the local press, radio and at community meetings in Lenasia. The interviewers in the study were volunteers from the community who had participated as interviewers in the community based survey of the aged in Lenasia. They were instructed during 3 training sessions conducted by the project supervisors. The function of the interviewer was to elicit the support of the members of the households sampled to obtain the demographic data and assist with queries relating to the questionnaire. The training sessions consisted of a) familiarisation with the protocol and questionnaire, b) observation of interviews during mock interview sessions, and c) troubleshooting guide. As this was a self-completed questionnaire, it was stressed that the respondents were not to be coerced to respond to any question they were unwilling to answer. A training manual was supplied to each interviewer (Appendix 3).

CHAPTER 5

METHODS

5.1 STUDY PLAN AND DATA COLLECTION

The planning phase of the study was completed in July, 1985. This included the training of the 40 community-based volunteer interviewers utilised for data collection. Questionnaire and demographic data collection was completed by Septernber, 1985. Lung function measurements were conducted at the Lenasia Health Centre. Testing was done over weekends from the 29th September until the 7th December, 1985. The raw data was then cleaned and prepared for analysis by the project co-ordinators.

5.2 METHODS OF MEASUREMENT

5.2.1 QUESTIONNAIRE AND DEMOGRAPHIC DATA

A standardised respiratory health questionnaire adapted from the ATS epidemiology standardisation project (Ferris, 1978) and the Tucson, Arizona respiratory health survey (Lebowitz *et al*, 1975) was used in the survey (Appendix 1). In addition to the standard questions on the ATS questionnaire, additional questions on tuberculosis, sinus trouble, asthma, angina, heart attack, smoking, alcohol and occupation were

included. Demographic data relating to the households were collected by the interviewer on a separate form (Appendix 2).

All adults permanently resident in households on the sampled plots were required to complete the respiratory health questionnaire and the interviewer completed the demographic data sheet. A household was defined as nuclear family units within the same house that shared amenities because more than one household may exist on some stands. The Indians still maintain an extended family unit to a significant extent so that many households have more than 1 nuclear family unit, that is two or more generations deep (Meer, 1969). For the purpose of the survey, adults were defined as those 15 years and older as at the arbitrarily chosen date of 30th September 1985. The interviewer checked that the respondent did not omit any questions, although no attempt was made to coerce the respondent to complete any question the respondent did not wish to.

The protocol for data collection was as follows:
An interviewer was assigned to a specific area. He/she was equipped with copy of the map of the assigned area so that the sampled stand could be correctly located and this was checked by the regional supervisors. If there was no response from any household, the interviewer had to make 2 additional attempts, one of which had to be

on a weekend, and at least one visit by the supervisor was also required. Only after these steps was the household deemed vacant and the co-ordinator supplied the alternative plot number. If a non-residential or vacant plot was sampled, it was replaced with the alternative plot number. Refusals were noted as such and were not replaced.

5.2.2 LUNG FUNCTION TESTS

5.2.2.1 SELECTION OF SUBJECTS

Spirometry was performed on a subsample of respondents between the ages of 18-45 years inclusive. This age range was selected because it would provide maximum representation of the working population to enable the examination of the influence of occupation on respiratory health, in addition to the other factors discussed in section 2.3. Time and financial constraints did not permit all the subjects in the selected age group to be tested. The sampling of subjects for spirometry was done after receipt of the completed questionnaires. The sample size was weighted so that 60% were men and 40% women. Pregnant women were specifically excluded. A random sampling technique was used.

A minimum sample size of 180 subjects would permit the detection of ethnic difference (ie. between individual differences) in FVC at a power

of 90%. This estimate of power was based on i) on the standard deviation of between individual difference in FVC set at 690 + 110ml/m^3 (Kauffman *et al*, 1982): ii) Indian /Caucasian differences in lung function of the order of 300ml in a VC of 4.0l in a Caucasian (Cotes, 1979), ie. 61.1ml/height in m^3. The calculated standardised difference therefore equals 61.1/110 or 0.55. To detect this difference at a power of 90% required a sample size of 180 at a 1% significance level (Altman, 1980), assuming that ethnic variation is all attributable to social class differences. A sample of 120 would reduce the significance level to 5% or reduce the power to approximately 85% at a 1% significance level. Based on these sample size calculations a minimum of 300 subjects (180 males and 120 females) were required for spirometric tests. Allowing for a 75% response rate, approximately 400 subjects in the 18-45 year age group needed to be sampled to provide 300 study subjects.

The spirometric tests were performed at the Lenasia health centre which was situated in the major shopping centre in the suburb. The tests were performed over weekends from the 29th September, 1985 until the 7th December, 1985. All the tests were performed by the author.

5.2.2.2 SPIROMETER AND CALIBRATION PROCEDURES

A bellows type model S Vitalograph^{R} (serial no. 31363) was used to measure the slow VC and the FVC and its derivatives. All measured volumes were corrected to BTPS. The Vitalograph^{R} was stored in the same room throughout the period of the lung function testing so that it remained equilibrated with the room environment at all times. The ambient temperature was measured twice daily (morning and midday) using an electronic thermometer and the barometric pressure was recorded daily with an aneroid barometer. The machine was calibrated daily for every test day over the full 8 l volume range of the instrument using a 3 l syringe. Data was recorded directly onto a portable IBM computer from the microprocessor of the Vitalograph^{R}. All values were BTPS corrected.

5.2.2.3 ANTHROPOMETRIC MEASUREMENTS

The age, sex, height, weight and date of last cold were recorded for each subject on the day of the lung function test. Both standing and sitting heights were measured. All the height measurements were taken by one observer who was specifically instructed on the correct technique as outlined by Cotes (1979). The standing height was measured with the subject with barefeet, using a stadiometer. The

subject's heels were together and the heels, calves, buttocks and back were all in a straight line against the stadiometer. The face was tilted by the observer so that the lower orbital margin of the subject's face was level with with the external auditory meatus, whilst applying gentle upward traction to the head. This technique produces the maximum height and improves the reproducibility of the measurement. Sitting height was taken with the subject seated on a high, flat topped stool using the same procedure as with the standing height. The weight was recorded with a calibrated scale with the subjects lightly clothed.

5.2.2.4 TESTING PROCEDURE AND DERIVATION OF SPIROMETRIC INDICES

Spirometry was performed with the subjects in the standing posture. The spirometric tests were performed in accordance with the procedure recommended by the American Thoracic Society (ATS) Snowbird workshop on standardisation of spirometry (Gardner, 1979). Whilst the ATS does not recommend a uniform posture, ie standing or sitting, the standing posture was preferred because this posture tends to produce higher values for the VC, FVC and its derivatives (Lalloo *et al*, 1991).

Noseclips were used in all instances and all restrictive clothing was either loosened or removed and shoes were removed during the test. The subjects were carefully instructed and demonstrated the technique of spirometry. After several practice maneouvres, a minimum of three aceptable traces in which the FVC's were within 3% or 100 ml (whichever was the lesser) of each other were recorded for each individual. The results were recorded directly onto a portable IBM computer. The spirogram was also recorded and stored for each subject.

5.3 APPROACH TO ANALYSIS:

5.3.1 DATA REDUCTION

The questionnaires and demographic data sheets were coded and submitted to the Institute of Biostatistics of the South African Medical Research Council (SAMRC) for key punching in and transfer to its mainframe computer. Questions which were not answered were recorded as missing data and appeared as blanks in the main data set. The demographic data for each household was linked to the questionnaire data set of each respondent resident in that household. The lung function results were recorded directly onto a portable IBM computer and processed using the DBase 111^{R} programme at the

National Centre of Occupational Health, Department of National Health and Population Development. It was then transferred to the SAMRC on a floppy disc and linked to the questionnaire information. The raw data was cleaned and processed and prepared for analysis by the project supervisors.

All analyses were performed in consultation with the biostatisticians of the Institute of Biostatistics of the SAMRC, and utilising the main frame computer facilities of the SAMRC. The BMDP and SAS (statistical analysis system) programmes were used for analysis.

Descriptive statistics were computed; these included means and standard deviations for continuous variables and percentages for categoric variables. The analysis was performed separately for men and women. In addition to univariate analysis to examine for associations between exposures and chronic respiratory symptoms, multivariate analysis was done to explore the determinants of respiratory symptoms, disorders and lung function level. The determinants used in the multivariate analysis were age, voluntary and involuntary tobacco smoking, alcohol consumption, dust and fume exposure in the workplace, area of residence (rural vs not), years of schooling, university education, crowding index, occupation, income, medical aid, physical exercise level, respiratory trouble before the age of 16 years, whooping

cough during childhood, recent respiratory illnesses (chest colds, bronchitis or pneumonia in the last 3 years), any kind of heart trouble and angina. In the case of lung function level standing height was included in the list of determinants. The determinants were expressed as categoric variables. The significance level was defined as 0.5% ($P < .05$) unless stated otherwise. In instances where an association was found, the odds ratio was calculated, with the 95% confidence interval.

5.3.2 QUESTIONNAIRE DATA

5.3.2.1 AGE:

Descriptive statistics were computed for four different age categories: 15-29, 30-44, 45-59, 60+ and totals by gender for the questionnaire respondents. Associations were examined within each age stratum and for the total group. The chi-square test was employed to test associations within strata. When the number of observations were 20 or less, the Fischer's exact test was applied; for numbers >20 and less than or equal to 40 the Pearson chisquare was applied; and if the expected number was less than 5, regardless of the number of observations, the Fischer's exact test was used.

5.3.2.2 SMOKING STATUS

A smoker was defined as a respondent who smoked more than 20 packs of cigarettes (20 cigarettes per pack) in his/her lifetime or more than 1 cigarette per day for one year and was referred to as an *ever* smoker. This was in accordance with the American Thoracic Society Epidemiology Standardisation Project recommendation (Ferris, 1978). Smokers were labelled *ex* smokers if they had stopped smoking as of 1 month prior to completion of the questionnaire and *current* smokers if they were currently smoking. Life time non-smokers were classified as *never* smokers. Pipe and cigar smoke exposure was converted to cigarette equivalent: 1 gram of pipe tobacco equivalent to 1 cigarette, and 1 cigar equivalent to 5 cigarettes (Lange, 1988).

Tobacco smoke exposure in an individual smoker was quantified in terms of *pack years* for ever smokers: 1 pack year equal to smoking 1 pack of cigarettes per day for 1 year (1 pack equal to 20 cigarettes). In addition the average number of cigarettes per day was used to estimate exposure levels in current smokers.

Households were classified as "smoking" households if there were 1 or more ever smokers permanently resident in a household, and as "non-smoking" households if there were no smokers permanently resident in the household. Passive or involuntary tobacco smoke exposure was

defined as never smokers who were resident in "smoking" households. Never smokers in "non-smoking" households were used as controls to assess the effect of passive tobacco smoke exposure in the home environment.

5.3.2.3 ALCOHOL CONSUMPTION

Alcohol consumption was expressed in terms of grams of alcohol consumed per week. Based on the information provided by the manufacturers the beverages were converted to gram equivalents of ethanol: beer was considered to be 5% ethanol, wine 11%, and spirits 40%.

5.3.2.4 SOCIOENVIRONMENTAL STATUS (SE) INDICATORS

Because of the lack of consensus on socioenvironmental (SE) indicators (Steinberg and Becklake, 1986) information on potential SE indicators were collected as follows:

a) Housing status: the crowding index was calculated from the number of residents in the household divided by the number of bedrooms. A

bedroom was any room that was usually used for sleeping. The extension in which a respondent resided was also recorded as a potential SE determinant, noting that Lenasia was developed into extensions by the Department of Community Development according to the socio-economic standard of housing provided (see section 4.1).

b) Occupational status: the usual occupation was classified into 5 categories according to the standardised system devised by Centre for Applied Social Studies of the University of Natal (Schlemmer and Stopforth, 1979). The jobs that people held were given a prestige scale rating according to a system devised by the same authors. A copy of the classification system is presented in Appendix 4 for reference. Occupational class and prestige scale rating was coded by one person who was carefully instructed in the procedure in order to standardise the method.

c) Education: the number of years of schooling and whether or not an individual studied further after leaving school was recorded. In addition, the type of post school studies; university or technical college education was classified.

d) Income: Because it was felt that individuals might be reluctant to disclose their income, income level was not directly asked on the questionnaire but respondents were asked to classify themselves into one of 5 income categories; and the income for individuals was recorded as the midpoint of the 5 income categories in question 48 of

the questionnaire. Total household income was calculated as the sum of incomes of earners in the respective households.

5.3.2.5 RESPIRATORY SYMPTOMS AND DISEASES

The prevalence of respiratory symptoms and diseases was derived from a "yes" response to the question about the particular condition. It was possible to assess 4 grades of breathlessness from responses to questions 16, 17 ,18, and 19. Differences in the prevalences of the conditions between ever and never smokers was calculated.

Multiple logistic regression analysis was used to examine the determinants of respiratory symptoms and disorders. A backward selection procedure was used to select the variables. The following model was used:

Respiratory symptom/disease = f {age, voluntary and involuntary tobacco smoking, alcohol consumption, dust and fume exposure in the workplace, area of residence (rural vs not), years of schooling, university education, crowding index, occupation, income, medical aid, physical exercise level, respiratory trouble before the age of 16 years, whooping cough during childhood, recent respiratory illnesses (chest colds, bronchitis or pneumonia in the last 3 years), any kind of heart trouble and angina.}

The most detailed analysis was conducted for the condition of asthma, in the first place because this condition formed the basis of the sample size calculation, in the second place because of the quite wide between country variation in asthma prevalence.

5.3.3 ANTHROPOMETRIC INDICES AND LUNG FUNCTION

Subjects who had lung function tests were stratified into 4 age categories: 18-24, 25-34, 35-45 and all. Anthropometric measurements were obtained for subjects performing lung function tests. The body mass index (w/h^2), and sitting/standing height ratio was also calculated and the means and standard deviations were calculated for each variable for each age category.

The spirometric indices analysed were the SVC, and the FVC and its derivatives which were derived automatically from the volume time curve by the built-in microprocessor of the Vitalograph^R. The derivatives of FVC were: FVC, FEV_1, PEF, $FEF_{200-1200}$, $FEF_{25-75\%}$, $FEF_{80\%}$, $FEF_{50\%}$, $FEF_{75-85\%}$, FMFT, and the FEV_1 /FVC ratio.

Each subject performed a minimum of three spirometric traces after careful instruction and several practice manoeuvres. The values recorded were according to the recommendations of the ATS Snowbird Workshop on the standardisation of spirometry (Gardner, 1979). The traces were accepted only if the FVC was within 3% or 100ml (whichever

was the lesser) of each preceding one. The FVC and FEV_1 selected was the highest value obtained from the three recorded traces and the flow parameters were derived from the trace with the greatest sum of FEV_1 and FVC.

The means and standard deviations for the SVC, FVC, FEV_1, $FEF_{25-75\%}$, and FEV_1/FVC ratio were calculated for each age category by smoking status (ever vs never smokers). These were also calculated after standardisation for standing height.

The body characteristics were examined as determinants of lung function using stepwise linear regression analysis (SAS). The Mallows C(p) statistic was used to determine the significant variable. The R^2 and standard error around the regression lines were also calculated. These were repeated following different levels of exclusions:

a) all subjects
b) excluding subjects with cardiorespiratory symptoms as determined by the questionnaire
c) excluding ever smokers and those with symptoms
d) excluding those with symptoms and never smokers, this in order to examine the "healthy" smoker hypothesis (Lalloo *et al*, 1990).

Subjects were excluded for the purpose of the analysis in b, c and d if they had any cardiorespiratory symptoms. The presence of any of the following in the questionnaire data of the lung function respondent was used as exclusion criteria: any heart trouble, any cough, any phlegm, any wheezing, any breathlessness, any kind of chest trouble, emphysema, chronic bronchitis, asthma, and any chest or lung surgery. As was done for the respiratory symptoms and diseases, multiple regression analysis was performed to examine the determinants of lung function, other than the body characteristics.

The models used were:

1) lung function = f {age, standing height, weight}

2) lung function = f {age, standing height}

3) lung function = f {age, sitting height}

4) lung function = f {age, sitting height/standing height ratio}

5) lung function = f {age, body mass index (w/h^2)

6) lung function = f {age, standing height, voluntary and involuntary tobacco smoking, alcohol consumption, dust and fume exposure in the workplace, area of residence (rural vs not), years of schooling, university education, crowding index, occupation, income, medical aid, physical exercise level, respiratory trouble before the age of 16 years, whooping cough during childhood, recent respiratory illnesses (chest colds, bronchitis or pneumonia in the last 3 years), any kind of heart trouble and angina.}

The GLM (General Linear Model) programme was used to examine the potential determinants of lung function in 6) above. The results for significant variables were expressed as the difference in the least square means (LSM) of the spirometric indices.

CHAPTER 6

RESULTS

6.1 QUESTIONNAIRE

6.1.1 RESPONSE RATES

The response rates of stands and households is presented in Table 6.1. A total of 9544 developed residential stands were identified in the 12 extensions of Lenasia. Flats/apartments were sampled as a separate extension and were designated "F". Of the 668 sampled stands, 86.5% (578) participated in the study. This represented 594 households ie. 16 stands had more than 1 household. 34 stands were replaced: 29 because the houses were unoccupied according to the protocol (see section 5.2.1); 3 were non-residential stands and 2 were vacant plots. The response rate by extension ranged from 72.5% to 100% (Table 6.2).

There were 2840 subjects, including children, who were permanently resident in the participating households. The age distribution of these is shown in Figure 6.1. There were 1871 adults (defined as those 15 years and older) in the households and 97.2% agreed to complete the questionnaire. The reasons for refusal are summarised in Table 6.1. Apart from the demographic data about the households in which they were resident, no further information about the refusals were obtained and they were excluded from subsequent analyses. The distribution of the questionnaire respondents by age categories is shown in Figure 6.2.

Table 6.1

RESPONSE RATES OF STANDS AND SUBJECTS

	NUMBER	RESPONSE RATE %
TOTAL NO. OF DEVELOPED RESIDENTIAL STANDS	9544	
7% STRATIFIED RANDOM SAMPLE	668	
NO. OF STANDS IN STUDY	578	86,5%
NO. OF HOUSEHOLDS	594[1]	
NO. OF SUBJECTS 15 YEARS AND OLDER	1871	
NO. OF SUBJECTS WHO COMPLETED THE QUESTIONNAIRE	1819	97.2%

NO. OF STANDS REPLACED = 34

REASONS FOR REPLACEMENT:

HOUSE EMPTY AFTER 3 VISITS = 29

EMPTY PLOT/BUSINESS/SCHOOL/ PARK SAMPLED IN ERROR = 5

REASONS FOR NON-RESPONSE (SUBJECTS):

CATEGORIC REFUSALS = 36

NOT AVAILABLE DURING STUDY PERIOD:

ON HOLIDAY = 6

STUDYING AWAY FROM HOME = 10

TOTAL REFUSALS = 52

[1] 16 STANDS WITH >1 HOUSEHOLD

Table 6.2

RESPONSE RATES OF HOUSEHOLDS BY EXTENSION

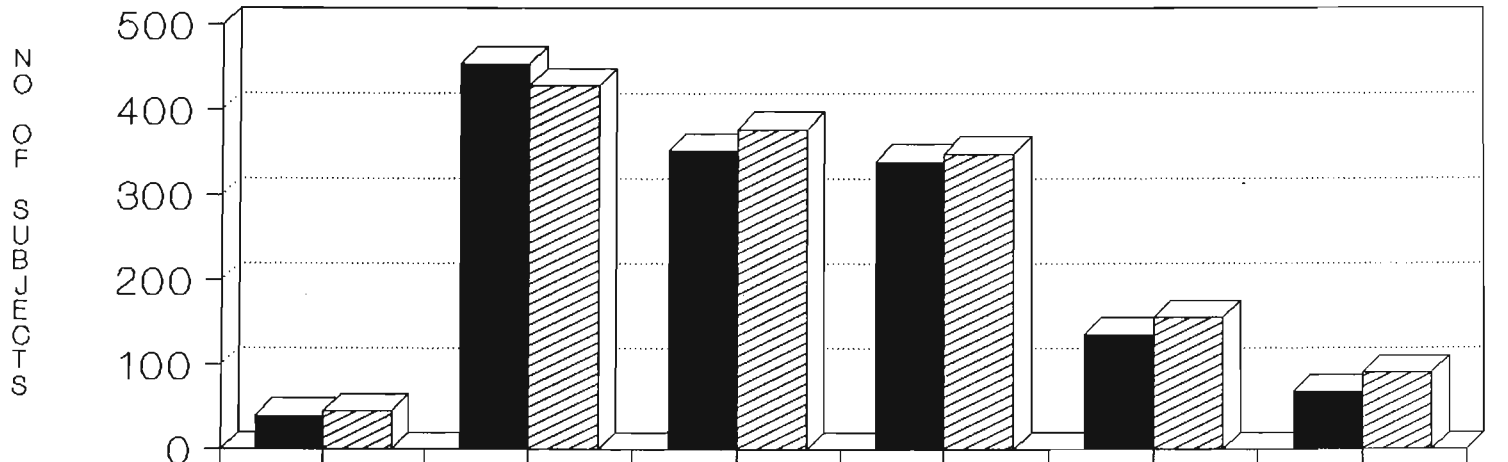
EXT.NO.	NO.STANDS	NO.SAMPLED	NO.REPLACED	NO.RESPONDED	NO.WITH>1 HOUSEHOLD	% RESPONSE
1	2072	145	4	129	8	89.0
2	985	69	1	60	2	87.0
3	915	64	4	62	0	96.9
4	242	17	1	16	0	94.1
5	1257	88	3	73	3	83.0
6	229	16	0	16	0	100
7	320	21	4	18	1	85.7
8	330	23	3	23	0	100
9	571	40	3	30	1	75.0
10A	986	69	6	50	0	72.5
10B	515	36	1	32	0	88.9
11	379	27	1	24	0	88.9
F[1]	743	52	3	45	1	86.5
TOTAL	9544	668	34	578	16	86.5

[1] FLATS/APARTMENTS

FIGURE 6.1

AGE DISTRIBUTION OF SUBJECTS LIVING ON THE SAMPLED STANDS

n = 2840



	<=1	2-14	15-29	30-44	45-59	60+
MALES	40	455	353	340	136	68
FEMALES	45	429	378	349	156	91

AGE CATEGORIES IN YEARS

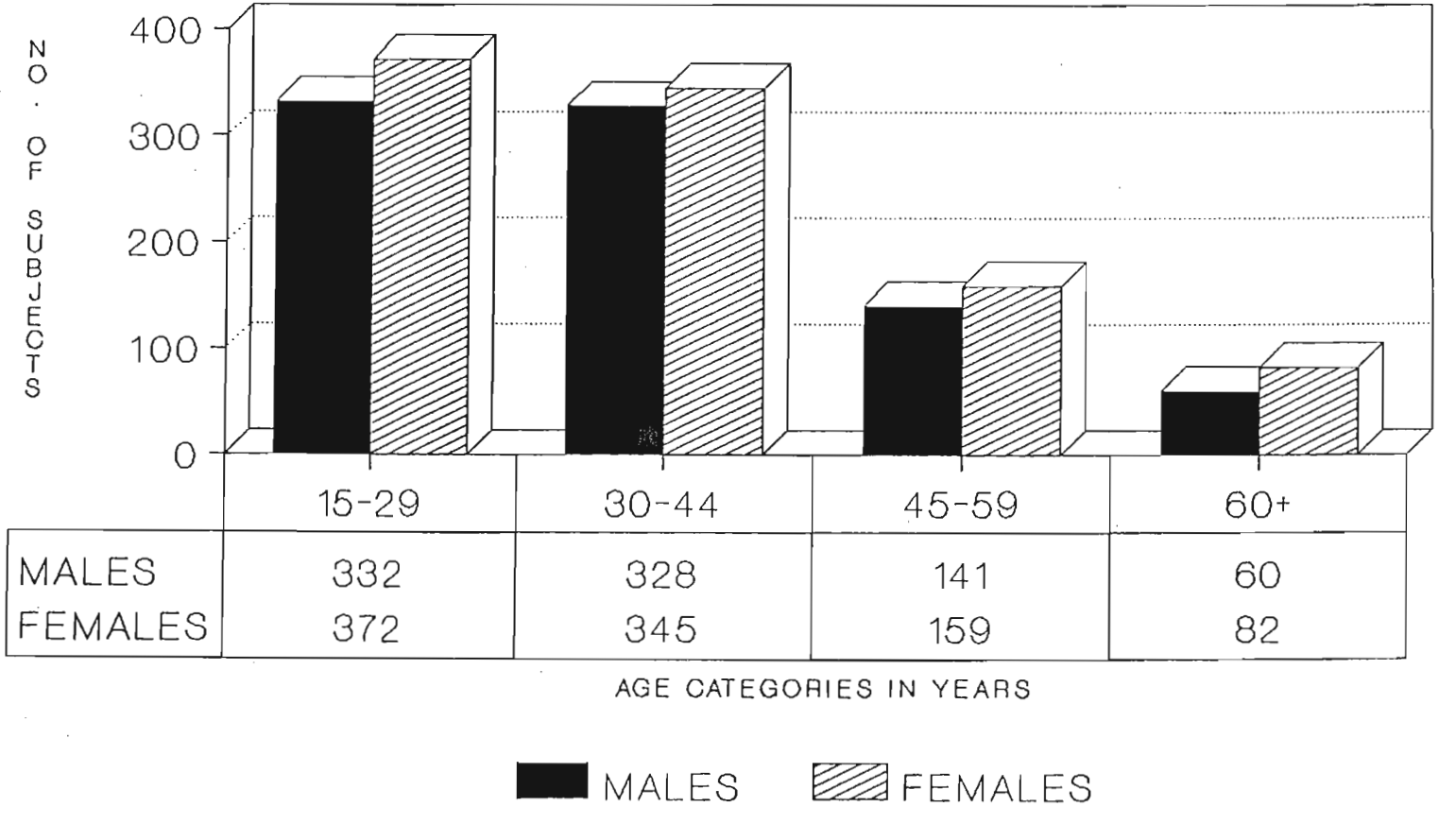
MALES FEMALES

Males = 1392 Females = 1448

FIGURE 6.2

AGE DISTRIBUTION OF RESPONDENTS TO THE STUDY QUESTIONNAIRE

n = 1819



Males = 861 Females = 958

6.1.2 HOUSEHOLDS

The household characteristics are summarised in Table 6.3. Over 50% of the households had 5 or more occupants and 11.3% of households had 2 or more families per household. Almost all the households utilised electricity as the main fuel source (96.9% to 100%). Additional fuel sources (wood, coal and gas) was used by 10.8% of households.

The mean age of the householders, 15 years and older, was similar in all extensions and for men and women. The proportion of respondents covered by medical aid insurance ranged from 19.2% to 61.8% in the extensions.

Over 80% of the households had a crowding index of less than or equal to 2 (Table 6.4). As indicated above the crowding index (persons per room) was calculated by dividing the number of householders by the number of bedrooms. The total household income ranged from R675 to R2098 per month.

The educational status of the respondents by extension is also summarised in Table 6.4 in terms of number of years of schooling completed, post school education and the proportion of the latter who had university education. There was a significant difference between

Table 6.3

DESCRIPTION OF HOUSEHOLD UNITS BY EXTENSION[1]

EXT NO.	NO. OF HOUSEHOLDS (TOTAL)	NO. OF PEOPLE PER HOUSEHOLD 1-2	3-4	5+	NO. OF FAMILIES[3] PER HOUSEHOLD 1	2	3+	NO. OF PEOPLE (TOTAL)	PROPORTION OF PEOPLE ≤ 15 YEARS	> 15 YEARS
1	137	9.9	30.5	59.6	80.6	14.2	5.2	692	27.1	72.9
2	62	15.9	38.1	46.0	85.7	12.7	1.6	293	32.4	67.6
3	62	0.2	29.5	62.3	83.6	14.8	1.6	323	30.0	70.0
4	16	0.0	53.3	46.7	100	–	–	78	46.2	53.8
5	76	7.9	32.9	59.2	90.1	9.1	–	392	29.1	70.9
6	16	5.9	47.1	47.0	100	–	–	75	46.7	53.3
7	19	5.3	31.6	63.1	94.7	5.3	–	95	50.5	49.5
8	23	13.0	34.8	52.2	95.7	4.3	–	114	42.1	57.9
9	31	9.7	54.8	35.5	96.8	3.2	–	130	37.2	63.8
10A	50	4.0	56.0	40.0	96.0	2.0	2.0	237	44.7	55.3
10B	32	18.8	37.5	43.7	93.7	3.1	3.1	133	41.4	58.6
11	24	0.3	25.0	66.7	83.3	16.7	–	117	43.6	56.4
F[2]	46	15.9	70.5	13.6	91.1	6.7	2.2	161	29.8	70.2
TOTAL	594	10.1	39.4	50.5	88.7	9.3	2.0	2840	34.1	65.9

[1] TABLE SHOWS % DISTRIBUTION OF CHARACTERISTICS UNLESS INDICATED OTHERWISE

[2] FLATS/APARTMENTS

[3] A FAMILY IS DEFINED AS A NUCLEAR UNIT

[4] OTHER INCLUDES WOOD, GAS AND COAL AS FUEL SOURCES

Continued.....

Table 6.3 Continued

DESCRIPTION OF HOUSEHOLD UNITS BY EXTENSION[1]

EXT NO.	FUEL SOURCES%* ELECTRICITY	OTHER[4]	% MEDICAL INSURANCE*	MEAN AGE OF HOUSEHOLDS ≥ 15 YEARS (SD) MALES	FEMALES
1	99.3	7.3	34.8	36.6(15.8)	37.3(15.0)
2	98.3	28.4	19.2	32.9(13.2)	36.2(17.6)
3	100	4.9	32.9	36.7(15.0)	40.2(18.1)
4	100	18.7	34.3	33.9(12.7)	31.7(11.5)
5	100	7.8	37.8	35.7(13.7)	34.2(14.9)
6	100	5.9	61.8	35.6(7.6)	34.4(11.6)
7	100	15.8	31.9	36.7(12.0)	36.0(10.6)
8	100	–	33.8	34.7(14.4)	34.5(13.7)
9	100	–	45.5	31.7(12.5)	34.1(14.8)
10	100	7.0	39.1	33.1(11.9)	31.2(9.8)
11A	96.9	12.5	37.7	36.1(12.8)	36.3(14.6)
11B	100	–	42.9	35.9(14.2)	35.2(14.3)
F2	100	10.8	58.9	32.9(11.7)	32.9(12.7)
TOTAL	99.5	5.1	36.3	35.3(14.3)	35.8(15.1)

1 TABLE SHOWS % DISTRIBUTION OF CHARACTERISTICS

2 FLATS/APARTMENTS

3 A FAMILY IS DEFINED AS A NUCLEAR UNIT

4 OTHER INCLUDES WOOD, GAS AND COAL AS FUEL SOURCES

TABLE 6-4

DISTRIBUTION (%) OF SOCIOECONOMIC INDICATORS IN HOUSEHOLDS BY EXTENSION

EXT	HOUSING CROWDING INDEX				INCOME				
					TOTAL HOUSEHOLD INCOME	PER CAPITA INCOME (%)[1]			
	0-1	1.1-2	2.1-3	>3	MEAN RANDS/MONTH	<500	501-1000	1001-1500	>1500
						RANDS/MONTH			
1	22.4	70.4	7.2	-	2128	72.5	24.2	2.5	0.8
2	12.5	42.9	30.4	14.3	1013	94.0	6.0	-	-
3	25.9	62.1	12.1	-	2098	75.0	21.4	3.6	-
4	-	63.6	18.2	18.2	675	100.0	-	-	-
5	25.3	44.0	26.7	4.0	1959	77.5	18.3	4.2	-
6	20.0	66.7	13.3	-	1394	86.7	6.7	6.7	-
7	15.8	78.9	5.3	-	2229	66.7	33.3	0	-
8	26.1	47.8	26.1	-	1300	80.9	19.1	0	-
9	30.0	63.3	6.7	-	1750	69.0	27.6	3.5	-
10	14.3	65.3	16.3	4.1	1622	20.4	27.3	2.3	-
11A	34.4	50.0	12.5	3.1	1055	77.3	18.2	4.5	-
$11B_4$	16.7	58.3	16.7	8.3	1528	89.5	5.3	5.2	-
F	20.0	60.0	13.3	6.7	1760	60.5	30.2	7.0	2.3
TOTAL	21.5	59.1	15.7	3.7	1771	76.3	20.3	3.1	0.4

Continued.....

TABLE 6-4 CONTINUED

DISTRIBUTION (%) OF SOCIOECONOMIC INDICATORS IN HOUSEHOLDS BY EXTENSION

		EDUCATION				OCCUPATION[3]					
EXT	NO. COMPLETED SCHOOLING	NO. OF YEARS[2] OF SCHOOLING% 0-5	6-11	12	POST SCHOOL STUDIES ANY	% OF ANY WITH UNIVERSITY[5]	CLASS 1-2	3	4-5	3+4+5	RATIO 1+2/3+4+5
1	459	12.9	56.9	30.2	19.2	39.1	146	103	33	136	1.07
2	181	17.1	71.0	11.9	45.3	-	28	56	34	89	0.3
3	192	14.7	51.4	33.9	21.9	48.8	63	34	13	47	1.3
4	35	26.3	68.4	5.3	2.8	-	5	15	5	20	0.25
5	219	9.6	62.3	28.1	16.4	42.9	73	41	18	59	1.24
6	32	11.8	52.9	35.3	31.3	45.5	11	8	2	10	0.91
7	43	4.3	59.6	36.1	27.9	58.3	21	6	0	6	.29
9	52	11.7	61.7	26.6	19.2	60.0	16	4	4	8	2.00
10A	72	5.2	49.3	45.5	23.6	47.1	35	13	4	17	2.06
10B	124	12.3	60.0	27.7	10.5	38.5	32	44	15	59	0.54
11	74	9.1	61.0	29.9	21.6	31.2	29	16	11	27	1.07
	51	10.5	64.9	24.6	13.7	14.3	21	10	3	13	1.62
	102	9.4	52.3	38.3	20.6	57.1	45	27	5	23	1.96
	1636	12.3	59.0	28.7	21.7	33.0	525	387	147	534	0.98

[1] TOTAL HOUSEHOLD INCOME DIVIDED BY NO. OF PERSONS RESIDING IN THE HOUSEHOLD (INCLUDING CHILDREN)

[2] OF THOSE WHO HAVE STOPPED SCHOOLING

[3] ACCORDING TO SCHEMMER AND STOPFORTH (1979) - OF THOSE ANSWERED YES TO "HAVE YOU EVER WORKED FULL TIME" AND EXCLUDES STUDENTS AND HOUSEWIVES SEE APPENDIX 4

[4] REFERS TO FLATS/APARTMENTS

[5] EXPRESSED AS A PROPORTION OF RESPONDENTS WHO STUDIED FURTHER AFTER LEAVING SCHOOL

the extensions. The proportion of respondents who completed 12 years of schooling was highest in extension 9. This correlated with the crowding index because this extension also had the most favourable crowding index distribution.

There was an almost equal distribution of white and blue collar workers in the respondents "who ever worked full time" as defined in question 45a of the questionnaire. The occupational classes were classified into 5 categories according to the system of Schlemmer and Stopforth (1979). A summary of the occupational classification system is shown in Appendix 4.

6.1.3 RESPONDENTS

6.1.3.1 SOCIAL CHARACTERISTICS OF RESPONDENTS

Only a small number of men and women (6.0% and 6.5%, respectively) spent most of their lives in a rural environment (Table 6.5 and 6.6). A greater proportion of women than men had less than 12 years of schooling and this trend was present across all age categories. Similarly, fewer women than men had post school education. Overall 37% of men and 35% of women were covered by medical insurance. In both men and women the percent who exercised moderately or regularly decreased with increasing age.

Table 6.5

DISTRIBUTION % OF SOCIAL CHARACTERISTICS OF STUDY POPULATION BY AGE : MEN

		AGE IN YEARS				
		15–29	30–44	45–59	60+	ALL
	NUMBER	332	328	141	60	861
A.	AREA OF RESIDENCE: RURAL	5.1	4.9	11.3	5.0	6.0
B.	EDUCATION: % COMPLETED SCHOOLING	7.2	100	100	100	89.2
	PROPORTION[1] WITH: UP TO 5 YEARS SCHOOLING	1.2	4.3	7.8	35.0	6.5
	6–11 YEARS SCHOOLING	35.2	51.8	72.3	50.0	54.6
	12 YEARS SCHOOLING	35.5	43.9	19.9	15.0	39.8
	% WITH POST SCHOOL EDUCATION (ANY)	42.3	25.3	13.5	3.3	26.7
	% OF ANY WITH UNIVERSITY EDUCATION[2]	39.6	47.0	26.3	–	41.0
C.	USUAL OCCUPATION: CLASS[3] 1	13.5	23.8	17.0	10.0	17.8
	2	16.9	29.0	29.1	13.3	23.2
	3	20.8	33.5	30.5	31.7	28.0
	4	8.1	9.7	17.7	21.7	11.3
	5	0.3	0.3	0.7	–	0.3
	STUDENTS	28.0	–	–	–	10.8
	OTHER[4]	12.3	3.7	5.0	23.3	8.6
D.	MEDICAL INSURANCE	38.6	46.9	23.4	6.7	37.0
E.	PHYSICAL EXERCISE : NONE	7.5	26.8	48.2	68.3	25.8
	MODERATE	41.3	39.3	34.0	23.3	38.1
	SOCIAL	25.9	25.0	16.3	6.7	22.6
	REGULAR	25.3	8.8	1.4	1.7	13.5

1 OF SUBJECTS WHO HAVE COMPLETED SCHOOLING
2 EXPRESSED AS A PERCENTAGE OF SUBJECTS WITH POST SCHOOL EDUCATION
3 CLASSIFIED ACCORDING TO SCHLEMMER AND STOPFORTH (1979) [OF SUBJECTS WITH YES TO "HAVE YOU EVER WORKED FULL-TIME"].
4 OTHER REFER TO SUBJECTS WHO DID NOT SPECIFY AN OCCUPATION, OR WERE UNEMPLOYED AND NEVER WORKED FULL-TIME

Table 6.6

DISTRIBUTION % OF SOCIAL CHARACTERISTICS OF STUDY POPULATION BY AGE : WOMEN

		AGE IN YEARS				
		15–29	30–44	45–59	60+	ALL
	NUMBER	372	345	159	82	958
A.	AREA OF RESIDENCE: RURAL	6.2	5.8	6.9	11.0	6.6
B.	EDUCATION: % COMPLETED SCHOOLING	75.5	100	100	100	90.6
	PROPORTION[1] WITH: UP TO 5 YEARS SCHOOLING	4.3	11.1	36.5	76.8	19.7
	6.11 YEARS SCHOOLING	55.2	70.1	57.2	23.2	58.4
	12 YEARS SCHOOLING	40.6	18.8	6.3	–	21.9
	% WITH POST SCHOOL EDUCATION (ANY)[2]	27.0	19.4	4.4	–	17.3
	% OF ANY WITH UNIVERSITY EDUCATION[2]	23.7	4.3	–	–	22.0
C.	USUAL OCCUPATION: CLASS[3] 1	7.3	9.6	2.5	1.2	6.8
	2	15.9	14.5	3.8	–	12.0
	3	18.8	18.3	7.5	3.7	15.4
	4	2.4	4.3	9.4	3.7	4.4
	5	0.5	0.9	–	–	0.5
	STUDENTS	24.5	–	–	–	9.5
	HOUSEWIFE	19.3	44.1	67.3	58.5	39.6
	OTHER[4]	1.1	3.5	9.4	32.9	6.1
D.	MEDICAL INSURANCE	44.9	38.3	18.2	8.5	35.0
E.	PHYSICAL EXERCISE : NONE	28.2	48.7	62.3	79.3	38.6
	MODERATE	44.1	33.0	20.1	14.6	35.4
	SOCIAL	18.3	13.9	11.9	4.9	16.1
	REGULAR	8.9	2.6	2.5	–	8.5

1 OF SUBJECTS WHO HAVE COMPLETED SCHOOLING
2 EXPRESSED AS A PERCENTAGE OF SUBJECTS WITH POST SCHOOL EDUCATION
3 CLASSIFIED ACCORDING TO SCHLEMMER AND STOPFORTH (1979) [OF SUBJECTS WITH YES TO "HAVE YOU EVER WORKED FULL-TIME"].
4 "OTHER" REFERS TO SUBJECTS WHO DID NOT SPECIFY AN OCCUPATION, OR WERE UNEMPLOYED AND NEVER WORKED FULL-TIME

6.1.3.2 EXPOSURE CHARACTERISTICS OF RESPONDENTS

The exposure characteristics of the respondents is shown in Table 6.7 for men and 6.8 for women.

Twelve men and 10 women did not respond to the questions on their smoking status and they were excluded from analysis which examined associations with smoking. Only 11.8% of women were ever smokers compared with 54.8% of men (see section 5.3.2.2 for definition of smoking status). Voluntary tobacco smoking was quantified in terms of cigarettes smoked per day for current smokers and pack years to quantify the cumulative exposure in ever smokers. Overall, 43.2% of men who were current smokers smoked between 10 and 20 cigarettes per day, and 33.8% smoked 20+ cigarettes per day. Among women current smokers, 32.9% smoked between 10 and 20 cigarettes per day and 20.5% smoked 20+ cigarettes per day. The number of pack years smoked obviously shows an increase with age.

Table 6.7

DISTRIBUTION (%) OF EXPOSURES OF STUDY POPULATION BY AGE : MEN

		AGE IN YEARS				
		15–29	30–44	45–59	60+	ALL
	NUMBER	332	328	141	60	861
A)	SMOKING STATUS[1]: NEVER	54.8	36.0	35.5	45.0	43.8
	EX	6.0	9.5	14.2	16.7	9.4
	CURRENT	37.7	53.4	50.3	33.3	45.4
	PROPORTION OF CURRENT SMOKERS WITH					
	<10 CIGARETTES/DAY	35.2	21.1	8.5	15.0	23.0
	10–20 CIGARETTES/DAY	39.2	45.7	50.7	20.0	43.2
	20+ CIGARETTES/DAY	25.6	33.1	40.8	65.0	33.8
	PROPORTION OF EVER SMOKERS WITH					
	<10 PACK YEARS	87.6	40.8	14.3	6.7	47.9
	10–20 PACK YEARS	11.7	39.3	26.4	23.3	27.3
	20+ PACK YEARS	0.7	19.9	59.3	70.0	24.8
B)	PASSIVE SMOKE EXPOSURE IN THE HOME[2]	36.4	10.4	11.3	21.7	21.4
C)	OCCUPATIONAL EXPOSURE					
	DUST – ANY	13.0	23.5	24.1	20.0	19.2
	– WORKPLACE VERY DUSTY	7.2	14.9	13.5	13.3	11.6
	FUMES/VAPOURS	6.0	8.5	5.7	1.7	6.6
D)	GAS/WOOD/COAL COMBUSTION IN THE HOME	1.2	3.7	9.2	1.7	3.5
E)	ALCOHOL CONSUMPTION: ANY	20.5	27.4	26.2	21.7	24.2
	PROPORTION WITH <100ML ALCOHOL/WEEK	55.9	53.3	40.5	46.1	12.4
	100–200ML ALCOHOL/WEEK	23.5	24.4	16.2	23.1	5.4
	>200ML ALCOHOL/WEEK	20.6	22.2	43.2	30.8	6.3

[1] DATA MISSING IN 12 SUBJECTS. SMOKING STATUS INCLUDES PIPE AND CIGAR SMOKING – CONVERTED TO CIGARETTE EQUIVALENT VIZ:
1 GRAM PIPE TOBACCO = 1 CIGARETTE
1 CIGAR = 5 CIGARETTES

[2] NEVER SMOKERS LIVING IN HOUSEHOLDS WHERE THERE ARE EVER SMOKERS

Table 6.8

DISTRIBUTION (%) OF EXPOSURES OF STUDY POPULATION BY AGE : WOMEN

		AGE IN YEARS				
		15–29	30–44	45–59	60+	ALL
	NUMBER	372	345	159	82	958
A)	SMOKING STATUS[1]: NEVER	90.8	84.6	81.1	92.7	87.2
	EX	3.2	2.0	3.8	–	2.6
	CURRENT	5.4	12.8	12.6	4.9	9.2
	PROPORTION OF CURRENT SMOKERS WITH					
	<10 CIGARETTES/DAY	60.0	47.7	30.0	50.0	46.6
	10–20 CIGARETTES/DAY	25.0	29.5	45.0	50.0	32.9
	20+ CIGARETTES/DAY	15.0	22.7	25.0	–	20.5
	PROPORTION OF EVER SMOKERS WITH					
	<10 PACK YEARS	81.3	54.9	34.6	25.0	56.6
	10–20 PACK YEARS	18.7	29.4	26.9	–	24.8
	20+ PACK YEARS	–	15.7	38.5	75.0	18.6
B)	PASSIVE SMOKE EXPOSURE IN THE HOME[2]	63.2	55.7	56.0	68.3	59.7
C)	OCCUPATIONAL EXPOSURE					
	DUST – ANY	4.8	9.0	13.8	1.2	7.5
	– WORKPLACE VERY DUSTY	3.2	6.7	10.1	–	5.3
	FUMES/VAPOURS	1.6	2.6	1.9	–	1.8
D)	GAS/WOOD/COAL COMBUSTION IN THE HOME	2.1	3.2	3.1	6.1	3.0
E)	ALCOHOL CONSUMPTION: ANY	2.7	2.0	3.1	2.4	2.5
	PROPORTION WITH <100ML ALCOHOL/WEEK	80.0	100.0	40.0	–	70.8
	100–200ML ALCOHOL/WEEK	10.0	–	–	100.0	12.5
	>200ML ALCOHOL/WEEK	10.0	–	60.0	–	16.7

[1] DATA MISSING IN 10 SUBJECTS. SMOKING STATUS INCLUDES PIPE AND CIGAR SMOKING – CONVERTED TO CIGARETTE EQUIVALENT VIZ:
1 GRAM PIPE TOBACCO = 1 CIGARETTE
1 CIGAR = 5 CIGARETTES

[2] NEVER SMOKERS LIVING IN HOUSEHOLDS WHERE THERE WERE EVER SMOKERS

Passive or involuntary tobacco smoke exposure was determined as never smokers who resided in households where there were ever smokers. A higher proportion of women were exposed to passive tobacco smoke, 59.7% vs 21.4% of men, which was consistent with the lower prevalence of smoking amongst women.

As expected a higher proportion of men compared with women admitted to any dust or fume/vapour exposure in their occupational environment. The majority of those reporting dust exposure regarded the work condition to be "very" dusty. Almost all the households used electricity as the primary domestic fuel source and therefore, only 3.5% of men and 3.0% of women were exposed to gas, wood or coal combustion products in the home environment.

As was the case with smoking, a much smaller percentage of women consumed alcohol compared to men (2.5% vs 24.2%): see Tables 6.7 and 6.8. Alcohol consumption was quantified in mls. per week and was calculated from the alcohol content of the beverages. The distribution of alcohol consumption by smoking status is shown in Table 6.9. There was a significant correlation with smoking status and alcohol consumption in men and women, and the proportion of drinkers increased with smoking. In addition, the number of drinkers was greater in current smokers than in ex-smokers in men but not in women. However, the number of women who drank alcohol was small.

Table 6.9

DISTRIBUTION (%) OF ALCOHOL* CONSUMPTION BY SMOKING STATUS IN MEN AND WOMEN

		NEVER SMOKED	EX-SMOKER	CURRENT SMOKER	p VALUE
MEN					
	NUMBER	377	81	391	
	ALCOHOL	54(14.3)	21(25.9)	136(34.8)	0.0000
WOMEN					
	NUMBER	835	25	88	
	ALCOHOL	23(2.8)	2(8.0)	6(6.8)	0.0276

* "YES" RESPONSE TO "DO YOU DRINK ANY ALCOHOL BEVERAGES"

6.1.3.3 PREVALENCE OF SELECTED RESPIRATORY SYMPTOMS SYMPTOMS BY SMOKING STATUS IN MEN AND WOMEN

The prevalence of selected respiratory symptoms by smoking status in men and women is shown in Table 6.10. The symptoms presented and analysed were usual cough, usual phlegm, ever wheeze, shortness of breath with wheezing, shortness of breath, and cough with phlegm. The presence of any symptom was based on a "yes" response to the relevant question in the questionnaire. Overall, the prevalence of each of the symptoms was higher in ever compared to never smokers and was significant in all instances. This was also the case for most symptoms in most age categories in men and women.

The association of these symptoms with the degree of inhalation of tobacco smoke was also examined. This was significant only for chronic phlegm in men in that there was a greater prevalence of this symptom in men who admitted to inhaling the tobacco smoke moderately/deeply compared to those who inhaled it slightly/not at all (**P** .02).

Table 6.10

PREVALENCE (%) OF SELECTED PULMONARY SYMPTOMS IN MEN AND WOMEN BY AGE AND SMOKING STATUS

	MEN					WOMEN				
AGE GROUPS	15–29	30–44	45–59	60+	ALL	15–29	30–44	45–59	60+	ALL
NO. OF SUBJECTS:										
NEVER SMOKED	182	118	50	27	377	338	292	129	76	835
EVER SMOKED[1]	145	206	91	30	472	32	51	26	4	113
SYMPTOMS (PREVALENCE)										
a) USUAL COUGH										
NEVER SMOKED	10.9*	11.0*	20.0*	22.2	13.0*	10.1$	9.9*	18.6#	30.3	13.2*
EVER SMOKED	26.9*	29.1*	37.3*	36.7	30.5*	21.9$	31.4*	34.6#	75	31.0*
b) USUAL PHLEGM										
NEVER SMOKER	7.1*	15.3*	26	25.9	13.5*	8.0#	8.9*	12.4	26.3	10.7*
EVER SMOKED	35.8*	35.4*	37.4	43.3	36.4*	15.6#	25.4*	26.9	75.0	24.8*
c) EVER WHEEZE										
NEVER SMOKED	12.1*	14.4	12.0#	22.2	13.5#	8.6#	9.6*	17.1	21.0	11.4*
EVER SMOKED	24.1*	14.6	29.7#	0.3	21.3#	25.0#	25.5*	30.8	50.0	27.4*
d) SHORTNESS OF BREATH WITH WHEEZING										
NEVER SMOKED	4.4	9.3	12.0	11.1	7.4#	3.3#	6.2#	14.0	22.3	7.7*
EVER SMOKED	9.7	11.6	14.2	26.7	12.5#	15.6#	17.6#	15.4	75.0	18.6*
e) SHORTNESS OF BREATH[2]										
NEVER SMOKED	9.9	13.6$	22.2	29.6$	14.1*	13.3	16.1$	32.5	52.6	20.8#
EVER SMOKED	16.6	23.8$	29.7	50.7$	24.8*	21.9	27.5$	42.3	100.0	31.9#
f) COUGH AND PHLEGM										
NEVER SMOKED	2.2$	5.1	10.0	11.1$	4.8#	5.3	3.4*	54.3	18.4$	5.9#
EVER SMOKED	6.9$	10.7	11.0	23.3$	10.4#	12.5	11.8*	15.4	75.0$	15.0#

[1] INCLUDES CURRENT AND EX SMOKERS

[2] ALL GRADES OF SHORTNESS OF BREATH

* $p < .001$

# $p < .01$

$ $p < .05$

6.1.3.4 PREVALENCE OF ASTHMA, SYMPTOMS OF ASTHMA, AND THE ASSOCIATION OF ASTHMA WITH SELECTED SYMPTOMS AND ENVIRONMENTAL FACTORS

The prevalence of asthma was assessed by a "yes" response to the question "have you ever had asthma" and "if yes, was it confirmed by a physician". The prevalence of asthma and the symptoms of asthma by age category and gender is presented in Table 6.11, and the overall prevalences with the 95% confidence intervals (CI) in parentheses in Table 6.13. The overall prevalence of asthma (physician confirmed) in men and women combined was 3.6% (95% CI: 2.7-4.3). The rates of a "yes" response to the question, have you ever had asthma, are so close to those answering "yes" to the question was it confirmed by a doctor?, to suggest that individuals did not consider they had asthma unless so told by a doctor.

The symptoms of asthma examined: "does your chest ever sound wheezy or whistling" and "have you ever had shortness of breath with wheezing" were those frequently employed in epidemiological studies to assess the prevalence of asthma. The prevalence of the disease as assessed by the symptoms are higher than when employing the diagnostic category of "asthma". The reporting of ever wheezing or

whistling of the chest produced the highest rates in men and women (17.7% and 22.0% respectively).

Univariate analysis of the association of asthma with selected symptoms, diseases and environmental factors including areas of residence and smoking status is shown in Table 6.12. There was a significant association between reporting asthma and all respiratory symptoms studied in men and women with the exception of usual cough in men. There were also significant associations of reported asthma with hayfever, allergies and chronic bronchitis in men and women: in addition in women reported asthma was significantly associated with eczema and sinus trouble. Smoking status, current or ever, was however not associated with asthma in men and women. Surprisingly, there was a significant positive association of asthma with reporting having "spent most of their life in a rural area" (P .016) in men. In women only 8.1% of asthmatics "spent most of their lives in a rural area" compared to 6.5% of non-asthmatics, but this was not statistically significant.

Table 6.11

PREVALENCE (%) OF ASTHMA AND SYMPTOMS OF ASTHMA BY AGE IN MEN AND WOMEN

	MEN					WOMEN				
NUMBER	15–29	30–44	45–59	60+	ALL	15–29	30–44	45–59	60+	ALL
	332	328	141	60	861	372	345	159	82	958
1. HAVE YOU EVER HAD ASTHMA	2.4	3.6	3.5	6.6	3.3	2.4	3.5	5.0	9.8	3.9
ASTHMA PHYSICIAN CONFIRMED	2.1	3.6	3.5	6.6	3.3	2.4	3.2	5.0	9.8	3.8
2. DOES YOUR CHEST EVER SOUND WHEEZY OR WHISTLING	17.2	14.3	23.4	25.0	17.7	10.0	11.9	18.9	22.0	13.2
a) WITH COLDS	14.8	10.7	17.0	18.3	13.8	8.3	10.1	14.5	15.9	10.6
b) WITHOUT COLDS	5.4	8.5	9.9	16.7	8.1	3.5	4.6	8.8	12.2	5.5
c) MOST DAYS	3.6	5.5	7.8	15.0	5.8	3.0	2.6	9.4	13.4	4.8
3. HAVE YOU EVER HAD SHORTNESS OF BREATH WITH WHEEZING	0.8	10.6	13.4	18.3	10.1	4.3	7.8	13.8	24.4	8.9

Table 6.12

ASSOCIATION OF REPORTED ASTHMA WITH PREVALENCE % OF SELECTED SYMPTOMS, DISORDERS AND ENVIRONMENTAL FACTORS INCLUDING AREA OF RESIDENCE AND SMOKING STATUS

	MEN			WOMEN		
	WITH ASTHMA n = 29	WITHOUT ASTHMA n = 832	P	WITH ASTHMA n = 37	WITHOUT ASTHMA n = 921	P
SYMPTOMS						
. DOES YOUR CHEST EVER SOUND WHEEZY OR WHISTLING	79.3[1]	15.5	.000	70.3	10.7	.000
a) WITH COLDS	62.1	12.1	.000	48.6	9.0	.000
b) WITHOUT COLDS	51.7	6.6	.000	43.2	4.0	.000
c) MOST DAYS	34.5	4.8	.000	43.2	3.3	.000
. HAVE YOU EVER HAD ATTACKS OF SHORTNESS OF BREATH WITH WHEEZING?	75.9	7.8	.000	67.6	6.5	.000
. ANY SHORTNESS OF BREATH	62.1	18.3	.000	75.7	19.8	.000
. USUAL COUGH	34.5	22.0	.130	45.9	13.9	.000
. USUAL PHLEGM	58.6	24.8	.000	37.8	11.2	.000
DISORDERS						
. HAVE YOU EVER HAD ECZEMA	10.3	4.2	.175	13.5	4.8	.047
. HAVE YOU EVER HAD HAY FEVER	44.8	16.2	.001	29.7	12.8	.033
. HAVE YOU EVER HAD SINUS TROUBLE	27.6	18.1	.221	29.7	16.2	.047
. HAVE YOU EVER BEEN ALLERGIC TO ANYTHING	44.8	15.4	.000	29.7	16.8	.048
. HAVE YOU EVER HAD CHRONIC BRONCHITIS	24.1	7.8	.005	18.9	2.8	.000
ENVIRONMENTAL FACTORS						
SPENT MOST OF YOUR LIFE IN A RURAL AREA	20.7	5.5	.016	8.1	6.5	.731
EVER SMOKED	62.1	55.8	.493	18.9	11.5	.206
CURRENT SMOKER	58.6	45.0	.144	8.1	9.2	.804

FIGURES EXPRESSED AS PREVALENCE%

6.1.3.5 PREVALENCE OF RESPIRATORY AND OTHER DISEASES

The prevalence of respiratory and other chronic diseases together with the 95% CI by age and gender is shown in Tables 6.13 and 6.14. This data was collected in order to assess the general health status of the study population and to examine the association of these conditions with chronic bronchitis. In both men and women, the prevalence of all reported chronic conditions examined was higher in older (45 years +) than in the younger (15-45 years) subjects, except for childhood eczema in women. Any chest trouble was reported more frequently in men, but chronic bronchitis was commoner in women. The prevalence of emphysema was extremely low in both men and women. The prevalence of tuberculosis was also low. The prevalence of asthma was similar in men and women. Sinus trouble was common and its prevalence was higher in the 15-44 age group in men and women. The prevalence of hay fever was very high in the 45+ age group in women.

Table 6.13

PREVALENCE % OF RESPIRATORY AND OTHER DISEASES[1] BY AGE : MEN

	MEN		
	15-44 660	45+ 201	ALL 861
RESPIRATORY			
CHRONIC BRONCHITIS	3.9(2.4-5.4)[2]	7.0(3.5-10.5)	4.6(3.2-6.0)
EMPHYSEMA	0.5(0-1.0)	0.0 -	0.3(0-0.7)
PNEUMONIA/BRONCHOPNEUMONIA	2.9(1.6-4.2)	5.5(2.3-8.7)	3.5(2.3-4.7)
TUBERCULOSIS	0.0 -	3.5(0.9-6.0)	0.8(0.2-1.4)
ANY KIND OF CHEST TROUBLE	10.3(8.0-12.6)	16.9(11.7-22.1)	11.8(9.6-13.9)
ASTHMA AND OTHERS			
ASTHMA	2.9(1.6-4.2)	4.5(1.6-7.4)	3.3(2.1-4.5)
HAY FEVER	18.0(15.1-20.9)	14.4(9.5-19.3)	17.2(14.7-19.7)
SINUS TROUBLE	20.0(16.9-23.0)	13.41(8.7-18.1)	18.5(15.9-21.1)
ECZEMA (skin rash in infancy)	3.8(2.3-5.3)	6.5(3.1-9.9)	4.4(3.0-5.8)
CIRCULATORY DISEASES			
HIGH BLOOD PRESSURE	3.0(1.7-4.3)	17.9(12.6-23.2)	6.6(4.9-8.3)
ANGINA	2.0(0.9-3.1)	17.4(12.2-22.6)	5.8(4.2-7.4)
HEART ATTACK	1.2(0.4-2.0)	13.4(8.7-18.1)	4.1(2.8-5.4)
STROKE	0.2(0-0,5)	4.5(1.6-7.4)	1.2(0.5-1.9)
ANY KIND OF HEART TROUBLE	2.7(1.5-3.9)	16.4(11.3-21.5)	5.9(4.3-7.5)
OTHERS			
DIABETES	1.5(0.6-2.4)	14.4(9.5-19.3)	4.5(3.1-5.9)
ULCER OF STOMACH OR DUODENUM	5.1(3.4-6.8)	11.4(7.0-15.8)	12.0(9.8-14.2)
ARTHRITIS	3.2(1.9-4.5)	16.4(11.3-21.5)	6.2(4.6-7.8)
KIDNEY TROUBLE	4.1(2.6-5.6)	9.0(5.0-12.9)	5.2(3.7-6.7)
LIVER TROUBLE	0.5(0-1.0)	2.0(0.1-3.9)	0.8(0.2-1.4)

[1] BASED ON "YES" RESPONSE TO "HAVE YOU EVER HAD ..... SPECIFIED CONDITION?"

[2] FIGURES IN PARENTHESES ARE 95% CONFIDENCE INTERVALS

Table 6.14

PREVALENCE PERCENT OF RESPIRATORY AND OTHER DISEASES[1] BY AGE : WOMEN

	15-44 717	45 241	ALL 958
RESPIRATORY			
CHRONIC BRONCHITIS	4.5(3.0-6.0)[2]	11.6(7.5-15.6)	6.3(4.8-7.8)
EMPHYSEMA	0.0 -	0.4(0-1.2)	0.1(0 -0.3)
PNEUMONIA/BRONCHOPNEUMONIA	3.2(1.9-4.5)	7.1(3.9-10.3)	4.2(2.9-5.5)
TUBERCULOSIS	0.3(0-0.7)	3.7(1.3-6.1)	1.1(0.4-1.8)
ANY KIND OF CHEST TROUBLE	6.4(4.6-8.2)	10.4(6.5-14.3)	7.4(5.7-9.1)
ASTHMA AND OTHERS			
ASTHMA	2.8(1.6-4.0)	6.6(3.5-9.7)	3.8(2.6-5.0)
HAY FEVER	0.1(0-0.3)	41.1(34.9-47.3)	10.4(8.5-12.3)
SINUS TROUBLE	17.6(14.8-20.4)	14.5(10.1-18.9)	16.8(14.4-19.2)
ECZEMA (skin rash in infancy)	5.3(3.7-6.9)	4.6(1.9-7.2)	5.1(3.7-6.5)
CIRCULATORY DISEASES			
HIGH BLOOD PRESSURE	4.0(2.5-5.4)	39.8(33.6-46.0)	13.0(10.9-15.1)
ANGINA	1.0(0.3-1.7)	8.3(4.8-11.8)	2.8(1.7-3.8)
HEART ATTACK	0.0 -	4.6(1.9-7.2)	1.5(0.7-2.3)
STROKE	0.6(0-1.2)	3.3(1.0-5.5)	1.3(0.6-2.0)
ANY KIND OF HEART TROUBLE	1.1(0.3-1.9)	10.8(6.9-14.7)	3.5(2.3-4.7)
OTHERS			
DIABETES	2.0(1.0-3.0)	19.5(14.5-24.5)	6.4(4.8-8.0)
ULCER OF STOMACH OR DUODENUM	7.5(5.6-9.4)	14.5(10.1-18.9)	9.3(7.5-11.1)
ARTHRITIS	4.3(2.8-5.8)	42.3(36.1-48.5)	13.9(11.7-16.1)
KIDNEY TROUBLE	3.9(2.5-5.3)	7.9(4.5-11.3)	4.9(3.5-6.3)
LIVER TROUBLE	0.0 -	1.7(0.1-3.3)	0.4(0-0.8)

1 BASED ON "YES" RESPONSE TO "HAVE YOU EVER HAD ..... SPECIFIED CONDITION?"

2 FIGURES IN PARENTHESES ARE 95% CONFIDENCE INTERVALS

6.1.3.6 CHRONIC NON-SPECIFIC RESPIRATORY DISEASE

Chronic non-specific respiratory disease (CNSRD) was defined as the presence of any of: wheezing most days, grade 3 dyspnoea, chronic phlegm or asthma still present, using the definition of Ferris *et al* (1967). Their definition also included the presence of an obstuctive ventilatory defect on spirometry (FEV_1/FVC ratio < 60%). Because not all the subjects in the current study had lung function tests this criterion was excluded. The effect of this would be to underestimate the true prevalence of CNSRD in this population, compared to findings in the published community based respiratory health surveys in the USA and Europe.

Table 6.15 shows the prevalence of CNSRD by gender and smoking status in the Lenasia population. The overall prevalence was 22.9% in men and 17.8% in women. There was a significant difference across smoking categories, with higher rates in ex and current smokers compared to non smokers.

Table 6.15

PREVALENCE OF CHRONIC NON-SPECIFIC RESPIRATORY DISEASE (CNSRD)[1]
BY GENDER AND SMOKING STATUS

		NEVER SMOKED	EX-SMOKER	CURRENT SMOKER	p VALUE[2]
MEN					
	NUMBER	377	81	391	
	CNSRD	53(14.3)[3]	25(30.9)	116(29.7)	0.0000
WOMEN					
	NUMBER	835	25	88	
	CNSRD	136(16.3)	6(24.0)	27(30.7)	0.0013

1 DEFINED AS WHEEZING MOST DAYS AND /OR GRADE III DYSPNOEA AND/OR CHRONIC PHLEGM AND/OR ASTHMA STILL PRESENT (CF BERLIN, NEW HAMPSHIRE STUDY, FERRIS ET AL 1967)

2 PEARSON CHISQUARED TEST

3 FIGURES IN PARENTHESES ARE PERCENTAGES

6.1.3.7 THE ASSOCIATION OF CHRONIC BRONCHITIS WITH OTHER SELECTED REPORTED CHRONIC CONDITIONS

The association of chronic bronchitis with other reported conditions (ulcer of the stomach or duodenum, arthritis, any kind of heart trouble, hypertension, diabetes, angina, heart attack and whooping cough) was examined (Table 6.16). In men reporting any kind of heart trouble and whooping cough was significantly associated with chronic bronchitis, whereas in women all the conditions listed were significantly associated with chronic bronchitis.

Table 6.16

THE ASSOCIATION OF CHRONIC BRONCHITIS WITH OTHER SELECTED REPORTED CHRONIC CONDITIONS

MEN :	WITH CHRONIC BRONCHITIS	WITHOUT CHRONIC BRONCHITIS	P[2]	WOMEN:	WITH CHRONIC BRONCHITIS	WITHOUT CHRONIC BRONCHITIS	P[2]
	n = 40	n = 821			n = 50	n = 908	
ULCER OF STOMACH AND DUODENUM	17.5[1]	11.7	.79		32.0	8.0	.00
ARTHRITIS	15.0	5.7	.13		36.0	12.7	.00
ANY KIND OF HEART TROUBLE	17.5	5.3	.02		16.0	2.9	.00
HYPERTENSION	12.5	6.1	.43		36.0	11.9	.00
DIABETES	5.0	4.5	1.0		16.0	5.8	.06
ANGINA	10.0	5.3	.62		12.0	2.3	.00
HEART ATTACK	10.0	3.8	.28		6.0	0.9	.03
WHOOPING COUGH	32.5	81(9.9)	.00		30.0	10.0	.00

1 FIGURES EXPRESSED AS PREVALENCE %

2 P VALUE

6.1.3.8 PAST AND PRESENT CHEST ILLNESSES

Table 6.17 shows the prevalence of remote and recent chest illnesses by smoking status and gender. The remote or childhood illnesses examined were chest trouble before the age of 16, measles and whooping cough. Approximately 60% of men and 66% of women recalled having measles and this was found across all age categories in men and women. The higher proportion of ever smokers amongst men with a history of measles is surprising because one would not expect any relationship. Similarly, the greater proportion of ever smokers amongst women with a history of chest trouble and whooping cough before age 16 is unexplained.

There was a small number of men and women who had chest or lung surgery or who were hospitalised for chest trouble. Emphysema was rarely reported in never and ever smokers. As indicated earlier, chronic bronchitis was commoner in women. There was a significant association of chronic bronchitis with smoking in both genders. Chest colds, acute bronchitis, and pneumonia in the past 3 years was reported more frequently in women. Similar proportions of men and women had the other conditions listed in Table 6.15.

Sinus trouble was noted more significantly frequent in ever compared to never smokers in both men and women. The presence of any allergy

was only significantly associated with smoking in women. Overall reported asthma was not associated with smoking in either men or older women (30 years +) but interestingly enough was associated with smoking in women 15-29 years old.

Table 6.17

PREVALENCE % OF REPORTED CHEST ILLNESSES, REMOTE AND RECENT IN MEN AND WOMEN BY AGE AND SMOKING STATUS

	MEN n = 849					WOMEN n = 948				
AGE GROUPS	15–	30–	45–	60+	ALL	15–	30–	45–	60+	ALL
NUMBER										
NEVER SMOKED	182	118	50	27	377	338	292	129	76	835
EVER SMOKED	145	206	91	30	472	32	51	26	4	113
IN CHILDHOOD										
CHEST TOUBLE BEFORE AGE 16										
NEVER SMOKED	4.9	4.2	2.0	3.7	4.2	3.5	2.4	2.3	5.3	3.1
EVER SMOKED	4.8	4.4	2.2	0	3.8	15.6	2.0	3.8	50.0*	8.0*
MEASLES										
NEVER SMOKED	62.6	45.8	48.0	59.3	55.2	69.2	64.7	65.9	53.9	65.7
EVER SMOKED	74.5	54.9	68.1*	56.7	63.5*	68.7	70.6	80.8	100	73.4
WHOOPING COUGH										
NEVER SMOKED	11.0	7.6	6.0	11.1	9.3	9.5	11.0	10.9	10.5	10.3*
EVER SMOKED	13.8	11.2	13.2	20.0	12.9	15.6	15.7	19.2	50.0	17.7
IN ADULTHOOD										
HOSPITALISED FOR CHEST TROUBLE										
NEVER SMOKED	0	3.4	12.0	7.4	3.2	1.5	2.4	3.9	2.6	32.7
EVER SMOKED	0.7	4.4	6.6	13.3	4.2	3.1	3.9	3.8	25.0	4.4
CHEST OR LUNG SURGERY										
NEVER SMOKED	0.5	.8	0	0	0.5	0	0	0.8	0	0.1
EVER SMOKED	0	0	1.1	0	0.2	0	2.0	0	0	0.8
CHRONIC BRONCHITIS (PHYSICIAN CONFIRMED)										
NEVER SMOKED	1.1	6.8	4.0	0	3.2	3.6	4.5	7.7	17.1	4.5
EVER SMOKED	5.5*	3.9	6.6*	20.0*	5.9*	9.4	7.8	15.4*	25.0	10.6*

Continued.....

Table 6.17 Continued

PREVALENCE % OF REPORTED CHEST ILLNESSES, REMOTE AND RECENT IN MEN AND WOMEN BY AGE AND SMOKING STATUS

	MEN n = 849					WOMEN n = 948				
AGE GROUPS	15–	30–	45–	60+	ALL	15–	30–	45–	60+	ALL
EMPHYSEMA (PHYSICIAN CONFIRMED)										
NEVER SMOKED	0.5	0	0	0	0.3	0	0.3	0.8	1.3	0.3
EVER SMOKED	0.7	0.5	0	0	0.4	0	0	0	0	0
ASTHMA										
NEVER SMOKED	1.6	3.4	4.0	7.4	2.9	1.8	3.1	5.4	9.2	3.5
EVER SMOKED	2.7	3.9	3.3	6.7	3.6	9.4*	3.9	3.8	25.0	6.2
PNEUMONIA/BRONCHOPNEUMONIA										
NEVER SMOKED	2.2	3.4	2.0	7.4	2.9	2.4	3.8	3.1	13.1	3.9
EVER SMOKED	2.1	3.9	5.5	10.0	4.0	6.3	3.9	7.7	25.0	6.2
CHEST COLDS/BRONCHITIS/PNEUMONIA IN PAST 3 YEARS										
NEVER SMOKED	22.5	18.6	32.0	33.3	23.3	18.6	78.7	72.1	55.3	51.3
EVER SMOKED	26.2	21.4	23.1	50.0	25.0	34.3	72.5	80.8	50.0	62.8
HAY FEVER										
NEVER SMOKED	23.1*	17.8	14.0	7.4	19.1	12.4	15.4	16.3	7.9	13.7
EVER SMOKED	14.5	17.0	17.6	13.3	16.1	18.7	13.7	7.7	0	13.3
SINUS TROUBLE										
NEVER SMOKED	17.6	15.3	10.0	7.4	15.1	14.8	19.9	13.2	10.5	15.9
EVER SMOKED	22.7	23.8	18.7	10.0	21.6*	18.7	23.5	30.8*	50.0*	24.8*
ANY ALLERGY										
NEVER SMOKED	16.5	17.8	18.0	3.7	16.2	16.0	18.5	14.7	11.8	16.3
EVER SMOKED	16.6	14.6	23.1	16.7	16.9	28.1	21.5	26.9	75.0*	26.5*
CHEST TROUBLE (ANY)										
NEVER SMOKED	7.7	11.0	18.0	14.8	10.6	5.3	6.2	9.3	13.1	6.9
EVER SMOKED	8.3	14.1	14.3	26.7	13.1	18.7	7.8	7.7	25.0	11.5

* Difference between never and ever smokers significant at $p \leq 0.05$

6.1.3.9 PASSIVE/INVOLUNTARY TOBACCO SMOKE EXPOSURE

The respondents who were defined as passive or involuntary smokers were never smokers who lived in households where there were ever smokers. Never smokers who lived in households where there were no smokers were defined as the control group for the purpose of this analysis. They were examined for the presence of any of the respiratory conditions listed in Table 6.18 by gender.There were 377 never smoking men and 835 never smoking women whose household smoking status was defined. There were more women because of the smaller number of smokers in this group.

When compared with nonsmokers living in nonsmoking households there was no significant difference in the reporting of any respiratory condition when men and women were examined separately except for pneumonia in women. When they were analysed together there was a greater proportion of passive smokers with usual cough and the association was significant (P .04). A similar finding was noted with the reporting of sinus trouble. The reporting of pneumonia was also significant when both the groups were analysed together (P.02).

Table 6.18

PREVALENCE PERCENT OF CHRONIC RESPIRATORY DISEASE AND SYMPTOMS BY PASSIVE/ INVOLUNTARY TOBACCO SMOKE EXPOSURE[1] IN THE HOME ENVIRONMENT BY GENDER[2]

	MEN n = 377			WOMEN n = 835		
	NSMHH	SMHH	P[3]	NSMHH	SMHH	P[3]
NO. OF NEVER SMOKERS[4]	193	184		263	572	
USUAL COUGH	10.4	15.8	.12	10.6	14.2	.16
USUAL PHLEGM	12.4	14.7	.53	9.9	10.5	.79
COUGH AND PHLEGM	4.7	4.3	.88	5.7	5.8	.97
EVER WHEEZE	14.0	13.0	.79	9.9	11.9	.41
SHORTNESS OF BREATH WITH WHEEZING	8.3	6.6	.52	6.5	7.9	.47
ANY SHORTNESS OF BREATH	13.5	14.7	.74	17.9	21.9	.19
ANY KIND OF CHEST TROUBLE	10.9	10.3	.86	6.1	7.2	.56
CHEST COLDS, BRONCHITIS OR PNEUMONIA IN LAST 3 YRS.	75.1	75.5	.35	82.4	85.8	.22
CHRONIC BRONCHITIS	3.1	5.4	.27	4.6	6.8	.20
ASTHMA	2.6	3.3	.70	1.9	4.2	.09
PNEUMONIA	2.8	3.3	.67	1.7	5.3	.02
HAY FEVER	9.8	13.0	.96	7.6	9.3	.77
SINUS TROUBLE	11.9	18.5	.07	13.8	17.0	.18
ANY OF ABOVE	53.4	51.1	.66	54.8	53.3	.70

1 DEFINED AS NEVER SMOKERS LIVING IN HOUSEHOLDS WHERE THERE ARE NEVER SMOKERS (NSMHH) AND COMPARED WITH HOUSEHOLDS WHERE THERE ARE EVER SMOKERS (SMHH)

2 WITH THE GENDERS COMBINED (n=1212) THE FOLLOWING WERE SIGNIFICANTLY ASSOCIATED WITH PASSIVE/INVOLUNTARY TOBACCO SMOKE EXPOSURE : USUAL COUGH (P.04), PNEUMONIA (P.02) AND SINUS TROUBLE (P.03)

3 P VALUE

4 NUMBER OF NEVER SMOKERS IN NSMHH AND SMHH AS DEFINED IN [1] ABOVE

6.1.3.10 RESPIRATORY SYMPTOMS AND ALCOHOL CONSUMPTION BY SMOKING STATUS

There were very few women who consumed alcohol and therefore this analysis was confined to men only. The association expressed as probability percent of respiratory symptoms after controlling for smoking status is shown in Table 6.19. There was a trend for an increased probability of having cough, phlegm, ever wheeze or shortness of breath with increasing alcohol consumption in ever and never smokers. This was significant for wheeze at the P.03 level and P.07 level for phlegm.

Table 6.19

RESPIRATORY SYMPTOMS (PROBABILITY%) BY ALCOHOL CONSUMPTION AND SMOKING STATUS IN MEN

	WEEKLY ALCOHOL CONSUMPTION (ml/WEEK)				
	NIL	< 100	100–200	> 200	P[2]
COUGH					
NEVER SMOKED	12.0[1]	13.5	14.8	16.0	.33
EVER SMOKED	27.7	29.9	32.1	34.4	
PHLEGM					
NEVER SMOKED	11.9	14.0	16.4	19.2	.07
EVER SMOKED	33.1	37.4	41.9	46.6	
EVER WHEEZE					
NEVER SMOKED	13.4	16.4	19.9	23.9	.03
EVER SMOKED	19.1	22.9	27.4	32.3	
SHORTNESS OF BREATH					
NEVER SMOKED	13.6	13.8	13.9	14.1	.90
EVER SMOKED	24.4	24.6	24.9	25.1	

[1] PROBABILITY (%) OF SYMPTOM GIVEN ALCOHOL AND SMOKING STATUS CALCULATED FROM LOGISTIC REGRESSION PROCEDURE

[2] P VALUE REFLECTING THE SIGNIFICANCE LEVEL OF THE INCREASED PROBABILITY OF RESPIRATORY SYMPTOMS WITH ALCOHOL CONSUMPTION, CONTROLLING FOR SMOKING STATUS

6.1.4.1 MULTIVARIATE ANALYSIS OF THE DETERMINANTS OF RESPIRATORY SYMPTOMS

In this analysis the major determinants of respiratory symptoms were analysed using logistic regression model. The symptoms examined were usual cough, usual phlegm, any shortness of breath, ever wheeze and wheeze with breathlessness. These were obtained from positive responses to the relevant questions in the questionnaire. Altogether 23 potential determinants were examined which included age, indices of SE status, passive and voluntary tobacco smoke exposure, dust and fume exposure in the workplace, alcohol, exercise, area of residence, childhood respiratory trouble (CRT) before the age of 16 years, whooping cough and heart trouble.

When a factor was found to be significant at the P.05 level, the odds ratio of having the symptom together with the 95% confidence interval was calculated. The results of this analysis in men and women is shown in Tables 6.20 and 6.21.

Table 6.20

RESPIRATORY SYMPTOMS IN RELATION TO AGE, SMOKING, DUST AND FUME EXPOSURE, ALCOHOL AND PAST RESPIRATORY ILLNESS

RESPIRATORY SYMPTOMS	AGE	SMOKE	OCCUPATIONAL EXPOSURE TO DUST AND FUMES	EXERCISE LITTLE OR NONE VS MODERATE TO PLENTY	SCHOOLING ≤STD 8
USUAL COUGH					
MEN	NS	2.96(1.96-4.48)#	2.78(1.53-5.06)#	NS	2.36(1.62-3.43)§
WOMEN	2.29(1.53-3.44)§	2.49(1.52-4.07)#	NS		NS
USUAL PHLEGM					
MEN	NS	3.04(2.07-4.28)§	NS	NS	NS
WOMEN	1.98(1.28-3.06)*	2.38(1.41-4.02)#	NS	NS	NS
SHORTNESS OF BREATH					
MEN	NS	1.97(1.28-3.03)#	NS	1.90(1.18-3.06)*	NS
WOMEN	3.01(2.07-4.38)§	NS	NS	NS	NS
WHEEZE					
MEN	NS	NS	NS	NS	NS
WOMEN	NS	2.86(1.66-4.93)#	NS	NS	NS
WHEEZE WITH BREATHLESSNESS					
MEN	NS	NS	NS	NS	NS
WOMEN	2.45(1.38-4.34)#	NS	NS	NS	NS

Table shows odds ratio and 95% confidence interval (in brackets) based on logistic regression analysis in a model which contained all the SE indicators, voluntary and passive smoking, alcohol, exercise, area of residence, dust and fume exposure, past and recent respiratory illnesses, chest trouble before age 16, whooping cough, heart trouble and angina.

* P≤0.01 # P≤.001 § P≤.0001

Table 6.21

RESPIRATORY SYMPTOMS IN RELATION TO RECENT CHEST ILLNESS, ANY KIND OF CHEST PROBLEM, CHEST TROUBLE BEFORE 16 YEARS AND ANY KIND OF HEART TROUBLE

RESPIRATORY SYMPTOMS	RECENT CHEST ILLNESS[1]	ANY KIND OF CHEST PROBLEM	CHEST TROUBLE BEFORE 16 YEARS	ANY KIND OF HEART TROUBLE
USUAL COUGH				
MEN	2.69(1.82-3.96)§	NS	NS	NS
WOMEN	NS	4.67(2.79-7.79)§	NS	NS
USUAL PHLEGM				
MEN	2.04(1.39-3.01)#	2.76(1.78-4.28)#	NS	NS
WOMEN	2.04(1.29-3.22)*	3.55(2.04-6.19)§	NS	NS
SHORTNESS OF BREATH				
MEN	2.50(1.64-3.81)§	3.54(2.21-5.66)§	NS	3.99(2.02-7.87)§
WOMEN	2.24(1.50-3.30)§	5.46(3.15-9.48)§	NS	3.58(1.52-8.41)#
WHEEZE				
MEN	3.89(2.54-5.95)§	6.12(3.88-9.65)§	NS	NS
WOMEN	3.01(1.90-4.76)§	7.79(4.52-12.06)§	NS	NS
WHEEZE WITH BREATHLESSNESS				
MEN	3.13(1.77-5.56)§	7.86(4.89-13.99)§	6.65(2.52-17.55)§	NS
WOMEN	2.78(1.59-4.85)#	5.46(3.15-9.48)§	NS	4.79(1.68-13.71)*

Table shows odds ratio and 95% confidence interval (in brackets) based on logistic regression analysis in a model which contained all the SE indicators, voluntayr and passive smoking, alcohol, exercise, area of residence, dust and fume exposure, past and recent respiratory illnesses, chest trouble before age 16, whooping cough, heart trouble and angina.

[1] RECENT CHEST ILLNESS INCLUDES CHEST COLDS, BRONCHITIS OR PNEUMONIA IN LAST 3 YEARS

* P≤0.01 # P≤.001 § P≤.0001

Age was a significant determinant of usual cough, phlegm, and shortness of breath in women. It was not an important determinant of symptoms in men.

As expected, voluntary smoking was significantly associated with all the symptoms, except wheeze in men and all except usual cough and shortness of breath in women. Passive smoking was not a significant determinant of any of the symptoms when the other determinants were accounted for.

Occupational exposure to dust was a significant predictor of usual cough in men. Little or no exercise was significantly associated with shortness of breath. Number of years of schooling was the only SE factor that was related to symptoms. It was significant for usual cough only in men but not in women.

Recent chest illnesses, defined as chest colds, bronchitis or pneumonia in the last 3 years, were important predictors of all the symptoms in both genders except for cough in women. Any kind of chest problem was also associated with all the symptoms except for usual cough in men. Heart trouble was a significant predictor of shortness of breath in men and women.

In men there was an increased chance of reporting wheeze with breathlessness if they had a history of respiratory trouble before the age of 16 years and recent chest illnesses.

6.1.4.2 MULTIVARIATE ANALYSIS OF THE DETERMINANTS OF RESPIRATORY DISEASES

Symptoms were also examined as potential correlates of hay fever, sinus trouble, pneumonia, asthma and chronic bronchitis. Table 6.22 shows the factors which were significantly associated with sinus trouble. The odds ratio of having sinus trouble was significant in men who had 10 years or less schooling (up to Std 8) and in women who were on medical aid. Of particular note is that women who reported any kind of chest trouble and men who reported recent chest illnesses had a greater chance of reporting sinus trouble. Dust exposure in the workplace was associated with a significantly higher risk of sinus trouble.

A positive history of respiratory trouble before the age of 16 years in men was associated with a 11.14 times increased risk (95% confidence interval of 3.89-31.93) of having asthma (P.0001). There was no significant association of any of the other respiratory disorders with the determinants in the regression model.

Table 6.22

SINUS TROUBLE IN RELATION TO SOCIOENVIRONMENTAL (SE) FACTORS, DUST EXPOSURE AND CHEST PROBLEMS IN MEN AND WOMEN

	MEN	WOMEN
SE FACTORS:		
SCHOOLING (≤STD 8)	1.94(1.31-2.88)#	NS
MEDICAL AID (NO)	NS	1.78(1.23-2.56)*
DUST EXPOSURE	1.82(1.18-2.80)*	2.58(1.50-4.44)#
ANY KIND OF CHEST TROUBLE:	NS	2.12(1.25-3.62)*
RECENT CHEST ILLNESS[1]	2.16(1.44-3.25)#	NS

Table shows odds ratio and 95% confidence interval (in brackets) based on logistic regression analysis in a model which contained all the SE indicators, voluntary and passive smoking alcohol, exercise, area of residence, dust and fume exposure, past and recent respiratory illnesses, chest trouble before age 16, whooping cough, heart trouble and angina.

[1] RECENT CHEST ILLNESS INCLUDES CHEST COLDS, BRONCHITIS OR PNEUMONIA IN LAST 3 YEARS

* P≤0.01 # P≤.001 § P≤.0001

6.2 LUNG FUNCTION

6.2.1 RESPONSE RATE

As indicated earlier a random sample of respondents between the ages of 18-45 years was invited for lung function tests. The response rate of those sampled was 74.0% and 65.7% in men and women respectively and is shown in Table 6.23. This produced the number of subjects required for stastistical purposes. The reasons for subjects defaulting are also summarised in this Table. The subjects who were unavailable for tests were either away on holiday or found the time of testing to be unsuitable to perform the tests. There was no significant difference between the respondents aged 18-45 years who performed lung function tests and those who did not (including the defaulters and those not sampled) in terms of their respiratory symptoms, diseases and the socio-environmental variables analysed in the study.

6.2.2 ANTHROPOMETRIC CHARACTERISTICS

The anthropometric characteristics by age category of the subjects who performed spirometry is shown in Table 6.24. There was a trend for an increase in the body mass index (BMI i.e w/h^2) with age in women. A BMI of >25 in women and >27 in men signifies obesity. By this definition the mean BMI for women in the 35-45 age category was in the obese range.

Table 6.23

RESPONSE RATE OF SUBJECTS SAMPLED FOR SPIROMETRIC TESTS

	MEN	%	WOMEN	%
No. of respondents 18–45 years who completed questionnaires	n 606	% 100	n 647	% 100
No. sampled for lung function[1]	258	42.5	178	27.5
No. completed spirometry	191	74.0	117	65.7
Reasons for defaulting:				
1. Pregnant women sampled but excluded	–	–	7	3.9
2. Unable to perform lung function	5	1.9	4	2.2
3. Unavailable during study	24	9.3	23	12.9
4. Refusals	38	14.7	27	15.2
Total defaulters	67	25.9	61	34.2

[1] Sample size was calculated on 35% of target age group (18–45 years) comprising 60% males and 40% females

TABLE 6.24

ANTHROPOMETRIC CHARACTERISTICS OF STUDY SUBJECTS WHO PERFORMED SPIROMETRY

	AGE IN YEARS			
	18-24	25-34	35-45	ALL
MEN :				
NUMBER	49	62	80	191
STANDING HEIGHT (cm)	170.8 (6.0)[1]	169.5 (5.9)	168.5 (5,7)	169.4 (5.9)
SITTING HEIGHT (cm)	86.0 (6.0)	85.3 (5.5)	85.7 (4,0)	85.7 (4.4)
SITTING/STANDING HEIGHT RATIO	0.504(0.012)	0.503(.025)	0.509(.018)	0.507(.024)
WEIGHT (kg)	58.2 (8.2)	65.6 (11.3)	68.0 (11,3)	64.7 (11.4)
BODY MASS INDEX[2] (Kg/cm^2)	20.0 (2.7)	22.8 (3.9)	23.9 (3,8)	22.6 (3.9)
WOMEN :				
NUMBER	32	38	47	117
STANDING HEIGHT (cm)	156.5 (5.1)	157.3 (6.0)	155.9 (4.7)	156.5 (5.2)
SITTING HEIGHT (cm)	79.5 (3.5)	80.8 (3.1)	79.8 (2.9)	80.0 (3.1)
SITTING/STANDING HEIGHT RATIO	.507(.014)	0.514(.011)	0.512(.014)	0.513(.013)
WEIGHT (Kg)	49.6 (6.8)	60.6 (13.5)	61.8 (11.7)	58.1 (12.3)
BODY MASS INDEX[2] (Kg/cm^2)	20.4 (3.2)	24.5 (5.0)	25.4 (4.6)	23.7 (4.9)

[1] FIGURES SHOWN ARE MEANS WITH STANDARD DEVIATION IN PARENTHESIS

[2] WEIGHT/STANDING HEIGHT^2 (QUETELET INDEX)

6.2.3 SPIROMETRIC LUNG FUNCTION IN RELATION TO AGE AND SMOKING STATUS

The spirometric characteristics recorded in this study were: SVC, FVC and its derivatives viz. FEV_1, PEF, $FEF_{200-1200}$, $FEF_{25-75\%}$, $FEF_{80\%}$, $FEF_{50\%}$, $FEF_{75-85\%}$, and the FEV_1/FVC ratio. All results were expressed at BTPS. Only the SVC, FVC, FEV_1, PEF, $FEF_{25-75\%}$ and the FEV_1/FVC ratio were used in subsequent analysis of the determinants of lung function. These latter indices are the ones most commonly used in clinical and epidemiological studies.

Tables 6.25 and 6.26 show the mean spirometric values for men and women by smoking status and age categories; these values were not standardised for standing height. The number of women who were ever smokers were small and similar to the pattern in the questionnaire respondents. The mean values for many of the indices were higher in the ever compared to the never smoking group of men and women. When the data was standardised for standing height of 170 cm in men and 160 cm in women (Tables 6.27 and 6.28), fewer variables in both men and women were higher for ever smokers. None of these differences were statistically significant in men. Those statistically significant in women were the SVC and FVC. Nor were the deleterious effects of smoking evident in most parameters. In men only the FEV_1/FVC ratio was significantly lower for smokers than nonsmokers (P

.03), and in women only the $FEF_{25-75\%}$ and the FEV_1/FVC ratio (P .05 and .01 respectively).

Table 6.25

SPIROMETRIC LUNG FUNCTIONS BY AGE AND SMOKING STATUS IN MEN (UNSTANDARDISED FOR STANDING HEIGHT)

	AGE IN YEARS			
	18–24	25–34	35–45	ALL
NUMBER (ALL)	49	62	80	191
NEVER SMOKER	30	26	29	85
EVER SMOKER	19	36	51	106
SVC (ℓ)				
NEVER SMOKER	4.40(0.66)[1]	4.14(0.56)	3.70(0.76)	4.08(0.72)
EVER SMOKER	4.38(0.42)	4.22(0.60)	3.93(0.51)	4.11(0.54)
FVC (ℓ)				
NEVER SMOKER	4.43(0.60)	4.19(0.62)	3.66(0.75)	4.08(0.72)
EVER SMOKER	4.42(0.40)	4.26(0.54)	3.95(0.52)	4.14(0.54)
FEV_1 (ℓ)				
NEVER SMOKER	3.92(0.47)	3.50(0.58)	2.95(0.60)	3.46(0.67)
EVER SMOKER	3.91(0.44)	3.54(0.57)	3.13(0.47)	3.41(0.58)
PEF (ℓ/sec)				
NEVER SMOKER	550(143)	501(193)	420(221)	491(191)
EVER SMOKER	483(225)	527(185)	504(160)	508(180)
$FEF_{25-75\%}$ (ℓ/sec)				
NEVER SMOKER	4.61(1.05)	3.76(1.19)	3.10(1.14)	3.86(1.26)
EVER SMOKER	4.66(1.33)	3.1?(1.28)	3.07(1.24)	3.61(1.39)
FEV_1/FVC %				
NEVER SMOKER	89.1 (6.4)	83.5 (7.4)	81(7.8)	85(7.8)
EVER SMOKER	88.7 (8.3)	83.1 (8.7)	79(6.7)	82(8.4)

[1] FIGURES SHOWN ARE MEANS WITH STANDARD DEVIATION IN PARENTHESIS

Table 6.26

SPIROMETRIC LUNG FUNCTIONS BY AGE AND SMOKING STATUS IN WOMEN (UNSTANDARDISED FOR STANDING HEIGHT)

	AGE IN YEARS			
	18–24	25–34	35–45	ALL
NUMBER (ALL)	32	38	47	117
NEVER SMOKER	29	33	41	103
EVER SMOKER	3	5	6	14
VC (ℓ)				
NEVER SMOKER	2.84(0.46)[1]	2.85(0.46)	2.62(0.41)	2.77(0.45)
EVER SMOKER	3.39(0.53)	2.91(0.55)	3.05(0.63)	3.07(0.57)
FVC (ℓ)				
NEVER SMOKER	2.92(0.48)	2.94(0.45)	2.68(0.45)	2.84(0.47)
EVER SMOKER	3.37(0.48)	3.05(0.43)	3.09(0.63)	3.14(0.51)
FEV_1 (ℓ)				
NEVER SMOKER	2.69(0.41)	2.55(0.41)	2.22(0.45)	2.45(0.46)
EVER SMOKER	3.07(0.46)	2.50(0.25)	2.28(0.73)	2.53(0.59)
PEF (ℓ/sec)				
NEVER SMOKER	420(62)	370(39)	329(126)	366(109)
EVER SMOKER	460(42)	391(107)	249(201)	345(156)
$FEF_{25-75\%}$ (ℓ/sec)				
NEVER SMOKER	3.73(0.92)	3.14(0.97)	2.45(0.92)	3.00(1.06)
EVER SMOKER	3.71(0.73)	2.46(0.36)	1.90(1.43)	2.49(1.19)
FEV_1/FVC				
NEVER SMOKER	92(5.4)	87(6.4)	83(8.5)	86(8)
EVER SMOKER	91(4.1)	82(4.9)	73(1.7)	80(4.1)

[1] FIGURES SHOWN ARE MEANS WITH STANDARD DEVIATION IN PARENTHESIS

Table 6.27

SPIROMETRIC LUNG FUNCTIONS BY AGE AND SMOKING STATUS IN MEN (STANDARDISED FOR STANDING HEIGHT)

	AGE IN YEARS			
	18–24	25–34	35–45	ALL
NUMBER (ALL)	49	62	80	191
NEVER SMOKER	30	26	29	85
EVER SMOKER	19	36	51	106
VC (ℓ)				
NEVER SMOKER	4.40	4.20	3.81	4.12
EVER SMOKER	4.38	4.16	3.87	4.07
FVC (ℓ)				
NEVER SMOKER	4.42	4.24	3.77	4.13
EVER SMOKER	4.42	4.21	3.89	4.11
FEV_1 (ℓ)				
NEVER SMOKER	3.92	3.57	3.03	3.50
EVER SMOKER	3.90	3.48	3.09	3.38
PEF (ℓ/sec)				
NEVER SMOKER	550	519	425	496
EVER SMOKER	483	515	501	504
$FEF_{25-75\%}$ (ℓ/sec)				
NEVER SMOKER	4.61	3.95	3.15	3.90
EVER SMOKER	4.66	3.73	3.05	3.57
FEV_1/FVC				
NEVER SMOKER	89	84	81	85*
EVER SMOKER	89	83	79	82

* ASTERISK DENOTES THAT THE DIFFERENCE IN MEAN BETWEEN NEVER AND EVER SMOKERS WAS SIGNIFICANT AT THE 5% LEVEL.

Table 6.28

SPIROMETRIC LUNG FUNCTIONS BY AGE AND SMOKING STATUS IN WOMEN (STANDARDISED FOR STANDING HEIGHT)

	AGE IN YEARS			
	18–24	25–34	35–45	ALL
NUMBER (ALL)	32	38	47	117
NEVER SMOKER	29	33	41	103
EVER SMOKER	3	5	6	14
VC (ℓ)				
NEVER SMOKER	2.86	2.85	2.65*	2.78*
EVER SMOKER	3.37	2.80	3.03	3.02
FVC (ℓ)				
NEVER SMOKER	2.93	2.94	2.70*	2.84*
EVER SMOKER	3.37	2.96	3.08	3.09
FEV_1 (ℓ)				
NEVER SMOKER	2.69	2.41	2.22	2.45
EVER SMOKER	3.06	2.55	2.27	2.49
PEF (ℓ/sec)				
NEVER SMOKER	418	374	325	367
EVER SMOKER	459	388	245	338
$FEF_{25-75\%}$ (ℓ/sec)				
NEVER SMOKER.	3.70	3.16*	2.40	3.00*
EVER SMOKER	3.64	2.31	1.89	2.41
FEV_1/FVC				
NEVER SMOKER	92	87	82*	86.3*
EVER SMOKER	91	82	73	80

* ASTERISK DENOTES THAT THE DIFFERENCE IN MEANS BETWEEN NEVER AND EVER SMOKERS WAS SIGNIFICANT AT THE 5% LEVEL.

6.2.4 BODY CHARACTERISTICS AS PREDICTORS OF FEV_1 $FEF_{25-75\%}$ AND FVC

The body characteristics that were analysed as potential predictors of FEV_1, FVC and $FEF_{25-75\%}$ were: age, standing height, sitting height, sitting/standing height ratio, weight and BMI. These were examined using stepwise linear regression analysis. The variables were entered into the regression model if they were significant at the .50 level for the purpose of this analysis. The results are shown in Tables 6.29 and 6.30.

The standing height was an important and significant ($P < .05$) predictor of the FEV_1, FVC and $FEF_{25-75\%}$ in men and women.

In the models with age, standing height, weight, and sitting height, weight contributed significantly to FVC in women but not in men. It did not contribute to FEV_1 or $FEF_{25-75\%}$ in men and women. Sitting height was a significant predictor of FVC in men and women. However, the substitution of sitting height for standing height did not contribute further to the overall variation in FVC and, in fact, resulted in a lower R^2 (35.93% and 22.30% in men and women respectively vs 41.11% and 25.04% in the equation with standing height). Similarly, sitting height was a significant determinant of FEV_1 and $FEF_{25-75\%}$, but did not contribute further to the overall variation.

The sitting/standing height ratio was not a significant predictor of any of the indices. The BMI was a significant predictor only of FVC in women (P.046) and of $FEF_{25-75\%}$ in men (P.034), but once again contributed less to the overall variation (R^2) in these spirometric indices. Except for the FVC, weight did not contribute to the other indices in men or women.

Age was a significant predictor of all spirometric indices in men and women.

Table 6.29

BODY CHARACTERISTICS AS PREDICTORS OF FVC FEV_1 AND $FEF_{25-75\%}$
IN MEN (n=191)[1] ALL SUBJECTS INCLUDED

SPIROMETRIC INDEX	INTERCEPT	AGE	STANDING HEIGHT (cm)	SITTING HEIGHT (cm)	SITTING/STANDING HT RATIO	BODY MASS INDEX ($Kg/_{Cm^2}$)	WEIGHT Kg	R^2 (%)
FVC	-4.028	-.026(.0001)[2]	+.053(.0001)	NE[3]	NE	NE	NE	40.54
	-3.778	-.029(.0001)	+.050(.0001)	NE	NE	NE	+.005(.1810)	41.11
	-0.138	-.036(.0001)	NE	+.055(.0001)	NE	NE	+.010(.0038)	35.93
	-3.490	-.032(.0001)	NE	NE	+3.237(.1278)	NE	NE	17.00
	+5.100	-.031(.0001)	NE	NE	NE	(>.5)	NE	7.41
FEV_1	-2.559	-.042(.0001)	+.043(.0001)	NE	NE	NE	(>.5)	52.26
	+0.486	-.047(.0001)	NE	+.050(.0001)	NE	NE	+.003(.3368)	48.63
	+3.160	-.047(.0001)	NE	NE	+3.469(.0592)	NE	NE	36.79
	+5.110	-.043(.0001)	NE	NE	NE	-139.255(.1690)	NE	36.23
$FEF_{25-75\%}$	-.761	-.081(.0001)	+.0416(.0034)	NE	NE	NE	NE	29.29
	-1.519	-.073(.0001)	+.050(.0008)	NE	NE	NE	-.014(.0807)	30.44
	+1.565	-.080(.0608)	NE	-.062(.0240)	NE	NE	-.009(.0677)	30.11
	+3.266	-.086(.0001)	NE	NE	+6.300(.1392)	NE	NE	26.84
	+7.200	-.074(.0001)	NE	NE	NE	-495.877(.0337)	NE	27.74

1 FOR THE PURPOSE OF THIS TABLE A VARIABLE WAS ONLY ENTERED INTO THE MODEL IF IT MET THE 0.500 SIGNIFICANCE LEVEL

2 FIGURES IN PARENTHESES ARE PROBABILITIES

3 "NE" INDICATES THAT THE VARIABLE WAS NOT ENTERED IN THE PARTICULAR MODEL

Table 6.30

BODY CHARACTERISTICS AS PREDICTORS OF FVC_1 FEV_1 AND $FEF_{25-75\%}$ IN WOMEN (n=117)[1] - ALL SUBJECTS INCLUDED

SPIROMETRIC INDEX	INTERCEPT	AGE	STANDING HEIGHT (cm)	SITTING HEIGHT (cm)	SITTING/STANDING HT RATIO	BODY MASS INDEX Kg/Cm^2	WEIGHT Kg	R^2 (%)
FVC	-1.819	-.0146(.00 34)[2]	+.027(.0001)	NE[3]	NE	NE	NE	20.43
	-1.315	-.021(.0037)	NE	NE	NE	NE	+.010(.0100)	25.04
	-0.040	-.021(.0019)	NE	+.038(.0002)	NE	NE	+.009(.0217)	22.30
	+3.391	-.016(.0023)	NE	NE	(>.5)	NE	NE	7.88
	+3.081	-.021(.0023)	NE	NE	NE	+197.392(.0464)	NE	11.07
FEV_1	-1.205	-.028(.0001)	+.029(.0001)	NE	NE	NE	NE	36.39
	-1.060	-.030(.0001)	+.028(.0001)	NE	NE	NE	+.003(.4080)	36.78
	+0.299	-.029(.0001)	NE	+.046(.0001)	NE	NE	NE	35.47
	+3.395	-.030(.0001)	NE	NE	(>.5)	NE	NE	31.50
	+3.395	-.030(.0001)	NE	NE	NE	(>.5)	NE	26.39
$FEF_{25-75\%}$	-2.108	-.071(.0001)	+.0466(.0036)	NE	NE	NE	NE	36.46
	-2.555	-.066(.0001)	+.052(.0020)	NE	NE	NE	-.009(.2603)	37.18
	-0.802	-.067(.0001)	NE	-.081(.0127)	NE	NE	-.010(.1851)	36.19
	+5.265	-.074(.0001)	NE	NE	(>.5)	NE	NE	31.50
	+5.703	-.067(.0001)	NE	NE	NE	-278.585(.1491)	NE	32.75

1 FOR THE PURPOSE OF THIS TABLE A VARIABLE WAS ONLY ENTERED INTO THE MODEL IF IT MET THE .500 SIGNIFICANCE LEVEL

2 FIGURES IN PARENTHESES ARE PROBABILITIES

3 "NE" INDICATES THAT THE VARIABLE WAS NOT ENTERED IN THE PARTICULAR MODEL

6.2.5 REGRESSION ANALYSIS OF SPIROMETRIC INDICES, STANDARDISED FOR AGE, STATURE AND WEIGHT, IN RELATION TO SMOKING AND SYMPTOMS

The spirometric indices derived in this study were analysed by gender in relation to age and standing height using stepwise regression analysis (SAS). The Mallow's c(p) statistic was used to select the order of the variables. It selects the best fit variable first and subsequent ones in hierarchical order. The regression equations were obtained using age and standing height for all the indices and repeated as follows:

a) all subjects
b) excluding subjects with cardiorespiratory symptoms
c) excluding subjects as in b) above and ever smokers
d) excluding subjects as in b) above and never smokers

The above analysis was repeated in a model using age, standing height and weight; and age, sitting height and weight.

The regression equations, together with the individual R^2 values, overall R^2 and standard error are presented in appendix 5 for reference. The

number of women who were ever smokers and were free of cardiorespiratory disease was small (n = 3) and therefore step d) was not possible.

Table 6.31 is a summary of the predicted values by gender utilising the regression equations derived as described above for FVC, FEV_1 and $FEF_{25-75\%}$. It can be seen that excluding smokers and subjects with cardiorespiratory symptoms made no significant difference in the predicted values. In men, smokers without symptoms had the highest FVC value. This finding is consistent with a "healthy" smoker effect described by Becklake and Lalloo (1991). This will be discussed later. The number of women smokers without symptoms was too small to permit a similar analysis in this group.

Substituting sitting height predicted lower values which was to be anticipated given that it contributed less to the overall variation in lung function (R^2).

Table 6.31

PREDICTION VALUES FOR FVC_1, FEV_1 AND $FEF_{25-75\%}$ IN LENASIA SUBJECTS

APPLYING LINEAR REGRESSION EQUATIONS DERIVED FROM THE PRESENT STUDY

REGRESSION EQUATIONS WITH AGE AND STANDING HEIGHT

	FVC(ℓ)	FEV(ℓ)	$FEF_{25-75\%}$ (ℓ/sec)
MEN AGE 35, STANDING HEIGHT 170cm			
ALL SUBJECTS	4.06	3.32	3.48
EXCLUDING WITHOUT SYMPTOMS[1]	4.08	3.35	3.59
WITHOUT SYMPTOMS:NEVER SMOKED			
EXCLUDING EVER SMOKERS & SYMPTOMS	4.08	3.38	3.75
EXCLUDING NEVER SMOKERS & SYMPTOMS :EVER SMOKED	4.12	3.36	3.47
WOMEN AGE 35, STANDING HEIGHT 170cm			
ALL SUBJECTS	3.26	2.76	3.31
WITHOUT SYMPTOMS	3.24	2.79	3.44
WITHOUT SYMPTOMS:NEVER SMOKED[2]	3.16	2.74	3.42

1 SEE SECTION 6.3.3 FOR EXCLUSION CRITERIA

2 THE NUMBER OF WOMEN WITHOUT SYMPTOMS AND EVER SMOKED WERE TOO SMALL TO PERMIT SIMILAR ANALYSIS AS IN MEN

6.2.6 MULTIVARIATE ANALYSIS OF THE DETERMINANTS OF LUNG FUNCTION

As with the respiratory symptoms the potential determinants of lung function were examined as categoric variables in a multiple regression model. A total of 23 determinants were examined. Only the FVC, FEV_1, $FEF_{25-75\%}$, FEV_1/FVC and PEF were examined in this analysis. The results were expressed as the difference in the least square means (LSM) obtained from the general linear model (GLM) regression equations.

The summary of the findings in men and women are shown in Tables 6.32 and 6.33 respectively. A determinant was presented in the Table if it the differences in the LSM's were significant at the P.10 level.

Voluntary smoking status was not a significant determinant of any of the spirometric indices examined in men and women. In women, however, passive tobacco smoking in the home environment was significantly associated with a lower FEV_1/FVC ratio. Of the SE factors examined only medical aid was important independent determinant of lung function. Men with medical aid had higher FVC and FEV_1 levels. Women with < 10 years of schooling (Std 8 or lower) had lower lung function values. On the other hand those with university education had higher values.

Residence in a rural area was associated with better lung function in women and not men. Men who were exposed to dust in the work environment had lower indices of airflow viz $FEF_{25-75\%}$ and FEV_1/FVC ratio. Chest trouble before the age of 16 years or childhood respiratory trouble (CRT) was an independent determinant of FEV_1 in women. Men who had a history of whooping cough had lower PEF levels. Alcohol consumption in men was associated with a lower FVC and FEV_1 level in men at the P.07 level.

The significance of these findings will be discussed in Chapter 8.

Table 6.32

THE EFFECT OF SMOKING STATUS, ALCOHOL, MEDICAL AID, AREA OF RESIDENCE AND DUST EXPOSURE ON SPIROMETRIC LUNG FUNCTION IN MEN n = 191

LUNG FUNCTION	SMOKING STATUS		ALCOHOL		MEDICAL AID		RESIDENCE[1] RURAL AREA		DUST EXPOSURE		WHOOPING COUGH	
	NEVER	EVER	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
FVC		NS[2]	-.14 .07(.04)[3]		+.12 .09(.05)		NS		NS		NS	
FEV_1		NS	-.12 .07(.07)		+.11 .08(.08)		NS		NS		NS	
$FEF_{25-75\%}$		NS	NS		NS		NS		-.49 .02(.56)		NS	
FEV_1/FVC		NS	NS		NS		NS		-3.0 .02(.56)		NS	
PEF		NS	NS		NS		NS		NS		-74 .06(14)	

Table shows the difference between the least square means of the spirometric indices after standardisation for standing height and age in the reference categories. The explanatory variables used in the regression model were : voluntary and passive smoking, alcohol, educational indicators, exercise, medical aid, occupation, area of residence, chest trouble before age 16 and whooping cough.

[1] IN RESPONSE TO "IN WHAT TYPE OF AREA DID YOU SPEND MOST OF YOUR LIFE".

[2] NS: NOT SIGNIFICANT AT $P \leq .1$

[3] P VALUE WITH THE STANDARD ERROR (SE) OF THE LEAST SQUARE MEANS IN PARENTHESES

Table 6.33

THE EFFECT OF SMOKING STATUS, EDUCATION, AREA OF RESIDENCE AND CHEST TROUBLE BEFORE 16 YEARS ON SPIROMETRIC LUNG FUNCTION IN WOMEN n = 117

LUNG FUNCTION	SMOKING STATUS		PASSIVE SMOKE		SCHOOLING		UNIVERSITY EDUCATION		RESIDENCE[1] RURAL AREA		CHEST TROUBLE BEFORE 16 YEARS	
	NEVER	EVER	YES	NO	STD 8	<STD 8	YES	NO	YES	NO	YES	NO
FVC		NS[2]	NS			NS	+.41		+.24		NS	
			NS			NS	.04(19)[3]		.08(.13)			
FEV_1		NS	NS			NS	+.39 .03(.17)		+.25 .04(.11)		-.16 .08(.08)	
$FEF_{25-75\%}$		NS	NS			NS	NS		NS		NS	
FEV_1/FVC		NS	-4.3 .03(.7)			-2.7 .09(.8)	NS		NS		NS	
PEF		NS	NS			NS	NS		NS		NS	

Table shows the difference between the least square means of the spirometric indices after standardisation for standing height and age in the reference categories. The explanatory variables used in the regression model were : voluntary and passive smoking, alcohol, educational indicators, exercise, medical aid, occupation, area of residence, chest trouble before age 16 and whooping cough.

[1] IN RESPONSE TO "IN WHAT TYPE OF AREA DID YOU SPEND MOST OF YOUR LIFE".

[2] NS: NOT SIGNIFICANT AT $P \leq .1$

[3] P VALUE WITH THE STANDARD ERROR (SE) OF THE LEAST SQUARE MEANS IN PARENTHESES

CHAPTER 7

DETERMINANTS OF RESPIRATORY SYMPTOMS AND DISEASE

7.1 GENERAL COMMENTS

The objectives of this study were to describe the distribution and determinants of respiratory symptoms, diseases and lung function in an Indian South African community. This chapter deals with the distribution and determinants of respiratory symptoms and diseases. The major recognised putative determinants examined were environmental and host factors. The major environmental factors examined were tobacco smoke exposure, occupational dust and fume exposure, alcohol consumption, socio-environmental factors (occupational class, education, housing and area of residence ie. rural vs not); host factors examined were gender, age, and past and present illnesses.

Before discussing the findings and their implications it is important to consider the methodologic factors in this study in order to assess the extent, if any, to which they may have influenced the findings.

7.2 METHODOLOGIC ISSUES PERTINENT TO THE INTERPRETATION OF THE RESULTS IN THE PRESENT STUDY

7.2.1 RESPONSE RATES

A good response rate was obtained in this study. The total of 1819 adults (respondents) who completed the questionnaire phase of the study represented 97.2% of the eligible subjects resident in the 86.5% of the participating households which were sampled. This number represented 95.1% of the 1912 subjects required in the sample size calculation (section 4.2).

The response rate obtained in the only other published community based respiratory health survey in South Africa, which was conducted in Belville in the Western Cape was 42.4%. of the 1200 adults sampled (Wicht *et al*, 1977). That study sampled 600 men and 600 women from the voters roll of the district surveyed. The epidemiological study of obstructive lung disease conducted in Tucson, Arizona in the United States had a response rate of 74.7% of the 2214 eligible households which were sampled for study (Lebowitz *et al*, 1975).

The reason for the good response rate in the present study was attributed to the community participation in the planning phase and

conduct of the survey and the advertising campaign prior to execution of the study. Furthermore, the Lenasia community demonstrated a tremendous sense of social responsibility which was also exemplified by the excellent response rate in a survey of the needs of the aged in Lenasia (Padayachee, 1985) and their involvement in the social welfare of the people in their community.

There was no significant difference in the response rates among the extensions (Table 6.2). This ensured representation of all socio-environmental categories of people in Lenasia, an important consideration, since one of the objectives of this study was was to examine the association of socio-environmental status with respiratory health indicators. As mentioned earlier, Lenasia was developed into extensions which had different socio-economic housing standards, hence the need for stratified sampling by extension.

7.2.2 THE QUESTIONNAIRE

The questionnaire used in this study was a slightly modified version of the ATS Epidemiology Standardisation Project questionnaire (Ferris, 1978). The ATS questionnaire was adapted from the British MRC one and has been applied widely (Becklake, 1987). The questions from the British MRC one were retained in the ATS questionnaire and several

were added in relation to acute and chronic respiratory conditions, smoking, occupational exposures etc.

The value of the standardised questionnaire in epidemiological studies has been reviewed by Samet (1978). It is considered to be a powerful tool in the measurement of respiratory status and its potential determinants. It has also been translated into several languages and applied in developed and underdeveloped countries of the world (Becklake *et al*, 1987). The questions on breathlessness which were also used in this study were reviewed recently by Vestbo *et al* (1988). They found them to be sensitive and objective indices of breathlessness in their study which compared the questions with lung function measurements.

Harlow and Limet (1989) reviewed published questionnaire studies for agreement between this form of data collection and medical records. They found that hay fever, asthma, sinusitis and bronchitis were each more likely to be reported by the respondent but not recorded in their medical records. Only small differences in reporting were found by age, sex, race and education. However, the frequency and recency of physician visits for a given condition increased the self reporting rate of that condition.

Several other potential sources of bias exist in questionnaire information. These include interviewer/interviewee interactions, the season during which the questionnaire is administered, modification of the questionniare and psychological perceptions of the respondents

7.2.2.1 INTERVIEWER/INTERVIEWEE INTERACTIONS

The most important of the potential biases in questionnaires is interviewer/interviewee interactions.

The interviewers used in the present study were drawn from within the lay community of Lenasia. It is a controversial issue as to whether health professionals or lay persons are more effective interviewers (Collins, 1986). It is also suggested that people coming from outside the community may be more successful in dealing with sensitive issues. The interviewers in this study were respected members of the community and community leaders in Lenasia. They had prior experience with a questionnaire survey which had a 98% response rate (Padayachee, 1986). Questions on sensitive issues were answered reasonably well; only 12 (0.7%) did not answer the questions on alcohol consumption, 31 (1.7%) the questions on occupation, 22 (1.2%) the questions on smoking and 41 (2.3%) the question on income.

The interviewers were also specifically instructed not to coerce the respondents to answer any question they did not wish to. However, the accuracy of this kind of data is often difficult to assess in studies of this nature. In the assessment of smoking for instance it is possible to measure urinary conitine levels and blood carboxyhaemoglobin levels to verify the data (Wald *et al*, 1981). This was not done in this study because these tests are invasive, expensive and time consuming. Furthermore, the reliabilty of most of the questions in the questionnaire have already been tested in epidemiological studies (Samet, 1978).

The interviewers also received intensive training for the survey. It has been shown that training improves the reliability (repeatability) of results (Garrad and Bennet, 1971; Choi and Comstock, 1975). An attempt was made to reduce interviewer bias further by having a rigidly standardised protocol for data collection, constant supervision throughout the survey and having the questionnaire self-administered.

Fletcher and Tinker (1961) compared the self-completed version of the Britsh MRC questionnaire with the interviewer administered form. The answers to questions about cough, phlegm, breathlessness and smoking habits corresponded closely. However 25% did not complete the entire questionnaire. This latter problem was addressed in the present study by having the interviewer check the questionnaire for

completion in the presence of the respondent. This resulted in an almost 100% completion rate in the majority of instances. Mittman *et al* (1979) also reviewed the self-completed version of the respiratory disease questionnaire and found it to be useful in epidemiological studies.

There is also a hazard with someone other than the designated respondent completing the questionnaire. This was obviated by the respondent completing the questionnaire in the presence of the interviewer. When the designated respondent was not at home the interviewer was requested to call back at a suitable time. It was important for the designated respondent to complete the questionnaire personally. For instance, Holland *et al* (1969) found that wives tended to report a lower prevalence of "morning phlegm" and of "increased cough and phlegm" in their husbands than was subsequently reported by the husbands themselves.

7.2.2.2 SEASON DURING WHICH THE QUESTIONNAIRE WAS ADMINISTERED

The season during which the questionnaire was completed may potentially influence the reporting of symptoms because of the higher

incidence of viral respiratory illnesses in winter and the higher air pollution levels during this season (Monto and Cavallero, 1971; Lanther *et al*, 1970). The evidence in the literature about this source of bias is conflicting. Fletcher and Tinker (1961) and Holland *et al* (1966) found an effect of seasons whereas Ferris and Anderson (1962) and Van der Lende (1972) found no effect. The climate in Lenasia is moderate and there is very little air pollution. The questionnaire was administered in spring and any seasonal effect in this study is therefore likely to have resulted in under rather than over-reporting of symptoms.

7.2.2.3 QUESTIONNAIRE MODIFICATION

This is an important consideration because modification of the questionnaire may reduce the comparability of between studies although it will not limit the internal validity of the study (Samet, 1978). The modification of the questionnaire in the present study involved inclusion of questions about occupation, education, alcohol and other disorders. The important questions relating to respiratory health were not altered, and the additional questions were added to the end of the questionnaire, in conformity with recommended practice.

7.2.2.4 PSYCHOLOGICAL PERCEPTIONS

The psychological perception in the reporting of respiratory symptoms has been stressed recently by Dales *et al* (1989). One cannot exclude the possibility of an effect of perception on the internal validity in the present study, particularly in the relationships between symptoms and socio-environmental indicators. Likewise, generalisability of the present questionnaire study to other populations of different languages and cultural groups should be guarded. This is the reason why the WHO/IUAT-LD consultation on chronic airways disease argued for flexible definitions of respiratory conditions so that data from many countries as possible could be considered and compared (Murray, 1989).

7.2.3 GENERALISABILTY

The study population in this study were adults resident in households sampled in a stratified random sampling procedure. Given the good response rate and uniform response rate among extensions, it is reasonable to conclude that the study sample is representative of the Lenasia community.

The extent to which these results are generalisable to the Indian population in South Africa is difficult to assess. There are no

comparative studies of respiratory health in Indian South Africans to shed light on this question.

Potential differences in Indian communities resident in other parts of South Africa could be due to different socio-environmental status, exposure characteristics and climatic conditions. The Indians in Lenasia have a similar origin to the Indians resident elsewhere in the country (Meer, 1969). Wyndham (1986) compared mortality statistics for respiratory diseases in whites in 8 cities in South Africa. He found that the mortalities from chronic diseases like chronic bronchitis, emphysema, asthma, bronchiectasis, extrinsic allergic alveolitis, and chronic airways obstruction were similar in the Highveld and coastal cities. There was a higher mortality rate from pneumonias in the Highveld compared to coastal cities. Whilst it is difficult to extrapolate this mortality data to the Indian population and to the prevalence of respiratory conditions in a population, it suggests that there may be climatic differences for some respiratory conditions, thus tending to reduce the generalisability of the data.

The National Manpower study of the Division of Labour in South Africa by Simkins and Hindson (1979) found a similar occupational distribution in the Indian population in South Africa as in the present study suggesting similarities in this respect between Indians in Lenasia and other parts of the country.

7.2.4 ASSOCIATIONS IN CROSS-SECTIONAL DATA

As is common in prevalence (cross-sectional) studies such as the present one, analysis has focussed on establishing associations between the outcomes of interest (respiratory ill health indicators) and potential determinants with a view to establishing causality. However, caution is always necessary in this context since with cross-sectionally gathered information, the time sequence of events is not necessarily clear. For this reason, the interpretation of the results is presented with emphasis on biologic plausibility and not simply on statistical significance. An additional reason for cautious interpretation is the fact that, given the many associations examined, a certain number will be expected to occur from chance alone.

7.3 PREVALENCE AND DISTRIBUTION OF THE DETERMINANTS OF RESPIRATORY ILLHEALTH IN THE PRESENT STUDY POPULATION

7.3.1 GENERAL COMMENTS

The World Health Organisation (WHO) and the International Union Against Tuberculosis and Lung Disease (IUATLD) held a conference in

1988, in Yugoslavia, to discuss the distribution and determinants of the global health problem of chronic airways disease and to develop strategies on their prevention and control (Murray, 1989). The conference proposed a broad definition of chronic airways disease in order to incorporate a wide spectrum of disorders which include chronic bronchitis, emphysema, asthma and COPD. The symptoms which accompany chronic airways diseases include cough, phlegm (mucus hypersecretion), wheeze and breathlessness (Speizer and Tager, 1979; Huchon, 1991).

The present study gathered information on the distribution and determinants of chronic airways disease as defined in the WHO/IUATLD conference in the Indian population resident in Lenasia, Johannesburg utilising a standardised respiratory health questionnaire. Although the present study was retrospective in relation to the above conference the data collected was in accordance with the recommendations of the conference. The results of the present study will be discussed in this light.

Voluntary smoking is regarded as the major risk factor for the development of chronic airways disease (United States Surgeon General, 1984; Crofton and Masironi, 1989; Huchon, 1991). In relation to smoking most of the other risk factors are regarded as putative and

because of their mild effects are frequently difficult to prove (Huchon, 1991). These include environmental exposures (atmospheric, occupational, domestic and passive smoking), socioenvironmental (SE) status and alcohol. Personal factors include age, gender, genetic factors (alpha-1-antitrypsin deficiency) and airway hyperresponsiveness. A difficulty with the interpretation of the published evidence in the literature regarding many of the risk factors is lack of control for confounding variables in some of the studies. The one universally accounted for is smoking because of its established causal role in chronic airways disease.

7.3.2 VOLUNTARY TOBACCO SMOKING

A comparison of smoking status in different populations is shown in Table 7.1. It shows the crude prevalence rates of smoking found in the studies quoted. It can be seen that the proportion of men, 15 years and older, in Lenasia who had ever smoked was not dissimilar to that in white men in the Tucson, Arizona epidemiologic study of respiratory diseases (Lebowitz *et al*, 1975). However, a larger percent of Lenasia men were current smokers. Comparison was not possible with the only community based epidemiologic study of respiratory diseases in a white group in South Africa (Wicht *et al*, 1977) because this latter study

classified subjects as smokers and non-smokers and it is unclear whether smokers included current or ex or both. In that study 71% of men 20 years and older were classed as smokers.

Overall Coloured men in South Africa smoked much more than Indians or whites. Black men in the community-based sample in Van der Burgh's study had the highest smoking prevalence. Other studies in Blacks in South Africa were confined to occupational groupings. Mokoetle's study of Black university employees found a lower prevalence of smoking compared with Van der Burgh's study. Her data is not strictly comparable because her study was not community based and comprised of subjects 20 years and older.

On the other hand, the women in Lenasia smoked much less than the white women in Tucson, the Cape Coloured women and the Black women in Johannesburg, in Mokoetle's study. Thus Indian women in Lenasia appear to smoke much less than women of other racial groups. This observation has been confirmed by Van der Burgh, and Seedat *et al* (1991) in a study of risk factors for coronary heart disease in Indians in Durban, South Africa. No comparable published data in Indians in India were found. The lower level of smoking amongst Indian women is most likely due to cultural influences (Meer, 1969).

Table 7.1

DISTRIBUTION % OF SMOKING CHARACTERISTICS IN DIFFERENT POPULATIONS

AUTHOR (YEAR)[1]	CITY/REGION COUNTRY	POPULATION SELECTION	MEN				WOMEN			
			NO. (AGE RANGE)	NEVER SMOKERS	EX SMOKERS	CURRENT SMOKERS	NO. (AGE RANGE)	NEVER SMOKERS	EX SMOKERS	CURRENT SMOKERS
LEBOWITZ (1975)	TUCSON ARIZONA USA	COMMUNITY BASED, WHITES	1270 (15-96)	33.0	30.9	36.1	1586 (15-96)	53.5	16.8	29.7
VAN DER BURGH (1979)	NATIONAL CENSUS SURVEYS S.AFRICA	RANDOM SAMPLE IN SEPARATE RACE GROUPS IN URBAN AND RURAL AREAS IN THE 4 PROVINCES	WHITES 2500 1975[2] (20-59)	21	21	58	2500 (20-59)	57	12	31
			BLACKS 2000 1976[2] (20-59)	25	5	70	2000 (20-59)	78	2	20
			INDIANS 1500 1977[2] (20-59)	25	7	68	1000 (20-59)	90	5	5
			COLOUREDS 1500 1977[2] (20-59)	15	6	79	1000 (20-59)	41	7	52
STEYN (1987)	CAPE PENINSULA S. AFRICA	COMMUNITY SAMPLE COLOUREDS	478 (15-64)	26.2	12.5	61.3	498 (15-64)	48.0	10.6	41.4
MOKOETLE (1990)	JO'BURG S AFRICA	UNIVERSITY WORKERS BLACKS	206 (20-)	31.6	16.0	52.4	203 (20-)	85.7	4.0	10.3
LALLOO (PRESENT) (STUDY)	LENASIA S. AFRICA	RANDOM SAMPLE COMMUNITY BASED	861 (15-)	43.8	9.4	45.4	958 (15-)	87.2	2.6	9.2

[1] YEAR OF PUBLICATION

[2] YEAR OF NATIONAL CENSUS SURVEYS IN RESPECTIVE RACE GROUPS

The quantity of cigarettes smoked by current smokers was calculated in terms of number of cigarettes per day and in pack years for ever smokers and is shown in Table 6.7 for men and Table 6.8 for women in the present study. Overall, women smoked less than men. The quantity of cigarettes smoked appeared to be similar to that recorded in the studies quoted above.

7.3.3 INVOLUNTARY/PASSIVE SMOKING

Passive smokers in the present study were defined as respondents who were never smokers and lived in households where there were one or more smokers. Never smokers who lived in households where there were never smokers were used as controls. Using this definition 21.4% of men and 59.7% of women were defined as passive smokers. The present study was not specifically designed to examine involuntary smoking. The method used to identify involuntary smokers may have limitations. It is based on the assumption that the involuntary smokers were exposed for a significant period of time to smokers in the households and that the smokers smoked in their presence. Given the socio-cultural patterns of Indians in South Africa it is reasonable to believe that the former is the case (Meer, 1969). Indian families maintain an extended family unit. Any potential bias may be controlled for because a control group was selected from within this study. A similar

method was used by Sandler *et al* (1989) to evaluate the factors associated with household exposure to tobacco smoke in a study of 48342 adults in Washington County, Maryland. These workers found this method useful to examine household exposure to involuntary smoking.

The control group was matched with the study group in terms of gender, age and SE status. However the findings in this study in relation to involuntary smoking must be viewed with the potential limitations discussed above in mind.

7.3.4 ALCOHOL CONSUMPTION AND SMOKINIG

As noted in other studies on alcohol and respiratory diseases (Lebowitz, 1981; Lyons *et al*, 1986; Lange *et al*, 1988) alcohol consumption was related to smoking status and is shown in Table 6.9. Compared to men, only a small number of women (24.2% vs 2.5%) admitted to drinking alcohol. Therefore the relationship of alcohol to respiratory symptoms, taking into account smoking status, was only examined in men.

7.3.5 OCCUPATIONAL AND OTHER EXPOSURES

Although the present study was not specifically designed to examine the impact of occupational exposure on respiratory health status, an occupational history was recorded in all the respondents. The exposures examined were any exposure to dust, and fumes/vapours in the workplace vs none. Data was not collected regarding the nature of the exposure. Workers subjective assessment of the conditions in the workplace as dusty or not has been shown to be reasonably accurate when correlated with actual dust measurements.

Only 19.2% of men reported any dust exposure in the present study compared to 59.8% in the equivalent study in Tucson, Arizona (Lebowitz, 1977). As expected only a small number of women reported any dust exposure.

Other exposures examined in the present study were fumes/vapours in the workplace and fuel combustion in the home. Only a small proportion of men and women reported any exposure to these factors.

7.4. VARIOUS DETERMINANTS OF SYMPTOMS

7.4.1 SMOKING

The major symptoms examined in this study were cough, phlegm, cough and phlegm, ever wheeze, shortness of breath and shortness of breath with wheezing. Scrutiny of Table 6.10 shows that the presence of all these symptoms were significantly associated with smoking. The crude prevalences of all the symptoms, except cough and phlegm were comparable in women who smoked to prevalences in men who smoked. This finding suggests that compared to men, women in Lenasia are more susceptible to chronic airways disease due to smoking given that the women smoked less than men, as can be seen in Table 6.9. The explanation for this is unclear and has not been reported before. This needs further investigation to exclude personal predisposition based on gender. One possible hypothesis is that smoking may act synergistically with exposure to fumes by women from cooking at home. The preparation of traditional foods by Indian women involves much use of oil, spices and frying over open vessels. Also Indian women spend much longer hours in the kitchen (Meer, 1969).

Smoking was an independent determinant of most of the respiratory symptoms in the present study after accounting for the other potential determinants in a multivariate regression analysis (Table 6.20).

A comparison of respiratory symptoms with 4 selected community based studies is shown in Table 7.2. The rates shown are not age standardised. Cough and phlegm were more prevalent in men and women in the present study compared to Indians in Guyana and Whites in the Cape. Breathlessness in women in Lenasia was, however, higher than in women in Guyana and lower than White women in the Cape.

Miller and Ashcroft's (1971) study in Guyana found a higher prevalence of chronic respiratory symptoms in the East Indian residents compared with the African residents. The differences between the 2 races were not accounted for by smoking or occupational factors. Miller and Ashcroft concluded that Indians appear to have a higher susceptibility than Africans to chronic airways disease. When the rates in the present study are compared Lenasia men had a higher prevalence of the symptoms than Indian men in Guyana. The prevalence of symptoms in Indians in Lenasia was higher than that in a community based survey of Blacks in Gatoona in Zimbabwe (Cookson and Mataka, 1978). There was no community based study of respiratory health status in Blacks in South Africa for comparison.

Table 7.2

PREVALENCE % OF CHRONIC RESPIRATORY SYMPTOMS IN LENASIA SUBJECTS : COMPARISON WITH OTHER COMMUNITY BASED STUDIES

	LENASIA S.A.	BERLIN, NEW HAMPSHIRE USA:WHITES	VILLAGES IN GUYANA:INDIANS	TUCSON, ARIZONA USA:WHITES	BELLVILLE CAPE SA:WHITES
FIRST AUTHOR (YEAR)[1]	LALLOO (PRESENT STUDY)	FERRIS (1962)	MILLER (1971)	LEBOWITZ (1975)	WICHT (1977)
MEN:					
NO (AGE RANGE)	849(15+)	542(25-74)	183(35-54)	1013(25+)	272(20-79)
USUAL COUGH	22.7	35.6	13.1	-	8.1
USUAL PHLEGM	26.3	33.0	10.4	27.1	9.9
WHEEZE	17.9	33.9	-	11.3[2]	22.8
BREATHLESSNESS	20.0	9.3	12.6	32.8	9.6
WOMEN:					
NO (AGE RANGE)	948(15+)	625(25-74)	196(35-54)[3]	1303(25+)	237(20-79)
USUAL COUGH	15.3	14.6	7.7	-	3.4
USUAL PHLEGM	14.0	14.1	6.1	16.6	5.9
WHEEZE	13.3	28.8	-	6.0[2]	27.3
BREATHLESSNESS	22.1	17.2	30.6	42.8	8.9

1 YEAR OF PUBLICATION

2 WHEEZE MOST DAYS

3 NON SMOKERS

7.4.2 RACE

From the foregoing, there appears to be a racial predisposition for the development of chronic airways disease. This observation has been made before by Sluis-Cremer *et al*, 1981) in a study which compared respiratory symptoms and lung function in Black and White miners in South Africa. In this study, Blacks had a lower SE status in comparison with Whites and this therefore did not account for the observed difference. Also smoking did not account for the difference. These authors proposed, however, that Blacks do not inhale cigarette smoke as deeply as their White counterparts. In the present study the higher prevalence of symptoms in women was not accounted for by smoking. The respondents in Lenasia were also asked whether they inhaled the cigarette smoke "deeply, moderately, slightly or not at all". This was correlated with respiratory symptoms. Only in men was there a correlation of chronic cough with deeper inhalation of the smoke (P.01). There was no significant correlation with the other symptoms in men and there was no correlation in women. Sluis-Cremer's hypothesis that the higher prevalence of respiratory symptoms in South African White miners compared with Black miners is due to White subjects inhaling the cigarette smoke deeper does not explain the higher prevalence in Indian women compared with men in the present study.

7.4.3 AGE

The inclusion of younger subjects in the present study would be expected to lower the overall prevalence of symptoms in comparison with studies which focussed on older age groups. An age related increase in all the symptoms is evident from examination of Table 6.10. The effect of age as an independent risk factor has been questioned by Speizer and Tager (1979). They believe that age is closely linked with duration of exposure to other factors and is therefore not an independent predictor of chronic respiratory symptoms. In the present study the multivariate analysis of the determinants of respiratory symptoms found that age was a significant independent predictor of all the symptoms except for wheeze in women (Table 6.20). It was, however, not an independent determinant of any symptom in men. The reasons for the sex differences in this association are not clear.

7.4.4 OCCUPATIONAL EXPOSURES

Occupational exposure to dust was an independent determinant of cough in men (P.001). There was no association with fume/vapour exposure in the workplace. This latter observation has been confirmed previously in community based respiratory health studies (Lebowitz, 1977; Korn *et al*, 1987 and Kryzyzanowski *et al*, 1987). Of course the evidence for dust exposure and chronic airways disease has been

confirmed in workforce based studies (Becklake, 1989). The finding of an independent association of dust exposure as perceived by the male respondents in this study adds to the database on the subject. The shortcomings and strengths of community based studies to implicate dust exposure in the aetiology of chronic airways disease have been discussed by Becklake (1989). The obvious weakness is the absence of quantitative environmental exposures which is only possible in workforce based studies. Their strength lies in the larger number of subjects that give power to the study to detect exposure effects. Community based studies will also tend to obviate the healthy-worker bias inherent in workforce based studies.

As discussed earlier, domestic exposure to fumes/vapours related to cooking (not fuel combustion) may be the environmental factor to explain the higher prevalence of symptoms in Lenasia women. There is no published study that tests this hypothesis. If domestic exposure to cooking fumes/vapours is not the explanation then some other environmental or genetic factor must be implicated. Further studies are needed to confirm or refute these observations and to test the hypothesis.

7.4.5 SOCIOENVIRONMENTAL (SE) FACTORS

SE factors (viz: occupational class, income, and crowding index) were not independent determinants of respiratory symptoms in the present study (Table 6.20). Schooling (less than Std 8) was however an important determinant of cough in men (P.0001). Some authors consider the evidence implicating social class as a risk factor for respiratory symptoms is inconclusive (Speizer and Tager, 1979) and contend that as the measurement of other factors becomes possible, social class may become less important as an independent determinant of chronic airways disease. One needs to note that exposure to environmental factors, for instance occupational exposures, may be dependent on social class. The finding of a significant association of cough with education in men in this study as an independent determinant is important. However, the lack of a similar association in women in unexplained. This is particularly relevant because of the higher prevalence of symptoms in Lenasia women compared with women in many other studies.

Lack of exercise was found to be significantly associated with shortness of breath in men in the present study (Table 6.20). This does not imply a causal association. A plausible explanation is that subjects who experience shortness of breath exercise less than those who do not.

7.4.6 ALCOHOL CONSUMPTION

The excess use of alcohol has often been associated with exacerbations of chronic bronchitis (Speizer and Tager, 1979). This association has led to the colloquial expression "whisky bronchitis" in England (Lyons *et al*, 1986). Alcohol consumption is frequently associated with cigarette smoking as has been confirmed in the present study (Table 6.9). Speizer and Tager suggest that the effect of alcohol, independent of smoking, on the development of chronic airways disease must be relatively small. In the present study the effect of alcohol on respiratory symptoms in men was examined after controlling for smoking. A dose related increase in prevalence of respiratory symptoms was noted (Table 6.19). This was only significant (P.03) for ever wheeze and approached significance (P.07) for phlegm. However, when alcohol consumption was examined in the multivariate regression model which included all the potential determinants of respiratory symptoms, it was not found to be an independent determinant of any symptom or chronic bronchitis. The findings in this study are therefore important in this respect. It also highlights the value of multivariate analysis which is able to account for many variables. Obviously further studies are required to resolve the nature of the association of alcohol with chronic airways disease.

7.4.7 INVOLUNTARY/PASSIVE SMOKING

Involuntary smoking has received considerable attention in the literature as a contributory factor in the aetiology of acute and chronic respiratory disorders (Weiss *et al*, 1983). The United States Surgeon General (1986) has issued a warning against the health effects of involuntary smoking. Based on the published data, the Surgeon General has concluded that this form of smoke exposure increases the occurrence of lower respiratory tract illnesses in childhood and reduces the rate of lung growth during childhood. There is only limited data pertaining to adults which do not permit similar conclusions to that in children. The present study attempted to look at the effect of involuntary smoking in adults in Lenasia. The procedure utilised and its potential limitations have already been alluded to in section 7.3.2.

Altogether 1212 adults in the study were potentially exposed to involuntary smoking (table 6.18). Compared to those not so exposed they exhibited a higher prevalence for almost all the respiratory conditions examined. These were only significant for pneumonia in women (P.02) and approached significance for sinus trouble in men (P.07). When the genders were combined, usual cough, pneumonia and sinus trouble were significant at $P<.05$. Any shortness of breath, chronic bronchitis and asthma approached significance level. This data suggests that involuntary smoking does influence respiratory disorders

in adults. The effect of involuntary smoking on respiratory symptoms may also be due to other exposures or is a sequel to similar exposures during childhood. Similarly the lack of a significant effect for some of the symptoms could be attributed to misclassification due to unrecognised exposures in the control group. When the influence of involuntary smoking was examined in the multivariate regression model it was found not to be an independent predictor (Table 6.20). It is possible that with a larger number of subjects this may have been significant: the ill effects of tobacco exposure are dose related, and passive exposure in general is associated with lower doses than active smoking.

7.4.8 PAST RESPIRATORY ILLNESSES

A history of childhood respiratory trouble (CRT) before the age of 16 years has been shown to be important in the development of chronic airways disease in adulthood (Speizer and Tager, 1979). The possibility of recall bias affecting the association cannot be excluded (Samet *et al*, 1983). The association of CRT illness with chronic airways disease in adults has been demonstrated in cross-sectional studies (Burrows *et al*, 1977) and in longitudinal studies (Samet *et al*, 1983). The association of CRT was stronger for impaired lung function than it was for respiratory symptoms.

In the present study CRT before the age of 16 was reported more frequently in women who were ever smokers and therefore must be accounted for in an examination of the effect of smoking on respiratory symptoms. Also a greater proportion of men and women who reported whooping cough and measles were smokers. The reason for this association is unclear. One possible explanation could be recall bias: smokers who were more likely to have respiratory symptoms may also be more likely to recall any childhood illnesses that could explain their symptoms. Another postulate is that a low SE status may increase the chances of an individual taking up the smoking habit and a lower SE status also predisposes to measles and whooping cough in childhood. The association of smoking with SE status has been demonstrated in several studies.

In the multiple regression model of the determinants of respiratory symptoms CRT was an independent determinant of wheeze with breathlessness in men (Table 6.20). The strong relationship of wheeze with breathlessness has also been demonstrated in several recent studies (Paoletti *et al*, 1989; Di Pede *et al*, 1991). The present results contribute to the increasing database on CRT illness as an important independent predictor of chronic respiratory symptoms.

7.5 DETERMINANTS OF ASTHMA

Asthma is a chronic airways disorder that has stimulated considerable interest in the last decade because of the increase in prevalence, morbidity and mortality from asthma despite advances in therapy (Evans R III *et al*, 1987; Cookson, 1987). One of the limitations in the study of the epidemiology of asthma is that there is no satisfactory definition of asthma that can be readily applied in the field in order to identify the condition with reasonable accuracy (Gregg, 1984). Woolcock (1987) reviewed the problem of definition of asthma and proposed that arbitrary definitions be utilised for epidemiologic purposes, acknowledging that there are several kinds of asthma. She also suggested that the questionnaire assessment of asthma be validated against tests of bronchial hyperresponsiveness (BHR). The present study, like many epidemiologic studies of respiratory health status, did not measure BHR.

The overall prevalence of asthma by physician diagnosis was 3.6% (95% confidence interval of 2.7%-4.3.%). The prevalence of asthma in selected populations in developed and developing populations around the world are shown in Table 7.3. The Indians in Lenasia had a higher prevalence of asthma compared with most countries except the Tucson, Arizona community and the Finnish rural community. The Tucson study used the same definition as the present study and the Finnish study used a measure of BHR. Except for the Tucson study, most others are not strictly comparable because of the different definitions employed. Therefore the differences noted in the Table may not represent true differences in the prevalence of asthma.

It would be useful if the studies had used several definitions so that international comparison is facilitated. Table 6.11 shows the prevalences of asthma by gender in the present study using several definitions of asthma that have been used previously. The definitions based on symptoms show a higher prevalence of asthma than that based on the diagnostic category of asthma which is obviously influenced by physician bias in the specific regions. As well as by access to medical sources the present data suggests that subjects do not report asthma unless so diagnosed by a doctor. Burney and Chinn,

1987 assessed the sensitivity and specificity of the question "have you had wheezing or whistling in your chest at any time in the last 12 months" against a test of BHR. They found that this question had a sensitivity of 86% and a specificity of 72%. The overall agreement was 76%. Using this definition without including the time limit of "in the last 12 months" a prevalence of 17.7% and 13.2% was obtained in men and women respectively in the present study.

Table 7.3

CRUDE PREVALENCE RATES OF ASTHMA IN SELECTED STUDIES

FIRST AUTHOR (YEAR)	POPULATION CITY/REGION COUNTRY	SUBJECTS RACE, NO. (AGE RANGE)	DEFINITION OF ASTHMA	METHOD	PREVALENCE %
BURR (1975)	COMMUNITY SOUTH WALES U.K.	WHITES, 3065 (20-44)	Wheeze and claimed to have asthma	Questionnaire Survey	3.4
DODGE (1980)	COMMUNITY TUCSON, ARIZONA USA	WHITES, 3069 (15 +)	Have you ever had asthma? was it confirmed by a doctor	Questionnaire Survey	6.2
ANDERSON (1965)	COMMUNITY CHILLIWACK CANADA	WHITES, 557 (25-74)	Asthma diagnosed by a physician	Questionnaire Survey	1.1
FINLAND (1970)	RURAL COMMUNITY FINLAND	WHITES, 3721 (20-59)	Bronchial hyper-reactivity	Methacholine and isoprenaline challenge	8.4
VISWANATHAN (1969)	URBAN COMMUNITY PATNA, INDIA	INDIANS, 11392 (10-70+)	Not stated	Questionnaire Survey	2.4
WOLSTENHOLWE (1979)	ISLAND COMMUNITY MALDIVES	INDIANS, 2760 (15+)	History of variable airways obstruction and audible rhonchi	Questionnaire Survey	3.3
COOKSON (1980)	SEMI-URBAN COMMUNITY ZIMBABWE	BLACKS, 4994 (20+)	Variable wheezy breathlesness	Questionnaire Survey	1.6
LALLOO (PRESENT STUDY)	COMMUNITY LENASIA S. AFRICA	INDIANS, 1819 (15+)	Have you ever had asthma? was it confirmed by a doctor	Questionnaire Survey	3.6

The association of asthma with selected symptoms, disorders and environmental factors are shown in Table 6.12. An unusual finding was the positive association of asthma in men who "spent most of their life in a rural area". The association with eczema, hayfever and any allergy is well known and was confirmed in this study. Unlike other studies, smoking was not a significant determinant of asthma.

The determinants of respiratory symptoms that were examined in the multiple regression model were also examined in relation to the reported diagnosis of asthma. The only relevant determinant that emerged as an independent predictor of asthma in men was a history of CRT ("any chest problem before the age of 16"). The odds ratio for this factor was 11.14 (P.0001). This finding could be explained on the basis that a significant number of the respondents who answered "yes" to the question "have you ever had asthma " may have had the onset of their asthma in childhood. It could also be a chance finding due to the multiple associations tested.

7.6 DETERMINANTS OF CHRONIC BRONCHITIS

Chronic bronchitis forms a major component of chronic airways disease (Woolcock, 1987). It was defined by the Ciba Guest Symposium of the British Thoracic Society in 1959 as chronic or recurrent hypersecretion

of mucus into the bronchial tree" and chronic was defined as "occurring on most days for at least 3 months in the year during the last 2 years" (Ciba Guest Symposium, 1959). Because of its frequent association with airway obstruction qualifying labels such as "simple" or "obstructive" were added to the definition (Medical Research Council, 1965). It has also been suggested that term "chronic bronchitis" be replaced by the term "chronic mucus hypersecretion" in order to obviate the confusion related to the term chronic bronchitis and that the term COPD be added to qualify the presence of airway obstruction (Vermiere, 1991).

Chronic bronchitis is more common in men than in women all over the world and inceases with age in men and women. Population studies showed a strong association with tobacco smoking and air pollution (Woolcock, 1987). At the IUATLD/WHO consultative meeting, Woolcock highlighted the need to obtain reliable data to assess the nature and magnitude of chronic airways disease and to identify the role of identified and putative risk factors. The findings in the present cross-sectional study respond to this need.

Table 7.4

PREVALENCE % OF CHRONIC BRONCHITIS IN SELECTED STUDIES

FIRST AUTHOR (YEAR)	CITY:REGION COUNTRY	POPULATION RACE:NO.	AGE RANGE	MEN SMK[1] %	MEN CHRONIC BRONCHITIS TOTAL	MEN NSMK[2]	MEN SMK	WOMEN SMK %	WOMEN CHRONIC BRONCHITIS TOTAL	WOMEN NSMK	WOMEN SMK
LEBOWITZ (1975)	TUCSON,ARIZONA USA	COMMUNITY WHITES:3805	15+	36	-	2.4	8.4	30	-	5.1	7.9
HIGGINS (1978)	TECUMSEH MICHIGAN, USA	COMMUNITY WHITES:4699	20-74	56.6	16.5	5.1	29.9	36.2	5.9	3.5	15.3
LA VECCHIA (1988)	NATIONAL CENSUS ITALY	HEALTH SURVEY ITALIANS:72284	16+	44.0	-	4.1	8.7	17.7	-	3.5	5.8
PANDEY (1984)	HILL REGION NEPAL	COMMUNITY INDIANS:2826	20-80	78.3	17.6	3.0	18.6	58.9	18.9	13.8	20.8
VISWANATHAN (1977)	DELHI INDIA	URBAN AND RURAL INDIA NS:300	35-74	-	12.0	-	-	-	5.0	-	-
COOKSON (1978)	ZIMBABWE	SEMI-URBAN BLACKS:9287	35-44	-	7.6	-	-	-	11.6	-	-
LALLOO (PRESENT STUDY)	LENASIA S. AFRICA	COMMUNITY INDIANS:1819	15+	54.8	4.6	3.2	5.9	11.8	6.3	4.5	10.6

[1]SMK = SMOKERS

[2]NSMK = NON SMOKERS

The prevalence of chronic bronchitis was 4.6% in men and 6.3% in women in Lenasia. Age was found to be an independent determinant of this condition in women but not in men in the multiple regression model which was used to examine the determinants of respiratory symptoms and chronic bronchitis. Table 7.4 shows the crude prevalence rates of chronic bronchitis in selected published studies around the world for comparison with the present study. The most directly comparable study was the study in Tucson which used similar methodology. An important feature noted in this Table is that the prevalence of chronic bronchitis was higher in women than men not only in the present study, but also in Cookson's study in Zimbabwean Blacks, and Pandey's study in Nepal. This is contrary to the usual picture as outlined by Woolcock. A higher prevalence was also noted in women in Samet *et al's* study of Hispanics and Anglo Whites in New Mexico, USA (1982), which is not shown in the Table. The increased susceptibility of women, in this and some other studies, to chronic bronchitis and certain respiratory symptoms as noted earlier (see section 7.4) is not readily explained. The possibility of other exposures eg. to indoor pollution related to cooking as may be the case in women in Lenasia needs to be examined in future studies.

Pandey (1984) suggested that the higher prevalence of chronic bronchitis in women in his study in Nepal was due to the increased exposure to domestic smoke caused by wood and straw fires used for cooking and heating in ill-ventilated houses without chimneys which was

experienced by women. This did not explain the higher prevalence of this disorder in women in the present study. Only a very small proportion of homes in Lenasia used wood, gas or coal as cooking fuel, and, in the multiple regression model which was used to examine the determinants of chronic bronchitis in addition to selected respiratory symptoms, domestic combustion of these fuels were not found to be important. Whilst the prevalence of chronic bronchitis was higher in smokers in both genders it still did not explain the discrepancy.

The association of chronic bronchitis with other chronic disorders in the Lenasia respondents was examined in Table 6.16. Only "any kind of heart trouble" was significantly associated with chronic bronchitis in men, whereas in women all the chronic conditions except for diabetes (which was of borderline significance) were significantly associated with chronic bronchitis. Of note also is that most of the chronic disorders were higher in women compared with men. The nature of these associations ie. whether causal or not could not be examined in this study given its cross-sectional design. Smoking could be the common factor associating heart trouble and, stomach and duodenal ulcers with chronic bronchitis. A similar association as was found in Lebowitz *et al's* study in Tucson, Arizona (1975). Diabetes and its effect on lung function has received attention recently (Sandler *et al*). However, there were no published studies of its association with chronic bronchitis. These associations need to be explored further in future studies.

7.7 DETERMINANTS OF SINUS TROUBLE

A high prevalence of sinus trouble was noted in the present study (see Table 6.13 and 6.14). The determinants examined in relation to respiratory symptoms were also examined in relation to reported sinus trouble. The findings were interesting in that SE factors (schooling and medical aid), dust exposure, any kind of chest trouble and a history of recent chest illnesses (chest colds bronchitis or pneumonia in the last 3 years) were all highly significantly associated with the reporting of sinus trouble in the respondents (see Table 6.22). Sinus trouble was also significantly associated with asthma in women and not men (see Table 6.12).

These findings may be pertinent in relation to the aetiology of chronic airways disease. There is evidence implicating sinus trouble in the pathogenesis of asthma and the results in the present study contributes to that database (Slavin, 1982). The association with other chronic airways disease has not been studied before and the IUATLD/WHO consultative meeting did not discuss this association. The association of aspiration of nasopharyngeal contents with pneumonia has however been discussed previously (Lorber and Swenson, 1974).

One possibility is that the subjects who develop chronic airways disease are also susceptible to developing sinusitis, noting that the mucosal lining of the sinuses are similar to that of the bronchial tree. An alternative explanation would be that subjects with sinus disease aspirate infected contents from the sinuses into the tracheobronchial tree. In an elegant study, Bardin *et al* (1990) failed to demonstrate that subjects who had sinusitis with and without asthma aspirated radiolabelled sinus contents into their tracheobronchial tree. This finding tends to refute the aspiration hypothesis.

7.8 CHRONIC NON-SPECIFIC LUNG DISEASE

The Ciba Guest Symposium (1959) grouped the chronic airways disease under the umbrella term of "chronic nonspecific lung disease". The term was used by Dutch workers as "chronic aspecific respiratory disease". Similar terms were adopted by researchers in other countries. For instance, Ferris *et al* (1971) used the term "chronic nonspecific respiratory disease" (CNSRD) and defined it as chronic airways obstruction (FEV_1/FVC ratio of $< 60\%$), and/or chronic phlegm production, and/or asthma, physician diagnosed. The prevalence of CNSRD as defined by Ferris *et al* was determined in the respondents in the present study. A comparison of the prevalence of CNSRD in Lenasia with the Tucson study (Lebowitz *et al*, 1975) and the Berlin, New Hampshire study (Ferris *et al*, 1971) is shown in Table 7.5. The rates in

the Lenasia study do not include the criteria of chronic airway obstruction. This will lead to lower estimated rates. Despite this the rates in Lenasia women were higher than that in Tucson. Furthermore, the women in Tucson have a higher prevalence of smoking than the women in Lenasia (see Table 7.1).

The finding of a higher prevalence of CNSRD in Lenasia women is consistent with the higher prevalence of certain respiratory symptoms and chronic bronchitis. This emphasises the need for further research to confirm and explain this finding.

Table 7.5

PREVALENCE % OF CHRONIC NON SPECIFIC RESPIRATORY DISEASE CNSRD[1] BY SMOKING STATUS IN LENASIA AND COMPARISON WITH THE TUCSON AND BERLIN, NEW HAMPSHIRE STUDY

SMOKING HISTORY	LENASIA[2] (LALL00)	TUCSON (LEBOWITZ 198%)	BERLIN (FERMS 1971)
MEN:			
TOTAL	22.8	42.4	33.3
NEVER SMOKER	14.3	21.6	12.8
EX SMOKER	30.9	42.2	20.6
CURRENT SMOKER	29.7	56.2	46.6
WOMEN:			
TOTAL	17.8	33.7	17.2
NEVER SMOKER	16.3	26.0	12.2
EX SMOKER	24.0	31.3	12.9
CURRENT SMOKER	30.7	46.8	27.1

1 DEFINED AS WHEEZING MOST DAYS AND/OR GRADE III DYSPNOEA AND/OR PHLEGM AND/OR ASTHMA STILL PRESENT AND/OR FEV_1/FVC RATIO < 60%

2 EXCLUDES FEV_1/FVC RATIO < 60%.

CHAPTER 8

DETERMINANTS OF LUNG FUNCTION

8.1 GENERAL COMMENTS

This chapter deals with the distribution and determinants of lung function in the study population. Becklake (1986) reviewed the biologic factors that may influence the level of spirometric lung function. She classified them into intra-subject, inter-subject and inter-population differences. Intra-subject factors include measurement errors (technical) and diurnal and seasonal effects. Stature, gender, race, socio-economic and environmental factors are examples of inter-subject sources of variation. Inter-population differences may be due to all the above and selection factors which determine the inclusion of subjects into studies from which reference values are derived. The potential determinants of spirometric lung function will be discussed in relation to this study. Ethnic factors and certain environmental factors like altitude were examined by comparison with published studies in other populations. These comparisons will obviously be limited by methodological differences.

8.2 METHODOLOGICAL ISSUES PERTINENT TO THE INTERPRETATION OF THE RESULTS IN THE PRESENT STUDY

8.2.1 RESPONSE RATE

Amongst the subjects in the 18-45 year age category who were sampled for lung function there was a satisfactory response rate of 74.0% and 65.7% in men and women respectively. These rates provided a sufficient number of subjects to examine the determinants of lung function (see section 5.2.2.1). There were no differences in the prevalence of respiratory symptoms, diseases, socio-environmental characteristics and exposures between the subjects who had lung function and those who did not, including the defaulters and those not sampled in this age category. On this basis, therefore it seems reasonable to regard the spirometric measurements analysed as generalisable to the 18-45 year age group of the questionnaire respondents in this study.

8.2.2 METHODS OF MEASUREMENT

The spirometer used in this study was a bellows type model S Vitalograph^{R}. This instrument complied with the minimum specifications of the ATS (Gardner, 1979). The Vitalograph^{R} is a robust instrument which has been has been widely used in epidemiological studies (Mc Dermot *et al*, 1982; Myers *et al*, 1985; Fox, 1988; White, 1989; Hessel and Sluis-Cremer, 1989; Goldin, 1990; Mokoetle, 1990; and Lalloo *et al*, 1991). It has been shown to give reproducible results (Rees, 1988).

Standardisation of methodology has markedly reduced measurement error and improved comparability of results of spirometric tests. Nevertheless there are several other potential technical sources of error in lung function measurements, including a) number of trials and selection of results to be reported, b) observer (technologist) related, c) subject co-operation and comprehension, and d) temperature and altitude (Clausen, 1982). For forced vital capacity, measurement error in normal subjects is estimated at 3% in good laboratories and approximately 6% for $FEF_{25-75\%}$ (Clausen, 1982). Measurement error, if random affects the internal validity of a study and if systematic affects the external validity (Becklake, 1986).

The strict protocol for lung function measurement in this study, including adherence to standardised methodology (Gardner, 1979), can be assumed to have maximimised its internal vailidity as well as its comparability with other studies using similar standardised methodology.

The instrument was calibrated daily. The ambient temperature ranged between 21 and 26 degrees centigrade during the study period. It has been shown that routine correction to BTPS was appropriate for the spirometer within this temperature range, also noting that the instrument was kept in the same room throughout the study so that it remained equilibrated with the environment at all times (Cramer *et al*, 1984). All tests were carried out by the same tester (the author). This eliminated the variability between testers which could lead to within study differences. All the tests were performed between 08h00 and 14h00 over weekends during late spring. This should reduce any potential diurnal and seasonal influences. All tests were conducted with the subjects in the standing position utilising noseclips. This posture was recently shown to produce slightly higher values than in the sitting position (Lalloo *et al*, 1991).

Anthropometric measurements were also made by a trained individual using standardised procedures as described in section 5.2.2.3. This procedure is often not described in most studies involving lung function.

8.3 DETERMINANTS OF LUNG FUNCTION

8.3.1 GENDER

Like most biological variables, the spirometric indices are different in men compared to women and were therefore analysed separately. For instance, the FEV_1 after standardising for age 35 years and height 170cm, was 560ml (17.9%) higher in men in the present study. Cotes (1979) estimated that the vital capacity was 8% higher in boys before puberty. The difference in gender becomes marked during adolescence when boys experience a greater increase in the lateral and longitudinal dimensions of the thorax (Brody *et al*, 1970). The strength of the respiratory muscles is also greater in men (Cooke *et al*, 1964).

During growth the weight of the lungs in girls increases in tandem with the increase in volume whereas in boys the weight lags behind the volume increase. This is attributed to the lungs of women having a greater collagen content. This increases the forces which allow expansion of the lung without a corresponding increase in the elastic recoil and partly explains the larger lungs in men.

The proportion of the forced vital capacity expired in one second (FEV_1/FVC) was greater in women than men in this study (83.4% vs 81.7%) and has been observed previously (Cotes, 1979). This may be related to the greater strength of the respiratory muscles in men possibly rendering the airways more susceptible to dynamic compression thus accounting for the discrepancy between males and females.

8.3.2 CHRONOLOGICAL AGEING

All studies in adults show that after a certain age the VC and the FVC and its derivatives decrease. The age at which the decline starts is obviously after full growth is achieved, and after a varying period of stability thereafter. This was also noted in the present study in men and women and is inferred from the age co-efficient of the regression equations for the spirometric indices presented in Appendix 5. This phenomenon was also present in asymptomatic never-smokers. The period of stability was not defined in the present study. It was also demonstrated by Hutchinson (1846) who first measured spirometry in epidemiological studies. The ageing process appears to be mainly a biological one (Thurlbeck, 1991). The effects of ageing are exaggerated by exposure to environmental pollutants, smoking and recurrent

respiratory tract illnesses.

The TLC remains constant once full growth of the lung is achieved. The VC decreases as a consequence of an increase in RV. The RV is determined by the balance between the outward recoil of the chest and the maximal force that expiratory muscles are able to generate (Leith *et al*, 1967). The resting length of the elastic structures of the airways and lung parenchyma increases with age, although the actual amount of elastic tissue remains constant. This finding is thought to explain the decrease in VC accompanied by the increase in RV (Knudson, 1991).

The lung function of men was expected to deteriorate faster than that of women. In the present study the FVC in men who were never smokers and free of cardiorespiratory disease declined by 24.6ml per year and by 9.2ml per year in women. Similarly, the FEV_1 and most parameters of flow decline at a faster rate in relation to age in men (Appendix 5). The faster decline in spirometry in men is found in most epidemiological studies of lung function. Whilst it could be a biological phenomenon, the greater burden of environmental exposures in men compared to women may also contribute to this finding. It is obviously unexplained by smoking.

The age related decline in the spirometric indices is predicted from the co-efficient for age in the regression equations. This is obtained by standardising for height and drawing the "best fit" line through the points. Cotes (1979) estimates the annual decline in FEV_1 to be about 30ml per year. The rate of decline is proportional to body size (Cole, 1974). In the present study the annual rate of decline of FEV_1 in men and women was 36.4ml and 20.4ml respectively.

The regression equations on lung function are used in routine clinical practice to predict the expected lung function values. The prediction equations used in pulmonary function laboratories all over the world have, for the most part been derived from cross-sectional studies such as the present one. Use of cross-sectional data incorporates the assumption that young cohorts will experience the same environmental and other influences as the older cohorts. At least 2 longitudinal studies on spirometry have shown this to be incorrect (Glindmeyer *et al*, 1982; Burrows *et al*, 1986) and they showed that the predicted values from the cross-sectional analyses at inception over-estimated the annual change in spirometry when compared to the actual observed decline, in the longitudinal study cohorts, even after accounting for the learning effect. It is also conceivable that cross-sectional data may overestimate the decline if a particular population experiences adverse environmental factors over a period of time. Therefore the cross-sectionally determined annual decline in lung function must be considered with reserve.

8.3.3 BODY CHARACTERISTICS

The results of the anthropometric measurements carried out on the Indians in Lenasia were similar to those in reported in published studies of Indians in other parts of South Africa (Omar *et al*, 1986; Seedat *et al*, 1990). They were also similar to those of the Indians in Guyana (Miller *et al*, 1970), Indians in India (Cotes *et al*, 1975) and the Pakistanis (Ayub *et al*, 1987). Whilst the Indian men in this study had comparable anthropometric characteristics to the South African black men in the study (van de Wal *et al*, 1971 and Mokoetle, 1990), the Indian women were much lighter and had a lower BMI than the black women. The white men in Goldin's study (1989) were taller and heavier than black and Indian men in South Africa. However, the sitting/standing height ratios were comparable in Indian men in the present study to those in Black and White men in Goldin's study (1989). There were no studies in white women in South Africa for comparison.

As mentioned earlier, most epidemiologic studies of spirometry show that stature (standing height) is the most significant predictor of lung function (Becklake, 1986). There are only a few studies which have examined the effect of using other measurements of stature like sitting height and sitting to standing height ratio (Goldin, 1989; Mokoetle, 1990). In the present study these latter parameters did not improve the

R^2, ie improve the proportion by which stature explains the inter-subject variability in lung function in men and women (Tables 6.29 and 6.30). Goldin's study on black bank workers in Johannesburg showed that the sitting/standing height ratio was superior to standing height alone and was reflected by an improvement in the R^2. This was not confirmed by Mokoetle's data which was also based on Black university workers in Johannesburg. The reason for the disparity is uncertain and is unaccounted for by methodological differences because these studies including the present one used similar standardised techniques to measure lung function.

Weight contributes about 2% to the overall variation in FVC (Becklake, 1986). In this study weight had a significant effect on FVC, FEV_1 and $FEF_{25-75\%}$ (Tables 6.29 and 6.30). However it did not contribute much more to the overall R^2. The index of body mass, BMI (Kg/cm^2) contributed less to the R^2 than when height alone or when height and weight were included in the regression analysis. Even in South African black women in Mokoetle's (1990) study who were much heavier and had BMI's in the obese range, weight did not contribute significantly to the overall variation in the spirometric indices.

Schoenberg *et al* (1978) recommended a quadratic, polynomial regression equation including indices of weight and showed that the R^2

was improved compared with convential regression equations using age and height only. They contended that lung function was positively influenced by muscularity and that weight is an index of muscularity. This approach is criticised by most pulmonary epidemiologists because Schoenberg's equation is cumbersome, not readily applicable to most clinical situations and does not obviate the effect of race. Furthermore, the values derived from this equation are comparable to other studies and the R^2 was not greatly improved over that in other studies.

8.3.4 SMOKING AND LUNG FUNCTION AND THE "HEALTHY" SMOKER EFFECT, AND PASSIVE/INVOLUNTARY TOBACCO SMOKE EXPOSURE

The detrimental effects of tobacco smoke exposure especially on the respiratory system are well known. It has been shown to cause an accelerated decline in lung function and is the major cause of COPD the world over (United States Surgeon General, 1984). The evidence is derived from cross-sectional studies which show that damage, especially at the level of the small airways, may be detectable after a relatively short smoking history, and from longitudinal studies which show that smoking is associated with an increased rate of loss of lung function over time. All epidemiological studies on lung function either

exclude smokers if the aim is to examine lung function in healthy individuals or control for the effects of smoking if the objective is to examine influences like environmental factors on lung function. It is assumed that smokers will have poorer lung function when compared with non-smokers, whether they have symptoms or not. Therefore, almost all reference values for lung function are derived from healthy non-smoking populations (Clausen, 1982).

The present study also examined smoking as a determinant of lung function. The subjects who underwent lung function tests were relatively young (18-45 years), and compared with never smokers, both men and women ever-smokers in this study had higher mean values for all the spirometric indices, except for the $FEF_{25-75\%}$, compared with never smokers (Table 6.16 and 6.17). However, these differences were only significant for the the VC and FVC in women (P.05) after standardising for standing height. The regression equations for spirometry also predicted slightly higher values for FEV_1, for example, in both men and women if the equation was derived from the group of subjects which included asymptomatic smokers compared to that derived from the asymptomatic never-smokers (Table 6.33 and Appendix 5).

Regression equations on spirometric lung functions were also derived for the men who were ever smokers but free of cardio-respiratory symptoms and disease (Apppendix 5.7). The highest FVC value was obtained from this equation compared to the other regression equations (Table 6.33). A similar analysis was not possible in women because of the smaller number of asymptomatic smokers. However, extrapolating from the findings in the regression equations it is likely that this effect may well have been enhanced in this gender if there were sufficient numbers of women smokers to perform this analysis.

The observation that relatively young adult smokers may have higher than average values for some spirometric indices has been made before by Becklake and Lalloo (1990). They coined the term "healthy" smoker effect to describe this phenomenon. This term was derived from the "healthy worker effect" (Last, 1988) which was originally coined to describe the more favourable mortality experience of occupational groups compared to that of the general population - the usual reference group used for calculation of standardised mortality ratios (McMichael *et al*, 1976; Howe *et al*, 1988).

The evidence for the concept of the healthy smoker effect was found in published studies of lung function which were reviewed by Becklake and Lalloo (1990). Many of the papers quoted in this review failed to recognise the effect, possibly because of the assumption that smokers

always had poorer lung function. It is suggested a similar health selection process as in relation to the "healthy" worker effect operates with smoking. The finding of the "healthy" smoker supports the concept that an individual takes up the habit of smoking because his/her lungs are relatively resistant to the early effects of smoking. If this is correct then the earlier studies may have underestimated the effects of smoking on lung function.

Smokers do however, still demonstrate a faster decline in lung function. The FEV_1 appears to deteriorate at a faster rate in healthy smokers (Appendix 5.7) compared to healthy never smokers (Appendix 5.6) and was 41.7ml and 36.4ml per year respectively, inferred from the age co-efficients of the regression equations. The latter effect was not observed for all parameters of spirometry probably because this study examined lung function in a relatively young subset of subjects, and given sufficient exposure time an accelerated decline may have been noted.

The implications of the "healthy" smoker effect in this and other studies are several. Firstly, as already stated it suggests that the effects of smoking may be underestimated; secondly, excluding smokers from studies of lung function in the young adults in population studies may exclude individuals with higher values and so prediction values derived from such data may under-estimate the lung function level of the

population they describe or to which they are applied; and thirdly, the concept may also throw light on the characteristics which identify the susceptible smokers. Prospective studies are required to elucidate these concepts further.

The relatively minimal effects of smoking on lung function in this study may also be due to the young age group studied since the quantity of cigarettes smoked by the subjects compares with that reported in other studies in men (Lebowitz *et al*, 1975). The effects of smoking in the present study remained small even after controlling for other potential determinants like socio-environmental status and alcohol (Table 6.33). However, the number of women smokers were small.

A significant finding in the present study was that passive/involuntary tobacco smoke exposure in the home environment had a deleterious effect on the FEV_1/FVC ratio in women, after accounting for the other variables. The evidence for the effect of passive smoking on lung function in adults is increasing, although inconsistent in many studies (Samet *et al*, 1987). The finding in this study of a significant effect of passive smoking on the FEV_1/FVC ratio adds to the evidence that this form of environmental exposure is deleterious to health. A cross-sectional study in 163 non-smoking Dutch women found an adverse effect of passive smoking (Remijn *et al*, 1985; Brunekreef *et al*, 1985).

They showed reductions in most spirometric values, although it was only significant for flows at higher volumes. This was similar to the findings in the present study, in that the FEV_1/FVC ratio which is an index of flow at higher volumes was lower in passive smokers. Other studies did not find an effect on lung function. For instance, Kentner *et al* (1984) found no effect in 1351 white collar workers in Germany. Jones *et al* (1983), also found no effect in a case-control study of a cohort in the Tecumseh Health Study cohort, after accounting for domestic fuel exposure. Domestic fuel exposure was controlled for in the present study.

8.3.5 ALCOHOL

Alcohol has been postulated to have a specific toxic effect on the lung (Burch and DePasquale, 1967). The present study showed that alcohol consumption in men was associated with a -140ml mean difference in FVC and a -120mldifference in FEV_1 compared with non-drinkers after accounting for socio-environmental factors, smoking, dust exposure, age and height (Table 6.33). However these differences were only significant at the 7% level, and the numbers were too small to look for a dose-response effect.

Two recent studies showed opposite effects of alcohol on the lung after controlling for smoking. Lyons *et al* (1986) found no effect of alcohol on lung function in 27 chronic alcoholics referred to their clinic for various alcohol related problems when compared with matched controls. The lack of an effect of alcohol was confirmed in 2 large epidemiological studies (Cohen *et al*, 1980; Sparrow *et al*, 1983). The study by Sparrow *et al* controlled for SE status by controlling for number of years of schooling. On the other hand, Lange *et al* (1988) found that alcohol consumption of => 350ml/week was associated with an accelerated loss of FEV_1 comparable to the effects of 15g of tobacco/day in a population study in the city of Copenhagen. The latter study did not control for socio-environmental status or other environmental exposures apart from smoking. They concluded that moderate alcohol consumption was associated with significant loss of lung function. This has been shown previously by Lebowitz (1981).

The studies on alcohol may be limited by underreporting of the quantity consumed which serves to overestimate the effect of alcohol. The findings in the present study suggests that alcohol consumption may be an independent predictor of impairment in lung function. There is sufficient evidence to warrant further study into the effect of alcohol on lung function.

8.3.6 SOCIO-ENVIRONMENTAL (SE) STATUS

A review of the literature suggests that SE factors are important determinants of lung function and need to be accounted for in between-population comparisons of lung function (Steinberg and Becklake, 1986; Becklake, 1986). The limitations relating to the measurement of SE status in different populations has already been discussed in Chapter 7 in relation to the determinants of respiratory symptoms. The difficulty in controlling for other determinants of lung function in studies has in part been overcome by the routine availability of statistical packages to perform multi-variate analyses that can control for the determinants of lung function.

Previous studies have shown an effect of SE factors on lung function (Stebbings, 1971; Lebowitz, 1977; Cohen *et al*, 1977) These studies which were reviewed by Steinberg and Becklake (1986) were not strictly comparable because they used different SE indicators. Many used a scoring system developed from a number of individual variables. Although occupation showed the strongest link to lung function in their review, the present study did not show this.

In the present study several potential SE determinants of lung function were collected because of the lack of standardisation of the measurement of SE factors in different populations and the fact that SE factors are likely to be country-specific (Nikon and Pearn, 1980;

Steinberg and Becklake, 1986). These were examined in relation to FVC, FEV_1, $FEF_{25-75\%}$, FEV_1/FVC and PEF, after controlling for age, stature, smoking. The results of the multivariate analysis of the determinants of lung function shown in Tables 6.33 and 6.34 were also discussed in sections 6.25 and 6.26. Occupation, income and crowding index did not significantly influence the lung function indices in this study. The reason for income not being significant may be related to inaccurate reporting, questions on income being a sensitive issue in studies (Liberatos *et al*, 1988), or to the general upward social mobility of the Indians in South Africa (Meer, 1969). There was also an inadequate representation of the lower occupational strata in this study. This was a reflection of the overall higher SE status of Indian South Africans in relation to black South Africans.

The study of Mokoetle (1990) in Black university employees in Johannesburg also showed inconsistent relationships of SE factors to lung function. She found a positive relationship of FEV_1 with occupational status and educational level, a negative relationship with PEF and an inconsistent one with $FEF_{25-75\%}$. On the other hand, Goldin's (1989) study, using a composite socioeconomic index, showed a direct relationship between SE status and lung function level in Black bank employees in Johannesburg, higher SE status being associated with higher lung function levels. The lack of a consistent effect in

Mokoetle's study may be attributed to the lack of adequate SE representation in her study sample. However, Mokoetle's study also found the highest spirometric values in Blacks ever reported.

In the present study the effect of SE status was most marked in women in relation to "rural" residence. Women who "spent most of their lives in a rural area" had a higher mean difference in the least square means (LSM) of 240ml for FVC and 250ml for FEV_1. This was significant at P.08 and P.04 levels respectively. This finding can be explained on the basis that a rural life is associated with less environmental pollution and may be associated with a higher level of habitual physical activity (Cotes, 1979). The absence of a similar trend in men is unexplained. Although the level of voluntary tobacco smoke exposure was higher in men this did not account for the lack of an effect of rural residence because this analysis controlled for all other influences, including dust and fume exposure in the work environment.

In men none of the SE factors examined, except being a member of a medical aid plan, had a significant effect on the spirometric indices examined, even at the $P<.10$ level of significance. This is discussed further below. In women, however, education had a significant effect. Women who had a university education had a difference in the LSM of 410ml and 390ml in the FVC and the FEV_1 respectively. These were

significant at the $P<.05$ level (see Table 6.33). Also women who had more than 10 years schooling (higher than standard 8) had a difference of -2.7% (P.09) in the LSM of the FEV_1/FVC ratio. Why education and not the other SE indicators was related to lung function is unclear. Faia (1981) found that women receive less income in relation to their educational status compared to white males when education is measured by number of years of schooling but not by certification. However, in the present study both education and certification (university education) were associated with an effect on lung function. Education is considered to be the most important single indicator of social class and has more frequently been shown to be associated with health status than other indicators (Liberatos *et al*, 1988). The absence of a similar effect in men is once again unclear.

As already mentioned, information on medical aid or medical insurance, often not available in community based surveys was collected in the present study. The possession of medical aid implies better access to health care in South Africa, a country which does not have a national health care system. It is therefore reasonable to expect people with medical insurance to have a better health status (Benatar, 1991). This factor has not been addressed in previous studies. In the present study men had a better FVC and FEV_1 level if they had medical aid. This finding lends support to the hypothesis that medical aid predicts a

higher SE status and consequently, better lung function. This needs to be looked at in future studies which examine SE influences on disease. The absence of a similar effect in women is unexplained.

In conclusion the findings in this study suggest that SE factors do influence lung function but that this relation is inconsistent between Indian men and women. Many of the the associations observed were statistically significant especially in women and are therefore important in considering the determinants of lung function.

8.3.7 PREVIOUS RESPIRATORY ILLNESSES

Previous respiratory illness, in particular childhood respiratory trouble (CRT), has been proposed as one of the potential non-cigarette associated risk factors for the development of COPD in adulthood (Samet *et al*, 1983). Many of the studies which found associations obtained illness histories from retrospective questionnaire data and were therefore subject to preferential recall bias. Subjects with symptomatic COPD were more likely to remember childhood respiratory illnesses compared to those without COPD (Samet *et al*, 1983). This source of bias needs to be considered when reviewing the evidence in support of this hypothesis.

The association of CRT was first identified in epidemiological investigations in adults. Oswald *et al* (1953) found that adults with chronic bronchitis had a higher absenteeism rate from school before the age of 12 years compared with control subjects without chronic bronchitis. Their study lacked pulmonary function data. In a study of 114 subjects who had been identified as having "catarrh" or "recurrent bronchitis" from clinic records 30 years previously, Harnett and Mair (1963) found a higher prevalence of respiratory symptoms compared to controls. The differences were, however, not statistically significant. Also there were no significant differences in the PEFR readings between the subjects and controls. Burrows *et al* (1977), however, found increased symptoms and lower spirometric values (FEV_1) in subjects with a positive history of CRT compared to those without in a cross-sectional community based respiratory health survey in Tucson, Arizona.

Samet *et al* (1983) reviewed 7 prospective cohort (longitudinal) studies involving children and found an effect of CRT on respiratory symptoms in adulthood, although the associations were weak. The association of CRT with impaired lung function was stronger.

In the present study women who gave a history of CRT problems before the age of 16 years had on average a FEV_1 160ml lower than those without this history (see Table 6.33). This was found after controlling for

the potential determinants of lung function such as smoking and SE factors. Although this was not significant at the P.05 level it does suggest an influence of CRT on lung function which is consistent with the available evidence.

8.3.8 OCCUPATIONAL EXPOSURES

The occupational exposures examined in this study were exposure to dusts and chemical fumes in the workplace assessed by a positive response to direct questions on exposure. As expected, a higher proportion of men than women were exposed to dust in the workplace (19.2% of men vs 7.5% of women). This was consistent with the findings in other community based studies that fewer women report occupational exposures (Lebowitz *et al*, 1975; Lebowitz, 1977). Epidemiological studies have shown that workers reporting of dust exposure in the workplace correlated well with objective measurements of dust levels in the workplace (Fonn, 1989). There is no reason to assume that this relationship does not also pertain to the present study and therefore the reporting of dust exposure should be reasonably accurate.

The relationship between dust and fume/vapours in the workplace and respiratory health is well known (Becklake, 1985; Becklake, 1989). An

increased awareness of the problem coupled with better environmental control has resulted in a decline in the incidence of the classic diseases of dusty occupation, particularly the pneumoconioses (Sadoul, 1983). However, the diseases characterised by airflow limitation (COPD) are on the increase. The aetiology of these diseases are multifactorial, with smoking being the most important factor (United States Surgeon General, 1984). As mentioned earlier the ability to perform multivariate analysis has facilitated the investigation of environmental factors by controlling for confounding variables like smoking, past and present respiratory health, domestic exposures, age and gender.

In the present study dust exposure was found to be an independent determinant of chronic airflow limitation in men. This was shown by the fact that men exposed to dust in the workplace had on average a reduction of .49 l/sec in the $FEF_{25-75\%}$ and of 3.0% in the FEV_1/FVC ratio. Both of these functions are sensitive indices of chronic airflow limitation (see Table 6.32). There was no significant difference in the FVC or FEV_1. This association was also independent of the fact that dust exposure was not significantly associated with chronic respiratory symptoms in the multivariate analysis (see Table 6.20). This has important implications in relation to the pathophysiological processes involved in the development of COPD following occupational exposure. It suggests that an "asthmatic tendency" is a necessary factor in the

early stages, in keeping with the conclusions of Weiss and Speizer (1984). They suggest that chronic airflow limitation follows on increased airway responsiveness and subsequently develops into mucus hypersecretion (chronic bronchitis). The former (increased airway responsiveness) is integral to the original Dutch hypothesis of the natural history of chronic airflow limitation , and the latter (mucus hypersecretion) integral to the original British hypothesis (Burrows, 1981; Speizer and Tager, 1979).

Besides the present study at least 4 other community based studies, 2 in Europe (Krzyzanowski *et al*, 1986; Prediletto *et al,* 1987) and 2 in the United States (Leibowitz, 1977; Korn *et al*, 1987) have shown significant associations between dust exposure and lung function levels. Also, except for Krzyzanowski's study, the association was not with fumes but with dusts as was the case in the present study. The association of dust exposure and airflow limitation has also been well documented in workforce based studies (Becklake, 1989). This association was independent of the development of pneumoconioses. The present findings are therefore consistent with there being a causal association between dust exposure and chronic airflow limitation and contribute to the database on the subject.

8.4 COMPARISON OF LUNG FUNCTION LEVELS RECORDED IN THE PRESENT STUDY WITH PUBLISHED DATA ON SUBJECTS IN SOUTH AFRICA AND ABROAD

8.4.1 GENERAL COMMENTS

Spirometry has been used in both clinical and epidemiological practice to evaluate the effect of diseases and exposures on lung function since the beginning of this century (Becklake, 1986). It is clear from the literature that there is no single set of prediction formulae that would be universally applicable (Clausen, 1982). The ATS (Gardner, 1979) and the ECCS (Quanjer, 1983) have laid down guidelines in order to standardise the procedure to measure spirometry which would improve comparability and repeatability of the tests. It is also recommended that separate prediction values be determined for each region/country/population given the large number of factors that potentially influence lung function values. One of the aims of this was to address the controversy relating to ethnic/racial differences in lung function (Myers, 1984; Davies and Becklake, 1984) by comparing the findings in this study with published data in other populations, and to provide reference values for the Indian South African population under study.

The spirometric values in this study have been collected in accordance with recommended standards and the issue of internal and external generalisability has already been addressed in section 8.2. The prediction formulae for the spirometric indices in this study have been expressed in the form of regression equations which are shown in Appendix 5. Comparisons with other studies within South Africa and abroad are shown in Tables 8.1 to 8.8). The studies are listed in chronological order by the year of publication. Whenever available the R^2 values are also shown for comparison with the present study. Also presented are the regression formulae; source and number of study subjects, their personal characteristics; selection criteria; and methodological factors including type of instrument used to measure spirometry and procedure used to select the reported values.

In order to facilitate comparisons between studies the predicted values for the spirometric indices were calculated for age 35 years and standing height 170cm in men; and age 35 years and height 160cm in women. These values were chosen because they lie in the midrange of the distribution of anthropometric characteristics in most of the studies. In each Table the predicted value calculated from the present study is also shown for comparison. No formal statistical comparison was carried out between the present study and the others cited in the Tables.

8.4.2 FVC IN SELECTED STUDIES OF MEN OF INDIAN DESCENT (Table 8.1).

There were no other studies on lung function in Indians in South Africa. The studies cited in this Table were selected studies in Indians resident in different countries.

The first study quoted was that of Cotes and Ward (1966) amongst Bhutanese men resident at an altitude of 3500m and shows the highest predicted value for FVC of any of the studies quoted, including Whites in South Africa (Table 8.1) and in other studies in Whites elsewhere (Knudson *et al*, 1976). The only other study which produced higher predicted values than that in the Bhutanese was in Swedish men (Grimby and Soderholm, 1963). Cotes (1979) attributes the higher values to altitude, the higher level of habitual physical activity and genetic selection. The latter was probably the most important reason. The subjects with better lung function were probably naturally selected for life at a higher altitude.

Increasing physical activity after full growth of the lung has been achieved does not appear to increase lung volumes (Cotes, 1979). Stuart and Collings (1959) found a larger VC (but not maximal breathing capacity) in groups of athletes compared with non-athletes. On the other hand Hepper *et al* (1960) found no difference in 10 tall athletes.

Table 8.1

FVC IN SELECTED STUDIES IN MEN OF INDIAN DESCENT

STUDY	REGRESSION MODEL				SUBJECTS			METHODS			PREDICTED
AUTHOR (YEAR)	REGRESSION EQUATION INTERCEPT	AGE	HEIGHT	R^2	POPULATION CITY/AREA	SELECTION CRITERIA n*	MEAN AGE (SD or) (RANGE)	SMOKING STATUS	INSTRUMENT USED	POSTURE	VALUE USED	Ht 170cm AGE 35
COTES (1966)	-4.05	-0.020A	+0.058H	-	BHUTAN	HEALTHY SUBJECTS n=69	- (20-69)	MIXED	MC DERMOTT DRY SPIROMETER	NOT STATED	NOT STATED	5.62[1]
MILLER (1970)	-3.07	-0.024A	+0.044H	-	INDIANS IN GUYANA	HEALTHY SUBJECTS n=129	43.8 (6.0)	MIXED	MC DERMOTT DRY SPIROMETER	NOT STATED	MEAN OF OF 3 EFFORTS	3.57
MALIK (1973)	-5.98	-0.034A	+0.066H	.60	WEST PAKISTANI TEXTILE WORKERS IN LANCASHIRE ENGLAND	HEALTHY SUBJECTS n=178	36.7 (7.96)	MIXED	MC DERMOTT DRY SPIROMETER	SEATED	MEAN OF 2 HIGHEST	4.05
COTES (1975)	-	-	-		NORTH INDIAN CIVILIANS AND SERVICEMEN DELHI, INDIA	HEALTHY SUBJECTS n=62	25.4 (19-35)	MIXED	MC DERMOTT DRY SPIROMETER	SEATED	MEAN OF 3 EFFORTS	4.42[2]
COTES (1975)	-	-	-		SOUTH INDIAN SERVICEMEN RESIDENT IN DELHI, INDIA	HEALTHY SUBJECTS n=30	27.9 (22.35)	MIXED	MC DERMOTT DRY SPIROMETER	SEATED	MEAN OF 3 EFFORTS	4.24[2]
COTES (1975)	-	-	-		NEPALESE DESCENT GURKHA SERVICEMEN RESIDENT IN DELHI, INDIA	HEALTHY SUBJECTS n=30	25.5 (19-34)	MIXED	MC DERMOTT DRY SPIROMETER	SEATED	MEAN OF 3 EFFORTS	5.12[2]
BANGHAM (1977)	-1.59	-0.957A	+0.046H	-	NEPALESE IN SIMIGAON AND BEDING VILLAGES IN NEPAL	HEALTHY SUBJECTS n=18	33.6 -	MIXED	NOT STATED	SEATED	MEAN OF 3 EFFORTS	4.24
RASTOGGI (1983)	-4.43	-0.017A	+0.053H	.35	NORTH INDIAN DELHI, INDIA	INDUSTRIAL WORKERS n=530	29.7 (7.8)	MIXED	VITALO-GRAPH	STANDING	LARGEST OF 3 RECORDS	3.99
UDWADIA (1986)	-4.83	-0.018A	+0.054H	.41	BEACH CANDY HOSPITAL BOMBAY, INDIA	HEALTHY WORKERS n=310	≥ 30 YRS	NON SMOKERS	FLEISCH PNEUMO-TACHOGRAPH	SEATED	LARGEST OF 3 RECORDS	3.72
AYUB (1987)	-3.07	-0.006A	+0.043H	-	HARIPUR AND ABBOTTABAD, NORTHERN PAKISTAN	HEALTHY VOLUNTEEERS n=116	- (18-65)	NEVER SMOKERS	GOULD STATHAM PNEUMO-TACHOGRAPH	NOT STATED	SPIROGRAM WITH LARGEST SUM OF FEV_1 + FVC	4.03
LALLOO (PRESENT) (STUDY)	-5.62	-0.025A	+0.062H	.50	INDIANS RESIDENT IN LENASIA JHBURG, S.A.	HEALTHY SUBJECTS RANDOM SAMPLE FROM COMMUNITY n=57	- (18-45)	NEVER SMOKERS	VITALO-GRAPH S-MODEL	STANDING	LARGEST OF 3 RECORDS	4.05

[1] RECORDED AT ATPS - BTPS CORRECTED (+10%)

[2] STANDARISED TO HT 170cm AND MEAN AGE IN STUDY (REGRESSION EQUATIONS NOT GIVEN)

* n = NUMBER OF SUBJECTS IN STUDY

Physical activity has to possibly commence in childhood or adolescence to produce significant differences. Cotes *et al* (1975) found that subjects of Nepalese origin who had spent most of their lives in the mountainous region of Nepal had much higher FVC values when compared to Indians of north and south India origin in the same study: this data is depicted in the Table.

Altitude may also account for differences in lung function because the VC was much higher in New Guinea highlanders (living between 1000 and 1500m above sea-level) than in the New Guineans living at sea level (Woolcock *etal*, 1972). Goldman and Becklake (1956) on the other hand showed that Whites resident at a median altitude of 1760m in Johannesburg had similar levels of VC compared with those resident at coastal levels, although resting and exercise ventilation and maximal breathing capacity were higher. The different findings in the 2 studies may be attributed to the higher level of habitual physical activity in the New Guinea highland dwellers compared to the subjects in Goldman and Becklake's study. Furthermore, DeGraff *et al* (1970) found that the FVC and TLC of Europeans living at 3100m (and presumably leading a sedentary lifestyle) in the United States were similar to those of Europeans at sea level. Thus the influence of altitude alone appears to be insufficient to explain the higher lung function levels in Indian men from Lenasia.

The FVC level in the present study of Indian South Africans appears to be comparable with that of the migrant Indian textile workers in England (Malik *et al*, 1972), but is higher than in Miller's study of Indians in Guyana and Indians in India in the studies of Rastogi and Udwadia. The extent to which technical factors contributed to the observed differences is uncertain. Rastogi *et al* (1983) used the same method of measurement as the present study and is therefore perhaps the most comparable study.

8.4.3 FVC IN SELECTED STUDIES IN BLACK AND WHITE MEN RESIDENT IN SOUTH AFRICA (Table 8.2).

The predicted FVC values for Indians in the present study are lower than those found in most studies of Blacks in South Africa. The studies of Goldin (1990) and Mokoetle (1991) used similar methodology and the same instrument therefore making them the most comparable. Their subjects were also resident at the same altitude as the subjects in this study. The lower FVC values in Indians may therefore represent a true ethnic variation in lung function. The possibility that subject selection may account for at least some proportion of the difference observed cannot be excluded. The subjects in the latter 2 studies were selected from an unexposed workforce viz: bank and university employees and

may reflect a selection bias and this may also account for the higher reported values in comparison with other published data in South African Blacks who were sampled from industries where there may be exposure to dusts and fumes in the workplace.

The socioenvironmental (SE) status of the subjects was, however, lower in these 2 studies when compared to the present study, making it unlikely that SE factors alone are able to explain the difference. If the hypothesis that SE factors account for most of the difference in lung function as asserted by Myers (1984) is correct, then the blacks in Goldin's and Mokoetle's study may have shown even higher values if SE factors were controlled for and the Indians in the present study should have had even higher spirometric values. These former 2 authors did show an effect of SE factors on lung function. This was consistent with the findings of Steinberg and Becklake (1986) who reviewed the published literature and found positive evidence for the effect of SE factors on lung function. As mentioned in section 8.3.6, there was at the most a slight effect of SE status on lung function in men in the present study, although not consistent, allowing for other variables.

Table 8.2

FVC IN SELECTED STUDIES IN BLACK AND WHITE MEN IN SOUTH AFRICA

STUDY	REGRESSION MODEL				SUBJECTS			METHODS			PREDICTED
AUTHOR (YEAR)	REGRESSION EQUATION INTERCEPT	AGE	HEIGHT	R^2	POPULATION CITY/AREA	SELECTION CRITERIA n*	MEAN AGE (SD or) (RANGE)	SMOKING STATUS	INSTRUMENT USED	POSTURE	VALUE USED	Ht 170cm AGE 35
BLACKS												
JOHANNSEN (1968)	-2.83	-	+0.037H	.45	PRETORIA S.A.	HEALTHY VOLUNTEER HOSPITAL EMPLOYEES n=120	34.1 (9.1)	MIXED	PULMONIZER MODEL 325R	NOT STATED	LARGEST OF 3-5 TESTS	3.81[1]
GOLDIN (1989)	-3.08	-0.024A	+0.048H	.33	JHBURG S.A.	HEALTHY BANK EMPLOYEES n=106	41.1 (10.2)	NON SMOKERS	VITALOGRAPH S - MODEL	SEATED	LARGEST OF 3-5 TESTS	4.24
MOKOETLE (1990)	-3.66	-0.029A	+0.053H	.51	JHBURG S.A.	HEALTHY UNIVERSITY EMPLOYEES n=49	42.0 (10.5)	NEVER SMOKERS	VITALOGRAPH S - MODEL	STANDING	LARGEST OF 3 TESTS	4.33
WHITES												
ERAMUS (1967)	-10.41	-0.027A	+0.094H		JHBURG S.A.	PRE EMPLOYMENT TEST URANIUM MINERS n=464	22.6 (6.26)	MIXED	GODART EXPIROGRAPH GRAPH	NOT STATED	NOT STATED	
DE KOCK (1988)	-3.19	0.036A	+0.051H	.30	ROSSING URANIUM MINE NAMIBIA (S.W.A.)	PRE EMPLOYMENT TEST URANIUM MINERS n=78	≥ 30	NON SMOKERS	CAVITRON SC - 20	NOT STATED	LARGEST OF 2 RECORDS	4.22
GOLDIN (1989)	-3.42	-0.031A	+0.056H	.55	JHBURG S.A.	HEALTHY BANK EMPLOYEES n=72	37.3 (11.3)	NON SMOKERS	VITALOGRAPH S - MODEL WATER	NOT STATED	LARGEST OF 3 TESTS	5.01
LALLOO[3] (PRESENT) (STUDY)	-5.62	-0.025A	+0.062H	.50	INDIANS RESIDENT IN IN LENASIA JHBURG S.A.	HEALTHY SUBJECTS. RANDOM SAMPLE FROM COMMUNITY n=57	- 18-45	NEVER SMOKERS	VITALOGRAPH S-MODEL	STANDING	LARGEST OF 3 TESTS	4.05

[1] RECORDED AT ATPS - BTPS CORRECTED (+10%)

[2] PRESENTED FOR COMPARISON

* n = NUMBER OF SUBJECTS IN STUDY

The difference in FVC between Whites and Indians in South Africa was in line with findings elsewhere (Cotes, 1979). The present results cannot, as indicated above, be directly compared with lung function in the only community based study in Whites in this country. The lung function level in white groups that have been studied in South Africa are on the whole similar to that in published studies in white communities abroad (Goldman and Becklake, 1956; Woolcock *et al*, 1972; Cotes, 1979; Quanjer, 1983; Mathur *et al,* 1990). Based on this assumption the findings in Goldin's study are consistent with the concept of an ethnic variation in lung function level as it relates to standing height, after accounting for SE status.

8.4.4 FEV_1 IN SELECTED STUDIES IN MEN OF EAST INDIAN DESCENT (Table 8.3).

The FEV_1 level obtained in Indians in South Africa compares to that in published studies of Indians elsewhere in much the same way as FVC levels, with the same order of differences to that noted with the FVC. Thus the highest reported levels were obtained in the Bhutanese, the Nepalese descent Gurkha servicemen and the Nepalese in Simigaon and Beding. Once again the present study yielded higher levels than those recorded in Indians in Guyana. It is also important to note that the FEV_1 measurement is subject to less technical variabilty than the FVC

(Clausen, 1982), and thus FEV_1 differences among the studies are more likely to reflect the true values than are differences in the other indices of lung function where the methods of measurement differ, and the reproducibility in consequence is lower.

Table 8.3

FEV_1 IN SELECTED STUDIES IN MEN OF INDIAN DESCENT

STUDY	REGRESSION MODEL				SUBJECTS				METHODS			PREDICTED
AUTHOR (YEAR)	REGRESSION EQUATION INTERCEPT	AGE	HEIGHT	R^2	POPULATION CITY/AREA	SELECTION CRITERIA n*	MEAN AGE (SD or) (RANGE)	SMOKING STATUS	INSTRUMENT USED	POSTURE	VALUE USED	Ht 170cm AGE 35
COTES (1966)	-1.66	-0.022A	+0.037H	-	BHUTANESE HIGHLANDERS INDIA	HEALTHY SUBJECTS n=69	- (20.69)	MIXED	MC DERMOTT DRY SPIROMETER	NOT STATED	NOT STATED	4.25[1]
MILLER (1970)	-1.98	-0.024A	+0.034H	.37	INDIANS IN GUYANA	HEALTHY SUBJECTS n=129	43.8 (6.0)	MIXED	MC DERMOTT DRY SPIROMETER	NOT STATED	MEAN OF OF 3 EFFORTS	2.96
MALIK (1973)	-4.38	-0.038A	+0.054H	.64	WEST PAKISTANI TEXTILE WORKERS IN LANCASHIRE ENGLAND	HEALTHY SUBJECTS n=198	36.7 (7.96)	MIXED	G-ARTHUR VITALOGRAPH SPIROMETER	SEATED	MEAN OF 2 HIGHEST	3.47
COTES (1975)	-	-	-		NORTH INDIAN CIVILIANS AND SERVICEMEN DELHI, INDIA	HEALTHY SUBJECTS n=62	25.4 (19-35)	MIXED	MC DERMOTT DRY SPIROMETER	SEATED	MEAN OF 3 EFFORTS	3.44[2]
COTES (1975)	-	-	-		SOUTH INDIAN SERVICEMEN RESIDENT IN DELHI, INDIA	HEALTHY SUBJECTS n=30	27.9 (22.35)	MIXED	MC DERMOTT DRY SPIROMETER	SEATED	MEAN OF 3 EFFORTS	3.36[2]
COTES (1975)	-	-	-		NEPALESE DESCENT GURKHA SERVICEMEN RESIDENT IN DELHI, INDIA	HEALTHY SUBJECTS n=30	25.5 (19-34)	MIXED	MC DERMOTT DRY SPIROMETER	SEATED	MEAN OF 3 EFFORTS	3.94[2]
BANGHAM (1977)	-0.08	-0.044A	+0.030H	-	NEPALESE IN SIMIGAON AND BEDING VILLAGES IN NEPAL	HEALTHY SUBJECTS n=18	33.6 (25-55)	MIXED	NOT STATED	SEATED	MEAN OF 3 EFFORTS	3.48
RASTOGGI (1983)	-2.31	-0.026A	+0.037H	.29	NORTH INDIAN DELHI, INDIA	INDUSTRIAL WORKERS n=530	29.7 (7.8)	MIXED	VITALO-GRAPH	STANDING	LARGEST OF 3 RECORDS	3.07
UDWADIA (1986)	-2.65	-0.022A	+0.037H	.47	BEACH CANDY HOSPITAL BOMBAY, INDIA	HEALTHY WORKERS n=310	≥ 30 YRS (NOT STATED)	NON SMOKERS	FLEISCH PNEUMO-TACHOGRAPH	SEATED	LARGEST OF 3 RECORDS	2.87
AYUB (1987)	-2.69	-0.012A	+0.038H	-	HARIPUR AND ABBOTTABAD, NORTHERN PAKISTAN	HEALTHY VOLUNTEEERS n=116	- (18-65)	NEVER SMOKERS	GOULD STATHAM PNEUMO-TACHOGRAPH	NOT STATED	SPIROGRAM WITH LARGEST SUM OF FEV_1 + FVC	3.35
LALLOO (PRESENT) (STUDY)	-2.98	-0.036A	+0.045H	.53	INDIANS RESIDENT IN LENASIA JHBURG, S.A.	HEALTHY SUBJECTS RANDOM SAMPLE FROM COMMUNITY n=57	- (18-45)	NEVER SMOKERS	VITALO-GRAPH S-MODEL	STANDING	LARGEST OF 3 RECORDS	3.38

[1] RECORDED AT ATPS - CORRECTED TO BTPS (+10%)

[2] STANDARISED TO HT 170cm AND MEAN AGE IN STUDY (REGRESSION EQUATIONS NOT GIVEN).

8.4.5 FEV_1 IN SELECTED STUDIES IN BLACK AND WHITE MEN IN SOUTH AFRICA (Table 8.4)

In general reported Black/White differences in FEV_1 levels in South Africa are less than than reported Black/White FVC differences. Mokoetle's study which had the highest values yet recorded in Blacks in South Africa, used the same methodology as the present study, including the same posture still yielded considerably higher values than those in the Indians in this study. Once again, the limitation of the comparison is that Mokoetle's study was workforce based and subject to the healthy worker effect, whereas the present study was community based. Allowing for these limitations there is still appears to be an ethnic variation in FEV_1 levels in relation to standing height.

Table 8.4

FEV_1 IN SELECTED STUDIES IN BLACK AND WHITE MEN IN SOUTH AFRICA

STUDY	REGRESSION MODEL				SUBJECTS			METHODS			PREDICTED
AUTHOR (YEAR)	REGRESSION EQUATION INTERCEPT	AGE	HEIGHT	R^2	POPULATION CITY/AREA	SELECTION CRITERIA n*	MEAN AGE (SD or) (RANGE)	SMOKING STATUS	INSTRUMENT USED	POSTURE	VALUE USED	Ht 170cm AGE 35
BLACKS												
JOHANNSEN (1968)	-1.19	-0.016A	+0.026H	.44	PRETORIA S.A.	HEALTHY VOLUNTEER HOSPITAL EMPLOYEES n=120	34.1 (9.1)	MIXED	PULMONIZER MODEL 325R	NOT STATED	LARGEST OF 3-5 TESTS	3.01[1]
GOLDIN (1989)	-0.54	-0.027A	+0.029H	.35	JHBURG S.A.	HEALTHY BANK EMPLOYEES n=106	41.1 (10.2)	NON SMOKERS	VITALOGRAPH S - MODEL	SEATED	LARGEST OF 3-5 TESTS	3.45
MOKOETLE (1990)	-1.92	-0.037A	+0.041H	.58	JHBURG S.A.	HEALTHY UNIVERSITY EMPLOYEES n=49	42.0 (10.5)	NEVER SMOKERS	VITALOGRAPH S - MODEL	STANDING	LARGEST OF 3 TESTS	3.75
WHITES												
ERASMUS (1967)	-5.92	-0.057A	+0.067H	.56	JHBURG S.A.	PRE EMPLOYMENT TEST GOLD-MINERS n=464	22.6 (6.26)	MIXED	GODART EXPIROGRAPH	NOT STATED	NOT STATED	3.47
DE KOCK (1988)	-0.80	-0.039A	+0.033H	.36	ROSSING URANIUM MINE NAMIBIA (S.WEST A.)	PRE EMPLOYMENT TEST URANIUM MINERS n=78	≥ 30	NON SMOKERS	CAVITRON SC - 20	NOT STATED	LARGEST OF 2 RECORDS	3.45
GOLDIN (1989)	-1.84	-0.036A	+0.042H	.25	JHBURG S.A.	HEALTHY BANK EMPLOYEES n=72	37.3 (11.3)	NON SMOKERS	VITALOGRAPH S. - MODEL	SEATED	LARGEST OF 3-5 TESTS	4.04
LALLOO[2] (PRESENT) (STUDY)	-2.98	-0.036A	+0.045H	.53	INDIANS RESIDENT IN IN LENASIA JHBURG S.A.	HEALTHY SUBJECTS. RANDOM SAMPLE FROM COMMUNITY n=57	- 18-45	NEVER SMOKERS	VITALOGRAPH S-MODEL	STANDING	LARGEST OF 3 TESTS	3.38

[1] RECORDED AT ATPS - CORRECTED TO BTPS (+10%)

[2] PRESENTED FOR COMPARISON

* n = NUMBER OF SUBJECTS IN STUDY

8.4.6 FVC IN SELECTED STUDIES IN WOMEN OF INDIAN DESCENT (Table 8.5)

This is the only lung function study in Indian South African women and therefore as with the FVC, comparisons were made with studies in Indian women abroad. Comparable FVC values were found in Ayub's study of healthy volunteers in Northern Pakistan. Of interest is that the levels in women in Nepal were similar to that in the present study, unlike the results in Indian South African men. The Nepalese men had higher values than the South African Indian men (Table 8.1). The authors of the study (Bangham and Veale, 1976) do not discuss this issue. It is tempting to postulate that the disparity could be due to women having a lower level of habitual physical activity compared to men in Nepal, but this information is not available.

Table 8.5

FVC IN SELECTED STUDIES IN WOMEN OF INDIAN DESCENT

STUDY	REGRESSION MODEL				SUBJECTS			METHODS			PREDICTED
AUTHOR (YEAR)	REGRESSION EQUATION INTERCEPT	AGE	HEIGHT	R^2	POPULATION CITY/AREA	SELECTION CRITERIA n*	MEAN AGE (SD or) (RANGE)	SMOKING STATUS	INSTRUMENT USED	POSTURE	VALUE USED	Ht 160c AGE 35
MILLER (1970)	-1.65	-0.020A	+0.0315H	.38	INDIANS IN GUYANA	HEALTHY SUBJECTS n=99	42.8 (6.0)	MIXED	MC DERMOTT DRY SPIROMETER	NOT STATED	MEAN OF 3 TESTS	2.69
BANGHAM (1976)	-3.41	-0.022A	+0.044H	-	NEPALESE IN SIMIGAON AND BEDING VILLAGES IN NEPAL	HEALTHY SUBJECTS n=18	40.8 (25-68)	NON SMOKERS	NOT STATED	SEATED	MEAN OF 3 EFFORTS	2.86
UDWADIA (1986)	-3.755	-0.010A	+0.043H	.41	BEACH CANDY HOSPITAL, BOMBAY INDIA	HEALTHY VOLUNTEERS n=141	≥ 30 YRS -	NON SMOKERS	FLEISCH PNEUMOTACHOGRAPH	SEATED	LARGEST OF 3 RECORDS	2.78
AYUB (1987)	-8.474	-0.013A	+0.074H	-	HARIPUR AND ABBOTTABAD NORTHERN PAKISTAN	HEALTHY VOLUNTEERS -	- 25-48	NEVER SMOKERS	GOULD STATHAM PNEUMOTACHOGRAPH	NOT STATED	SPIROGRAM WITH LARGEST SUM OF FEV_1 + FVC	2.91
LALLOO (PRESENT) (STUDY)	-0.999	-0.009A	+0.026H	.15	LENASIA JHBURG S.A.	HEALTHY RANDOM SAMPLE FROM COMMUNITY n=78	- (18-45)	NEVER SMOKERS	VITALOGRAPH S-MODEL	STANDING	LARGEST OF 3 RECORDS	2.85

* n = NUMBER OF SUBJECTS IN STUDY

8.4.7 FVC IN SELECTED STUDIES BLACK AND WHITE WOMEN IN SOUTH AFRICA AND WHITE WOMEN IN THE USA (Table 8.6)

There were only 2 published studies on spirometry in Black women in South Africa (Johannsen, 1968 and Mokoetle, 1990) and only 1 in White women(Goldman and Becklake, 1956). The latter study measured only the SVC and not the FVC. None of these studies were community based. Therefore the findings from Tucson, Arizona in the United States (Knudson *et al*, 1976) is shown for comparison. All the studies quoted except for Johannsen's study had higher values compared to the Indian women in the present study.

The values in Black South African women appear to be similar to those in White women, while Indian women have lower values than Black women. The higher values in Black women may well be due to the healthy worker effect or a higher level of habitual physical activity in these subjects. The differences cannot be explained on the basis of SE factors because 96% of the women in Mokoetle's study were in the unskilled (68%) or semi-skilled (38%) occupational classes. The Indian women had a higher SE status than the women in Mokoetle's study. The difference may thus also reflect a true ethnic variation in lung function in women in relation to standing height.

Table 8.6

FVC IN SELECTED STUDIES IN BLACK AND WHITE WOMEN IN SOUTH AFRICA AND WHITE WOMEN IN THE USA

STUDY	REGRESSION MODEL				SUBJECTS			METHODS			PREDICTEI
AUTHOR (YEAR)	REGRESSION EQUATION INTERCEPT	AGE	HEIGHT	R^2	POPULATION CITY/AREA	SELECTION CRITERIA n*	MEAN AGE (SD) or (RANGE)	SMOKING STATUS	INSTRUMENT USED	POSTURE	VALUE USED	Ht 160 AGE 35
BLACKS												
JOHANNSEN (1968)	-0.66	-014A	+0.023H	.29	HOSPITAL PRETORIA S.A.	HEALTHY VOLUNTEERS n=100	34.6 (8.7)	MIXED	PULMONIZER MODEL 325R	NOT STATED	LARGEST OF 3-5 TESTS	2.78
MOKOETLE (1990)	-2.87	-0.023A	+0.044H	.33	JHBURG S.A.	HEALTHY UNIVERSITY n=94	41.0 (9.8)	NEVER SMOKERS	VITALOGRAPH S - MODEL	STANDING	LARGEST OF 3 TESTS	3.3
WHITES												
GOLDMAN[2] (1959)	-4.36	-0.018A	+0.052H	.55	JHBURG S.A.	HEALTHY HOSPITAL SAMPLE n=50	NOT GIVEN	NOT STATED	KNIPPING TYPE SPIROMETER	SEATED	NOT STATED	3.3
KNUDSON (1976)	-1.77	-0.022A	+0.037	.55	TUCSON ARIZONA USA	HEALTHY COMMUNITY SAMPLE n=321	≥20 YEARS	NEVER SMOKERS	PNEUMO-TACHO-GRAPH	NOT STATED	LARGEST OF 5 TESTS	3.38
LALLOO[3] (PRESENT) (STUDY)	-1.00	-0.009A	+0.026H	.15	LENASIA JHBURG S.A.	HEALTHY RANDOM SAMPLE FROM COMMUNITY n=78	- 18-45	NEVER SMOKER	VITALOGRAPH S-MODEL	STANDING	LARGEST OF 3 TESTS	2.84

* n = NUMBER OF SUBJECTS IN STUDY

[1] RECORDED AT ATPS - BTPS CORRECTED (+10%)

[2] FORMULA FOR SVC AND NOT FVC

[3] PRESENTED FOR COMPARISON

8.4.8 FEV_1 IN SELECTED STUDIES IN WOMEN OF INDIAN DESCENT (Table 8.7)

The FEV_1 which, as already indicated, is less subject to technical variation than the FVC was higher than the values predicted from most studies in Indians elsewhere, except for the study of north Pakistani women (Ayub *et al*, 1987). It was also higher than that found in the Nepalese women in Bangham's study. Although Indian South Africans had lower predicted FEV_1 values than White or Black South African women, their FEV_1 levels were higher than Indians elsewhere.

8.4.9 FEV_1 IN SELECTED STUDIES IN WOMEN IN SOUTH AFRICA (Table 8.8)

There were no studies measuring FEV_1 levels in White South African women and therefore 2 studies from the United States (Knudson, *et al*, 1976; Crapo *et al*, 1981) were used as comparisons. The difference in FEV_1 levels between Black and Indian South African women was lower than for the FVC. Possible explanations for the disparity in the FEV_1 and FVC differences between races include greater airflow limitation in Black women resulting from exposure to wood and coal combustion in the domestic environment in Blacks, or greater elasticity of the lungs of Indian women.

Table 8.7

FEV_1 IN SELECTED STUDIES IN WOMEN OF INDIAN DESCENT

STUDY	REGRESSION MODEL				SUBJECTS			METHODS			PREDICTED
AUTHOR (YEAR)	REGRESSION EQUATION INTERCEPT	AGE	HEIGHT	R^2	POPULATION CITY/AREA	SELECTION CRITERIA n*	MEAN AGE (SD or) (RANGE)	SMOKING STATUS	INSTRUMENT USED	POSTURE	VALUE USED	Ht 160cm AGE 35
MILLER (1970)	-1.17	-0.018A	+0.025H	.31	INDIANS IN GUYANA	HEALTHY SUBJECTS n=99	42.8 (6.0)	MIXED	MC DERMOTT DRY SPIROMETER	NOT STATED	MEAN OF OF 3 EFFORTS	2.20
BANGHAM (1976)	-2.78	-0.015A	+0.035H	-	NEPALESE IN SIMIGAON AND BEDING VILLAGES IN NEPAL	HEALTHY SUBJECTS n=18	40.8 (25-68)	MIXED	NOT STATED	SEATED	MEAN OF 3 EFFORTS	2.29
UDWADIA (1986)	-2.58	-0.012A	+0.032H	.37	BEACH CANDY HOSPITAL BOMBAY, INDIA	HEALTHY WORKERS n=141	≥ 30 YRS (NOT STATED)	NON SMOKERS	FLEISCH PNEUMO-TACHOGRAPH	SEATED	LARGEST OF 3 RECORDS	2.12
AYUB (1987)	-5.97	-0.017A	+0.057H	-	HARIPUR AND ABBOTTABAD, NORTHERN PAKISTAN	HEALTHY VOLUNTEERS	- (24-59)	NEVER SMOKERS	GOULD STATHAM PNEUMO-TACHOGRAPH	NOT STATED	SPIROGRAM WITH LARGEST SUM OF FEV_1 + FVC	2.55
LALLOO (PRESENT) (STUDY)	-0.87	-0.020A	+0.025H	.53	LENASIA JHBURG SOUTH AFRICA	HEALTHY SUBJECTS RANDOM SAMPLE FROM COMMUNITY n=78	- (18-45)	NEVER SMOKERS	VITALO-GRAPH S-MODEL	STANDING	LARGEST OF 3 RECORDS	2.43

* n = NUMBER OF SUBJECTS

Table 8.8

FEV_1 IN SELECTED STUDIES IN BLACK WOMEN IN SOUTH AFRICA AND WHITE WOMEN ELSEWHERE[1]

STUDY	REGRESSION MODEL				SUBJECTS				METHODS			PREDICTE
AUTHOR (YEAR)	REGRESSION EQUATION INTERCEPT	AGE	HEIGHT	R^2	POPULATION CITY/AREA	SELECTION CRITERIA n*	MEAN AGE (SD or) (RANGE)	SMOKING STATUS	INSTRUMENT USED	POSTURE	VALUE USED	Ht 160c AGE 35
BLACKS												
JOHANNSEN (1968)	-0.70	-0.012	+0.020	.54	HOSPITAL PRETORIA S.A.	HEALTHY VOLUNTEERS n=100	34.6 (8.7)	MIXED	PULMONIZER MODEL 325R	NOT STATED	LARGEST OF 3-5 TESTS	2.28
MOKOETLE (1990)	-1.40	-0.028A	+0.032H	.39	JHBURG S.A.	HEALTHY UNIVERSITY EMPLOYEES n=94	41.0 (9.8)	NEVER SMOKERS	VITALOGRAPH S - MODEL	STANDING	LARGEST OF 3 TESTS	2.7
WHITES												
KNUDSON (1976)	-0.79	-0.021A	+0.027H	.55	TUCSON ARIZONA USA	HEALTHY COMMUNITY SAMPLE n=321	≥20 YEARS -	NEVER SMOKERS	PNEUMO-TACHO-GRAPH	NOT STATED	LARGEST OF 5 TESTS	2.7
CRAPO (1981)	-1.58	-0.023A	+0.034H	.80	SALT LAKE CITY UTAH USA	HEALTHY VOLUNTEERS FROM MORMON CHURCH n=126	49 (20)	NEVER SMOKERS	COLLINS P1300 WATER SEAL SPIROMETER	NOT STATED	LARGEST OF SEVERAL RECORDS	3.0
LALLOO[3] (PRESENT) (STUDY)	-0.87	-0.020A	+0.025H	.32	LENASIA JHBURG S.A.	HEALTHY RANDOM SAMPLE FROM COMMUNITY n=78	- 18-45	NEVER SMOKERS	VITALOGRAPH S-MODEL	STANDING	LARGEST OF 3 TESTS	2.4

[1] THERE WERE NO PUBLISHED STUDIES OF FEV_1 IN WHITE WOMEN IN SOUTH AFRICA

[2] RECORDED AT ATPS - CORRECTED TO BTPS (+10%)

[3] PRESENTED FOR COMPARISON

White women in the studies in the United States had higher values than the Indian women in the present study. Note also that Knudson's study yielded FEV_1 values which were similar to those in Mokoetle's study, as was also noted in the FVC values. The lower FVC and higher FEV_1 levels in relation to the comparison between Blacks and Indians favours greater lung elasticity as the most feasible explanation.

CHAPTER 9

CONCLUSIONS

The objectives of this study were to examine the distribution and determinants of respiratory symptoms, diseases and lung function in the adult Indian population resident in Lenasia, Johannesburg, South Africa. These objectives were achieved by means of a self-administered, and slightly modified version of the standardised respiratory health questionnaire (Ferris, 1979) and the performance of spirometry using standardised methodology in a subsample of the questionnaire respondents in the study.

9.1 GENERALISABILTY OF THE RESULTS

The sampling procedure and good response rate obtained in the study makes the results generalisable to the Lenasia population (internal validity). The issue of generalisability of the findings in the present study to Indian populations in the rest of South Africa (external validity) is uncertain given the wide spectrum of factors that may potentially influence the respiratory health status of a population as discussed in Chapters 7 and 8. However, the use of standardised methodology in the present study will facilitate the comparability of the findings with other studies, past and future. This will aid in the understanding of the

distribution and determinants of chronic airways disease, an increasing problem in terms of morbidity and mortality in developed and developing countries all over the world (Murray, 1989) and also help to develop preventive strategies. The present study contributes to the international database on this problem.

9.2 SOCIAL AND EXPOSURE CHARACTERISTICS

The equal distribution of white and blue collar workers which was demonstrated amongst the employed in Lenasia made this a suitable ideal population in which to examine the effects of occupation on respiratory health status.

The men in this study had a very high proportion of current smokers compared with that documented in other community based studies locally and abroad. On the other hand women had a very low prevalence of smoking compared with women in Western populations. Of particular concern is that the proportion of current smokers appears to be increasing amongst women. This trend was also noted in women elsewhere. Alcohol consumption was related to smoking status.

9.3 DISTRIBUTION AND DETERMINANTS OF SYMPTOMS AND DISEASE

Both men and women in Lenasia had a high prevalence of symptoms of cough, phlegm, wheeze, and breathlessness in relation to other community based studies. They had a higher prevalence of chronic respiratory symptoms, except for wheeze, than their white counterparts in Belville, South Africa. This observation must, however, be qualified by the fact that comparability between these two studies was limited by differences in methodology, population selection and response rates. There was a lack of community based studies on respiratory health status in other population groups in South Africa which did not permit comparison. The Lenasia Indian population also had a higher prevalence of chronic respiratory symptoms than Indians in Guyana (Miller, 1971). No equivalent published studies which recorded respiratory symptoms were encountered in Indians in India for comparison.

The major determinants of symptoms found in the multiple regression model were age, smoking, occupational exposure to dust and fumes, exercise, schooling, recent chest illnesses, any kind of chest problem, chest trouble before the age of 16 years and any kind of heart trouble. The regression model included included most of the putative determinants of symptoms.

As expected, all the respiratory symptoms were significantly higher in smokers compared with non-smokers, even after controlling for the potential determinants of respiratory symptoms in a multiple regression model. This study therefore confirmed that smoking was an independent determinant of chronic respiratory symptoms. The symptom of cough was correlated with deeper inhalation of the tobacco smoke in men. Except for usual cough, involuntary tobacco smoke exposure was not associated with chronic respiratory symptoms in this population. The association of usual cough with involuntary smoking was not significant in the multiple regression model.

Involuntary tobacco smoke exposure has not been conclusively shown to be associated with chronic respiratory symptoms as opposed to acute respiratory symptoms. In addition, the latter has been demonstrated mainly in children. The findings in the this study suggest that there is no definite association of chronic respiratory symptoms with involuntary tobacco smoke exposure. It must be emphasised that this study was not specifically designed to examine this determinant and the lack of an association may also be due to methodological issues like inadequate sample size.

Alcohol consumption was related to smoking in this study. It was an important determinant, independent of smoking status, of the symptom

of wheeze (P.03) and approached significance for phlegm (P.07) in men. However, it was not found to be an independent determinant of any symptom in the multiple regression model.

Age was found to be an important determinant of symptoms in women but not in men. Women who smoked demonstrated an increased susceptibility to symptoms in comparison with women in other studies. This observation requires further investigation. A possible explanation is a greater exposure of Indian women to the vapours and fumes produced by cooking which was not examined in this study.

In terms of SE factors, schooling status (less than standard eight education) was shown to be an important independent determinant of cough in men. However, the other SE factors viz: occupation, crowding index and income were not shown to be important independent determinants of respiratory symptoms in this population. The possible reasons for the failure to find an association with these factors could be that these SE variables examined were inappropriate for the population under study, an inadequate sample size, inadequate representation of the different social strata or that there was truly no association. Given the prevalence of the symptoms in this study, the sample size was probably adequate to detect such effects.

The Lenasia population had a high SE status with an almost 100% literacy rate and favourable housing characteristics. There could have been significant upward social mobility within this population and SE status determined on current information, as was done in the present study, may be overestimated in relation to previous SE status which may be more pertinent to chronic symptoms, past respiratory illness, and lung function level. A national manpower study conducted 15 years previously found a similar occupational distribution amongst Indians in South Africa as noted in this study. This makes upward social mobility, at least in terms of occupation, an unlikely explanation for the lack of an association.

The prevalence of chronic bronchitis appeared lower in Lenasia compared with most of the studies quoted. This was despite finding higher prevalences of chronic respiratory symptoms in this population. The disparity may represent a form of physician bias in this region in that the doctors underdiagnosed the condition. The very low prevalence of emphysema in this population lends support to this explanation. Age was an independent determinant of chronic bronchitis in women in Lenasia. In women there was a significant association of this condition with other chronic disorders like arthritis, stomach and duodenal ulcers, any kind of heart trouble and hypertension. In men there was a significant association with any kind of heart trouble only. Whilst whooping cough was associated with chronic bronchitis in men

and women it was not found to be an independent determinant in the multiple regression model.

The overall prevalence of asthma by physician diagnosis was similar to that in developed countries. As noted in other published studies, the prevalence of asthma was higher when it was determined by the major symptoms of asthma viz: wheezing or whistling of the chest and shortness of breath with wheezing. Smoking was not associated with asthma. An interesting observation was that men who spent most of their lives in a rural area were more likely to have a diagnosis of asthma. However, this association was not significant in a multiple regression model in which all the potential determinants of respiratory symptoms were also used to examine asthma. A history of respiratory trouble before the age of 16 years was an important independent predictor of asthma in this study.

A high prevalence of sinus trouble was found in the adults in Lenasia. Schooling (less than standard eight education), the lack of medical aid, dust exposure, any kind of chest trouble and recent chest illnesses were significant independent predictors of sinus trouble when the potential determinants of symptoms were also examined as potential determinants of sinus trouble.

9.4 DISTRIBUTION AND DETERMINANTS OF LUNG FUNCTION LEVEL

Spirometric lung function tests were performed on a random sample of the questionnaire respondents in the 18-45 year age category in this study. The tests were preformed using standardised methodology.

The spirometric indices were higher in healthy never smoking men than in healthy never smoking women after controlling for stature and age. Men tended to have slightly greater airflow limitation compared to women as evidenced by the lower FEV_1/FVC ratio in men. This is probably due to the greater strength of the respiratory muscles in men rendering the airways more susceptible to dynamic compression.

The decline of lung function with age in the healthy subjects in this study was similar to that observed in published data in other populations.

The present study confirms that stature is the most important determinant of lung function. Standing height was the best index of stature because it accounted for the highest overall variability (R^2) in the spirometric indices examined. Using sitting height, sitting/standing height ratio or an index of body mass (w/h^2) did not improve the R^2 in the regression equations derived to predict the spirometric indices.

Weight was also not an important determinant of the spirometric indices examined in this study.

This study showed minimal effects of smoking on lung function. The explanation for this may be that the subjects who had lung function were in the age group when the effects of smoking had not as yet become evident. In fact, the men who were smokers and free of cardiorespiratory symptoms had higher values for the FVC and the FEV_1. This was attributed to the "healthy" smoker effect. These findings contribute further evidence for a healthy smoker effect. However, the $FEF_{25-75\%}$ was lower in this group suggesting an early effect of smoking on airflow in the smaller airways which did not manifest with symptoms. The group of healthy smokers did have a greater age related decline in lung function values when compared with healthy never-smokers. The finding of the "healthy" smoker effect suggests that the actual effects of smoking on lung function level may have been underestimated in previous studies if the lung function loss was determined in comparison with prediction formulae derived from healthy never-smokers as is the usual practice. This also has implications in relation to excluding asymptomatic smokers from lung function studies in populations designed to provide prediction formulae in that the true values may be underestimated if the young smokers are excluded from studies of lung function.

Involuntary tobacco smoke exposure was found to be an important independent determinant of the FEV_1/FVC level in women. This finding suggests that this form of environmental exposure has an effect on airflow. These findings were limited to women only, possibly because women may have an increased susceptibility to the effects of involuntary smoking.

The effect of alcohol consumption on lung function level was also examined in this study. In the multiple regression model alcohol consumption in men was associated with a mean difference of -140ml in the FEV_1 level, although only significant at the P.07 level. This data suggests a mild effect of alcohol on lung function level in this population.

Some of the socio-environmental (SE) factors that were examined in this study were found to independently influence the spirometric indices in the multiple regression model which contained all the potential determinants of lung function. This was particularly important in women. The significant factors ($P<.05$) that were associated with a higher value in women were spending early years in a rural environment and the possession of a university education. In men the possession of medical aid was associated with a higher FVC and FEV_1 level which was of borderline significance.

Occupational exposure to dust was a significant independent determinant of the $FEF_{25-75\%}$ and the FEV_1/FVC ratio in men.

Women who had a history of childhood respiratory trouble had a lower FEV_1 level which was of borderline significance. A history of whooping cough in men was associated with a lower PEF value.

The spirometric lung function levels recorded in this study were lower than that recorded in recent studies which utilised similar methodology in Black workforces in South Africa. However, the comparability may be limited by the fact the studies in Blacks were not community based and reflect a healthy worker effect. SE factors are unlikely to account for the observed difference because the Indian subjects in the present study appeared to have a higher SE status than the Black subjects in South Africa. Although the present study showed an influence of SE factors on spirometric lung function levels this was unlikely to explain the racial/ethnic difference. Therefore, SE factors do not completely explain the difference in lung function levels observed between Indians in the present study, and Blacks and Whites in South Africa. Most of the differences may therefore reflect a true biological difference in lung function between Indians and other race/ethnic groups in South Africa.

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APPENDIX 1

QUESTIONNAIRE USED IN THE STUDY

FOR OFFICIAL USE ONLY

CARD No. 1 (1) 1

CBRHS ID (2-8) | | | | | | | |

UNIVERSITY OF THE WITWATERSRAND
FACULTY OF MEDICINE
RESPIRATORY HEALTH SURVEY

ADULT QUESTIONNAIRE
(for those 15 years and older)

The aim of the study is to assess the respiratory health and other health problems (eg. heart disease) in Lenasia. It will also be helpful in planning health services. Therefore your co-operation is vital to the success of this study. This study is sponsored by the South African Medical Research Council and the Richard Ward Endowment Fund of the University of the Witwatersrand, and has been approved by JISWA (Johannesburg Indian Social Welfare Association).

The co-ordinator of the study is Dr. U.G. Lalloo from the National Centre for Occupational Health (NCOH) PO Box 4788, Johannesburg. Telephone 724-1844 Ext 279.

Thank you for your willingness to participate in the respiratory health study. Your household has been selected by a scientific sampling procedure.

This is a questionnaire you are kindly requested to fill out. Please answer the questions as frankly and accurately as possible.

ALL INFORMATION IN THE STUDY WILL BE KEPT CONFIDENTIAL

The questions can be answered by circling the number of the best answer or by filling in a blank with a number or word.

EXAMPLE: Do you live in South Africa? (1.) Yes

2. No

The interviewer will help you with any queries, but please attempt to answer every question on your own as far as possible.

I hereby indicate my willingness to participate in this Respiratory Health Survey. I am aware that the results will be used for scientific purposes and will remain confidential.

SIGNED: _____

NAME OF INTERVIEWER: _____ (9-10) | |

DATE OF INTERVIEW: | | | | | | (11-16)
month day year

Over please ➤

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1. WHAT IS YOUR NAME? (a) Surname: _____ (17-36)

(b) First names: _____ (37-39) ☐☐☐

2. WHAT IS YOUR SEX?

1. Male
2. Female

(40) ☐

3. WHAT IS YOUR MARITAL STATUS?

1. Never married
2. Married
3. Separated
4. Widowed
5. Divorced

(41) ☐

4. HOME ADDRESS: (a) House No.: _____

(b) Street name: _____

(c) Extension No.: _____

(d) Plot No.: _____ (42-46) ☐☐☐☐☐

5. TELEPHONE NO.: (a) Home: _____

(b) Business: _____

6. THE FOLLOWING QUESTIONS ARE ABOUT YOUR EDUCATION

(a) SCHOOLING:
What is the highest standard you achieved at school?

_____ (example Std 6, Matric, nil, etc) (47-48) ☐☐

(b) ARE YOU STILL SCHOOLING?

1. YES
2. NO

(49) ☐

(c) DID YOU STUDY FURTHER AFTER LEAVING SCHOOL?

1. YES
2. NO

(50) ☐

IF YES TO (c), ANSWER (d) AND (e) BELOW:

(d) WHAT TYPE OF INSTITUTION DID YOU ATTEND?

_____ (example, university, technical college, training college, typing school, etc) (51-52) ☐☐

(e) PLEASE STATE COURSE AND QUALIFICATIONS OBTAINED THUS FAR

_____ (example, BA degree, diploma, etc) (53) ☐

7. WHAT IS YOUR DATE OF BIRTH? ☐☐ ☐☐ ☐☐ (54-59) ☐☐☐☐☐☐

month day year

➤

FOR OFFICIAL USE ONLY

THE FOLLOWING QUESTIONS ARE ABOUT YOUR HEALTH
PLEASE REMEMBER ALL INFORMATION WILL BE KEPT CONFIDENTIAL

8. HAVE YOU EVER HAD ANY OF THE FOLLOWING CONDITIONS?
(If uncertain, answer NO).
IF YOU ARE ON TREATMENT FOR ANY CONDITION ASKED BELOW
THEN CIRCLE 1

(a) Ulcer of the stomach or duodenum	1. YES, I still have it 2. YES, but I no longer have it 3. NO	(60)	☐
(b) Arthritis	1. YES, I still have it 2. YES, but I no longer have it 3. NO	(61)	☐
(c) Kidney trouble	1. YES, I still have it 2. YES, but I no longer have it 3. NO	(62)	☐
(d) Liver trouble	1. YES, I still have it 2. YES, but I no longer have it 3. NO	(63)	☐
(e) Any kind of heart trouble	1. YES, I still have it 2. YES, but I no longer have it 3. NO	(64)	☐
(f) High blood pressure	1. YES, I still have it 2. YES, but I no longer have it 3. NO	(65)	☐
(g) Diabetes (sugar in urine)	1. YES, I still have it 2. YES, but I no longer have it 3. NO	(66)	☐
(h) Stroke	1. YES, I am still disabled 2. YES, but I have recovered from it 3. NO	(67)	☐
(i) A serious skin rash in infancy (eczema)	1. YES 2. NO	(68)	☐

9. HAVE YOU EVER BEEN TOLD BY A DOCTOR THAT YOU HAD ANGINA?
(chest pain due to the heart)

1. YES
2. NO

(69) ☐

10a. HAVE YOU EVER HAD A HEART ATTACK?
(ie. myocardial infarction or coronary thrombosis)

1. YES
2. NO

(70) ☐

CARD No. 2 (1) 2

CBRHS ID (2-8) ☐☐☐☐☐☐☐

IF YES TO 10a:
At what age did you have it? _____ (age in years)

(9-10) ☐☐

Over please ➤

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10b. DID EITHER OF YOUR PARENTS EVER HAVE A HEART ATTACK?

1. YES
2. NO

(11) ☐

IF YES, TO 10b

At what age did he/she first have it? _____ (age in years) (12-13) ☐☐

COUGH

11a. DO YOU USUALLY COUGH FIRST THING IN THE MORNING?

1. YES
2. NO

(14) ☐

11b. DO YOU USUALLY COUGH AT OTHER TIMES DURING THE DAY OR NIGHT?

1. YES
2. NO

(15) ☐

IF YES TO EITHER 11a OR 11b, ANSWER c AND d

c. DO YOU COUGH ON MOST DAYS FOR AS MUCH AS 3 MONTHS OF THE YEAR?

1. YES
2. NO

(16) ☐

d. FOR HOW MANY YEARS HAVE YOU HAD THIS COUGH?

1. Less than 2 years
2. 2-5 years
3. More than 5 years

(17) ☐

PHLEGM

12a. DO YOU USUALLY BRING UP PHLEGM, SPUTUM OR MUCUS FROM YOUR CHEST FIRST THING IN THE MORNING?

1. YES
2. NO

(18) ☐

12b. DO YOU USUALLY BRING UP PHLEGM, SPUTUM OR MUCUS FROM YOUR CHEST AT OTHER TIMES DURING THE DAY OR NIGHT?

1. YES
2. NO

(19) ☐

IF YES TO EITHER 12a OR b, ANSWER c AND d

c. DO YOU BRING UP PHLEGM, SPUTUM OR MUCUS FROM YOUR CHEST ON MOST DAYS FOR AS MUCH AS 3 MONTHS OF THE YEAR?

1. YES
2. NO

(20) ☐

d. FOR HOW MANY YEARS HAVE YOU RAISED PHLEGM, SPUTUM OR MUCUS FROM YOUR CHEST?

1. Less than 2 years
2. 2-5 years
3. More than 5 years

(21) ☐

COUGH AND PHLEGM

13a. HAVE YOU EVER HAD PERIODS OR EPISODES OF INCREASED COUGH AND PHLEGM LASTING FOR 3 WEEKS OR MORE EACH YEAR?

1. YES
2. NO

(22) ☐

►

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IF YES TO 13a

13b. FOR HOW LONG HAVE YOU HAD THIS? _____ years (23-24) ☐☐

WHEEZING

14a. DOES YOUR CHEST EVER SOUND WHEEZY OR WHISTLING?

1. YES
2. NO

(25) ☐

IF YES TO 14a

b. DO YOU GET THIS WITH COLDS?

1. YES
2. NO

(26) ☐

c. DO YOU GET THIS EVEN WHEN YOU DO NOT HAVE A COLD?

1. YES
2. NO

(27) ☐

d. DO YOU GET THIS ON MOST DAYS?

1. YES
2. NO

(28) ☐

15. HAVE YOU EVER HAD ATTACKS OF SHORTNESS OF BREATH WITH WHEEZING?

1. YES
2. NO

(29) ☐

BREATHLESSNESS

16. ARE YOU MORE SHORT OF BREATH THAN MOST PEOPLE YOUR AGE?

1. YES
2. NO

(30) ☐

17. ARE YOU TROUBLED BY SHORTNESS OF BREATH WHEN HURRYING ON LEVEL GROUND?

1. YES
2. NO

(31) ☐

18. DO YOU GET SHORT OF BREATH WALKING WITH OTHER PEOPLE OF YOUR OWN AGE ON LEVEL GROUND?

1. YES
2. NO

(32) ☐

19. DO YOU HAVE TO STOP FOR BREATH WHILE WALKING AT YOUR OWN PACE ON LEVEL GROUND?

1. YES
2. NO

(33) ☐

Over please ➤

FOR OFFICIAL USE ONLY

PREVIOUS CHEST ILLNESS

20a. HAVE YOU EVER HAD ANY KIND OF CHEST TROUBLE?

1. YES
2. NO

(34) ☐

IF YES TO 20a

b. WHAT SORT OF TROUBLE? _____ (35-36) ☐☐

c. HAVE YOU HAD THIS DURING THE PAST YEAR?

1. YES
2. NO

(37) ☐

21a. DID YOU HAVE ANY RESPIRATORY/CHEST TROUBLE BEFORE THE AGE OF 16?

1. YES
2. NO

(38) ☐

21b. DID YOU HAVE MEASLES AS A CHILD?

1. YES
2. NO

(39) ☐

21c. DID YOU HAVE WHOOPING COUGH AS A CHILD?

1. YES
2. NO

(40) ☐

22. DURING THE PAST THREE YEARS, HOW OFTEN WERE YOU UNABLE TO DO YOUR USUAL ACTIVITIES BECAUSE OF ILLNESSES SUCH AS CHEST COLDS, BRONCHITIS, OR PNEUMONIA? (Does not refer to head colds)

1. Never
2. During 1 such illness
3. During 2-5 illnesses
4. During 6 illnesses or more

(41) ☐

23. DURING THE PAST YEAR, FOR HOW MANY DAYS HAVE YOU BEEN UNABLE TO DO YOUR USUAL ACTIVITIES BECAUSE OF SUCH ILLNESSES? _____ days

(42-44) ☐☐☐

24a. HAVE YOU EVER HAD EMPHYSEMA?

1. YES
2. NO

(45) ☐

IF YES TO 24a

b. WAS IT CONFIRMED BY A DOCTOR?

1. YES
2. NO

(46) ☐

c. AT WHAT AGE DID IT START? _____ age in years

(47-48) ☐☐

25a. HAVE YOU EVER HAD **CHRONIC** BRONCHITIS?

1. YES
2. NO

(49) ☐

IF YES TO 25a

b. WAS IT CONFIRMED BY A DOCTOR?

1. YES
2. NO

(50) ☐

c. AT WHAT AGE DID IT START? _____ age in years

(51-52) ☐☐

►

FOR OFFICIAL USE ONLY

26a. HAVE YOU EVER HAD ASTHMA?

1. YES
2. NO

(53) ☐

IF YES TO 26a

b. WAS IT CONFIRMED BY A DOCTOR?

1. YES
2. NO

(54) ☐

c. IN THE PAST YEAR, HOW MANY ASTHMA ATTACKS DID YOU HAVE?

1. No attacks
2. A few attacks (1 per month)
3. Several attacks (1 per week)
4. Attacks almost every day

(55) ☐

d. CIRCLE THE MONTHS IN WHICH YOUR ATTACKS HAVE BEEN MOST FREQUENT

1	2	3	4	5	6	7	8	9	10	11	12
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(56-67) ☐☐☐☐☐☐

OR Tick here if no relation to time of year ☐

(68) ☐

e. HAVE YOU EVER SEEN A DOCTOR ABOUT YOUR ASTHMA?

1. YES
2. NO

(69) ☐

f. ARE YOU PRESENTLY TAKING MEDICATION OR TREATMENT FOR YOUR ASTHMA?

1. YES
2. NO

(70) ☐

CARD No. 3 (1) 3

ID (2-8)

g. HOW OLD WERE YOU WHEN YOU HAD YOUR FIRST ASTHMA ATTACK? _____ (age)

(9-10) ☐☐

h. WHICH FORM OF THERAPY DO YOU PREFER/LIKE FOR ASTHMA?

1. Pump/spray
2. Tablets
3. Both tablets and a pump
4. None of the above

(11) ☐

27. HAVE YOU HAD ANY OF THE FOLLOWING?

a. TUBERCULOSIS (TB)

1. YES
2. NO

(12) ☐

IF YES, WAS IT CONFIRMED BY A DOCTOR?

1. YES
2. NO

(13) ☐

AT WHAT AGE DID YOU HAVE IT? _____ (age)

(14-15) ☐☐

b. PNEUMONIA OR BRONCHOPNEUMONIA

1. YES
2. NO

(16) ☐

IF YES, WAS IT CONFIRMED BY A DOCTOR?

1. YES
2. NO

(17) ☐

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28a. HAVE YOU EVER HAD HAY FEVER OR ANY OTHER ALLERGY THAT MAKES YOUR NOSE RUNNY OR STUFFY, APART FROM COLDS?

1. YES, I still have it
2. YES, but I no longer have it
3. NO

(18) ☐

IF YES TO 28a

b. DURING THE PAST YEAR, HOW MUCH HAVE YOU BEEN BOTHERED BY IT?

1 2 3 4 5

very little very much

(circle appropriate number)

(19) ☐

c. CIRCLE THE MONTHS IN WHICH YOUR EPISODES HAVE BEEN MOST FREQUENT

1 2 3 4 5 6 7 8 9 10 11 12

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

(20-31) ☐☐☐☐☐☐ ☐☐☐☐☐☐

OR Tick here if no relation to time of year ☐

(32) ☐

29a. HAVE YOU EVER HAD SINUS TROUBLE?

1. YES
2. NO

(33) ☐

IF YES TO 29a

b. WAS IT CONFIRMED BY A DOCTOR?

1. YES
2. NO

(34) ☐

c. AT WHAT AGE DID IT START? _____ years

(35-36) ☐☐

30. HAVE YOU EVER BEEN ALLERGIC TO ANYTHING? (eg. Food, medicine, pets, clothing etc)

1. YES
2. NO

(37) ☐

IF YES TO 30, TO WHAT ARE YOU ALLERGIC? _____

_____

(38) ☐

31. HOW MUCH EXERCISE DO YOU GET?

1. None (no sports)
2. Little (occasional sports)
3. Moderate amount (social sports)
4. A great deal (regular sports)

(39) ☐

32. ***FOR FEMALES ONLY***

ARE YOU PREGNANT?

1. YES
2. NO
3. UNCERTAIN

(40) ☐

33a. IN THE PAST FIVE YEARS, HAVE YOU HAD A CHEST X-RAY?

1. YES
2. NO

(41) ☐

►

IF YES TO 33a

b. WHERE WAS IT DONE? _____ (42) ☐

_____

c. WAS IT ABNORMAL? 1. YES 2. NO (43) ☐

34. IN THE PAST YEAR HAVE YOU BEEN HOSPITALISED FOR ANY CHEST PROBLEM?

1. YES
2. NO

(44) ☐

35. HAVE YOU EVER HAD ANY CHEST OR LUNG SURGERY? (Do not include breast surgery)

1. YES
2. NO

(45) ☐

36. HAVE YOU EVER HAD AN ACCIDENT OR INJURY TO YOUR CHEST?

1. YES
2. NO

(46) ☐

37.a DID YOU MOVE TO LENASIA FROM ELSEWHERE?

1. YES
2. NO

(47) ☐

IF YES TO 37a

b. IN WHAT TYPE OF AREA HAVE YOU SPENT MOST OF YOUR LIFE?
1. A large city (eg Johannesburg, Durban)
2. A small city (eg Ladysmith, Estcourt)
3. A suburb in a city (eg Chatsworth, Asherville, Lenasia)
4. A rural/farming area

(48) ☐

c. FOR HOW MANY YEARS HAVE YOU LIVED IN LENASIA?

_____ years (49-50) ☐☐

38. ARE YOU ON MEDICAL AID?

1. YES
2. NO

(51) ☐

Over please ➤

FOR OFFICIAL USE ONLY

SMOKING

39a. HAVE YOU EVER SMOKED CIGARETTES?
(NO means less than 20 packs of cigarettes in your life or less than 1 cigarette a day for 1 year)

1. YES
2. NO

(52) ☐

IF YES TO 39a (ie more than 20 packs of cigarettes or more than 1 cigarette a day for 1 year)
THEN ANSWER THE FOLLOWING

b. DO YOU NOW SMOKE CIGARETTES?
(as of 1 month ago)

1. YES
2. NO

(53) ☐

c. HOW OLD WERE YOU WHEN YOU FIRST STARTED REGULAR CIGARETTE SMOKING? _____ (age in years) (54-55) ☐☐

d. IF YOU HAVE STOPPED SMOKING CIGARETTES COMPLETELY, HOW OLD WERE YOU WHEN YOU STOPPED? _____ (age stopped) (56-57) ☐☐

e. HOW MANY CIGARETTES DO YOU SMOKE PER DAY NOW? _____ (cigs per day) (58-59) ☐☐

f. ON THE AVERAGE OF THE ENTIRE TIME YOU SMOKED, HOW MANY CIGARETTES DID YOU SMOKE PER DAY? _____ (cigs per day) (60-61) ☐☐

g. DO YOU OR DID YOU INHALE THE CIGARETTE SMOKE?

1. Not at all
2. Slightly
3. Moderately
4. Deeply

(62) ☐

40a. HAVE YOU EVER SMOKED A PIPE REGULARLY?
(YES means more than 350 grams of tobacco in a life time)

1. YES
2. NO

(63) ☐

IF YES TO 40a
(ie you smoked more than 350 grams of tobacco in a lifetime)

b. HOW OLD WERE YOU WHEN YOU STARTED TO SMOKE A PIPE REGULARLY? _____ (age in years) (64-66) ☐☐☐

c. IF YOU HAVE STOPPED SMOKING A PIPE COMPLETELY, HOW OLD WERE YOU WHEN YOU STOPPED? _____ (age stopped) (67-68) ☐☐

d. ON THE AVERAGE OVER THE ENTIRE TIME YOU SMOKED A PIPE, HOW MUCH PIPE TOBACCO DID YOU SMOKE PER WEEK? _____ grams per week (69-71) ☐☐☐
(a standard pouch of tobacco contains 50 grams)

CARD No. 4 (1) 4

ID (2-8) ☐☐☐☐☐☐☐

e. HOW MUCH PIPE TOBACCO ARE YOU SMOKING NOW?
_____ grams per week (9-11) ☐☐☐

f. DO YOU OR DID YOU INHALE THE SMOKE?

1. Not at all
2. Slightly
3. Moderately
4. Deeply

(12) ☐

➤

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41a. HAVE YOU EVER SMOKED CIGARS REGULARLY?
(YES means more than 1 cigar per week for a year)

1. YES
2. NO

(13) ☐

IF YES TO 41a
(ie. you smoked more than 1 cigar per week for a year)
THEN ANSWER THE FOLLOWING

b. HOW OLD WERE YOU WHEN YOU STARTED SMOKING? CIGARS REGULARLY? _____ years (14-15) ☐☐

c. IF YOU HAVE STOPPED SMOKING CIGARS COMPLETELY, HOW OLD WERE YOU WHEN YOU STOPPED? _____ years (16-17) ☐☐

d. ON THE AVERAGE OF THE ENTIRE TIME YOU SMOKED CIGARS, HOW MANY CIGARS DID YOU SMOKE PER WEEK? _____ cigars per week (18-19) ☐☐

e. DO YOU OR DID YOU INHALE THE CIGAR SMOKE?

1. Not at all
2. Slightly
3. Moderately
4. Deeply

(20) ☐

42. HOW MUCH WATER DO YOU DRINK PER DAY?
(not in the form of tea, coffee or cool drinks)?

1. 1 glass or less
2. 2-3 glasses
3. More than 3 glasses

(21) ☐

43. DO YOU DRINK COOL DRINKS?

1. YES
2. NO

(22) ☐

44a. DO YOU DRINK ANY ALCOHOLIC BEVERAGES?

1. YES
2. NO

(23) ☐

IF YES TO 44a

b. HOW MANY GLASSES OR CANS OF BEER PER WEEK? (on the average) _____ glasses/cans (24-25) ☐☐

c. HOW MANY GLASSES OF WINE PER WEEK? (on the average) _____ glasses (26-27) ☐☐

d. HOW MUCH HARD LIQUOR PER WEEK? (eg brandy, whisky) (on the average) _____ tots/shots (28-29) ☐☐

Over please ➤

FOR OFFICIAL USE ONLY

THE FOLLOWING QUESTIONS ARE ABOUT YOUR OCCUPATION/JOB/WORK

45a. HAVE YOU EVER WORKED FULL TIME?
(ie 30 hours per week or more for 6 months or more)

1. YES
2. NO

(30) ☐

IF YES TO 45a

b. DID YOU EVER WORK IN A DUSTY JOB?

1. YES
2. NO

(31) ☐

IF YES, PLEASE SPECIFY JOB OR INDUSTRY IN WHICH YOU WORKED AND FOR HOW LONG? _____ (32-33) ☐☐

_____

IF YES TO 45b

c. WAS THE WORK PLACE

1. DUSTY
2. VERY DUSTY

(34) ☐

d. HAVE YOU EVER BEEN EXPOSED TO GAS OR CHEMICAL FUMES IN YOUR JOB?

1. YES
2. NO

(35) ☐

IF YES, PLEASE SPECIFY JOB OR INDUSTRY IN WHICH YOU WORKED AND FOR HOW LONG? _____ (36-37) ☐☐

_____

46. WHAT IS YOUR USUAL JOB OR OCCUPATION?
(ie the one you worked at the longest)

a. JOB/OCCUPATION _____ (38-39) ☐☐

b. NUMBER OF YEARS IN THIS JOB/OCCUPATION _____ years (40-41) ☐☐

c. POSITION OR TITLE OF JOB/OCCUPATION _____ (42-43) ☐☐

d. STATE BUSINESS FIELD OR INDUSTRY _____ (44-45) ☐☐

e. IF NOT WORKING AT THIS JOB
AT WHAT AGE DID YOU LAST WORK AT IT? _____ age in years (46-47) ☐☐

47. WHAT IS YOUR PRESENT JOB OR OCCUPATION? _____ (48-49) ☐☐

48. WHAT IS YOUR INCOME? _____ (50) ☐

1. No income at present
2. Less than R500 per month
3. R500-R999 per month
4. R1000-R1999 per month
5. R2000-R2999 per month
6. R3000 per month

THANK YOU FOR YOUR KIND CO-OPERATION IN COMPLETING THIS QUESTIONNAIRE. PLEASE BE REMINDED THAT ALL INFORMATION WILL BE TREATED CONFIDENTIALLY.

IF YOU ARE SELECTED FOR A LUNG FUNCTION TEST BY OUR COMPUTER BASED RANDOM SAMPLING TECHNIQUE YOU WILL BE CONTACTED FOR AN APPOINTMENT.
The test involves your blowing into a machine to measure how much air you are able to breathe in and how fast you can breathe it out. The test will be done on a Saturday at the Health Centre in Lenasia.

APPENDIX 2

DEMOGRAPHIC DATA SHEET

UNIVERSITY OF THE WITWATERSRAND CARD NO [1]

RESPIRATORY HEALTH SURVEY
DEMOGRAPHIC DATA

I.D. [| | |]

1. NAME OF INTERVIEWER:---------- [|]

2. NAME OF PERSON/S INTERVIEWED:
(1).----------CBRHS ID [| | | | | |] (13)

3. ADDRESS: STREET AND NO. ----------

4. EXTENSTION NO. ---------- [|]

5. PLOT NO. ---------- [| | | |]

6. NO. OF BUILDINGS ON STAND:
"1. MAINBUILDINGS -- [ ]
2. OUTBUILDINGS -- [ ]
*3. GARAGES -- [ ]
4. OTHERS (please specify) ---------- [ ] (23)

* If garage used for accommodation then count as out building.
" If flat then count as main building and specify.

7. NO. OF FAMILIES --- [ ]

8. TOTAL NO. IN HOUSEHOLD --- [|]

9. LIST AGES

	:MALES:	:FEMALES:
eg. 4= 0:4	:	:
.44= 4:4	:	:
	:	:
	:	:
	:	:
	:	:
	:	:
	:	:
	:	:
	:	:

(27-66)

10. No. of bedrooms: [|]

11. Type of fuel for cooking: [ ] (69-70)

(circle appropriate number/s)

1. electricity
2. gas
3. coal
4. wood
5. other

12. NAME OF FAMILY DOCTOR. ----------

13. SUPERVISORS NAME ----------

14. DATA COLLECTION SATISFACTORILY COMPLETED

[ ] YES [ ] NO

APPENDIX 3

TRAINING MANUAL FOR INTERVIEWERS

LENASIA
RESPIRATORY HEALTH SURVEY

TRAINING MANUAL

Compiled by:

Dr Umesh Lalloo
Dr Nicky Padayachee

UNIVERSITY OF WITWATERSRAND FACULTY OF MEDICINE
RESPIRATORY HEALTH SURVEY
ADULT QUESTIONNAIRE

15 AUGUST 1985.

Dear Interviewer,

Thank you for volunteering your time to assist in the Respiratory Health Survey in Lenasia.I am sure you will find it an enlightening experience.

Enclosed please find a Training Manual which will provide you with all the information you will need on the survey,and instructions on how to conduct the interview.

Please attend the training session at the JISWA centre on the 24th August 1985 at 14-00hrs(2.00pm).
Knowledge of the Training Manual is not enough,and it is therefore imperative that you attend the Training session as well.

If you have any problems or queries,please donot hestitate to contact:

1.Dr Umesh Lalloo or
2.Dr Nicky Padayachee
at:Tel.no.7241844 ext 279 or
8531533 (after hours)

Good luck,and I am looking forward to seeing you at the Training session.
Thank you once again for your participation and contribution.

BACK GROUND TO THE STUDY

This study was planned by Dr Umesh Lalloo who is studying chest diseases under a Wits scholarship.The study was planned in Lenasia for several important reasons.It is an observation that chest diseases like asthma and bronchitis are common in this area.There are no studies done that assess the prevalence of chest diseases in an Indian community,for that matter in in any community in this country.Smoking,as you are no doubt aware is an important factor in chest diseases and this study also assesses this.Many people work in dusty jobs and this may be a cause of chest or lung diseases.We are therefore asking questions about occupation or work.

A community based study of this nature therefore will provide important answers to help plan health services which may be lacking in our community.In order to plan what facilities are required we need to know what problems are common.This was the idea in doing the study for the aged in Lenasia.JISWA can as a result of this make a valid representation for the facilities that are needed for the aged.

Lung function measurement is a very important method for a physician to assess the condition of a patients lungs and a study like this one will provide reference values to decide whether a patients lung function measurement is normal or abnormal.For this purpose simple lung function tests will be done.

With these motivating factors the Respiratory Health Survey was designed.This was done under the guidance of Professor Margaret R.Becklake an experienced epidemiologist and respiratory physician from Mc Gill University,Montreal,Canada.She is an experienced researcher and it was therefore a unique opportunity to have a study designed under her guidance.In addition Dr.Allen Herman who is a renowned epidemiologist assisted with the design of the study.Dr.N.Padayachee who co-ordinated one the most succeseful community based studies in the world viz.the Study of The Aged in Lenasia is one of the coordinators in this study. Professor J C A Davies Director, The National Centre For Occupational Health is associate supervisor in this project.

This community based study,has the approval of the relevant community organisations,in particular,JISWA.

In this study which took more than 4 months to plan every attempt was made to ensure that the information generated would be valid and a true reflection of the respiratory health status of the people in Lenasia.

AIMS OF THE STUDY

The aims of the study are therefore to:

1. Assess the extent of chest diseases in adults in Lenasia.
2. Assess the extent of ischaemic heart diseases and diabetes mellitus in Lenasia.
3. Assess the lung function of adults in Lenasia in relation to sex, age, height and smoking in Lenasia.

DEFINITIONS

1. CHEST DISEASES: Examples of chest diseases are asthma, bronchitis, pneumonia, tuberculosis (TB), injuries to the chest, etc.

2. ISCHAEMIC HEART DISEASE: Synonyms for this term is coronary artery disease and angina.

3. DIABETES MELLITUS: Commonly used term by the community for this term is sugar diabetes.

4. LUNG FUNCTION TEST: This is a simple test using a Vitallograph a picture of which is enclosed in this manual. All the person has to do is to blow into this machine.

5. SMOKING: A person is called a smoker if he/she has smoked more than 1 cigarette a day for more than 1 year or 20 packets of cigarettes in his/her lifetime. This is a useful fact to remember.

WHO IS GOING TO BE STUDIED (RESPONDENTS)

This the most important part of any study. As has become clear to you we are studying the population of people in Lenasia living in extensions 1-11 inclusive. You can readily see that it is impossible to study everyone. To overcome this problem a random sample of people in this area was taken using a computer. This sample of people you are going to study is therefore unbiassed and representative. Only adults will be studied. For this purpose adults are all people in a household who are 15 years and older on the day on which you are conducting the interviews.

HOW IS THE STUDY GOING TO BE CONDUCTED

In simple terms the study is going to be done in two phases viz:

A. Questionnaire Administration.

B. Lung Function testing.

Both these phases will run concurrently.

A. QUESTIONNAIRE ADMINISTRATION

This where your role as a vital participant in the survey comes in play. The questionnaire is a self administered one. This means that the respondent (person being studied) fills in the questionnaire on his/her own. Your role is to ensure that everyone in the household 15 years and older fills one in and to help with any queries. In order to obtain valid results it is essential for all persons selected to participate in the study. Fundamental to your role as an interviewer is your ability to to convince the respondents to complete the questionnaire. This will be facilitated by:

a) familiarising yourself with the questionnaire and

b) attending the training session at the JISWA centre on scheduled date.

c) consultation with the co-ordinators and supervisors.

B. LUNG FUNCTION TESTING

This is a simple test as explained earlier. It will be performed on a Saturday at the Lenasia Health Centre. An appointment will be made for this by one of the co-ordinators or supervisors of the study. (see diagram of managerial structure). Please make sure that you know that lung function tests will not be done on everyone who answers the questionnaire. Those for lung function tests will be randomly selected, and will not mean that they have any chest problems. In view of the time constraints we cannot do tests on everyone. Your important task therefore will be to explain to the respondents (people who are participating in the study) that they may be contacted for a lung function test. This will be done on a Saturday at the Lenasia Health Centre by appointment.

ANALYSIS

This will be done with the assistance of the Institute of Biostatistics.

VALIDATION OF RESULTS

All studies, particularly one of this nature, which are going to be helpful in the planning of community health services need to be reassessed for validity and repeatability of data. This is going to done by a post survey test where 10% of our study sample will be reassessed as was done in the study of the aged.

I am sure that by now you are tired of reading about study designs. You are fortunate to have been given an insight into a field in which few have the opportunity. This opportunity was taken to explain it to you because one can achieve far better results by understanding why one does things in a particular manner. Maybe you should take a little break before proceeding with the rest of the manual.

THE MOST IMPORTANT PART OF YOUR ROLEIS TO APPROACH THE HOUSE-HOLDER WITH A SMILE. BE CONFIDENT AND AT EASE.THIS APPROACH WILL ENSURE A GOOD RESPONSE.THE STUDY WILL BE ADVERTISED IN THE NEWSPAPERS AND ON THE RADIO SO THE HOUSEHOLDER WILL HAVE ALREADY HEARD ABOUT THIS STUDY.
PROCEED TO GIVE AN EXPLANATION ABOUT THE STUDY.

a) GIVE THE AIM OF THE STUDY.viz:
TO GET AN IDEA OF RESPIRATORY/CHEST PROBLEMS IN LENASIA.

b) REASON FOR GATHERING THIS INFORMATION IS THAT NO STUDY HAS BEEN DONE TO ASSESS THE HEALTH PROBLEMS IN LENASIA.IT HAS BEEN NOTED THAT CERTAIN CHEST PROBLEMS LIKE ASTHMA AND BRONCHITIS ARE COMMON IN THIS AREA.

c) THIS INFORMATION WILL BE USEFUL IN PLANNING HEALTH SERVICES IN LENASIA AND IN ANY COMMUNITY IN WHICH A SIMILAR STUDY IS DONE.

NEXT AN EXPLANATION WHY THIS HOUSEHOLD HAS BEEN SELECTED MUST FOLLOW.THERE ARE 2 REASONS:

a) IT IS A COMMUNITY BASED STUDY.
b) COMPUTER BASED <u>RANDOM</u> SAMPLE.

NOW STRESS THE IMPORTANCE OF CO-OPERATION.THE RESPONDENT IS THE MOST IMPORTANT PERSON IN THE STUDY AND IT IS FROM HIS/HER INFORMATION THAT RESULTS CAN BE OBTAINED.IT IS THEREFORE ESSENTIAL FOR ALL MEMBERS LIVING IN THE HOUSEHOLD WHO ARE 15 YEARS AND OLDER TO PARTICIPATE.

<u>USEFUL HINTS.</u>

1. THE QUESTIONNAIRE IS SIMPLE TO ANSWER AND TAKES LESS THAN 10 MINUTES TO FILL IN.HE/SHE FILLS IT ON THEIR OWN WITH VERY LITTLE WRITING.STRESS THIS POINT.

2. AT ALL TIMES BE AT EASE.BE CONFIDENT YET DIPLOMATIC.EVERYONE STUDIED IN THE PILOT STUDY WERE, WITHOUT EXCEPTION, CO-OPERATIVE.

3. PLEASE ENSURE THAT YOU HAVE AN ERASER AND A SUFFICIENT NO.OF PENCILS WHEN UNDERTAKING THE STUDY.

ENQUIRE HOW MANY PEOPLE 15 YEARS AND OLDER LIVE PERMANENTLY IN THE HOUSE AND GIVE EACH ONE A QUESTIONNAIRE TO FILL IN.IF SOMEONE IS NOT IN LEAVE A QUESTIONNAIRE/S FOR HIM/ HER TO FILL IN WHEN THEY COME IN.IF THEY ARE ON HOLIDAY ETC.THEN FILL IN THEIR NAMES AND WRITE ON THE BACK OF THE FORM THE CIRCUMSTANCES.IF YOU HAVE TO COLLECT A QUESTIONNAIRE LATER ON THIS WILL GIVE YOU AN OPPORTUNITY TO HAVE ANY ERRORS ON THE COMPLETED FORMS TO BE CORRECTED.

PROCEED TO EXPLAIN HOW TO FILL IN THE QUESTIONNAIRE AND STRESS ITS SIMPLICITY.

CODING OF QUESTIONNAIRE:

CBRHS ID_____

CBRHS ID.

THIS STANDS FOR COMMUNITY BASED RESPIRATORY HEALTH STUDY. IT CONSISTS OF 7 NUMBERS. THE FIRST IS FOR SEX ie 1=MALE AND 2=FEMALE. THE SECOND 2 IS FOR EXTENSION NO. IN LENASIA eg EXT 1 IS DENOTED 01 AND EXT. 11 IS DENOTED 11. THE LAST 4 NUMBERS ARE THE STUDY NO. OF THE RESPONDENT. eg. A RESPONDENT WHO IS NO. 345 IS DENOTED 0345 AND NO. 12 IS DENOTED 0012.

UNIVERSITY OF WITWATERSRAND FACULTY OF MEDICINE

RESPIRATORY HEALTH SURVEY

ADULT QUESTIONNAIRE

(for those 15 years and older)

EXAMPLE: Do you live in South Africa? 1. Yes
2. No

PLEASE EMPHASIZE THIS EXAMPLE AS IT INDICATES HOW MOST OF THE QUESTONS ARE TO BE ANSWERED. AT THIS POINT ALSO STATE CLEARLY THAT "IF YES" PART IS ONLY TO BE ANSWERED IF "YES" WAS ANSWERED IN THE PRECEDING QUESTION. TELL THE RESPONDENT THAT BECAUSE OF THIS ONLY ABOUT HALF OF THE QUESTIONNAIRE IS ANSWERED IN EFFECT.

The interviewer will help you with any queries, but please attempt every question on your own as far as is possible.

I hereby indicate my willingness to participate in this Respiratory Health survey, aware that the data will be used for scientific purposes and will remain confidential.

SIGNED:_____

NAME OF INTERVIEWER:_____

DATE OF INTERVIEW: |___|___|___|
mon day year

PLEASE FILL IN YOUR NAME BEFORE ENTERING A HOME. THE DATE OF INTERVIEW MUST BE FILLED IN BY YOU THE INTERVIEWER AT THE TIME OF OF HANDING OVER THE THE QUESTIONNAIRE TO THE RESPONDENT. THE RESPONDENT BY THIS TIME WILL HAVE SIGNED HIS /HER NAME BUT DONOT INSIST THAT IT BE DONE NOW. IT CAN BE DONE AT THE END OR NOT AT ALL IF THE INDIVIDUAL IS NOT WILLING.

1. WHAT IS YOUR NAME? (a) SURNAME:_____

(b) FIRST NAMES:_____

THE RESPONDENT MAY ONLY FILL IN HIS INITIALS IF HE/SHE SO WISHES.

2. WHAT IS YOUR SEX?

1. MALE.
2. FEMALE.

3. WHAT IS YOUR MARITAL STATUS?

1. Never married
2. Married
3. Separated
4. Widowed
5. Divorced

A RESPONDENT CIRCLES 2 IF HE/SHE IS MARRIED BY CUSTOM OR IS REGISTERED.

4.HOME ADDRESS: (a)HOUSE NO.: ___

(b)STREET NAME: _____

(c)EXTENSION NO.: _____

(d)PLOT NO.: _____

5.TELEPHONE NO: (a)HOME _____

(b)BUSINESS _____

THESE QUESTIONS ARE IMPORTANT PARTICULARLY IF WE WANT TO CONTACT PEOPLE TO BOOK A LUNG FUNCTION TEST AND FOR A POST SURVEY STUDY.

6.THE FOLLOWING QUESTIONS ARE ABOUT YOUR EDUCATION

(a) SCHOOLING:
WHAT IS THE HIGHEST STANDARD YOU ACHIEVED AT SCHOOL?
.....(example Std. 6, Matric,nil,etc.)

(b) ARE YOU STILL SCHOOLING? 1.YES.
2.NO.

(c) DID YOU STUDY FURTHER AFTER LEAVING SCHOOL?
1.Yes
2.No

IF YES TO (c) ANSWER (d) AND (e) BELOW.

(d) WHAT TYPE OF INSTITUTION DID YOU ATTEND?
.....(example university,technical college,training college,typing school,etc.)

(e) PLEASE STATE COURSE AND QUALIFICATIONS OBTAINED THUS FAR.
.....(example B.A.degree,diploma etc.)

7.WHAT IS YOUR BIRTHDATE? |....|....|....|
month day year

CHECK HERE THAT YEAR IS CORRECTLY FILLED. IT IS A COMMON ERROR TO FILL IN 1985 INSTEAD OF YEAR OF BIRTH.THIS IS VITAL INFORMATION FOR LUNG FUNCTION TEST.

THE FOLLOWING QUESTIONS ARE ABOUT OUR HEALTH. PLEASE REMEMBER ALL INFORMATION WILL BE KEPT CONFIDENTIAL.

8. HAVE YOU EVER HAD ANY OF THE FOLLOWING CODITIONS. (If uncertain, circle NO). IF YOU ARE ON TREATMENT FOR ANY CONDITION ASKED BELOW THEN CIRCLE 1.

(a) Ulcer of the stomach or duodenum
1. YES, I still have it.
2. YES, but I no longer have it.
3. NO.

(b) Arthritis
1. YES, I still have it.
2. YES, but I no longer have it.
3. NO.

(c) Kidney trouble
1. YES, I still have it.
2. YES, but I no longer have it.
3. NO.

(d) Liver trouble
1. YES, I still have it.
2. YES, but I no longer have it.
3. NO.

(e) Any kind of heart trouble
1. YES, I still have it.
2. YES, but I no longer have it.
3. NO.

(f) High blood pressure
1. YES, I still have it.
2. YES, but I no longer have it.
3. NO.

(g) Diabetes (sugar in urine)
1. YES, I still have it.
2. YES, but I no longer have it.
3. NO.

(h) Stroke
1. YES, I am still disabled.
2. YES, but I have recovered from it.
3. NO.

(i) A serious skin rash in infancy (eczema)
1. YES.
2. NO.

THESE QUESTIONS MUST BE ANSWERED BY THE RESPONDENT WITHOUT EXPLAINING THE MEANING OF ANY TERM. IF THEY ARE NOT SURE THEN THEY MUST ANSWER "NO". THIS IS SO DESIGNED TO AVOID ANY BIAS.

9. HAVE YOU EVER BEEN TOLD BY A DOCTOR THAT YOU HAD ANGINA? (chest pain due to the heart)
1. YES.
2. NO.

10a. HAVE YOU EVER HAD A HEART ATTACK (ie. myocardial infarct. or coronary thrombosis)
1. YES.
2. NO.

IF YES AT WHAT AGE DID YOU HAVE IT.....

10b. DID ANY OF YOUR PARENTS EVER HAVE A HEART ATTACK?
1. YES.
2. NO.

IF YES AT WHAT AGE DID HE/SHE FIRST HAVE IT?
_____(age in years)

THESE QUESTION ARE ASKED TO ASSESS THE AMOUNT OF HEART TROUBLE PRESENT IN THE COMMUNITY BEARING IN MIND THAT A HEART FOUNDATION

COUGH

12a. DO YOU USUALLY COUGH FIRST THING IN THE MORNING?
1. YES.
2. NO.

12b. DO YOU USUALLY COUGH AT OTHER TIMES DURING THE DAY OR NIGHT?
1. YES.
2. NO.

IF YES TO EITHER 12a OR b, ANSWER c AND d

c. DO YOU COUGH ON MOST DAYS FOR AS MUCH AS 3 MONTHS OF THE YEAR?
1. YES.
2. NO.

d. FOR HOW MANY YEARS HAVE YOU HAD THIS COUGH?
1. Less than 2 years.
2. 2-5 years.
3. More than 5 years.

[ONCE AGAIN "COUGH" IS NOT TO BE DEFINED. "ON MOST DAYS" MEANS 4 OR MORE DAYS A WEEK. "AS MUCH AS THREE MONTHS A YEAR" MEANS FOR MOST DAYS OF 3 CONSECUTIVE MONTHS. IF THE RESPONDENT HAS NOT HEARD A TERM OR DOES NOT UNDERSTAND A TERM HE MUST ANSWER "NO".]

PHLEGM

13a. DO YOU USUALLY BRING UP PHLEGM, SPUTUM OR MUCUS FROM YOUR CHEST FIRST THING IN THE MORNING?
1. YES.
2. NO.

13b. DO YOU USUALLY BRING UP PHLEGM, SPUTUM, OR MUCUS FROM YOUR CHEST AT OTHER TIMES DURING THE DAY OR NIGHT?
1. YES.
2. NO.

IF YES TO EITHER 13a OR b, ANSWER c AND d:

c. DO YOU BRING UP PHLEGM, SPUTUM, OR MUCUS FROM YOUR CHEST ON MOST DAYS FOR AS MUCH AS 3 MONTHS OF THE YEAR?
1. YES.
2. NO.

d. FOR HOW MANY YEARS HAVE YOU RAISED PHLEGM, SPUTUM, OR MUCUS FROM YOUR CHEST?
1. Less than 2 years.
2. 2-5 years.
3. More than 5 years.

[PHLEGM, SPUTUM OR MUCUS REFERS TO THE STUFF ONE COUGHS OR BRINGS UP FROM ONES <u>CHEST</u>.]

COUGH AND PHLEGM

13a. HAVE YOU EVER HAD PERIODS OR EPISODES OF INCREASED COUGH AND PHLEGM LASTING FOR 3 WEEKS OR MORE EACH YEAR?
1. YES.
2. NO.

IF YES TO 13a
FOR HOW LONG HAVE YOU HAD THIS?_____years.

[THIS QUESTION REFERS TO COUGH AND PHLEGM OCCURING <u>TOGETHER</u>]

WHEEZING

14a. DOES YOUR CHEST EVER SOUND WHEEZY OR WHISTLING?
1. YES.
2. NO.

IF YES TO 14a

b. DO YOU GET THIS WITH COLDS? 1. YES.
2. NO.

c. DO YOU GET THIS EVEN WHEN YOU DO NOT HAVE A COLD?
1. YES.
2. NO.

d. DO YOU GET THIS ON MOST DAYS? 1. YES.
2. NO.

[ONCE AGAIN "MOST DAYS" REFERS TO 4 OR MORE DAYS A WEEK.]

15. HAVE YOU EVER HAD ATTACKS OF SHORTNESS OF BREATH WITH WHEEZING?
1. YES.
2. NO.

BREATHLESSNESS

16. ARE YOU MORE SHORT OF BREATH THAN MOST PEOPLE YOUR AGE?
1. YES.
2. NO.

17. ARE YOU TROUBLED BY SHORTNESS OF BREATH WHEN HURRYING ON LEVEL GROUND?
1. YES.
2. NO.

18. DO YOU GET SHORT OF BREATH WALKING WITH OTHER PEOPLE OF YOUR OWN AGE ON LEVEL GROUND?
1. YES.
2. NO.

19. DO YOU HAVE TO STOP FOR BREATH WHILE WALKING AT YOUR OWN PACE ON LEVEL GROUND?
1. YES.
2. NO.

[A FEW TERMS HERE MAY NEED DEFINING. "SHORT OF BREATH" MEANS DIFFICULTY IN BREATHING. "LEVEL GROUND" MEANS ON A FLAT SURFACE OR A SURFACE THAT IS NOT HILLY. "OWN PACE" REFERS TO WALKING WITH A NORMAL STRIDE.]

PREVIOUS CHEST ILLNESSES

20a.HAVE YOU EVER HAD ANY KIND OF CHEST TROUBLE?
1.YES.
2.NO.

"ANY KIND OF CHEST TROUBLE" REFERS TO ANY CHEST OR LUNG PROBLEM A RESPONDENT THINKS HE MAY HAVE HAD OR WAS TOLD BY A DOCTOR THAT HE HAS OR HAD.AVOID GIVING EXAMPLES AS THIS MAY BIAS THE RESPONDENT.

IF YES TO 20a

b.WHAT SORT OF TROUBLE?_____

c.HAVE YOU HAD THIS DURING THE PAST YEAR?
1.YES.
2.NO.

21a.DID YOU HAVE ANY RESPIRATORY/CHEST TROUBLE BEFORE AGE 16?
1.YES.
2.NO.

21b.DID YOU HAVE MEASLES AS A CHILD? 1.YES.
2.NO.

21c.DID YOU HAVE WHOOPING COUGH AS A CHILD?
1.YES.
2.NO.

22.DURING THE PAST THREE YEARS,HOW OFTEN WERE YOU UNABLE TO DO YOUR USUAL ACTIVITIES BECAUSE OF ILLNESSES SUCH AS CHEST COLDS. BRONCHITIS,OR PNEUMONIA?(Does not refer to head colds)
1.Never.
2.During one such illness.
3.During 2-5 illnesses.
4.During 6 illnesses or more.

"USUAL ACTIVITIES" MEANS THE WORK YOU USUALLY DO.IN THE CASE OF A HOUSEWIFE IT REFERS TO HOUSEWORK AND IN THE CASE OF A STUDENT IT REFERS TO ATTENDING SCHOOL OR COLLEGE.

23.DURING THE PAST YEAR,FOR HOW MANY DAYS HAVE YOU BEEN UNABLE TO DO YOUR USUAL ACTIVITIES BECAUSE OF SUCH ILLNESSES?_____days.

THE RESPONDENT MUST GIVE AN ESTIMATE OF THE NO. OF DAYS.

24a.HAVE YOU EVER HAD EMPHYSEMA? 1.YES.
2.NO.

IF YES TO 24a

b.WAS IT CONFIRMED BY A DOCTOR? 1.YES.
2.NO.

c.AT WHAT AGE DID IT START? ______years.

THIS REFERS TO AGE IN YEARS.

25a.HAVE YOU EVER HAD CHRONIC BRONCHITIS?

1.YES.
2.NO.

IF YES TO 25a
b.WAS IT CONFIRMED BY A DOCTOR? 1.YES.
2.NO.

c.AT WHAT AGE DID IT START? _____years.

TERM LIKE "EMPHYSEMA" AND "CHRONIC BRONCHITIS" MUST NOT BE DEFINED.IF THE RESPONDENT HAS NOT HEARD THEM THEN HE DID NOT HAVE THE CONDITION OR WAS NOT TOLD THAT HE HAS IT.ONLY EMPHASISE THE TERM "CHRONIC" BECAUSE CHRONIC BRONCHITIS IS DIFFERENT TO "ACUTE" BRONCHITIS. IF NOT SURE ANSWER "NO".

26a.HAVE YOU EVER HAD ASTHMA? 1.YES.
2.NO.

IF YES TO 26a
b.WAS IT CONFIRMED BY A DOCTOR? 1.YES.
2.NO.

c.IN THE PAST YEAR,HOW MANY ASTHMA ATTACKS DID YOU HAVE?

1.No attacks.
2.A few (1 per month)attacks.
3.Several (1 per week)attacks.
4.Attacks almost every day.

d.CIRCLE THE MONTHS IN WHICH YOUR ATTACKS HAVE BEEN MOST FREQUENT.

1	2	3	4	5	6	7	8	9	10	11	12
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

OR [] Tick here if no relation to time of year.

THE RESPONDENT MAY CIRCLE MORE THAN ONE MONTH IF APPLICABLE AND MAKE SURE TICK IS INSERTED ONLY IF THERE IS NO RELATION TO TIME OF YEAR.

e.HAVE YOU EVER SEEN A DOCTOR ABOUT YOUR ASTHMA?

1.YES.
2.NO.

e.ARE YOU PRESENTLY TAKING MEDICATION OR TREATMENT FOR YOUR ASTHMA?

1.YES.
2.NO.

f.HOW OLD WERE YOU WHEN YOU YOU HAD YOUR FIRST ASTHMA ATTACK?

_____(age)

THIS REFERS TO AGE IN YEARS MAY ESTIMATE IF EXACT YEAR NOT RECALLED.

g.WHICH FORM OF THERAPY DO YOU PREFER/LIKE FOR ASTHMA?

1.Pump/spray.
2.Tablets.
3.Both tablets and a pump.

27.HAVE YOU HAD ANY OF THE FOLLOWING?

a.Tuberculosis
1.YES.
2.NO.

IF YES,WAS IT CONFIRMED BY A DOCTOR?
1.YES.
2.NO.

AT WHAT AGE DID YOU HAVE IT?_____(age).

[ONCE AGAIN AGE IN YEARS CAN BE ESTIMATED.]

b.Pneumonia or Bronchopneumonia 1.YES.
2.NO.

IF YES,WAS IT CONFIRMED BY A DOCTOR?
1.YES.
2.NO.

28a.HAVE YOU EVER HAD HAY FEVER OR ANY OTHER ALLERGY THAT MAKES YOUR NOSE RUNNY OR STUFFY,APART FROM COLDS?
1.YES,I still have it.
2.YES,but I no longer have it.
3.NO.

IF YES TO 28a----------

b.DURING THE PAST YEAR,HOW MUCH HAVE YOU BEEN BOTHERED BY IT?

1 2 3 4 5
very little very much
(circle appropriate number)

[CHECK THAT ONLY ONE NUMBER IS CIRCLED.]

c.CIRCLE THE MONTHS IN WHICH YOUR EPISODES HAVE BEEN MOST FREQUENT.

1 2 3 4 5 6 7 8 9 10 11 12
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

OR [] Tick here if no relation to time of year.

29a.HAVE YOU EVER HAD SINUS TROUBLE? 1.YES.
2.NO.

IF YES TO 29a
b.WAS IT CONFIRMED BY A DOCTOR? 1.YES.
2.NO.

c.AT WHAT AGE DID IT START? _____years.

30.HAVE YOU EVER BEEN ALLERGIC TO ANYTHING?
(eg.foods, medicine, pets,clothing etc.)
1.YES.
2.NO.

IF YES,TO WHAT ARE YOU ALLERGIC?_____

[MAY BE ALLERGIC TO MORE THAN ONE THING.]

31.HOW MUCH EXERCISE DO YOU GET?
1.None.(no sports).
2.Little.(occasional sports)
3.Moderate amount.(social sports)
4.A great deal.(regular sports)

32. FOR FEMALES ONLY
ARE YOU NOW PREGNANT? 1.YES.
2.NO.
3.UNCERTAIN.

THIS QUESTION IS ONLY ASKED AS WE WILL NOT DO LUNG FUNCTION TEST ON PREGNANT WOMEN.

33a. IN THE PAST TWO YEARS, HAVE YOU HAD A CHEST X-RAY?
1.YES.
2.NO.

IF YES TO 36a----------
b.WHERE WAS IT DONE?_____

---

c.WAS IT ABNORMAL? 1.YES.
2.NO.

N.B. "YES MEANS THE X-RAY WAS ABNORMAL.

34. IN THE PAST YEAR HAVE YOU BEEN HOSPITALISED FOR ANY CHEST PROBLEM?
1.YES.
2.NO.

35. HAVE YOU EVER HAD ANY CHEST OR LUNG SURGERY? (Do not include breast surgery)
1.YES.
2.NO.

36. HAVE YOU EVER HAD AN ACCIDENT OR INJURY TO YOUR CHEST?
1.YES.
2.NO.

37a. DID YOU MOVE TO LENASIA FROM ELSEWHERE?
1.YES.
2.NO.

"YES" MEANS YOU WERE BORN ELSEWHERE.

IF YES TO 37a----------
b. IN WHAT TYPE OF AREA HAVE YOU SPENT MOST OF YOUR LIFE?
1.a large city (eg. Johannesburg, Durban).
2.a small city (eg. Ladysmith, Estcourt).
3.a suburb in a city (eg. Chatsworth, Asherville, Lenasia).
4.a rural/farming area

c. FOR HOW MANY YEARS HAVE YOU LIVED IN LENASIA?
_____years.

38. ARE YOU ON MEDICAL AID?
1.YES.
2.NO.

THIS QUESTION IS ASKED BECAUSE THIS MAY BE IMPORTANT INFORMATION IN PLANNING HEALTH SERVICES.

SMOKING

39a. HAVE YOU EVER SMOKED CIGARETTES? (NO means less than 20 packs of cigarettes or less than 1 cigarette a day for 1 year).
1. YES.
2. NO.

IF YES (ie more than 20 packs of cigarettes or more than 1 cigarette a day for 1 year) THEN ANSWER THE FOLLOWING

[MAKE SURE YOU UNDERSTAND WHAT "YES" AND "NO" MEANS.]

b. DO YOU NOW SMOKE CIGARETTES (as of 1 month ago)?
1. YES.
2. NO.

c. HOW OLD WERE YOU WHEN YOU FIRST STARTED REGULAR CIGARETTE SMOKING?_____(Age in years)

d. IF YOU HAVE STOPPED SMOKING CIGARETTES COMPLETELY HOW OLD WERE YOU WHEN YOU STOPPED?____(Age stopped)

e. HOW MANY CIGARETTES DO YOU SMOKE PER DAY NOW?
____(cigs per day).

f. ON THE AVERAGE OF THE ENTIRE TIME YOU SMOKED, HOW MANY CIGARETTES DID YOU SMOKE PER DAY?____(cigs per day).

g. DO OR DID YOU INHALE THE CIGARETTE SMOKE?
1. NOT AT ALL
2. SLIGHTLY.
3. MODERATELY .
4. DEEPLY

40a. HAVE YOU EVER SMOKED A PIPE REGULARLY? (YES means more than 12 oz. of tobacco in a life time)
1. YES.
2. NO.

IF YES TO 40a (ie. you smoked more than 12 oz. of tobacco in a lifetime)

bi. HOW OLD WERE YOU WHEN YOU STARTED TO SMOKE A PIPE REGULARLY?_____(age in years).

bii. IF YOU HAVE STOPPED SMOKING A PIPE COMPLETELY, HOW OLD WERE YOU WHEN YOU STOPPED?_____(Age stopped)

c. ON THE AVERAGE OVER THE ENTIRE TIME YOU SMOKED A PIPE, HOW MUCH PIPE TOBACCO DID YOU SMOKE PER WEEK?_____oz per week (a std pouch of tobacco contains 1 1/2 oz).

d. HOW MUCH PIPE TOBACCO ARE YOU SMOKING NOW?_____oz per week

e.DO YOU OR DID YOU INHALE THE SMOKE?
1.NOT AT ALL.
2.SLIGHTLY.
3.MODERATELY.
4.DEEPLY.

41a.HAVE YOU EVER SMOKED CIGARS REGULARLY?(YES means more than 1 cigar per week for a year).
1.YES.
2.NO.

IF YES TO 41a(ie you smoked more than 1 cigar per week for a year) THEN ANSWER THE FOLLOWING

bi.HOW OLD WERE YOU WHEN YOU STARTED SMOKING CIGARS REGULARLY?_____years.
bii.IF YOU HAVE STOPPED SMOKING CIGARS COMPLETELY,HOW OLD WERE YOU WHEN YOU STOPPED? _____years.

c.ON THE AVERAGE OVER THE ENTIRE TIME YOU SMOKED CIGARS, HOW MANY CIGARS DID YOU SMOKE PER WEEK?
_____cigars per week.

d.DO OR DID YOU INHALE THE CIGAR SMOKE?
1.NOT AT ALL.
2.SLIGHTLY.
3.MODERATELY.
4.DEEPLY.

NOTE THAT NOT MANY PEOPLE SMOKE PIPE OR CIGARS SO THAT THESE QUESTIONS WILL NOT APPLY TO MOST,BUT ENSURE THAT THE FIRST PART IS ANSWERED BY EVERYONE.PLEASE CHECK THIS.

42.HOW MUCH WATER DO YOU DRINK PER DAY(not in the form of tea,coffee or cool drinks)?
1.1 glass or less.
2.2-3 glasses.
3.more than 3 glasses.

43.DO YOU DRINK COOL DRINKS?
1.YES.
2.NO.

44a.DO YOU DRINK ANY ALCOHOLIC BEVERAGES?
1.YES.
2.NO.

IF YES TO 44a----------

b.HOW MANY GLASSES/CANS OF BEER PER WEEK?
(on the average)
_____glasses/cans.

c.HOW MANY GLASSES OF WINE PER WEEK?
(on the average)
_____glasses.

d.HOW MUCH HARD LIQUOR(eg.brandy,whiskey)PER WEEK?
(on the average)
_____tots/shots.

"BEVERAGES" MEANS DRINKS.

45a.HAVE YOU EVER WORKED FULL TIME (ie 30 hours per week or more for 6 months or more).
1.YES.
2.NO.

PLEASE READ AND UNDERSTAND THIS DEFINITION.

IF YES TO 45a
b.DID YOU WORK IN A DUSTY JOB? 1.YES.
2.NO.

IF YES PLEASE SPECIFY JOB OR INDUSTRY IN WHICH YOU WORKED AND FO
HOW LONG?_____
_____

IF YES TO 45b
c.WAS THE WORK PLACE 1.DUSTY.
2.VERY DUSTY.

d.HAVE YOU EVER BEEN EXPOSED TO GAS OR CHEMICAL FUMES IN YOUR JOB?
1.YES.
2.NO.

IF YES PLEASE SPECIFY JOB OR INDUSTRY IN WHICH YOU WORKED AND FOR HOW LONG?_____
_____

46.WHAT IS YOUR USUAL JOB OR OCCUPATION?(ie.the one you worked at the longest)
a.STATE JOB/OCCUPATION_____
b.NO. OF YEARS IN THIS JOB._____years
c.POSITION OR TITLE OF JOB._____
d.STATE BUSINESS FIELD OR INDUSTRY._____
e.IF NOT WORKING AT THIS JOB AT WHAT AG DID YOU LAST WORK AT IT?_____age in years.

"USUAL" MEANS THE JOB ONE IS TRAINED TO DO OR ONE HAS BEEN BEEN DOING FOR MOST OF ONES WORKING LIFE.FOR EXAMPLE A TEACHER WHO HAS BEEN TEACHING FOR A LONG TIME AND IS NOW A BUSINESSMAN WILL GIVE TEACHING AS THE USUAL OCCUPATION.

47.WHAT IS YOUR PRESENT JOB OR OCCUPATION?_____

48.WHAT IS YOUR INCOME?
1.Noincome at present.
2.<R500 per month.
3.R500-R999 per month.
4.R1000-R1999 per month.
5.R2000-R2999 per month.
6.>R3000 per month.

RESPONDENT MAY ESTIMATE INCOME.IF UNHAPPY TO FILL IN INCOME URGE RESPONDENT TO FILL IT IN BUT DONOT FORCE HIM/HER.

REMEMBER TO COLLECT DATA ABOUT FAMILY SIZE, NO. OF ROOMS AND TYPE OF FUEL FOR HEATING AND COOKING.

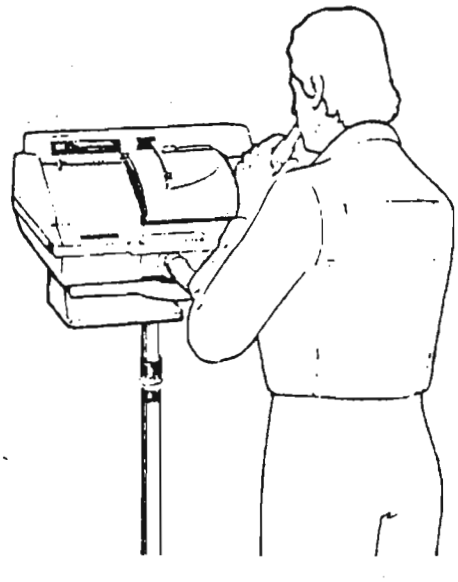
REMIND RESPONDENT THAT HE/SHE MAY BE CONTACTED FOR LUNG FUNCTION TESTS WHICH WILL BE DONE ON A SATURDAY AT THE LENASIA HEALTH CENTRE.

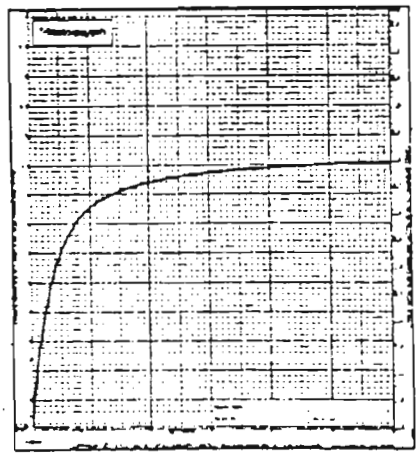
THANK THE RESPONDENT FOR HIS KINDNESS AND WILLINGNESS IN PARTICIPATING IN THE STUDY.

THERE MAY BE ADULTS IN A HOUSEHOLD WHO ARE 15 YEARS AND OLDER BUT UNABLE TO FILL IN THE QUESTIONNAIRE FOR VARIOUS REASONS eg ILL HEALTH.MENTAL RETARDATION etc.ON THESE INDIVIDUALS TRY TO GET AS

TESTING IN PROGRESS

THE VITALOGRAPH TEST





The Vitalograph Test in progress and
a Typical Forced Expiratory Vitalogram.

The most important and most easily performed pulmonary function test is to assess the respiratory organs and the breathing mechanism for their ability to ventilate; the main function of respiration being the supply of oxygen to all tissues of the body — and the subsequent removal of the waste product of this process, carbon dioxide — according to a complex but finely regulated supply-and-demand system.

ETHICAL CONSIDERATIONS

Ethical considerations are of paramount concern in the development and implementation of this study.

THE RIGHTS OF THE RESPONDENT ARE BASICALLY 3 IN NUMBER:

1. INFORMED CONSENT.
   Those participating in the study have right of access to clear, concise and full information regarding the study to enable a knowledgable decision with due regard to the implication of participation to be able to be made.

2. VOLUNTARY PARTICIPATION.

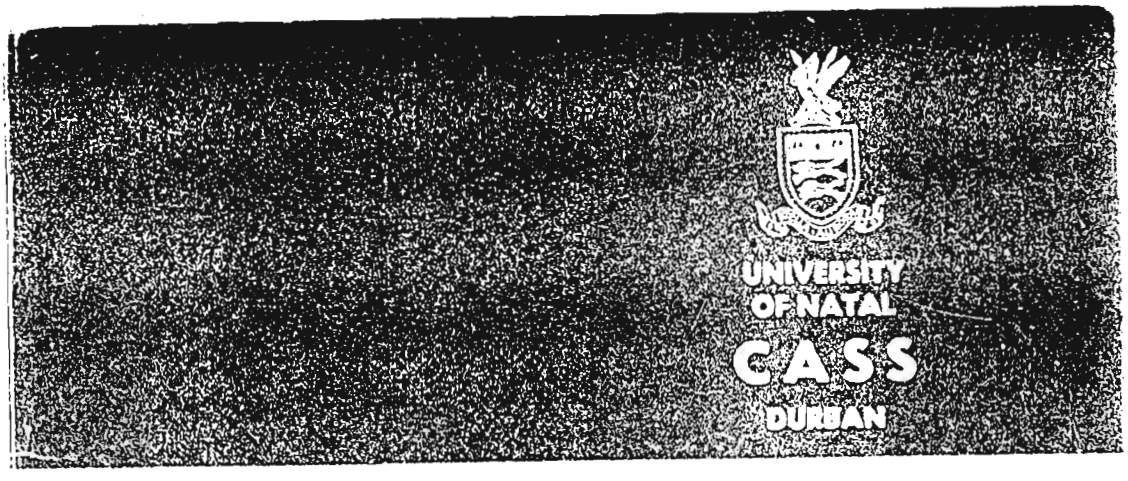
   The respondents have the right to refuse or withdraw from participation at any stage of the study. There should be no coercion or threat employed on the part of the investigator in the effort to motivate subject participation.

3. RIGHT TO CONFIDENTIALITY.

   Consent to participate in a research study does not constitute a waiver of the subjects right to confidentiality. The investigator must assure the subject that his/her disclosure will not be publicly reported. The investigator must take whatever steps are necessary to prevent violation of the subjects right to privacy.

APPENDIX 4

OCCUPATIONAL CLASSIFICATION SYSTEM



A GUIDE TO THE CODING OF OCCUPATIONS IN SOUTH AFRICA

LAWRENCE SCHLEMMER and PETER STOPFORTH
WITH TECHNICAL ASSISTANCE BY
ULLA BULTEEL

CENTRE FOR APPLIED SOCIAL SCIENCES
SENTRUM VIR TOEGEPASTE MAATSKAPLIKE WETENSKAPPE
1979 — FACT PAPER NO. 4

Table 1. Rank Order Of Broad CASS Occupational Categories: Criterion For Code Index Among 5 Categories Of Occupational Status.
(Code 1-5 in descending order of prestige.)

Rank and Coding Order	CASS Occupational Category	Ranks of Occupation Groups (Table 2)	Grade Intervals of Prestige Scale
1	Professional and Managerial	1- 5	82-73
2	Middle White-Collar	6-12	72-64
3	Manual Foreman, Skilled Artisans, Farmers*, and Status Equivalent	13-16	58-52
4**	Routine Non-Manual and Semi-Skilled Manual	17-18	52-48
5	Unskilled Manual and Menial	19-20	26-20

* White farmers in South Africa enjoy a higher social and occupational status than is prevalent in most modern countries. It is therefore possible if the case warrants it, to code them as a separate category between Ranks 2 and 3 above. They are included under Rank 3 above as their socio-economic index is equivalent to the Group (14) "Manual Foreman and Highcraft" - see Table 2.

** This categorisation reflects the general trend for lower non-manual occupations to sink below the traditional manual level in industrialised society.

Table 2. Rank Order of CASS Occupational Groups: Criterion For Code Index Of Occupations Among 20 Groups. (Code 1 - 20 in descending order of prestige.)

Rank and Coding Order	CASS Occupational Group	CASS Prestige Scale
1	Independent and High Professional, and Equivalent Status	82
2	High Managerial, Executive and Administrative in Large Organisations, and Equivalent Status	81
3	Salaried Professional and Equivalent Status	80
4*	Semi-Professional and Equivalent Status	73
5*	Lower Executive and Administrative and Equivalent Status	73
6	Production Managers, Technical Executives, Works Foreman, Executive Inspectors and Equivalent Status	72
7	Representatives, Agents, Salesmen and Equivalent Status	71
8	Owners and Executives in Small Commerce and Services and Equivalent Status	68
9	Owners and Executives in Small Technical, and Equivalent Status	67
10	Senior Clerical and Equivalent Status	66
11	Less Senior Clerical and Equivalent Status	65
12	Working Proprietor in Small Commerce and Services, and Equivalent Status	64
13**	Farmers (excepting very large and Industrialised Operators)	58
14	Manual Foreman and Highcraft and Status Equivalent	58
15	Skilled Artisan/Craft in Manufacturing and "Other"	56
16	Skilled Artisan/Craft in Construction	52
17	Routine Non-Manual and Equivalent Status	52
18	Semi-Skilled Manual and Equivalent Status	48
19	Unskilled Manual and Equivalent Status	26
20	Menial Routine and Labour Activities	20

* The order of ranks 4 and 5 is not unequivocal. Care should be exercised in coding salaried (3) and semi-(4) Professional occupations.

** Care should be exercised in coding Farmers (13) in order not to confuse the modal farmer status with large scale operations or marginal small scale activities and certainly not subsistence cultivators.

APPENDIX 5.1 - 5.14

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES

APPENDIX 5.1

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES – MODEL USING AGE AND STANDING HEIGHT
MEN – WITHOUT EXCLUSIONS n = 191

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 STANDING HEIGHT
SVC	-3.8375	-.0246	+.0514	37.13	.4998	9.86	27.26
FVC	-4.0278	-.0263	+.0530	40.54	.4847	11.28	29.26
FEV_1	-2.5594	-.0419	+.0432	52.27	.4297	35.58	16.69
PEF	-434.7978	-1.8183	+5.8601	4.48	181.67	.62	3.86
$FEF_{200-1200}$	-8.4492	-.0391	+.0976	5.81	2.790	1.20	4.61
$FEF_{25-75\%}$	-0.7611	-.0808	+.0416	29.29	1.129	25.98	3.31
$FEF_{80\%}$	-0.5491	-.0568	+.0198	30.08	.6227	35.92	2.16
$FEF_{50\%}$	-3.3159	-.0561	+.0553	8.51	1.9408	5.95	2.57
$FEF_{75-85\%}$	-0.0106	-.0683	+.0217	30.02	.8904	28.58	1.44
FMFT	+0.1599	+.0135	–	10.29	.3211	10.29	–
FEV_1/FVC	+0.9890	-.0049	–	23.22	.0720	23.22	–

APPENDIX 5.2

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES – MODEL USING AGE AND STANDING HEIGHT
WOMEN – WITHOUT EXCLUSIONS n = 117

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	R^2	SE	PARTIAL AGE	PARTIAL R^2 STANDING HEIGHT
SVC	-2.6182	-.0122	+.0371	23.19	.4177	4.57	18.62
FVC	-1.8186	-.0146	+.0329	20.43	.4374	6.18	14.26
FEV_1	-1.2048	-.0282	+.0291	36.39	.3869	26.39	10.00
PEF	-229.2039	-5.1672	+4.8476	21.75	98.933	16.52	5.23
$FEF_{200-1200}$	-6.6095	-.0820	+.0891	22.23	1.619	15.68	6.55
$FEF_{25-75\%}$	-2.1080	-.0715	+.0466	36.46	.8974	31.50	4.97
$FEF_{80\%}$	-0.1919	-.0488	+.0166	43.24	.4864	41.40	1.83
$FEF_{50\%}$	-4.3063	-.0696	+.0643	20.21	1.389	15.46	4.76
$FEF_{75-85\%}$	-1.5965	-.0562	+.0301	29.98	.7781	27.07	2.91
FMFT	-0.9049	+.0174	+.0059	9.01	.4637	8.60	0.41
FEV_1/FVC	+1.0406	-.0059	-	31.06	.0731	31.06	-

APPENDIX 5.3

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES - MODEL USING AGE STANDING HEIGHT
MEN - EXCLUDING SYMPTOMS (INCLUDES SMOKERS) n = 101

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	R^2	SE	PARTIAL AGE	R^2 SITTING HEIGHT
SVC	-3.9960	-.0210	+.0518	34.14	.5338	6.79	27.35
FVC	-4.0313	-.0241	+.0527	37.27	.5239	8.84	28.41
FEV_1	-1.8444	-.0391	+.0386	48.54	.4347	32.61	15.93
PEF	-514.146	-2.383	+6.499	6.80	174.536	1.16	5.65
$FEF_{200-1200}$	-9.3470	-.0431	+.1047	7.52	2.7047	1.43	6.09
$FEF_{25-75\%}$	+2.7235	-.0774	+.0210	25.74	1.1248	24.73	1.01
$FEF_{80\%}$	+1.0438	-.0567	+.0105	38.15	.1920	37.44	0.72
$FEF_{50\%}$	-2.7369	-.0582	+.0532	9.59	1.877	6.75	2.85
$FEF_{75-85\%}$	+1.8078	-.0695	+.0115	29.43	.9018	28.99	0.45
FMFT	-0.6044	+.0108	+.0050	8.18	.3066	7.25	.94
FEV_1/FVC	+1.2326	-.0046	-.0015	23.81	.0674	22.39	1.43

APPENDIX 5.4

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES - MODEL USING AGE AND STANDING HEIGHT
WOMEN - EXCLUDING SYMPTOMS (INCLUDES SMOKERS) n = 81

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 STANDING HEIGHT
SVC	-2.1675	-.0060	+.0329	18.36	.3973	1.27	1.81
FVC	-1.5058	-.0073	+.0294	15.46	.4099	1.81	13.65
FEV_1	-1.1991	-.0187	+.0273	30.31	.3404	17.68	12.63
PEF	+182.307	-2.911	+1.769	8.12	90.309	7.12	1.00
$FEF_{200-1200}$	-1.5649	-0.0478	+.0502	10.06	1.5035	7.23	2.83
$FEF_{25-75\%}$	-2.3756	-.0642	+.0474	35.59	.7911	31.25	6.34
$FEF_{80\%}$	-0.5097	-.0484	+.0187	41.97	.4972	39.65	2.32
$FEF_{50\%}$	-1.0653	-.0540	+.0412	13.40	1.3217	11.02	2.38
$FEF_{75-85\%}$	-1.5532	-.0537	+.0298	26.13	.8216	23.39	2.74
FMFT	+0.2098	+.0095	-	13.30	.1987	13.30	-
FEV_1/FVC	+0.8729	-.0046	-.0009	29.98	.0596	29.55	0.43

APPENDIX 5.5

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES – MODEL USING AGE AND STANDING HEIGHT
MEN – EXCLUDING SMOKERS (EVER) AND SYMPTOMS (HEALTHY NON-SMOKERS) n = 57

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 SITTING HEIGHT
SVC	– 5.9215	–.0200	+.0630	46.86	.5245	5.16	41.70
FVC	– 5.6210	–.0246	+.0621	50.58	.5029	7.85	42.73
FEV_1	– 2.9761	–.0364	+.0449	52.73	.4535	19.78	32.95
PEF	+ 36.8944	–4.0739	+3.4325	5.09	197.06	3.87	1.23
$FEF_{200-1200}$	+ 1.5642	–.0732	+.0439	5.89	2.973	5.02	0.88
$FEF_{25-75\%}$	+ 1.8408	–.0640	+.0244	21.45	1.146	19.93	1.52
$FEF_{80\%}$	+ 2.7064	–.0522	–	28.27	.6920	28.27	–
$FEF_{50\%}$	– 0.0501	–.0680	+.0387	9.78	2.0731	8.44	1.34
$FEF_{75-85\%}$	+3.3206	–.0540	–	17.81	.9666	17.81	–
FMFT	– 0.4975	+.0069	+.0048	3.18	.3272	2.29	.91
FEV_1/FVC	+ 1.3265	–.0039	–.0021	16.31	.0727	13.25	3.07

APPENDIX 5.6

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES - MODEL USING AGE AND STANDING HEIGHT
WOMEN - EXCLUDING SMOKERS (EVER) AND SYMPTOMS (HEALTHY NON-SMOKERS) n = 78

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 SITTING HEIGHT
SVC	-1.6894	-.0078	+.0300	17.97	.3902	2.15	2.89
FVC	-0.9994	-.0092	+.0264	15.20	.4031	2.89	12.30
FEV_1	-0.8664	-.0204	+.0254	31.73	.3384	20.69	11.04
PEF	+175.5712	-2.8969	+1.8067	7.88	92.008	6.86	1.02
$FEF_{200-1200}$	-1.3969	-.0480	+.0490	9.80	1.5294	7.14	2.66
$FEF_{25-75\%}$	-2.2050	-.0676	+.0470	39.76	.7896	33.63	6.14
$FEF_{80\%}$	-0.5105	-.0480	+.0191	43.32	.4990	40.94	2.38
$FEF_{50\%}$	-0.5098	-.0584	+.0384	14.36	1.3372	12.33	2.03
$FEF_{75-85\%}$	-1.3303	-.0569	+.0290	27.68	.8282	25.14	2.55
FMFT	+0.1974	+.0098	-	13.76	.2001	13.76	-
FEV_1/FVC	+0.08488	-.0047	+.0011	30.60	.0798	29.98	0.63

APPENDIX 5.7

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES MODEL USING AGE AND STANDING HEIGHT
MEN – EXCLUDING NEVER SMOKERS AND SYMPTOMS (HEALTHY SMOKERS) n = 44

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 STANDING HEIGHT
SVC	-0.6552	-.0196	+.0319	15.42	.5457	6.00	9.42
FVC	-0.9042	-.0230	+.0343	18.12	.5511	7.82	10.30
FEV_1	-0.0972	-.0417	+.0289	40.95	.4180	31.42	9.53
PEF	-1114.1989	-2.3672	+10.1423	15.83	140.919	1.30	14.53
$FEF_{200-1200}$	-21.9436	-.0382	+.1801	18.27	2.2808	1.25	17.0
$FEF_{25-75\%}$	-2.0414	-.0902	+.0270	27.07	1.1187	25.64	1.43
$FEF_{80\%}$	-1.6740	-.0642	+.0277	53.35	.4654	47.78	5.58
$FEF_{50\%}$	-5.9204	-.0518	+.0710	10.21	1.6513	4.84	5.58
$FEF_{75-85\%}$	+0.1344	-.0959	+.0264	45.77	.7864	43.72	2.06
FMFT	+0.1552	+.0144	-	12.57	.2773	12.57	-
FEV_1/FVC	+1.0074	-.0055	-	31.44	.0592	31.44	-

APPENDIX 5.8

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES – MODEL USING AGE STANDING HEIGHT AND WEIGHT
MEN – WITHOUT EXCLUSIONS n = 191

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	WEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 SITTING HEIGHT	PARTIAL R^2 WEIGHT
SVC	– 3.6861	–.0262	+.0497	+.0028	37.33	.5003	9.86	27.26	.21
FVC	– 3.7782	–.0289	+.0502	+.0047	41.11	.4836	11.28	29.26	.57
FEV_1	– 2.5594	–.0419	+.0432	–	52.26	.4298	35.58	16.69	–
PEF	–338.974	–2.849	+4.798	+1.804	5.44	181.234	.62	3.86	.96
$FEF_{200-1200}$	– 7.0307	–.0544	+.0819	+.0267	6.68	2.7843	1.20	4.61	.88
$FEF_{25-75\%}$	– 1.5189	–.0726	+.0500	–.0143	30.44	1.1231	25.98	3.31	1.15
$FEF_{80\%}$	– 1.3557	–.0481	+.0287	–.0152	41.83	.6052	35.92	2.16	3.74
$FEF_{50\%}$	– 2.6124	–.0637	+.0475	+.0132	8.95	1.9414	5.95	2.57	.43
$FEF_{75-85\%}$	– 0.7419	–.0604	+.0298	–.0138	31.72	.8819	28.58	1.44	1.70
FMFT	+ 0.5597	+.0103	–.0039	+.0055	12.96	.3180	10.29	.40	2.27
FEV_1/FVC	+ 0.9204	–.0040	+.0008	–.0016	26.82	.0706	23.22	.32	3.29

APPENDIX 5.9

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES – MODEL USING AGE, STANDING HEIGHT AND WEIGHT
WOMEN – WITHOUT EXCLUSIONS n = 117

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	WEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 SITTING HEIGHT	PARTIAL R^2 WEIGHT
SVC	– 2.2388	–.0167	+.0329	+.0072	25.96	.4119	4.57	18.62	2.77
FVC	– 1.3153	–.0206	+.0274	+.0095	25.04	.4265	6.18	14.26	4.60
FEV_1	– 1.0600	–.0299	+.0275	+.0027	36.78	.3875	26.39	10.00	.39
PEF	–229.204	–5.167	+4.848	–	21.75	98.335	16.52	5.23	–
$FEF_{200-1200}$	– 6.6095	–.0820	+.0891	–	22.24	1.6190	15.68	6.55	–
$FEF_{25-75\%}$	– 2.5552	–.0662	+.0515	–.0085	37.18	.8784	31.50	4.97	.72
$FEF_{80\%}$	– 0.8255	–.0413	+.0236	–.0120	47.45	.4701	41.40	3.44	2.60
$FEF_{50\%}$	– 4.3063	–.0696	+.0643	–	20.21	1.3894	15.46	4.76	–
$FEF_{75-85\%}$	– 2.2837	–.0481	+.0377	–.0130	32.37	.7681	27.07	2.91	2.39
FMFT	– 0.9048	+.0174	–.0059	–	9.01	.4637	8.60	.41	–
FEV_1/FVC	+ 0.8545	–.0046	+.0017	–.0021	37.76	.0701	31.06	.94	5.75

APPENDIX 5.10

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES USING MODEL WITH HEIGHT/AGE/WEIGHT
WOMEN - EXCLUDING NEVER SMOKERS AND SYMPTOMS (HEALTHY SMOKERS) n = 78

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	WEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 STANDING HEIGHT	PARTIAL R^2 WEIGHT
SVC	-2.0101	-.0122	+.0291	+.0108	23.60	.3791	4.72	15.82	3.07
FVC	-0.4530	-.0155	+.0252	+.0153	26.12	.3788	7.30	12.30	6.51
FEV_1	-1.0073	-.0223	+.0250	+.0045	32.82	.3380	20.69	11.04	1.09
PEF	+221.523	-2.261	+1.935	-1.547	10.21	91.453	6.86	1.17	2.19
$FEF_{200-1200}$	-1.0151	-.0427	+.0501	-.0129	10.37	1.535	7.14	2.66	.57
$FEF_{25-75\%}$	-1.6368	-.0598	+.0486	-.0191	42.94	.774	33.63	6.14	3.17
$FEF_{80\%}$	-.0020	-.0429	+.0205	-.0171	49.31	.475	40.94	2.74	5.63
$FEF_{50\%}$	-.0320	-.0517	+.0397	-.0161	15.47	1.338	12.33	2.03	1.11
$FEF_{75-85\%}$	-.7465	-.0488	+.0306	-.0197	31.34	.812	25.14	2.83	3.37
FMFT	-.0291	+.0077	-	+.0053	19.11	.195	13.76	-	5.34
FEV_1/FVC	+.9409	-.0034	+.0013	-.0031	47.35	.052	14.71	.96	31.68

Appendix 5.11

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES USING MODEL WITH HEIGHT/AGE/WEIGHT
MEN - EXCLUDING EVER SMOKERS AND SYMPTOMS n = 57

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	WEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 STANDING HEIGHT	PARTIAL R^2 WEIGHT
SVC	-5.3229	-.0218	+.0559	+.0106	48.81	.5196	5.16	41.7	1.95
FVC	-4.9527	-.0266	+.0541	+.0119	53.04	.4948	7.85	42.73	2.46
FEV_1	-2.6401	-.0374	+.0409	+.0060	53.46	.4542	32.95	19.78	.73
PEF	+495.261	-4.831	-	+2.316	5.29	196.86	3.87	-	1.42
$FEF_{200-1200}$	+6.5874	-.0835	-	+.0437	7.23	2.95	5.02	-	2.21
$FEF_{25-75\%}$	+1.8408	-.0640	+.0244	-	21.45	1.1456	19.93	1.52	-
$FEF_{80\%}$	+0.9062	-.0479	+.0176	-.0211	34.18	.6753	28.27	1.61	4.30
$FEF_{50\%}$	+4.5410	-.0769	-	+.0356	11.32	2.0553	8.44	-	2.89
FMFT	-0.4975	+.0069	+.0048	-	3.19	.3272	2.28	.91	-
$FEF_{75-85\%}$	+3.3206	-.0540	-	-	17.81	.9666	17.81	-	-
FEV_1/FVC	+1.2635	-.0037	+.0014	-.0011	18.08	.0726	13.25	1.06	3.77

Appendix 5.12

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES USING MODEL WITH HEIGHT/AGE/WEIGHT
MEN – "HEALTHY" SMOKERS (EVER SMOKERS WITHOUT SYMPTOMS) n = 44

INDEX	Y INTERCEPT	AGE	STANDING HEIGHT	WEIGHT	R^2	SE	PARTIAL R^2 AGE	PARTIAL R^2 STANDING HEIGHT	PARTIAL R^2 WEIGHT
SVC	-0.6852	-.0196	+.0319	-	15.42	.5457	6.00	9.42	-
FVC	-0.9042	-.0230	+.0343	-	18.12	.5511	18.12	10.30	-
FEV_1	-1.3654	-.0336	+.0394	-.0120	44.82	.4091	31.42	9.53	3.87
PEF	-866.522	-3.9513	+8.0918	+2.3414	17.68	141.09	1.30	14.53	1.85
$FEF_{200-1200}$	-18.8444	-.0580	+.1545	+.0293	19.34	2.294	1.25	17.01	1.07
$FEF_{25-75\%}$	-2.5567	-.0607	+.0651	-.0435	35.84	1.062	25.64	6.29	3.92
$FEF_{80\%}$	-3.7476	-.0509	+.0449	-.0196	59.95	.4366	47.78	5.58	6.60
$FEF_{50\%}$	-5.9203	-.0518	+.0709	-	10.20	1.6513	4.84	5.37	-
FMFT	-1.5790	+.0065	-.0088	+.0116	24.44	.2641	1.98	3.41	19.05
$FEF_{75-85\%}$	-1.6900	-.0843	+.0414	-.0172	47.85	.7808	43.72	2.06	2.08
FEV_1/FVC	-.6342	-.0035	+.0029	-.0030	44.77	.0545	31.44	4.22	9.11

APPENDIX 5.13

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES – MODEL USING AGE, SITTING HEIGHT AND WEIGHT
MEN – WITHOUT EXCLUSIONS n = 191

INDEX	Y INTERCEPT	AGE	SITTING HEIGHT	WEIGHT	R^2	SE	PARTIAL R^2		
							AGE	SITTING HEIGHT	WEIGHT
SVC	-0.0725	-.0335	+.0547	+.0083	32.23	.5202	14.04	16.25	1.94
FVC	-0.1377	-.0362	+.0554	+.0102	35.93.	.5045	15.89	17.10	2.94
FEV_1	+0.4859	+.0473	+.0496	+.0030	48.63	.4470	35.58	12.80	.25
PEF	+32.322	-3.555	+.5.005	+2.350	4.74	181.905	1.04	1.93	1.77
$FEF_{200-1200}$	-1.3777	-.0661	+.0937	-.0355	6.16	2.7920	1.81	2.67	1.69
$FEF_{25-75\%}$	+1.5646	-.0797	+.0616	-.0092	30.11	1.1258	25.98	3.61	.52
$FEF_{80\%}$	+0.8014	-.0523	+.0308	-.0120	40.59	.6116	35.92	2.13	2.54
$FEF_{50\%}$	+0.7650	-.0706	+.0532	+.0184	8.54	1.9457	5.95	1.68	.92
$FEF_{75-85\%}$	+1.0068	-.0646	+.0379	-.0108	31.67	.8822	28.58	1.95	1.14
FMFT	+0.3202	+.0108	-.0047	+.0051	12.93	.3181	10.29	.37	2.27
FEV_1/FVC	+0.9676	-.0041	+.0011	-.0015	26.83	.0706	23.22	.32	3.29

APPENDIX 5.14

REGRESSION EQUATIONS FOR SPIROMETRIC INDICES – MODEL USING AGE, SITTING HEIGHT AND WEIGHT
WOMEN – WITHOUT EXCLUSIONS n = 117

INDEX	Y INTERCEPT	AGE	SITTING HEIGHT	WEIGHT	R^2	SE	PARTIAL R^2		
							AGE	SITTING HEIGHT	WEIGHT
SVC	–0.8277	–.0175	+.0477	+.0063	22.34	.4219	5.72	14.63	1.99
FVC	–0.0404	–.0213	+.0383	+.0089	22.30	.4342	7.33	11.21	3.76
FEV_1	–0.2988	–.0293	+.0460	–	35.47	.3897	26.39	9.08	–
PEF	–204.202	–4.873	+9.604	–.7623	23.00	98.580	16.52	5.95	.53
$FEF_{200-1200}$	–5.3030	–.0851	+.1591	–	23.28	1.608	15.68	7.59	–
$FEF_{25-75\%}$	–0.8017	–.0669	+.0806	–.0104	36.19	.8853	31.50	3.68	1.01
$FEF_{80\%}$	+0.7998	–.0424	+.0261	–.0118	45.42	.4791	41.40	1.42	2.60
$FEF_{50\%}$	– 0.9956	–.0721	+.0854	–	18.50	1.4043	15.46	3.05	–
$FEF_{75-85\%}$	+0.1788	–.0497	+.0434	–.0129	30.02	.7813	27.07	1.90	1.06
FMFT	+0.0302	+.0170	–	–	8.60	.4627	8.60	–	–
FEV_1/FVC	+0.7656	–.0045	+.0046	–.0023	39.13	.0693	31.06	2.32	5.75

LIST OF ABBREVIATIONS

ATPS: Ambient temperature and pressure, saturated with water vapour at these conditions

BTPS: Body conditions: Body temperature, ambient pressure, and saturated with water vapour at these conditions

SVC: Slow vital capacity; the maximal volume of air exhaled from the point of maximal inspiration

FVC: Forced vital capacity; vital capacity performed with a maximally forced expiratory effort

FEV_1: Forced expiratory volume in one second. The volume of air exhaled in the first second during the performance of the forced vital capacity

PEF: The highest forced expiratory flow measured during the FVC manoeuvre

$FEF_{200-1200}$: Mean forced expiratory flow between 200ml and 1200ml of the FVC

$FEF_{25-75\%}$: Mean forced expiratory flow during the middle of the FVC (formerly called the maximal mid-expiratory flow rate or MMEF)

$FEF_{80\%}$: The instantaneous forced expiratory flow when 80% of the FVC has been exhaled

$FEF_{50\%}$: The instantaneous forced expiratory flow when 50% of the vital capacity is exhaled

$FEF_{75-85\%}$: Mean forced expiratory flow between 75 and 85% of the FVC

FMFT: Forced mid-expiratory flow time

FEV_1/FVC: Forced expiratory volume in one second to FVC expressed as a ratio

TLC: Total lung capacity; the sum of all volume compartments or the volume of air in the lungs after maximal expiration

RV: Residual volume; the volume of air remaining in the lung after maximal exhalation