

Housing Conditions and Health: A Review of Literature
Report Prepared for the Grand Council of the Crees (Eeyou Istchee)

by

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Introduction

The purpose of this Report is to review and summarize the scientific literature that addresses the relationship between housing conditions and health. An earlier review of the relationship between housing and health was conducted by the Northern Health Research Unit in 1991. This report interprets the results of the previous review with more recent studies. The review is based on articles available through a search of several scientific databases including Medline, Healthstar, Sociofile, and Social Science Abstracts. The paper also includes an exhaustive search of all published and unpublished case studies (including dissertations, consultants' reports and government papers) dealing with housing and health in Native communities in Canada. In addition, a few studies from U.S.A. Indian reservations and Greenland were also consulted and reported.

The health effects of poor housing have been recognized for a long time (Martin et al 1976). Indeed, Leviticus is quoted in the Bible (14:33-54) regarding the Lord's advice to Moses concerning housing-related health problems:

“The Lord gave Moses and Aaron the following regulations about houses affected by spreading mildew. Anyone who finds mildew in his house must go and tell the priest about it. The priest shall order everything to be moved out of the house before he goes to examine the mildew; otherwise, everything in the house will be declared unclean.”

Major advances in public health in the developed countries in the 19th century occurred when the dismal living conditions of the urban poor were ameliorated. In recent decades, in developed countries, attention has been shifted from gross dilapidation and unsanitary conditions to problems associated with indoor air quality and other chemical and physical hazards that exist in the residential environment. In terms of health effects, attention has also changed from severe morbidity to psychosocial well-being.

However, although improvements have occurred, housing conditions in Aboriginal communities continue to exhibit third-world like characteristics with dilapidated housing and unsanitary conditions (lack of running water and sewage facilities) in many communities.

The range of health problems which can be attributed to poor housing conditions is large, from psychological and physiological effects to specific diseases varying in the degree of associated morbidity. There is a large and significant body of scientific literature that demonstrates convincingly that there are direct causal links between different aspects of poor housing and particular health conditions (Smith, 1990).

Health problems that have been associated with poor housing include the infectious diseases, non-infectious respiratory diseases such as asthma, and social and psychological problems. Table I and II summarize the main findings of a selection of studies from around the world and from the 1940s to 1990. This is not an exhaustive list but is

illustrative only of the range of methodology used and health effects studied. Only the more accessible English-language peer-reviewed journals have been searched. Note that some of these studies did not have housing as their primary focus. For the purpose of the table, only variables related to the housing environment were listed under “exposure” and discussed under “results”.

The literature has identified three primary components of poor housing that are directly linked to poor health outcomes: overcrowding, dampness and moulds, and sanitation and basic housing quality. Each of these components will be reviewed in terms of the health consequences for people, with a particular focus on conditions that affect Aboriginal people in Canada. However, since many studies examined several of these factors together, some citations will appear in several places.

Overcrowding:

Crowding is generally considered as more of a threat to mental than physical health, although the spread of infectious diseases such as tuberculosis and scabies is also associated with overcrowding.

Most studies investigating crowding adopt a standard measure based on WHO guidelines of either persons/room or sq. ft / person. However, a caution is in order since cultures vary in terms of their tolerance for crowded living conditions. Mitchell (1971) found that in Hong Kong, one of the most crowded cities in the world, little ill effects in terms of family relationships, mental health, and work performance could be demonstrated after controlling for poverty. Mitchell (1976) proposed that crowding is a more complex variable that requires a distinction between density – the number of people per unit space, and congestion, which reflects the simultaneous demands for the use of available space. The adverse mental health effect of crowding stems from the lack of personal control over the available space, rather than the actual small size of the space. Cultural variations in definitions of “crowding” also play a mediating role.

In a review of several studies of crowded conditions in public housing in Britain, Hopton and Hunt (1996) conclude that crowding has a negative effect on mental health by enforcing social contact. In particular, Gabe and Williams (1987) found that emotional distress in women increases significantly with overcrowding. Duvall and Booth (1978) reported on the relationship between housing and various indices of women’s physical and mental health within a larger survey in Toronto. Children’s mental health is also negatively effected by crowded living conditions (Platt et al 1989; Hunt 1990). Lack of adequate play space has been shown to negatively correlate with higher levels of mental ill health in children (Cook and Morgan 1982). Privacy and circulation within the dwelling are deemed to be important factors for psychological well-being (Chapin 1951; Loring 1966).

The epidemiology of respiratory infections (including pneumonia, influenza and acute upper respiratory infections) was reviewed by Graham (1990). Many risk factors have been investigated: outdoor and indoor pollution, smoking, crowding, nutrition, psychosocial stress, climate, SES, etc. Crowding as a risk factor has been investigated dating back to the 1920s and 1930s (e.g. Woods 1927) when mortality was frequently used as an outcome measure. More recent studies (e.g. Leeder et al 1976, Monto et al 1977, Gardner et al 1984) showed that the number of sibs in the family was a predictor of respiratory morbidity. Collins et al (1971) reviewed respiratory mortality in England and Wales from 1958-64 and found that crowding was correlated with all-cause, bronchopneumonia and all respiratory disease mortality in the 0-1 year old whereas for the 1-4, 5-14, only accidents were correlated.

Other infectious diseases commonly associated with crowding include tuberculosis (Britten 1941, Schmitt 1955, McMillan 1957, Coetzee et al 1988), meningitis (Blum & Elkin 1949, Ghipponi et al 1971, Stuart et al 1988) and measles (Aaby et al 1984). Among non-communicable diseases which have been shown to be related to housing is rheumatic heart disease (Quinn et al 1948), which in fact is the sequelae of streptococcal infection. Of particular interest is Barker's (1990) study of stomach cancer, which was found to be related to earlier exposure to crowding during childhood. The authors attributed this to poor food storage, which leads to contamination with microorganisms and the production of toxic/carcinogenic substances.

Scabies is caused by the burrowing of a mite in the skin. Among risk factors associated with its transmission are SES, personal hygiene and overcrowding (Green 1987). As intrafamily spread is well recognized (Church et al 1978), it is to be expected that increased family size should be a risk factor (Sharma 1984), although other behavioral factors may be important such as sleeping pattern and the sharing of towels and clothes (Gulati et al 1977, Blumenthal 1976).

Michael (1984) studied the impact of water supply, sanitation and housing on health in the Northwest Territories. He did two studies, an ecologic one involving all communities in the NWT using official statistics, and a field study in three communities where more detailed information on individuals was obtained. For housing, rates of respiratory, skin and eye diseases were found to be higher in crowded houses (as measured by household size and number of persons per bedroom). No relations was found with housing type (detached, movable homes, etc) or tenure (government, private, rental).

Two studies looked specifically at infant health outcomes. The NWT Perinatal and Infant Mortality and Morbidity Study (PIMMS) followed a birth cohort of 1191 infants during 12 months in 1973/74 (Spady 1982). A large amount of data on socioeconomic status, health care, lifestyle, nutrition, obstetrical history, child care practices, and environmental quality (crowding and clean housing) were collected. The outcomes include all significant health events (death, disease, and developmental score) during the first year of life. Those housing and sanitation factors which emerged as independent predictors of various health outcomes in multiple regression analyses are listed as follows:

<u>Outcome Measure</u>	<u>Housing/Sanitation Factor</u>
Infant mortality	bedrooms/home
No. morbidity visits	persons/bedroom
Morbidity score	persons/bedroom
Incidence of upper respiratory infections	persons/bedroom
Incidence of pneumonia	public water supply, household size, cleanliness of house
Incidence of diarrhoea	persons/bedroom, public water supply, household size
Skin infections	persons/bedroom, public water supply, Cleanliness of house
Failure to thrive	public water supply, household size

Young and Mollins (1996) conducted an ecologic study in 49 predominantly Native communities in the Northwest Territories and found that although socio-economic status (SES) was the strongest predictor of a high frequency of visits to the health centre (as a measure of poor health), overcrowding also correlated with low SES and a perception that the house was in need of core repairs. This study would suggest that the poorest residents of northern communities also live in the most crowded housing and these conditions combine to put them at increased risk for a multitude of health problems.

Rosenberg et al (1997) report that an epidemic of shigellosis, a highly infectious diarrheal disease, was highly correlated with overcrowding and lack of sanitary conditions in 61 First Nations communities in Manitoba. This finding is particularly significant since shigellosis has all but disappeared in developed countries. The incidence rate during the epidemic in First Nations communities was 29 times higher than for the rest of the population and the hospitalization rate for the disease was 12.2 times higher. Compared with houses with two to three persons, the attack rate ratios for houses with 4 to 8 persons ranged from 4.0 to 7.7.

Dampness and Moulds:

In the last decade there has been an explosion of interest in the relationship between dampness and moulds in houses and health conditions. Acheson's (1991) review described the clear link between respiratory infections in both children and adults and damp and mould, and he stated clearly that this relationship had been shown to be independent of smoking, income, unemployment or the presence of pets based on studies by Platt et al (1989); Martin et al (1987) and others.

Acheson (1991) describes several pathways through which dampness and mould can affect health. Maintaining body temperature, particularly for children, can be a problem if clothes and bedding become wet. Moisture also promotes the growth of pathogens such as moulds, mites, viruses and bacteria of various kinds. The connection between

dampness and mould growth has received the most attention because moulds may be responsible for respiratory problems such as asthma, rhinitis, aveolitus and other allergies. Mite infestations are also promoted in damp conditions and are also associated with allergies and asthma. Verhoeff and Burge (1997) report in a more recent review that fungi also produce toxic metabolites which are human carcinogens, and a variety of volatiles (e.g., alcohols, aldehydes and ketones) which may produce headache, eye, nose and throat irritation and fatigue. This review also summarizes the major population-based studies that address the association between exposure to fungi in the home and health effects. This review is reproduced as Table II. Verhoeff and Burge (1997: 552) conclude that “ Fungi do contribute to allergenic disease and the extent of their involvement is probably greater than is indicated by the available clinical and epidemiological studies.”

Dales et al (1997) conducted a study in Wallaceburg, Ontario where a questionnaire was combined with an engineering assessment of 403 families in an attempt to demonstrate a stronger causal association between the presence of fungi and respiratory illness. Despite study design problems, results indicated a relatively high correlation between self-reports of the presence of fungi and the engineering reports.

Most studies of dampness and moulds have focused on damp raining climates (such as England). Pirhonen et al (1996) analysed the prevalence of mouldy homes and their association with respiratory symptoms and iseases in a sub-arctic town in Finland and found that up to 23% of homes had some evidence of mould infestations. The study also found high odds ratios that bronchitis (2.04), hoarseness (2.23) and difficulty in concentration (2.17) were strongly associated with living in a damp home. Other health problems included common colds, fever and chills, allergic rhinitis, fatigue, and stomach aches.

Verhoeff et al (1995) found that childhood respiratory illnesses were associated with living in damp homes and found reasonably strong evidence to suggest that allergic sensitization to moulds and dust mites was the causal factor. Packer et al (1994) also report a strong association between damp housing and ill health in children and provide evidence to suggest the relationship is not the result of people with respiratory illness moving to poor housing. Dales et al (1991a, 1991b) conducted a large questionnaire based study in 1988 of thirty Canadian communities on behalf of Health Canada and found strong unbiased evidence that the presence of indoor moulds and dampness are associated with many adverse health effects in Canadian children and adults.

In general, this evidence suggests that children are at particular risk for a variety of respiratory problems and allergies in damp homes with high levels of mould and mite infestations.

Sanitation and Housing Quality

In the international literature, few studies address problems of poor sanitation or dilapidated housing because these problems generally do not occur outside of third world

situations or urban slums. In these conditions, the focus is less on specific housing conditions and health and is more on broader structural issues such as urban renewal or social inequality. Needless to say, it is a Canadian embarrassment that the majority of literature in this general area describes situations in Aboriginal communities.

In Saskatchewan, Dennis and Pearson, (1978) correlated provincial health insurance plan hospital data with community profiles of central heating, running water and crowding. Indian hospital admission rates were higher than provincial average for most diagnoses, particularly pneumonia, burns, intestinal and skin infections. The 10 reserves with the highest proportion of homes with central heating had lower respiratory disease admission rates in the under-5 population than the other reserves. There was no significant difference in terms of intestinal and skin infections between the 10 reserves with the highest proportion of homes with piped water supply and the others. There was a correlation between population density (in 3 categories) and hospital rates of intestinal, skin and middle ear infections, and burns in all age groups.

Duxbury (1983) determined the relative influence of environmental (housing, socioeconomic status, degree of community control, social disintegration) vs. medical care factors (types and availability of personnel and facilities) on reported morbidity in 24 Indian communities in the Sioux Lookout Zone of northwestern Ontario. There were a total of 103 independent variables in the factor analysis. The logs maintained by nurses and community health workers, the first-contact primary care providers in these communities, served as the source of health data. These logs were developed as part of the evaluation of a telemedicine project and were standardized across all communities. From these the total number of patients visits, the total number of reported episodes of illness, the total number of reported episodes of respiratory illness and trauma were determined and used as dependent variables.

It was found that, compared to community and environmental factors, health service factors were relatively unimportant in predicting the level of morbidity in a community. Housing and sanitation, however, were not as significant compared to socioeconomic variables. One explanation offered by Duxbury was that there was too little variation in the generally poor quality of housing and sanitation among the communities, and thus their effect on reported illness was not apparent.

To examine the links between water supply and sanitation and health on First Nations reserves, Brocklehurst (1985) selected 13 remote northern, western and southern reserves in Manitoba. Morbidity data pertaining to water-related diseases (intestinal and skin infections) were derived from a variety of sources: nursing station visits, communicable disease notifications, and hospitalization and physician services from the Manitoba Health Services Commission. Water supply and sanitation data were obtained by household questionnaires and interviews. An average water consumption index and a servicing score related to water quality, convenience and system reliability were developed for each community. The servicing score was almost linearly related to water consumption, except at the upper and lower ends of the scale.

Plots of hospitalization rates by water consumption showed that rates for both enteric and skin diseases declined rapidly with increasing consumption, leveling off at a consumption level of about 90 lpcd, where hospital rates began to approach provincial averages. The authors recommended that system improvement should be implemented which make a daily consumption of at least 90 litres per person possible. The present system of trucked delivery to small containers should be discontinued.

Bruce (1991) modeled hospital utilization by Manitoba First Nations people in an ecological study which included a large number of housing, geographical isolation, demographic, socioeconomic, and health care variables. All 2-digit categories of diseases (ICD-9 chapters) were investigated in turn as outcome variables.

Inadequacies in housing as measured by persons per room and proportion needing major repair had a significant effect on hospital morbidity. Access by all-weather road or rail was by far the most important factor and it was positively associated with hospital utilization for infectious and parasitic diseases, endocrine and metabolic diseases, diseases of the circulatory and genitourinary systems, musculoskeletal and skin disorders, as well with total hospital utilization for all causes. Distance to the nearest hospital was negatively associated with hospital use for mental disorders, injuries, and ill-defined conditions.

A small case-control study involving 67 Inuit infant deaths from 9 communities during 1969-1971 and 67 survivor "controls" matched for age, sex and community was reported by Hobart (1975). A large number of predictor variables were investigated. Three health outcomes were used: survival/death, a monthly weighted medicated morbidity index, and a morbidity/mortality index. On univariate comparisons, housing and sanitation factors (crowding, heating, toilets, hygiene, household size) all showed some relationship with the health indices (Hobart 1975).

Bjerregaard & Bjerregaard (1985) reviewed the Danish and other literature on housing conditions in Greenland. They conducted an epidemiological study in Upernavik town in the West Coast of Greenland over a 12-month period (1979-80) and analyzed over 2600 health care contacts by 836 residents. Three housing groups were categorized according to housing size, space per person, heating and water supply; social class based on education, occupation and source of income was also determined. The results indicated that:

- 1) Residents of Upernavik town, predominantly Native Greenlanders [Inuit and mixed Inuit-European], when compared with Aarhus, Denmark, had age-standardized contact ratios greater than unity for pregnancy, skin disorders and accidents, and less than unity for neoplasms, endocrine and cardiovascular diseases.
- 2) Comparing Inuit with Danes living in Upernavik showed that the Inuit had higher outpatient and hospitalization rates, especially for skin and respiratory infections and accidents.

- 3) Among the Inuit, the poorest housing group had the highest hospital admission and contact rate for skin infections and accidents.

In an earlier study in the south of Greenland, Berg and Adler-Nissen (1976) studied 286 households with children and composed a housing index based on dwelling type, water, sewage, heating and kitchen facilities, as well as measured overcrowding separately during day and night time. The incidence of colds over the previous 12 months was correlated with the housing, day burden and night burden incidences; otitis media with only the housing and day burden indices; whereas tonsillitis and gastrointestinal infections were little affected by any of the three indices.

Lefebvre (1968) examined the effects on physical health and social function of public housing provided for 18 Indian families (117 individuals) in a reservation in North Dakota. Residents of a now housing project were surveyed over two 5-month periods “before” and “after” the rehousing. Seven indices were constructed, covering health, family and law, school performance, crime and delinquency, church attendance, family relationships, and community activities. Health indicators used included frequencies of communicable diseases, home accidents, teachers’ assessment of students’ diet and health problems such as head lice, scabies and impetigo. The author concluded that the level of physical health and social functioning improved after rehousing.

Rubenstein et al (1969) studied diarrhoeal diseases during infancy in a Hopi pueblo (population 700) from 1961-67. This community was divided politically and culturally into a “progressive” and a “traditional” faction. In 1964 the federal government installed indoor plumbing in the community but the traditionalists refused to accept it and continued to use outdoor taps and privies. The study revealed that the traditionalists had higher outpatient visits for diarrhoea and hospital admission for all causes and diarrhoea than the progressives. Among the latter, there was also a decline in all-cause and diarrhoea outpatient visits after the plumbing installation but no significant change could be observed among the traditionalists.

In an ecologic analysis of hospital utilization and surgical procedures on the Navajo reservation, Kunitz and others (1981) compared 8-year hospital use data in 18 land management districts. A large number of independent variables were included: socioeconomic, health care accessibility, and housing. The last mentioned group included percent living in a hogan, a traditional Navajo dwelling, percent with bathroom and household size. Distance of a community from the nearest hospital was the best predictor of total hospitalization rates, although wage employment and household size were also significant factors. Interestingly the proportion of dwellings with indoor bathrooms was a significant predictor of surgical rates (cholecystectomy, appendectomy and hysterectomy). The authors attributed this to the fact that the presence of indoor bathrooms was a proxy measure of modernization.

Engleberg et al (1982) analyzed outpatient visits for diarrhoeal disease at the San Carlos Apache Reservation in Arizona during 1977-79 and noted a sharp increase in cases late

during October and November each year. During the 1980 diarrhoea season, a small case-control study was done involving 19 patients and 12 controls under two years of age. Over half of the cases were found to have diarrhoea due to rotavirus. Four household risk factors were investigated, and their relative risks were as follows:

- 1) Presence of sibling under 2 years of age/absence = 13.4
- 2) Presence of dogs/absence = 9.3
- 3) Absence of indoor water service/presence = 6.1
- 4) Absence of indoor toilet/presence = 8.1

Only (1) and (2) were statistically significant. Due to the small size of the study there was insufficient power to detect a significant difference involving factors (3) and (4) had there in fact been a difference.

A larger case-control study of rotavirus diarrhoea in the White Mountain Apache Reservation showed that exposure to other children with diarrhoea was the most important risk factor, although a high score for environmental sanitation was also significant. These factors were independent of mother's education, age and employment status (Menon et al 1990).

Conclusions:

Clearly, living in a crowded, damp, mouldy house with poor water and sewage facilities and in need of major repairs is extremely hazardous to the health of residents. This conclusion is valid despite scientific cautions that the design of most of the studies cited above does not provide sufficient evidence to support causal statements (Peat et al 1998). Statements of "causality" usually require longitudinal case-control studies that clearly isolate the particular variable or health threat under investigation (e.g., smoking and cancer and heart disease). Such studies would be difficult, expensive and indeed, unethical, in the case of housing because the accumulated evidence should require that hazardous housing be eliminated before any such study was completed.

The accumulated evidence indicates that the health consequences of exposure to these various hazards are of sufficient magnitude that they constitute a serious public health problem. If the threat was a bacteria, the public health response would be to declare an emergency and quarantine the population. The problem with bad housing is that the alternative, in the absence of a major re-housing initiative, is no housing.

Of even more insidious importance to this review is the fact that children suffer the worst effects of bad housing. All of the health consequences cited above including infectious diseases, respiratory illness, and psychosocial problems have been found to be particularly prevalent in children who live in bad housing. The significance of this finding is that these health effects experienced in childhood may influence the health of the person throughout their life course (Power and Hertzman 1997).

There is increasing evidence that childhood experiences of multiple chronic infections may have long term consequences for the immune system and the adult onset of various chronic conditions such as heart disease and diabetes (Barker 1992;1997). Adult mental health and particularly depression has been shown to be strongly correlated with early childhood experiences of psychosocial deprivation and trauma (McEwen 1998; Acheson 1998).

The solution to this serious health threat is relatively simple. Eliminating damp and mouldy houses, and ensuring a sufficient number of sanitary housing units to reduce overcrowding does not require millions of dollars of medical research, expensive drugs or costly medical procedures. It simply requires an investment in the basic infrastructure of a community; an investment that not only will prevent a major public health problem but will also contribute to the economic well-being of the community and in the process ameliorate the other major and associated risk factor to health – low socioeconomic status.

Reference List

- Aaby, P., Bukh, J., Lisse, I.M., & Smith, S.J. (1984). Overcrowding and Intensive Exposure as Determinants of Measles Mortality. *American Journal of Epidemiology*, 120, 49-63.
- Acheson, D. (1991). Health and Housing--Annual Lecture. *Journal of the Royal Society of Health*, 111, 236-243.
- Acheson, D. Independent Inquiry into Inequalities in Health Report. The Stationary Office. (1998). 9 p.
- Barker, D. (1992). Fetal and Infant Origins of Adult Disease. *British Medical Journal*,
- Barker, D. (1997). Fetal Nutrition and Cardiovascular Disease in Later Life. *British Medical Bulletin*, 53, 96-108.
- Barker, D.J., Coggon, D., Osmond, C., & Wickham, C. (1990). Poor Housing in Childhood and High Rates of Stomach Cancer in England and Wales. *British Journal of Cancer*, 61, 575-578.
- Berg, O., & Adler-Nissen, J. (1976). Housing and Sickness in South Greenland: A Sociomedical Investigation. In R.J. Shephard & I. Itoh (Eds.), *Circumpolar Health: Proceedings of the Third International Symposium, Yellowknife, NWT.* (pp. 627-635). Toronto: Toronto University Press.
- Bjerregaard, P., & Bjerregaard, B. (1985). Disease Pattern in Upernavik in Relation to Housing Conditions and Social Group. *Meddelelser om Gronland: Man and Society*, 8, 3-18.

- Blackman, T., Evanson, E., Melaugh, M., & ods, R. (1989). Housing and Health: A Case Study of Two Areas in West Belfast. *Journal of Social Policy*, 18, 1-26.
- Blum, B.M., & Elkin, W.F. (1949). The Relation of Housing to the Incidence of Meningococci Disease in an Outbreak in Oak Ridge, Tenn. *American Journal of Public Health*, 39, 1571-1577.
- Blumenthal, D.S., Taplin, D., & Schultz, M.G. (1976). A Community Outbreak of Scabies. *American Journal of Epidemiology*, 104, 667-672.
- Briceno-Leon, R., Gonzales, S., & Phelan, M. (1990). Housing and Health: Psychosocial and Situational Effects in a Rural Disease Control Program. *Journal of Social Issues*, 46, 109-118.
- Britten, R.H. (1941). Illness and Accidents Among Persons Living Under Different Housing Conditions. *Public Health Reports*, 56, 609-640.
- Brocklehurst, C. (1985). The Effect of Water Supply and Sanitation on Health on Indian Reserves in Manitoba. University of Toronto, Department of Civil Engineering;
- Bruce, L. (1991). A Geographical Approach to Indian Health Care: Modelling Patterns of Hospital Use in Manitoba. University of Manitoba;
- Brunekreef, B. (1992). Damp Housing and Adult Respiratory Symptoms. *Allergy*, 47, 498-502.
- Chant, S. (1992). The Poor Die Young: Housing and Health in Third World Cities. *Progress in Human Geography*, 16, 456-458.
- Chapin, F.S. (1951). Some Housing Factors Related to Mental Hygiene. *American Journal of Public Health*, 41, 839-845.
- Church, R.E., & Knoweldon, J. (1978). Scabies in Sheffield: A Family Infestation. *British Medical Journal*, 1, 761-763.
- Coetzee, N., Yach, D., & Joubert, G. (1988). Crowding and Alcohol Abuse as Risk Factors for Tuberculosis in the Mamre Population: Results of a Case-Control Study. *South African Medical Journal*, 74, 352-354.
- Collins, J.J., Kasap, H.S., & Holland, W.W. (1971). Environmental Factors in Child Mortality in England and Wales. *American Journal of Epidemiology*, 91, 10-22.
- Court, C. (1994). Conference Urges Better Housing for Better Health [news]. *British Medical Journal*, 12, 1251
- D'Souza, R.M. (1997). Housing and Environmental Factors and Their Effects on the Health of Children in the Slums of Karachi, Pakistan. *Journal of Biosocial Science*, 29, 271-281.

- Dales, R.E., Zwanenburg, H., Burnett, R., & Franklin, C.A. (1991). Respiratory Health Effects of Home Dampness and Molds Among Canadian Children. *American Journal of Epidemiology*, 134, 196-203.
- Dales, R.E., Miller, D., & McMullen, E. (1997). Indoor Air Quality and Health: Validity and Determinants of Reported Home Dampness and Moulds. *International Journal of Epidemiology*, 26, 120-125.
- Dennis, C.A., & Pearson, B.L. Anonymous. The Effects of the Living Environment on the Health of Saskatchewan Indians. Prairie Institute of Environmental Health. (1978).
- Duvall, D., & Booth, A. (1978). The Housing Environment and Women's Health. *Journal of Health and Social Behaviour*, 19, 410-417.
- Duxbury, L. (1983). The Relative Effects of Community Characteristics and Health Care Facilities in the Sioux Lookout Zone. University of Waterloo, Faculty of Management;
- Engleberg, N.C., Holburt, E.N., Barrett, T.J., & et al. (1982). Epidemiology of Diarrhoea Due to Rotavirus on an Indian Reservation: Risk Factors in the Home Environment. *Journal of Infectious Diseases*, 145, 894-898.
- English, J. (1987). Housing and Health: The Relationship Between Housing Conditions and the Health of Council Tenants. *Journal of Social Policy*, 16, 260-262.
- Gabe, J. (1987). Women, Housing, and Mental Health. *International Journal of Health Services*, 17, 667-669.
- Gardner, G., Frank, A.L., & Taber, L. (1984). Effects of Social and Family Factors on Viral Respiratory Infection and Illness in the First Year of Life. *Journal of Epidemiology and Community Health*, 38, 42-48.
- Ghipponi, P., Darrigol, J., Skilova, R., & Cvetanovic, B. (1971). Study of Bacterial Air Pollution in an Arid Region of Africa Affected by Cerebrospinal Meningitis. *World Health Organization*, 45, 95-101.
- Goldstein, G., Novick, R., & Schaefer, M. (1990). Housing, Health and Well-being: An International Perspective. *Journal of Sociology and Social Welfare*, 17, 161-181.
- Graham, N.M. (1990). The Epidemiology of Acute Respiratory Infections in Children and Adults: A Global Perspective. *Epidemiology Review*, 12, 149-178.
- Green, M.S. (1989). Epidemiology of Scabies. *Epidemiology Review*, 11, 126-150.
- Griffin, W.V., Mauvitzen, J.H., & Kasmer, J.V. (1959). The Psychological Aspects of the Architectural Environment: A Review. *American Journal of Psychiatry*, 125, 1057-1062.

- Gulati, P.V., Singh, K.P., & Braganza, C. (1977). Role of Sociocultural and Environmental Factors in the Cause of Scabies. *International Journal of Dermatology*, 16, 281-283.
- Hobart, C.W. (1975). Socioeconomic Correlates of Mortality and Morbidity Among Inuit Infants. *Arctic Anthropology*, 12, 37-48.
- Hopton, J.L., & Hunt, S.M. (1996). Housing Conditions and Mental Health in a Disadvantaged Area in Scotland. *Journal of Epidemiology and Community Health*, 50, 56-61.
- Kellett, J. (1989). Health and Housing. *Journal of Psychosomatic Research*, 33, 255-268.
- Leeder, S., Corkhill, R., Irwig, L.M., & et al. (1976). Influence of Family Factors on the Incidence of Lower Respiratory Illness During the First Year of Life. *British Journal of Preventive Social Medicine*, 30, 203-212.
- Lefebvre, G.W. (1968). The Social and Physical Health Effects of Public Housing on Indian Reservation Families. University of Manitoba;
- Loring, W.C. (1966). Residential Environment: Nexus of Personal Interactions and Healthful Development. *Journal of Health and Human Behaviour*, 5, 166-169.
- MacDonald M, Remus, G., & Laing, G. (1994). Research Considerations: The Link Between Housing and Health in the Elderly. *Journal of Gerontological Nursing*, 20, 5-10.
- Martin, A.E., Kaloyanova, F., & Maziarka, S. (1976). Housing, the Housing Environment, and Health: An Annotated Bibliography. Geneva: World Health Organization,
- Martin, C.J., Platt, S.D., & Hunt, S.M. (1987). Housing Conditions and Ill Health. *British Medical Journal*, 1125-1127.
- McEwan, B. (1998). Protective and Damaging Effects of Stress Mediators. *New England Journal of Medicine*, 338, 171-179.
- McMillan, J.S. (1957). Examination of the Association Between Housing Conditions and Pulmonary Tuberculosis in Glasgow. *British Journal of Preventive Social Medicine*, 11, 142-151.
- Menon, S., Santosham, M., Reid, R., & et al. (1991). Rotavirus Diarrhoea in Apache Children: A Case-Control Study. *International Journal of Epidemiology*, 19, 715-721.
- Michael, M.P. (1984). Effects of Municipal Services and Housing on Public Health in the Northwest Territories. University of Toronto;

- Mitchell, R.E. (1971). Some Social Implications of High Density Housing. *American Sociology Review*, 36, 18-29.
- Mitchell, R.E. (1976). Cultural and Health Influences on Building, Housing, and Community Standards: Cost Implications for the Human Habitat. *Human Ecology*, 4, 297-330.
- Monto, A.S., & Ross, H.W. (1977). Acute Respiratory Illness in the Community: Effect of Family Composition, Smoking and Chronic Symptoms. *British Journal of Preventive Social Medicine*, 31, 101-108.
- Packer, C.N., Stewart-Brown, S., & Fowle, S.E. (1994). Damp Housing and Adult Health: Results from a Lifestyle Study in Worcester, England. *Journal of Epidemiology and Community Health*, 48, 555-559.
- Peat, J.K., Dickerson, J., & Li, J. (1998). Effects of Damp and Mould in the Home on Respiratory Health: A Review of the Literature. *Allergy*, 53, 120-128.
- Pirhonen, I., Nevalainen, A., Husman, T., & Pekkanen, J. (1996). Home Dampness, Moulds and their Influence on Respiratory Infections and Symptoms in Adults in Finland. *European Respiratory Journal*, 9, 2618-2622.
- Platt, S.D., Martin, C.J., Hunt, S.M., & Lewis, C.W. (1989). Damp Housing, Mould Growth, and Symptomatic Health State. *British Medical Journal*, 1673-1678.
- Power, C., & Hertzman, C. (1997). Social and Biological Pathways Linking Early Life and Adult Disease. *British Medical Bulletin*, 53, 210-221.
- Power, C., & Hertzman, C. (1999). Health, Well-being and Coping Skills. In D. Keating & C. Hertzman (Eds.), *Developmental Health and the Wealth of Nations*. (pp. 41-54). New York: Guilford Press.
- Quinn, R.W., Watkins, J.H., & Quinn, J.P. (1948). Rheumatic Heart Disease and Crowding: A Survey of Rural and Urban Connecticut School Children. *American Journal of Public Health*, 38, 1071-1081.
- Raffestin, C., & Lawrence, R. (1990). An Ecological Perspective on Housing, Health and Well-being. *Journal of Sociology and Social Welfare*, 17, 143-160.
- Rubenstein, A., Boyle, J., Odoreff, C.L., & et al. (1969). Effect of Improved Sanitary Facilities on Infant Diarrhoea in a Hopi Village. *Public Health Reports*, 84, 1093-1097.
- Schmitt, R.C. (1955). Housing and Health. *American Journal of Public Health*, 45, 1538-1540.
- Sharma, R.S. (1984). An Epidemiological Study of Scabies in a Rural Community in India. *Annals of Tropical Medicine and Parasitology*, 78, 157-164.

- Smith, S.J. (1990). Health Status and the Housing System. *Social Science and Medicine*, 31, 753-762.
- Spady, D.W. (1982). Between Two Worlds: The Report of the Northwest Territories Perinatal and Infant Mortality and Morbidity Study. *Boreal Institute for Northern Studies*, 16,
- Staurt, J.M., Cartwright, K.A., Dawson, J.A., & et al. (1988). Risk Factors for Meningococcal Disease: A Case Control Study in South West England. *Community Medicine*, 10, 139-146.
- Verhoeff, A.P., Van Strien, R.T., Van Wijnen, J.H., & runekreef, B. (1995). Damp Housing and Childhood Respiratory Symptoms: The Role of Sensitization to Dust Mites and Molds. *American Journal of Epidemiology*, 141, 103-110.
- Verhoeff, A.P., & Burge, I.A. (1997). Health Risk Assessment of Fungi in Home Environments. *Annals of Allergy, Asthma and Immunology*, 78, 544-554.
- Young, T.K., & Mollins, C.J. (1996). The Impact of Housing on Health: An Ecologic Study from the Canadian Arctic. *Arctic Medical Research*, 55, 52-61.
- Young, T.K., & Mollins, J. Anonymous. Impact of Housing on Health in the Northwest Territories. (1999).