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AND DEVELOPMENT IN SOUTHERN AFRICA

Housing and health

by

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INDEX

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Tim Dunne	Statistical Problems
Sue Myrdal	Results Table

ABSTRACT : HOUSING AND HEALTH

An association between housing and health has been acknowledged both in the internatinal literature, and locally, by the Department of Health and Welfare. Despite this, new priorities for housing have been developed, which have the potential to compromise the health of inhabitants further.

Housing is a component of the complex social matrix which determines the health of South Africans, and poor housing conditions are associated with a wide range of diseases. To this end, numerous organisations have become involved in housing struggles as part of a general struggle for a democratic society.

This paper examines the nature of the association between housing and health. Selected aspects of housing are shown to be associated with specific diseases, e.g. inadequate or poor water supply with diarrhoeal disease, overcrowding with respiratory disease, and so forth.

However, housing is just one of a number of socio-economic variables which produce ill-health, and extricating housing from the complex web as a causative factor is shown to be impossible.

A recommendation is made for the need to define minimal housing standards which are compatible with a healthy community.

INTRODUCTION

An association between health and housing has been known since the early days of medicine. Even in this country, its importance was repeatedly stressed in early editions of the South African Medical Journal. In a 1940 edition, M Maister, Medical Officer of Health in Pietermaritzburg, wrote:

> It is difficult to obtain a quantitative valuation of the exact relation between housing conditions and mortality or morbidity rates in South Africa ... There is no doubt however, that in numerous ways, the housing of people does to a very important extent influence their health in its physical, emotional and social aspects. It is almost too obvious to repeat that overcrowding will favour the spread of tuberculosis and the other droplet spread infectious diseases that even the the infectious respiratory diseases such as pneumonia will be favoured by ill-ventilated dark and damp conditions.
> (MAISTER, 1940)

An editorial in a 1945 edition of the same journal again attempted to draw the attention of the medical profession to the significance of the problem of housing:

> The importance of good housing cannot be overemphasized. From certain points of view it is even more important than nutrition. The relationship between infectious diseases and housing is not always fully appreciated even by the medical profession. Our South African cities are overcrowded with slums where the poorer classes live under appalling conditions. Not only are large families crowded into a couple of small rooms but the most elementary hygienic needs are lacking. The result is that the adults are disease ridden and the children are infected in early life. The wonder of it all is that quite a number still emerge relatively sound and healthy.
> (EDITORIAL, 1945)

Furthermore, the association between health and housing was clearly acknowledged by the present Department of Health when, in drawing up a new plan for the organisation of South Africa's health services (The National Health Services Facilities Plan), housing was accorded first level priority:

> everybody needs drinking water, food, a home and services to help with the disposal of sewage and work to maintain a complete basic level of minimal health.
> (quoted in STERN, 1981)

Nonetheless, over the last two years the Department of Community Development has completely re-orientated its approach to the provision of low income housing. As a result of cutbacks in finance available for housing and a desire to withdraw from its politically exposed role as sole landlord to the working classes, expenditure on low income housing has been drastically cut. Responsibility for its provision has been handed over to the private sector and the individual.

In toto, the new policy package comprises the following:

(i) The state will in future only be responsible for housing those earning under R150 per month, and the units will be built to much lower standards

(ii) Council tenants will be expected to purchase their houses. Those who do not will face massive rent increases

(iii) All new housing for those earning over R150 per month will be in the form of self-help schemes, serviced plots or units constructed by utility companies and the private sector.

The current low income housing situation in Cape Town (and elsewhere in the country) is critical; there is a huge housing backlog, serious overcrowding and for many tenants, rents which are beyond their means. Under the new policy, these problems will be greatly exacerbated. The lowered standards in state-provided units (which will in future be built without electricity, floor finishes, internal painting, fencing or washing lines) as well as the inability of the lower income groups to house themselves without state assistance, have serious implications for general standards of health. This is particularly the case when taken together with problems such as rising unemployment and soaring living costs. The already high prevalence of ill-health is likely to become worse.

Housing, of course, cannot be seen in isolation as a cause of ill-health The effects of housing in determining the health status of a population can only be viewed against the complex social conditions (social class, employment, education, nutrition, accessibility of health care facilities, etc) which exist. One must be cautious in attributing deteriorating health status to housing alone.

Nevertheless, confronted in this country by a range of diseases that are clearly rooted in a social matrix in which inadequate housing is an important component, numerous progressive organisations and individuals have become involved in housing struggles as part of a general struggle for a democratic society. While improved housing alone cannot ameliorate health, poor housing conditions are associated with certain diseases and therefore improved housing becomes a necessary, if not sufficient prerequisite in the reduction of these diseases.

The object of our study was to investigate the precise nature of the association between hosing and health; and in doing so, provide material which could possible be used to substantiate demands for better housing (See Table: Housing Issues in the Community). In the context of the impending decline of building standards, such demands become extremely urgent.

Because resources were limited, it was not possible to undertake primary epidemiological research in order to achieve our objectives. Since much headway has already been made in unravelling the complexities of the association, we decided that a literature search could profitably be used to clarify the housing-health linkage and to find out which parameters of housing and of health respectively have been clearly correlated.

Issue	Areas	Date
Generally Poor Housing Conditions	Guguletu	July 1981
	Elsies River	November 1981
- Cracked walls - Draughts - Damp	Hout Bay Parkwood	December 1981 December 1982
No electricity	Valhalla Park	October, 1981
	Bishop Lavis	Oct/Nov, 1981
	Cemenddam	December, 1982
	Bishop Lavis	December, 1982
	Valhalla Park	December, 1982
No maintenance	10 areas	July, 1981
	Bonteheuvel	November 1981
	Bonteheuvel	December 1981
Bucket Toilets	Elsies River	October 1981
Blocked Drains	Kewtown	August, 1982
Rents	All areas	December 1981

(Ref: Grassroots Community Newspaper
July 1981 - December 1982)

HOUSING ISSUES IN THE COMMUNITY

This work was done in association with another group of researchers who provided some statistical and descriptive evidence of the existing housing conditions in the Western Cape. Their information was used to determine which of the correlations found in the literature are potentially applicable to local conditions and, conversely, how local conditions at present can be shown in some measure, to be indicators of the present and future health status of the population concerned.

B: METHODOLOGY

1. Literature Search

(a) Derivation of literature: Only studies done in the past twenty years (i.e. sinc 1963) were sought. There were two reasons for this:

(i) In his book "The Housing Environment and Family Life" (1962) Milner et al. comprehensively review studies done until 1962.

(ii) a review of all studies done on the relationship between health and housing was quantitatively beyond the scope of our study.

Two sources were used to derive a bibliography of potentially relevant literature:

(i) "Housing, the Housing Environment and Health: An annotated Bibliography" A.E. Martin, F. kaloyanova, S Maziarka, Geneva: WHO, 1976

(ii) An off-line bibliographic citation list generated by MEDLARS II - a medical information dissemination service run by the Institute for Medical Literature. The bibliography generated was based on a request for literature on:

HOUSING (key word) and crowding, sanitation, heating, accidents (home), morbidity, hygiene, public health.

(b) Selection of literature from the bibliography

This was divided into a primary and secondary selection:

(i) Primary Selection: Seven criteria were used for the initial selection from the bibliographies:

only studies published in 1963 or later were considered;
only articles in English were considered;
only journals available in South Africa were considered;
only studies of housing parameteres relevant to South Africa were considered e.g. studies on the effects of formaldehyde on health were excluded since formaldehyde is not used for building in this country;
only studies of health parameters relevant to South Africa were considered;
only studies of a sound epidemiological nature were considered i.e. reviews, policy documents, opinion papers, etc., were not included;
only studies concerning the internal environment were considered ie all aspects of the external environment including air pollution were not considered.

In addition to these criteria, we decided to exclude a number of parameters which

seemed to by beyond the practical scope of this literature search. Each of these problems constitute an area of research on its own, and the literature dealing with their effects on health is too vast and diverse to include. Included here are:

food, its effect on health

asbestos, its effect on health

the relationship between housing and me ntal health (this includes numerous studies dealing with the effects of high-rise buildings on the mental well-being of their occupants)

(ii) Secondary Selection:' The studies selected from the bibliographical sources by the criteria described above were then carefully scrutinised and finally assessed for inclusion or exclusion according to a standard checklist of variables. The checklist used is included in the report as an Appendix.

In each case, the bibliography cited at the end of the study was scrutinised, and any studies that had not been included in the original source bibliographies and which conformed to the criteria described in section (1) were noted and sought.

(2) Derivation of Information on Housing in the Western Cape

(a) Comparative Housing Study

In April 1983 students of the School of Architecture, UCT, conducted a standardised survey of eight prototype working class houses. The houses were located in Lotus River and Nyanga and included four row houses, two semi-detached houses, one maisonette and one three-storey walk-up. They were selected to represent the commonest housing types.

The exercise was designed as a pilot study to look at thermal environment i.e. it was intended to pilot the method rather than to produce generalisable data.

(b) Local Housign Conditions

Statistics on general housing conditions in metropolitan Cape Town were derived from the Divisional Council data bank and from the Cape Town City Council's Technical Management Services department. These statistics covered electricity supply, water supply, sewage and toilet conditions.

RESULTS

CORRELATIONS SHOWN IN THE LITERATURE

	Respiratory							Gastro-intestinal						Mortality/ morbidity				Growth		Skin disease			Infectious			
	Upper respiratory infections	Croup	Bronchitis	Pneumonia	Asthma	Lung Function	Cough	Intestinal Parasites	Malaria	Amoebiasis	Shigella	Entero-bacteria	Gastro-intestinal disease	Child mortality	Infant mortality	General mortality	Morbidity	Height gain/ant	Rate of growth	Pyoderma	Scabies	Leprosy	Pneumonic fever	Meningitis (incidence)	Meningitis (incidence)	TYPHOID-PARATYPHOID
• Crowding																										
% households > 6 people	2	2	2	2																						
% persons > 1 room														5/6	15	19							29			
% persons/room			24										8/12				21	23	24	26	25	26		28	28	
persons/bed																		23			25					
• Water Supply										11			14/15													
Piped (lack of)								9	9			10	8/12				20			26	26	26				
Consumption(ℓ/person)										12			12/15								26					
Open surface									9				8		15											
Well								9	9				8		15						27					
Private tap (lack of)								9	9				12		15						27					
Public tap													12		15						27					
River								9													27					
• Toilet/Sewage									9	11	10	10														
Toilet"			24					9/10		11	10		8/12	16	15											
City sewage"										11	10		8													
Septic tank										11	10		8/12													
Bucket								9		11																
Pit								9		11	10		8/12													
• Sanitation													15				20									
Available bathroom"		24									10		10			19	20									
Fixed bath/shower"											10			16												
Sink/basin"											10															
Hot water"		24												16			20									
• Area																										
Industrial		2				1							12													
Rural																										
• Floors																										
Partial																								28	28	
Cement"																								28	28	
Mud/earth beaten																								28	28	
• Internal Environment																										
Wood burning	3/4		3/4	4																						
Gas burning (cookers)	5		5		4		5																			
Smoke outlet"																										
Relative humidity					6																			28		
Temperature					6																					30
Draughts/cold																										
• House Structure																										
Bricks with drainage																					27	27				
Bricks with no drainage																					27	27				
Mud bricks w no drainage																					27	27				
Level above street																	20									
Draughts and cold																	20									
• Composite Index																										
Crowding = People/room																	19									
Water = Supply/facilities																	19									
Vermin = Present/not																	19									
Sewage = Disposal																	19									
Garbage = Disposal																	19									
Structure = Deterioration																	19									

NOTES

Nos: refer to sequential bibliography

" : inverse relationship

DISCUSSION OF RESULTS

(a) HEALTH

1. Respiratory Diseases

Both overcrowding and pollution of the internal environment (i.e. inadequate ventilation and pollution) were shown to predispose towards respiratory disease:

OVERCROWDING: In an exploratory study done in 1983 to analyse a period covering four respiratory syncitial virus epidemics and assess the factors affecting spread of infection, overcrowding (defined as a % households with more than six people) was shown to be positively correlated with the incidence of upper respiratory trace infections, croup, bronchitis and pneumonia (2).

Further evidence for a positive correlation between the incidence of bronchitis and overcrowding was shown in a longitudinal study done to examine the relationship between housing conditions and children's health (24). (Here the overcrowding index was defined as number of person per room). In this study, too, inadequate access to amenities (i.e. lack of a batchroom, hot water and indoor lavatory) was also shown to be linked to the incidence of bronchitis.

FUMES AND SMOKE POLLUTION OF THE INTERNAL ENVIRONMENT: One of the most complex studies with respect to the effects of housing on health was that done in a series by Media, Florey, Altman and Swan (5a). Beginning in 1973, they studied the association between gas cooking in the household and the incidence of respiratory disease amongst a population of British children. Using a control group of children who lived in homes where electricity was used for cooking, they showed a significant correlation between the incidence of respiratory symptoms of disease (in both boys and girls) and gas cooking in the home. The agents responsible for this asociation are the emissions from gas cookers - NO_x, CO and small amounts of CH_4 and other hydrocarbons.

A follow-up study was conducted in 1979 and the conclusion not only supported the results of the 1973 study, but showed the association to be independent of age, sex, social class, the number of cigarette smokers in the home and latitude (5b). In a later study done in 1979 temperature and relative humidity were also studied as variables and the authors concluded that the prevalence of respiratory conditions such as bronchitis, URTI or cough, tended to be highest in homes with high levels of NO and a high relative humidity. (5c).

In another study, which examined the effects of smoke pollution in the dwellings of children admitted to hospital with bronchopneumonia, the noxious fumes mentioned above were again shown to be implicated in the generation of respiratory disease (4). The

author concluded that exposure to CO results in generalised systemic effects and that exposure to SO , NO and benzene results in bronchial irritation which predisposes to upper and lower respiratory tract infections including bronchitis and broncho-pneumonia.

Woodheating as an alternative to electricity or gas in the home was also shown in this study to produce an internal environment which predisposes to respiratory disease i.e. higher death rates from bronchial diseases was found to be associated with residence in which there was poor ventilation on woodburning stoves, especially during the rainy season when people cooked indoors. The study concluded that in well-planned and approved housing with functional chimneys or electic cooking facilities, one finds a decreased mortality from bronchitis, bronchiditis and pneumonia. In overcrowded conditions where cooking on woodburners takes place indoors, there is an increased mortality.

TEMPERATURE AND RELATIVE HUMIDITY: Since 1973 when Blackley reported that after breathing cultures of specific moulds he experienced a "bronchial catarrh which unfitted me for duty" (30) numerous investigators have studies the relationship between moulds and allergic symptoms. In a definitive study on the relationship between asthma and the house dust mite (Dermatophogoides pheronyssinus) Spieksma showed that the mite achived optimal growth at a temporature of more than 25° C and in a relative humidity of more than 45% and that concentration of the mite increases with increased activity in the home (6). This would suggest that for susceptible individuals, the incidence of asthma increases in hot humid and overcrowded conditions.

Among the other factors responsible for the incidence of allergic asthma, airborne spores have been implicated (31). These have been shown to be generated from fungi that grow in moist areas of the home and that damage from breaks in water lines, wet carpets or wet floors all produce an environment highly conducive to fungi. Such conditions are associated with structurally deteriorated buildings.

AREA OF RESIDENCE: Finally, the incidence of chronic respiratory disease has been shown to be associated with the area of residence (1). In a retrospective study of children resident in four respective areas of Kent, a decreased expiratory flow rate (as measured by a Wright Pak Flow Meter and indicating integrity of pulmonary function) was positively correlated with living in (or near) an industrial area in homes where hot water, a fixed bath and/or taps were lacking.

(2) Gastrointestinal Diseases

As can be seen by the clustering of correlations on the table, investigators have shown numerous associations between the incidence of G.I.T. disease and housing - more specifically, three parameters of housing: water supply, toilet/sewage and

SUBSTANDARD HOUSING: Diarrhoeal disease has been shown to be positively correlated with poor housing conditions in at least five separate studies (8,10,12,14,15) In a cross-sectional study done in Panama to evaluate the role of socio-environmental conditions on a group of infants with diarrhoeal disease, and to determine whether the type of housing influences the prevalence of certain bacteria, sanitation,, water supply and sewage were shown to influence the incidence of Salmonella, shigella and e. coli infections (8). These enterobacterial pathogens were found in 6 to 10% of children living in substandard dwellings, while none were found in children living in high standard housing.

WATER AND SANITATION : Research in the United States of America found that convenient access to adequate quantities of water for personal hygiene was related to the reduction of shigellosis (13) while in Costa Rica, reduction in the incidence of diarrhoea was related to a good level of sanitation i.e. piped water was shown to decrease the amount of infection with enteropathogenic organisms. (10) In this same study, a bathing facility was also shown to be necessary in order to obtain the best effect of piped water.

In another study the formation of aggregated measures of acute morbidity by means of frequency distributions, identified diarrhoeal disease in infants and young pre-school children as a morbidity problem in an urban area of a developing country (12)- Analysis of variation by means of the THAID method indicated that household characteristics with the strongest predictive power include several variables which may have a causal relationship with diarrhoeal disease. Thes include: type of floor (expressing quality of housing and ranging from bare ground to wood and tiles) source of water; crowding; latrine standard; and water consumption (litres per person per day). With regard to the latter, hygienic baths and accessibility of water both play important parts in the water-disease equation and therefore the quanitity and conveient access to it are important factors.

This conclusion was substantiated by the findings of another team of investigators who, after a longitudinal study done in four Venezuelan villages, concluded that sanitary measures are of the greatest importance in the redution of diarrhoea (15). Of the sanitary measures than can be taken the provision of unlimited amounts of good water seems to be correlated with the most important reduction in diarrhoea.

The importance of readily available water as well as other factors of sanitation was yet again demonstrated in cross-sectional studies done in seven different countries by the WHO Diarrhoeal Diseases Advisory Team (14). An analysis of their data showed that whereas basic sanitation adds only a little ot the reduction of the incidence of diarrhoea, complete sanitation can reduce it markedly.

In a cross sectional study of Nigerian children, where the presence of ascaris

lumbicoides, hookworkm stecoralis and malarial parasitaemia were used as health indicators, it was shown that the prevalence of the ova of intestinal parasites is associated with the sanitary conditions of the immediate environment, source of water (pipe borne or wells or streams), the type of latrine (water, pit or bucket) and also the availability of dining facilities (9). In this study, however, the author was unable to separate adequately, the effects of housing from other factors.

FLOORS: The reducton of ascaris lumbicoides and hookworm infection w. was shown in a separate study to be associated with durable floors (10). Cement or other finished floors are more easily kept free of and dust and are generally associated with cleaner living and a reduced prevalence of the parasites. In this study as reduction in. the prevalence of ascaris was also shown to be correlated with the presence of a flush toilet (as opposed to a septic tank, pit privy or no facility for excreta disposal).

TOILET: Latrine type has also been shown to be associated with the prevalence of amoebiosis (11). In a cross-sectional study done in India in which employees of an educational institute living inside the campus were compared with employees living outside, the investigators firstly determined the prevalence of amoebiosis (defined as the excrettion by an individual of entamoeba hystolitica in any form). They then went on to determine the ratio of cases to carriers, and investigate the circumstances under which carriers developed symptoms Inefficient latrines (or none at all) and unsafe water was shown to be associated with an increased prevalence of the parasite.

3. Morbidity and Mortality

Seven studies included in this review have been grouped into a general category of mortality and morbidiy. As shown on the table, association between morbidity, mortality and a whole range of housing parameters have been demonstrated.

The incidence of child mortality was shown in three separate studies to be influenced by housing quality. Brennan and Lancashire (16) analysed British National Census data for 1971 and concluded that mortality in the first five years of life increased with increased crowding (% houses with more than 1,5 persons per habitable room) and inadequate amenities (i.e. no hot water, bath or inside toilet). This study gave weight to an earlier study of national census data

which mortality rates for children were examined and analysed in relation to a number of social indices (18). The authors of the study concluded that amongst a number of factors overcrowding is an important determinant of childhood mortality.

Infant mortality rates have been shown in another study to be associated with poor quality of water supply and the absence of a toilet (19).

Poor housing, overcrowding, loneliness, family breakdown, personal disability and social instability were all shown to be correlates of excess mortality in a study done in Massachusetts (21). Multiple unit dwellings, substandard housing and overcrowding were included in the 76 significant correlations with the extremely high mortality rates found in the 39 areas studied.

A clear linkage between housing and general morbidiy was found in a study done in South Dos Palos, California (19). To look at the effects of improved housing on health, the investigators conducted a cohort study of 81 families from substandard housing who were rehoused. Crowding, water supply, sewage, garbage disposal, structural deficiencies and the presence or absence of vermin were included as variables in a compound housing index.

Consideration of changes in the cost of medical services and the "propensity of people to seek medical attention" were factors included as checks before the authors concluded that the decreased morbidity found after rehousing was a result of the better quality of housing.

This association (between morbidity and housing quality) was again demonstrated in an analytic survey done in Copenhagen (20). In contrast to many other studies which have shown a relationship between housing and health without controlling for other socio-economic variables, this study set out to investigate the effect of 109 social, medical, housing and hygienic factors on the morbidity of a sample population. Dividing the population into age-specific categories (1-6 years, 7-18 years and more than 19 years) the investigators showed a relationship between morbidity and, amongst other variables, the quality of housing (as determined by size, water and bathroom facilities, drafts and cold, heating and level of dwelling above the ground.

4. Growth

The relationship between housing conditions and the physical development of children was studied in a cohort of English, Welsh and Scottish children (24). Their morbidity (respiratory disease, headaches and general ill-health) and their height (used as an index of physical development) were studied in relation to crowding, access to amenities (i.e. whether a household has a bathroom, hot water and indoor toilet) and to tenure. Although the investigators concluded that contrary to expectations the relationships were mostly weak, a strongly positive correlation was found between crowding and the rate of growth of children. (Other correlations shown in the study were discussed under "respiratory diseases".)

Height quotient (i.e. height age as a percentage of chronologic age) was shown in another study to abe affected by crowding (23). In this case the population studied consisted of severely malnourished infants and children. The relationship between a depressed height quotient and increased numbers of persons per room or per bed was shown against a control group of children who, although equally malnourished, came from less crowded home environments.

5. Skin Diseases

An increased incidence of skin disease has been shown to be associated with crowded conditions, a water supply that is poor in quality aor quantity, and sturctural inadquacies in the housing.

OVERCROWDING: Overcrowding for sleeping space (as defined by the 1957 Housing Act of England), sleeping habits (sleeping alone or sharing) (25) and the degree of general crowding (number of family members per number of rooms in the home) (26, 27) have been positively correlated with the prevalence of scabies.

HOUSE STRUCTURE AND WATER SUPPLY: The latter has also been shown to be affected by the presence or absence of a piped water supply (26) the use of a private tap and to the type of housing structure (27). With respect ot structure, good housing (i.e. modern housing built of bricks with closed, clean drainage) was associated with a decreased prevalence of scabies while poor quality housing (built of wattle or mud, hatched with grass and housing either a pit latrine or no latrine and no drainage).

In this study, personal hygiene was also shown to be associated with

scabies i.e. washing of body and clothes was shown to be an important factor in preventing the spread of scabies. Therefore, quantity of water supplied and convenient access to it can be seen to be important factors - as important as quality of water.

Leprosy and pyoderma were also positively correlated with overcrowding and the absence of a piped water supply (26).

6. Infectious Diseases

Tuberculosis has long been known as a disease closely associated with poverty, malnutrition and poor environmental conditions, and many studies have been done to assess the relative importance of poor housing amongst all these factors (Martin, 1976). The majority of the definitive studies were done considerably earlier than 1963 (the cut-off date of this literature review) and include the series of studies done in Edinburgh and Glasgow by Stein (1950-4) in which a clear association between the incidence of tuberculosis and severe overcrowding was shown.

Of the studies included in this review, two are concerned with infectious diseases other than tuberculosis i.e. cerebospinal meningitis and rheumatic fever. In a study done in two areas of Africa in which epidemics of cerebrospinal meningitis occurred, Ghipponi et al (28) concluded that an increase in airborne bacteria is associated with poor ventilation, earth floors (as opposed to well constructed cement floors) and overcrowding. The latter was also shown to be correlated with ain creased attack rate of meningitis.

An association between the prevalence of acute rheumatic fever (or rheumatic heart conditions) and degree of crowding (number of people sharing a bedroom) was shown by MacLaren et al in the "Soweto Study" (29). In discussing their results, the authors concluded that the root cause of the high prevalence of RHD in Soweto, almost certainly lies in the low socio-economic status of the population. As long ago as 1930, when the incidence of rheumatic fever was already declining in Britain and the United States, Glover (as cited in 29) stated that "the incidence of acute rheumatic disease increases directly with poverty, malnutrition, overcrowding and bad housing". Overcrowding has since been shown to be the most important factor in contributing to a high incidence of rheumatic heart disease. (29).

(b) Housing

6. Housing

The majority of low income housing in the Cape Town metropolitan area is under the control of the Cape Town City Council, the Cape Divisional Council ('coloured' and Asian housing) and the Western Cape Administraton Board (African housing and Crossroads and KTC squatter camps).

This analysis deals primarily with housing which is administered directly by these local authorities, that is, the rented stock and the squatter camps. Council ownership schemes, which at any rate are in the minority and of a better quality, are for prseent purposes excluded.

Units to be analysed are therefore as follows:

City Council ('coloured')	35965	
Divisional Council ('coloured')	22356	
Administration Board (African)	±6245	(excludes hostels)
Squatters: Divisional Council	2207	
Admin Board	2300	(estimate)
TOTAL	79073	

These units contain at least 53% of the 'coloured', Asian and African population within these local authority boundaries. (Total 'coloured, Asian and African population at 1980 census was 927 660. We assumed six people average per unit).

The following aspects of the house and the living environment are considered to be important in terms of their affect on health:

1. Water and sewage

UNITS WITHOUT INSIDE TAPS AND TOILETS

Authority	Outside toilets	Outside taps (1)
Council	2156	2116
Council squatters	2207	2207
Admin Board (2)	13800	13800 (estimate)
Admin Board squatters	2300	2300
TOTAL	20463	20463
% of stock	25,8	25,8

Notes: 1. Usually units constructed with outside toilets who have outside taps

2. Accurate information for African townships is difficult to

obtain. However over 80% of units are standard 51/6 houses which have outside toilets and taps.

3. Even though toilets are outside, except in the case of squatter camps, sewage is water borne. Water is also purified.

2. Electricity

UNITS WITHOUT ELECTRICITY

Authority	No of units
Council	4456
Administration Board	6500
Council squatters	2207
Admin Board squatters	2300
TOTAL	15463
% of stock	19,5

Note: 1. Most units were built without electricity, but connections can be made at the cost of the tenant (at present approx R600 per unit). It is assumed here that at most 40% of tenants would have done this.

3. Overcrowding

It is difficult to guage the extent of overcrowding in 'coloured' and African areas in Cape Town but the problem is known to be serious. The following figures are samples from the 1980 census data:

PERSONS PER HABITABLE ROOM

Bonteheuwel	2,14
Kalksteenfontein	2,57
Manenberg	2,19
Mitchells Plain	1,37
Valhalla	2,73

Source: Cape Town's Housing Problem. Cape Town City Engineers Department, July 1983.

PERCENTAGE OF HOUSES WITH MORE THAN EIGHT PEOPLE

Bonteheuwel	21
Factreton	35
Kalksteenfontein	41
Valhalla	24
Hanover Park	22
Lavendar Hill	24

Source: Ibid.

According to the Slums Act each person requres a minimum of 3,22 square meters of space.

Manenberg	2,19 sq m
Valhalla Park	2,65 sq m

Source: Ibid.

One reasons for overcrowding is simply not enough houses. Another reason is that houses are of inadequate size. In relation to the 'coloured' population average family size is between three and 4.5 people (1) and African families are on the whole larger. This means that the average family will require a house of at least three bedrooms. However 87% of 'coloured' letting units in Cape Town have been built with two bedrooms or less, and 20% have only one bedroom. Similarly in the African townships the standard NE 51/6 has two bedrooms and a living room.

HOUSEHOLD SIZE 1980
'COLOURED' FAMILIES

Household size	Percentage
0 - 1,5	1,23
1,5 - 3,0	20,49
3,0 - 4,5	45,90
4,5 - 6,0	21,31
6,0 - 7,5	11,07

Source: L. Loots

'COLOURED' LETTING UNITS 01 REGION

1 room	4113	u 7%
1 bedroom	11022	20%
2 bedrooms	33507	60%
3 bedrooms	6709	12%
4 bedrooms	496	1%
	55849	

Source: L. Loots

(1) Lieb Loots "Preliminary Estimates of Housing Demand and Supply in Greater Metropolitan Area", 1981, University of Western Cape.

4. Internal Environment

The internal envirnoment is determined by a number of factors, of which some have already been mentioned i.e. overcrowding and the lack of electricity say for space heating.

One of the major factors affecting the metabolic comfort of the material environment of any dwelling is the manner of construction and specific materials used.

Centrally, the housing stock for the low income groups is poorly constructed with an attempt to minimise the amount of materials i.e. by using brick-on-edge,

1. Instead of an external 280 mm canty brick wall, a brick-on-edge cavity wall (200mm) or a wall without a cavity is used. In the Cape this is particularly problematic with the long wet winters. Walls without cavities allow the damp to penetrate to the interior skin.
2. The concrete floor slabs are minimised to 50mm thick and are often built without DPC (damp proof coursing). With the high water table on the Cape flats, rising damp is frequently experienced. No floor finishes /covering is provided.
3. Roofs are corrugated asbestos cement without ceiling. Asbestos cement allows for a high transferrance of temperatures.
4. Natural ventilation. Houses are generally built with air bricks and the required percentage of natural ventilation by windows, but because of windy conditions it is found that the air bricks are blocked up and windows rarely opened. Hence, the turnover of fresh air is not very high.

The following example serves to illustrate the mean internal environmental temperatures of a standard semi-detached house on the Cape flats. It is one of the case studies surveyed by the students from the School of Architecture, UCT:
The house has three rooms, a kitchen and an outside W.C. The occupancy is eight people. The exterior walls are 150mm brick-on-edge with no cavity. The concrete floor slab is 50mm. A corrugated asbestos cement roof if used with no ceiling.

The results of the table below illustrate the mean internal environmental temperatures over 24 hours of the day on 10 specific days of the year, ranging from mid-summer (column 1) through autumn to mid-winter (column 6) through spring and back to mid-summer.

The study takes the following factors into account:

1. The building material elements and their insulation values
2. The occupancy factor of the dwelling: the number of occupants and their activities over 24 hours of the day.
3. Solar intensity in the dwelling from between 05h00 to 19h00 over the 10 specific days of the year.
4. A ventilation constant
5. Hourly temperatures for Cape Town over 24 hours for the 10 specific days of the year.

HEAT TRANSFER ANALYSIS -

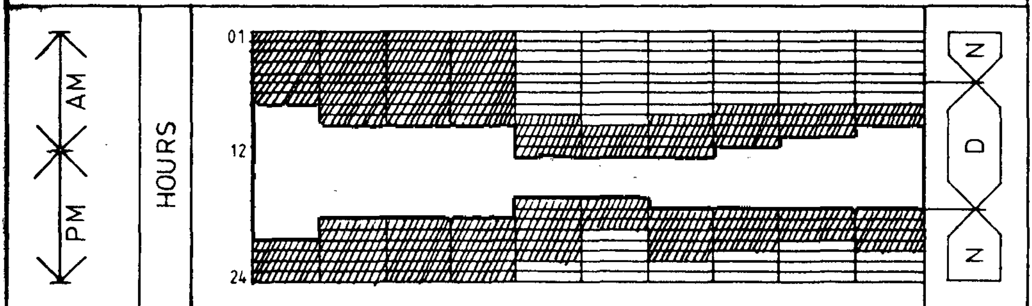
A. MEAN INTERNAL TEMPERATURES (°C)

REPRESENTATIVE DAYS 1-10

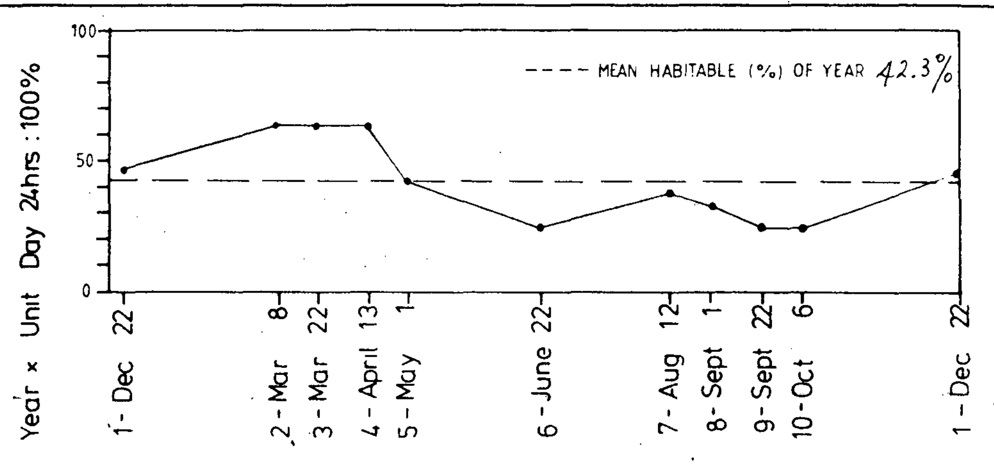
LENGTH OF DAY IN HOURS (AM / PM; NIGHT / DAY / NIGHT)

HOUR	01	02	03	04	05	06	07	08	09	10
01	22.3	20.6	21.0	21.3	16.9	8.3	16.6	17.4	17.1	17.2
02	21.5	20.6	21.0	20.9	16.3	7.5	15.8	17.1	16.6	16.6
03	20.8	20.1	20.5	20.3	16.1	6.2	15.5	17.0	16.7	16.4
04	19.7	19.5	19.9	20.0	16.2	5.3	15.1	16.6	16.3	16.1
05	19.3	18.9	19.2	19.5	16.0	4.6	15.2	16.7	16.4	16.1
06	19.9	19.0	19.3	20.7	16.3	4.2	15.2	17.0	16.7	16.6
07	24.1	20.3	20.6	22.0	17.7	5.9	16.1	18.3	18.1	18.5
08	28.9	21.9	22.2	22.6	18.1	7.2	16.5	19.4	19.5	21.6
09	33.2	26.3	26.5	25.2	20.4	13.0	19.6	22.2	22.3	25.1
10	36.4	30.7	30.9	28.6	23.7	19.7	23.6	25.1	25.3	27.9
11	40.5	32.9	33.1	30.2	25.5	23.9	25.5	26.7	27.0	29.6
12	42.6	35.0	35.1	31.9	27.0	25.9	27.0	27.8	28.1	30.4
13	43.5	35.5	35.6	34.7	29.3	28.9	30.1	30.4	30.8	30.6
14	43.9	36.5	36.6	33.7	28.1	27.6	26.8	29.2	29.8	31.4
15	43.1	36.8	36.9	33.9	28.6	28.4	29.2	28.8	29.0	30.6
16	42.6	36.6	36.9	34.1	29.1	25.0	29.7	29.2	29.4	30.2
17	39.7	33.6	33.8	31.6	27.0	26.8	27.9	27.1	27.1	27.6
18	34.9	29.2	29.4	27.5	23.4	22.5	23.7	23.2	23.0	24.0
19	31.1	26.3	26.7	25.6	21.9	19.4	21.9	21.4	21.1	21.9
20	27.2	24.2	24.6	24.4	20.8	16.0	20.7	19.0	19.5	20.1
21	25.6	23.3	23.8	23.6	20.2	14.9	19.7	19.1	18.8	19.6
22	24.7	22.8	23.2	23.0	19.3	13.6	19.1	18.6	18.2	18.9
23	24.0	22.0	22.4	22.5	18.6	12.5	18.6	18.3	17.9	15.6
24	23.1	21.1	21.6	21.9	17.5	12.1	17.5	17.9	17.6	17.9

B. COMFORT / DISCOMFORT ZONES



C. GRAPH OF HABITABLE & NON-HABITABLE TIME (%) OF YEAR



WITHIN METABOLIC COMFORT ZONE (19-27°C)

ABOVE METABOLIC COMFORT ZONE (> 27°C)

E.

SUMMARY OF RESULTS WITH EXAMPLES OF PERTINENT CONDITIONS IN LOW-INCOME HOUSING CAPE TOWN METROPOLITAN AREA

HOUSING PARAMETER	ASSOCIATED HEALTH PROBLEM	EXAMPLES OF PERTIENENT LOCAL CONDITIONS
INADEQUATE/ POOR WATER SUPPLY	* Gastro-enteric Diseases * Increased Morbidity * Increased Mortality * Skin Infections	20,423 units have an outside tap as their only source of water
OVERCROWDING	* Respiratory Diseases - URTI & LRTI * Diarrhoeal Disease * Morbidity * Mortality * Skin Infections * Infectious Disease eg Meningitis Tuberculosis Rheumatic Fever	* Between 21% and 41% of homes house more then 8 people * The average space per person in Manenberg and Valhalla Park is 2,42 sq m. This is 0,8 sq m short of minimum requirements cited in the Slums Act
SEWAGE/ TOILET FACILITIES (excreta disposal)	* Gastro-enteric Disease * Diarrhoea * Bronchitis * Child Morbidity & Mortality	* 20 463 units have outside toilets
POOR SANITATION	* Bronchitis * Gastrointestinal Disease * Morbidity * Mortality	* Usually units constructed with outside toilets also have outside taps
INTERNAL ENVIRONMENT * Pollution by indoor burning of fuel with inadequate ventilation	Respiratory Disease	15 463 units have no electricity and therefore make use of gas and wood burning indoors
* Thermal environmt (temperature and relative humidity)	* Allergic Asthma * Disturbance of body thermoregulation	The mean internal environmental temperatures of a standard semi-detached house in the Cape Flats lie well outside of the "Human Comfort Zone" - being too hot in in summer and too cold in winter

METHODOLOGICAL PROBLEMS IN THE STUDY OF HOUSING AND HEALTH

As stated earlier, a great deal of literature initially scrutinised was rejected for this review. Methodological deficiency was the most important reason for rejection, although not the only one. Characteristically the problems included:

- poor definition of variables;
- arbitrary selection of samples, unrepresentative of the general population;
- no control group;
- no checks for reliability and
- no attempt to analyse results.

Thus, the studies rejected were those which were 'unscientific' and in which conclusions reached were consequently unreliable.

There were, in addition, a number of methodological problems that recurred even amongst the studies included. Although it is beyond the scope of this paper to deal with these peoblems at great length, it is important that they be raised so that anyone undertaking studies in the area of housing and health may be wary of what appear to be common pitfalls.

The most important of these problems related to

1. the type of study;
2. the use of control groups;
3. definition of variables;
4. checks for reliability of data.

1. Type of Study

12 of the 30 studies included were cross-sectional surveys. Here, cause and effect are measured simultaneously and both measurements relate to the same point in time. Consequently, cross-sectional studies are most appropriate for studies of permanent (or reasonably permanent) characteristics of the individual, so that his status with respect to the cause measured at the same time he has the disease, has a high probability of reflecting his status at the time the disease was included (Milner 1962, page 20).

Since in the study of housing and health, neither the postulated cause (housing) nor the effect (health) is permanent nor static, a cross sectional study offers little possibility of establishing a conclusive direction of causality. Indeed, because of the 'once-off'

nature of the study, the fact that housing is but one of a number of varibles in a causal web (and in some cases is perhaps not a very important element) may well be obscured.

Nevertheless, a cross-sectional study is certainly an easier and a more economical undertaking, and may well point to important associations in a situation at a given time. Much information is valuable in pinpointing problems for more precise investigation.

2. Control groups

Although controls are never needed in surveys in which hypotheses are not tested (Abramson 1979) a study of the housing-health linkage is by implication an attempt to support a hypothesis of causation and therefore should include a control group. Measurement of a test population alone without a control, cannot reveal the true nature and extent of the influence of housing on health.

Only six of the 30 included studies made use of a control group. This problem may possibly be explained on the following grounds:

(a) An ideal control group is one which is exactly the same as the study group in all respects except for the characteristics which are to be studied (Abramson, 1979, page 49). Because housing is inextricably linked with social class, income and a whole host of other socio-economic variables, it is usually well nigh impossible to find a control in which all variables except housing are constant. Groups of similar socio-economic status tend also to live in housing of a similar standard.

(b) Inclusion of a control gorup in a study is often too expensive and time consuming

Consequently studies which did not make use of control groups were not automatically judged invalid and excluded. Those that were methodologically sound in all other respects were included, but one should be aware that conclusions reached in these studies are subject to this imperfection.

3. Definition of Variables

Incomplete or absent definition of variables and of scales of measurement was a problem common to nine of the included studies. Although in each of these cases the studies were included on the basis of good scientific method in every other respect, the deficiency evokes the strongest criticism. It is easily avoidable.

Each of the variables measured in a study should be clearly and explicitly defined. However full of insight an investigators hypotheses and conclusions may be, they remained tenuous unless suported by observations objectively recorded in quantitative terms. Unless this is done, there can be no assurance that the findings would be repeated if a similar study were undertaken by a different investigator.

4. Checks for Reliability of Data

High reliability in data collection does not mean that a study is automatically satisfactory. Moreover, the measurement of a phenomenon should not be given up simply because there is some degree of unreliability. Nevertheless, measures should always be taken to reduce variation to reasonable limits and investigators should be aware of the sources of variation.

In a number of studies included here, the investigators documented their attempts to reduce variability i.e. checks included standardisation of measurement, the use of more than one observer for clinical examination of individuals, the use of multiple samples in the case of dust measurements and bacterial culture plates, checks for non-responder bias in cohort studies and use of a computerised demographic profile system in a study which used census data.

However the majority of the studies did not indicate whether or not checks for reliability had been undertaken.

STATISTICAL METHOD AND ANALYSIS OF RESULTS

The method used to analyse results in the included studies may be divided into three categories:

(a) Descriptive Analysis: This includes the use of frequency distributions (in graphic or tabular form) and contingency tables (without the application of further statistical tests).

(b) Inferential Analysis: This includes any statistical claim for significance through the use of chi squared, the t test, f test, correlation coefficient (r), etc.

(c) Exploratory Analysis: This includes the use of any of the techniques of multivariate analysis (e.g. the automatic intervention detection techniques)

In general the purpose of statistical analysis beyond descriptive

analysis is to test whether the data collected provides statistical evidence in favour of the hypotheses implicit in the idea of collecting the data. The studies included in this review were for the most part sound in this area i.e. the methods chosen were appropriate to the type of data. In only four of the studies was descriptive analysis the only form of analysis used, but in each of these conclusions reached were in congruence with the overwhelming body of other medical literature.

Various techniques of multivariate analysis were used in another four studies. Although these techniques are not widely used by investigators, and although they do not provide a short cut solution to the problem of causal interpretation, they might offer the most appropriate way of clarifying the housing-health linkage. Multivariate analysis (more specifically the AID's) can streamline the production of information about the interrelationships which exist among a whole number of factors. This would be important in determining to what extent housing (amongst a whole net of factors) plays a role in determining the health of an individual.

CONCLUSION

At the outset of this literature search consideration of the ways in which housing quality differs and the ways in which patterns of ill-health are distributed, led to a number of expectations regarding the role of housing in the generation of ill-health. Among the important housing items considered were crowding, sharing of facilities, inadequate water and facilities for keeping clean and structural decay. It was moreover expected that certain categories of disease may be particularly affected by the housing differences: inter alia, acut respiratory infections, communicable diseases like tuberculosis and gastrointestinal diseases.

As the study unfolded a number of features emerged. Firstly, it is clear that housing, albeit an important ingredient, is invariably just one of a multiplicity of socio-economic conditions affecting health. Health conditions are strongly related to social factors such as social class, level of education and unemployment, as well as to physical variables like air pollution, injury producing hazards and housing conditions. And in searching for implications of finding strong correlations between housing and health, one becomes aware

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that modification of the physical environment can only have a maximum effect on health if accompanied by other socio-economic improvements.

Secondly, because of the complex web of adverse socio-economic conditions found in areas characterised by poor housing and because of the lack of adequate and reliable health records in such areas, the study of the direct housing health linkage is difficult. Extracting clear associations from the numerous confounding variables may in fact be impossible. Consequently, literature which describes and analyses the relationship in a detailed measureable fashion is very limited.

However despite these complexities the correlations shown in the results of the studies chosen are not insignificant and substantially reinforce what common sense would lead one to expect - certainly, one would not expect good health in poor housing conditions

The question which one is ultimately forced to ask are how much more research of this nature needs to be done, how many more correlations need to be scientifically proven, how useful is this type of research, how much more useful will it be if extended?

From a cost benefit point of view, it may be reasonable to contend that no new research need be carried out. Enough 'scientific' information is already available to warrant expenditure on action. Despite the fact that one recognises that housing is not the primary or sole determinant of health, the information we have does point to the possibility of positive physical intervention. Such intervention of course includes not only the control of population density and the provision of adquate water supplies and waste removal systems (which are mandatory!) but also areas of planning and design improvements directed at the attainment of better health e.g. provision of finished floors, electricity, bathing facilities. Intervention of this nature becomes crucial when one considers the poor housing conditions which presently characterise the Western Cape (including the vast squatter camps, devoid of infrastructure) and the coexistent high incidence of preventable diseases.

In the light of this the medical profession should view with alarm any attempts to decrease state expenditure on housing and particularly, any attempts to minimise standards. At the very least the results shown here point to the need for the definition of

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minimal housing standards compatible with a healthy community. This would also seem to be in line with the recommendations of the Health Services and Facilities Plan and perhaps would be an appropriate undertaking for the National Health Advisory Committee

We assume however that such a project would not be undertaken by the medical profession alone but would include the participation of representatives of the communities affected by poor housing and by ill-health.

APPENDIX

HOUSING AND HEALTH - LITERATURE CHECK-LIST

TITLE.....

AUTHORS.....

JOURNAL.....

DATE.....

TYPE OF STUDY.....

OBJECTIVE.....

.....

STUDY POPULATION

WHO.....

SAMPLE.....

METHOD OF SAMPLING.....

.....

SIZE OF SAMPLE.....

CONTROL GROUP (yes/no).....

VARIABLES MATCHED.....

.....

VARIABLES

VARIABLE	DEFINTION	SCALE
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

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