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Definitions of Crowding and the Effects of Crowding on Health: A Literature Review

Alison Gray

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Definitions of Crowding and the Effects of Crowding on Health:

A Literature Review

Prepared for the Ministry of Social Policy by

Alison Gray

Gray Matter Research Ltd

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Executive summary

1. This literature review aims to a) establish what definitions and measures of crowding are currently in use and why and b) summarise current knowledge of the adverse effects of crowding.
2. The review distinguishes between *density*, which is an objective measure with no positive or negative connotations, and *crowding*, which refers *either* to a level of density which is deemed by policy makers or statisticians to be crowded, *or* to the level at which people have an adverse psychological response to density. The two levels may not be the same.
3. The review examines statistical and research definitions of crowding as well as regulatory and administrative measures.
Statistical definitions include occupancy rate, persons per room and persons per bedroom and measures using bedroom standards. All measures have definitional problems. Many researchers have adopted statistical definitions, particularly the person per room rate, as a measure of crowding. Such definitions are easy to use and have some authority from being used in official statistics. However, using simple definitions that do not take account of household composition can limit the effectiveness or usefulness of research.
4. The rationales behind *regulatory and administrative definitions* of crowding are usually implicit rather than explicit. It is difficult to establish whether occupancy standards are set on the basis of beliefs about health, space, privacy, safety, lifestyle or morality. Few refer to the perceived health hazards of adverse living conditions. Standards generally reflect the values of dominant or decision-making groups and do not necessarily incorporate the views of householders or minority groups.
5. More work needs to be done in New Zealand to establish the validity of various measures of crowding for different groups. Such research may also indicate whether there are different cut-off points for health risks for people of different ages, genders and ethnic groups. No single indicator of crowding can entirely encompass such a complex and multi-faceted issue.
6. The debate about the relationship between crowding and health is long standing and inconclusive. The complexity of relationships makes it difficult to separate the effects of crowding from confounding variables such as the physical condition and type of housing, socio-economic factors and lifestyle choices. Issues of measurement and other methodological difficulties limit the ability to establish causality. Many researchers are left concluding that in practice it is not possible to move beyond the level of statistical association.
7. Studies looking at the incidence of common infectious diseases such as colds, asthma and influenza have found an association between prevalence and crowding. A recent New Zealand study identified crowding as a major risk factor for meningococcal disease. Overseas research into the relationship between crowding and the spread of tuberculosis or meningococcal disease is inconclusive. There have been anecdotal claims of such a relationship in New Zealand that would require further research for their significance to be resolved.
8. There is a similar lack of local research into the effects of crowding on mental health, particularly for different ethnic and socio-economic groups. Overseas research has mixed results. Few studies control adequately for gender, age, ethnicity or marital status.
9. Studies indicate that crowding is stressful for children as well as adults, and particularly for women, leading to poor social relationships, poor childcare, aggression or withdrawal. Both field- and laboratory-oriented studies into reactions to density have come up with inconsistent results.
10. Doubling up of households, particularly unrelated households, appears to contribute to psychological stress. Anecdotal studies involving Maori and Samoan households indicate that such pressures exist in New Zealand. To clarify the extent of such pressures, and the extent to which they have had adverse effects (including the effects of single parent families sharing housing), would require further research.

11. Research indicates that adverse effects may occur through a number of mechanisms. Although crowding may increase the likelihood of these happening, the relative importance of each of these factors has not been conclusively proven. The factors include:
 - children sharing a bed or bedroom
 - increased physical contact
 - lack of sleep
 - lack of privacy
 - an inability to care adequately for sick household members
 - poor hygiene practices.
12. There appears to be little research into the beneficial effects of reducing household crowding. Research into the effects of improvements to the physical condition of housing on health, particularly through improving insulation and heating, shows mixed results. Efforts to rehouse people may have adverse effects unless economic factors are also taken into account. There is little research into the effects of disrupting social networks. Immunisation campaigns can do much to control the spread of communicable diseases.
13. Possible benefits from crowding include stimulation of the immune system, at least from some viral infections, which could have a protective effect against other infections. Household members may also offer each other social support. There is little research in this area.
14. Literature on the long- and short-term effects of crowding on work and other task performance is also sparse. An experimental study concluded that crowding does not necessarily impair short-term task performance, perhaps because of adaptive strategies such as adjusting to noise and claiming personal space. However, costs may gradually accumulate and eventually affect subsequent functioning.
15. In New Zealand as in overseas, there appears to be a strong relationship between crowding, ethnicity and immigration especially among Pacific and some Asian groups. Research indicates that to some extent, crowding among immigrant groups is a self-correcting situation. Affordability limits families' ability to set up new households. Others may choose to stay together in order to provide mutual support and to manage migration by family members. It may be possible to speed up the transition by targeting housing assistance to recent immigrants, or more contentiously, by limiting immigration to those who can afford suitable accommodation.
16. Research also highlights differences among ethnic groups in their apparent acceptance of higher levels of crowding. It is unclear from the present state of research whether the higher levels of crowding apparent among some ethnic groups in New Zealand stem from affordability issues, obligations towards family members, personal preference or a combination of these factors.
17. Household size and composition are also associated with crowding. Large households with a high proportion of dependants, either children or older family members, are more likely to be crowded. The extent to which this is an affordability issue or reflects cultural norms or lack of suitable stock needs to be explored.
18. Low incomes are particularly associated with crowding in high-cost areas. Housing is only one financial pressure on low-income households, and increases in income may not lead immediately to improvements in housing.
19. Crowding for households with high numbers of children may also be temporary as children grow and leave home. However, the demands on space are likely to increase through the teenage years as young people seek more privacy. At present little is known from research about the prevailing norms in New Zealand or about the health implications of various household arrangements.

1. Introduction

The Ministry of Social Policy is undertaking a programme of work in response to public and government concern about the effects of crowding on health. To contribute to this work, the Ministry commissioned a literature review, firstly to establish what definitions and measures are currently in use and why they are used, with the aim of establishing clear and robust definitions of crowding for New Zealand. The second aim is to summarise current knowledge of the adverse effects of crowding.

1.1 Objectives

The objective of the review is to achieve a synthesis of the literature relating to crowding which:

- a) identifies and describes the approaches which have been used to define and measure crowding, reflecting the different interpretations of the term "crowding" and the effect of context and usage
- b) establishes whether crowding has an adverse effect on those living in crowded conditions and if so, describes the nature and extent of the adverse effects and the mechanisms by which they occur, and considers possible mediating factors
- c) identifies the main social and economic processes that give rise to crowding.

1.2 Key questions

The report addresses a number of key questions relating to regulatory approaches to defining and measuring crowding, the adverse effects of crowding and the dynamics of crowding. The key questions are:

1. Regulatory approaches to defining and measuring crowding

- a) What are the contexts in which crowding definitions have been developed?
- b) How has crowding been defined and measured in the different contexts? Have different contexts produced different approaches to defining and measuring crowding? To what extent do different approaches reflect different purposes and uses?
- c) What is the extent to which the definitions reflect normative or instrumental approaches to crowding? Does the crowding definition reflect a belief of what constitutes appropriate living conditions, or is it in response to what are perceived as the health hazards of adverse living conditions?
- d) Are there any regularly produced official statistics on crowding that have had a significant impact on government policy?

2. Adverse effects of crowding on those living in crowded conditions

- a) What are the nature and intensity of the adverse effects?
- b) Do particular types of crowding give rise to particular adverse effects?
- c) What are the mechanisms by which this occurs?
- d) Are there factors that mediate the likelihood of adverse effects, e.g. information, cultural behaviours?
- e) To what extent is it possible to isolate the effects of crowding from other related factors?

3. Dynamics of crowding

- a) Are there social and economic processes, such as migration, that tend to lead to concentrations of crowding in particular areas and population sub groups?
- b) To what extent does crowding in particular areas or amongst particular groups tend to be transitional or temporary?

The review draws mainly on material from the United Kingdom, the United States and New Zealand with contributions from Australian and Canadian literature. Because of the similarities of our cultures, information from these countries has considerable relevance to New Zealand. Information from Asian cultures has also proved useful, although the opportunity to make comparisons between studies in New Zealand and Asia is limited because the environments are so different.

The review is in four parts:

- I. Introduction
- II. Approaches to defining and measuring crowding
- III. Crowding and health
- IV. Dynamics of crowding

Each part concludes with a brief summary addressing key questions.

2. Approaches to defining and measuring crowding

2.1 Background

Definitions of crowding have been developed for several purposes, principally:

- statistical reporting
- research
- regulation
- administration e.g. for allocating housing and delivering social assistance.

Statistical definitions are descriptive and are used for enumerating data. Research is purposive and could therefore be expected to use definitions of crowding articulated to suit the purpose of the research. Housing regulations are presumably designed to protect residents' health or welfare or both and can therefore be expected to be either research or norm based. Administrative definitions, on the other hand, are generally part of a rationing process for allocating scarce resources. In this situation, crowding is usually set alongside other factors, such as income and the availability of suitable housing stock. Unfortunately, as is discussed below, the rationale behind the setting of most definitions is rarely articulated and it is often unclear whether crowding levels are set on a normative or instrumental basis.

2.1.1 Crowding as a subjective measure

Although the intended use of the definition affects the way crowding is defined, crowding can never really be measured objectively. "Crowding" and "overcrowding" should not be confused with density.

Density is an objective measure and refers to the number of people in any given space - e.g. per square metre, per room, per dwelling or per hectare. The term has no positive or negative connotations. The distinction is important "because the same objective density may or may not be uncomfortable depending on the situation. High density doesn't always lead to crowding" (Jazwinski 1998). There appears to be no research proving that there is a single point of density at which everyone will be affected in terms of health or at which everyone will feel crowded.

Crowding generally refers to people's psychological response to density, that is, to their feelings of being crowded, having a lack of privacy or an increase in unwanted interactions or psychological distress (Crothers et al 1993, Gove et al 1979, Jazwinski 1998). This interpretation of crowding tends to be used in research.

Definitions of *crowding* used in statistical reporting and for administrative purposes are based on density measures and do not usually incorporate people's perceptions of crowding.

These definitions express a judgement about density levels, that is, they set a *standard* by which society declares crowding beyond a particular density to be unacceptable. Myers et al (1996) note that "implicit in all discussions of crowding is the assumption that... the effects from crowding are deleterious to people's physical and mental health." However, the rationale for adopting a particular standard is rarely explicit and Myers et al conclude that "after a century of debate it is still in question whether so-called overcrowding is harmful to the people affected, or merely socially distasteful to outsiders who observe its presence".

It is possible to measure crowding using either a normative or a perceptual approach. Several commentators feel that the normative approach adopted by decision-makers is essentially paternalistic in that the standards set do not necessarily represent the views of many population groups and are likely to incorporate cultural biases (Barnett and Lowe 1991, Mitchell 1976). They argue that measures that include consumer preferences would be more grounded in social values and "create socially relevant standards, not bureaucratically determined ones" (Winter and Stone 1997).

Crowding standards change over time as economic conditions and social expectations change. However, the process by which standards are established or modified or the reasons for doing so are

rarely explicitly described (Myers et al 1996). This makes it extremely difficult to argue conclusively for one standard of crowding over any other. Morrison (1994), for example, notes that over two generations, falling household size and increased dwelling size have led to the amount of dwelling space per person in New Zealand being at an "all-time high". Measures of crowding have also changed over time. They may, he suggests, need to change again. "The multiplicity of demands now placed on the dwelling mean that 'crowding' may be occurring today at much lower occupancy rates than would have been applicable in the 1950s or 1960s... What we need now is research into how to determine what dwelling adequacy means and to put in place measures to assess adequate dwelling consumption levels in the twenty-first century."

2.1.2 The context of crowding

This report examines crowding within an individual dwelling, as opposed to crowding associated with high-rise living or being in densely populated areas. Housing in New Zealand is predominantly single unit family dwellings (82 percent of housing stock in 1996), with two-flat or house units making up a further 10 percent of housing stock. Larger blocks of flats make up only 8 percent of housing stock (Statistics New Zealand 1996). According to Morrison (1994), housing space per person is not only at an all-time high in New Zealand, but it exceeds that of virtually every other country in the world. It is important to bear this in mind when considering studies undertaken in societies with very different housing patterns and histories, including the United Kingdom, parts of North America, Thailand, Indonesia and China.

2.1.3 Terminology

In this report, the term *crowding* is used in preference to *overcrowding*. The terms tend to be used synonymously and both have negative connotations. Very few definitions, whether for statistical, research or administrative purposes, refer to more than one level of crowding or overcrowding. The British Housing Needs Index cited in section 2.5 below, is a rare exception.

Four types of definitions are discussed below: statistical definitions; research definitions; regulatory definitions; and administrative definitions.

2.2 Statistical definitions

Statistical definitions are based on elements that are easily countable and widely understood and set a level above which crowding is deemed to occur. However, as is discussed below, statistical definitions have considerable limitations. Typical measures used in statistical definitions include *occupancy rate*, *room occupancy rate* and *bedroom occupancy*.

2.2.1 Occupancy rate

In New Zealand, the *occupancy rate* is established by dividing the total occupants of permanent private dwellings by the total number of occupied permanent private dwellings. The result is the average number of persons per occupied dwelling. However, this measure allows for no adjustment for either the type of household or the size of dwelling (Morrison 1994) and appears to be little used in definitions of crowding.

2.2.2 Room occupancy rate/persons per room

"Persons per room" is widely used as an indicator of crowding. Although this appears to be an objective measure, the point at which dwellings are deemed to be crowded is subjectively determined. It is not usually clear whether this judgement is based on social norms or on health grounds.

As with occupancy rate, the definition of "persons per room" has limitations. Establishing what counts as a "room" is problematic. The term "room" makes assumptions about housing design and layout and the use of space. The measure also makes no allowance for different-sized rooms or for the amenities available to residents.

Statistics New Zealand, for example, divides the number of "major rooms" or "per room equivalents" by the number of occupants, but reporting depends on people reading and understanding the guide notes in the census form. The explicitness of the notes has varied - none at all were included in the 1991 census (Morrison 1994). Other countries, such as the Cook Islands, adopt a similar measure, with all rooms counted except for a laundry, bathroom and toilet.

The European Union counts all rooms excluding kitchens (Office of Population Censuses and Surveys 1996). Sweden uses a measure that does not count the kitchen and living room (Lindberg 1993).

The "per room" measure has other limitations. It cannot take into account an individual's need in his/her own milieu for private living space, nor does it differentiate between age and sex relationships in terms of culturally prescribed sleeping arrangements (Greenfield and Lewis 1973). Both these indicators would be useful for establishing social norms and for establishing the health effects of particular living arrangements.

The level at which room density has been defined as crowded has changed over time, apparently to reflect changes in standards and expectations in the use of dwelling space. The effects of such changes on health impacts have not been documented.

In New Zealand, criteria for crowding based on people-to-room ratios have ranged from one to two people per room (Statistics New Zealand 1998). The fall in the persons per room ratio in New Zealand has been due in part to a decline in household size and in part to an increase in the average size of houses (Morrison 1994). In the 1940s in the United States the definition of crowding was more than two people per room. This was lowered to 1.5 people by 1950 and to one person by 1960, with standards becoming more rigorous as the phenomenon of crowding declined (Myers et al 1996). A ratio of one person per room is in line with the standard prevailing in most European countries.

As in New Zealand, current European and North American densities are relatively low by world standards. The persons per room ratio in New Zealand in 1991 was 0.41 (Morrison 1994). In North America it is currently 0.5, "hardly what most people would consider very crowded conditions". The level of household crowding is somewhat higher in Europe, hovering in the range of 0.6 to 0.8, depending on the specific country, with particularly high levels in Greece, Italy and Portugal (Edwards et al 1994).

There has been some debate about whether the criteria for crowding should be adjusted upwards in time of economic hardship. Myers et al (1996) argue that adopting a less stringent standard of overcrowding (e.g. two people per room) would more clearly identify those most in need. In their view, "applying a high standard to the living conditions of those too poor to achieve it offers them small relief if society is unwilling to make up the difference between what we say people should have, and what we are willing to provide to help them achieve it". Their argument illustrates the extent to which it is difficult to separate statistical definitions from social expectations and economic pressures.

2.2.3 Bedroom occupancy

Bedroom occupancy is also used as an indicator of crowding. This can be either a simple calculation of the ratio of residents to bedrooms, or based on a formula that takes account of household size and composition to determine how many bedrooms a household "needs". The latter approach is highly normative, being based on assumptions about appropriate sleeping arrangements.

The preference for bedroom occupancy over per room rate appears to be based on the former's ability to take household structure into account. No writers refer directly to the health effects of bedroom occupancy rates. The emphasis appears to be much more on social acceptability, community expectations and cultural values (Foard et al 1994, Statistics New Zealand 1998).

Critics of the bedroom occupancy measure note that:

- there can be a wide variation in the number of rooms associated with any given number of bedrooms, so the measure is likely to overestimate crowding in larger houses (Morrison 1994)
- households may have additional space which they have chosen not to use as a bedroom, so that again, overcrowding may be overestimated (Karmel 1998)
- a more useful index would incorporate both the number of rooms and the number of bedrooms in a dwelling (Morrison 1994)
- definitions of bedrooms or acceptable sleeping arrangements are cultural constructs based on western notions of the value of physical and emotional privacy (Pader 1994)
- the floor area of bedrooms is rarely defined (Statistics New Zealand 1998).

Statistics New Zealand (1998) acknowledges that each household varies in its need for space and in its perceptions of crowding. Furthermore, living arrangements are dynamic and will change as the age and composition of households change.

Using the simple measure, the level at which a house is considered crowded has been variously set at more than 1.5 or two people per bedroom (Crothers et al 1993) and at more than two or three persons per bedroom (King 1994). In 1991 in New Zealand, approximately 3,500 dwellings had more than three people per bedroom. By 1996, that figure had fallen to 3,200 dwellings.

Australian, British and New Zealand statisticians have used bedroom standards to establish the numbers of households requiring one or more extra bedroom (McLennan 1994, Office of Population Censuses and Surveys 1995, Statistics New Zealand 1998). The Department of the Environment (1995) in England uses the need for two extra bedrooms as a measure of "severe overcrowding".

A concept of adult equivalent has sometimes been applied in formulas measuring bedroom need, with children under ten years being counted as half an adult. The number of adult equivalents is divided by the number of bedrooms, with anything in excess of one per bedroom counted as crowding (Ulrich-Cloher and Murphy 1994). A refinement to this formula is a crowding index which weights each individual who is in a couple relationship as one half, as well as children under ten years (Morrison 1994). Both this indicator and the simpler person per bedroom indicator show a fall in levels of crowding in New Zealand between 1986 and 1996.

2.2.4 The bedroom standard

Bedroom standard formulas have been developed in Britain and Canada. These are sensitive to both household size and composition but inevitably reflect majority norms. Judgements on age limits for sharing bedrooms "are quite clearly imbued with all sorts of assumptions about gender, parent-child relationships, sibling relationships and so on" (Winter and Stone 1997). Pader (1994) goes further, arguing that "the particular person-to-bedroom ratio written into many regulations [in the United States] should be decreed discriminatory on the basis of national origin, race and familial status, all of which are protected classes under Fair Housing".

In Britain, the "bedroom standard" compares the number of bedrooms available to a household with a calculation of its bedroom requirements. The calculation is based on the age, sex and marital status composition of the household and the relationship of the members to one another (Office of Population Censuses and Surveys 1995). Details of the standard are included in Appendix I.

The Canadian National Occupancy Standard was developed by the Canadian Mortgage and Housing Corporation in the 1980s and has since been adopted by the Australian Bureau of Statistics (1996). Details of this standard are also in Appendix I. The standard differs from that used in Britain in respect to the age limits for sharing bedrooms. In the Canadian standard, children under five of different sexes are permitted to share a room, compared with children under ten in Britain. The age at which young adults should have their own room is also lower - 18 years compared with 21 years in Britain.

In Britain, each pair of adolescents aged ten to 20 of the same sex can share a bedroom. Any person aged ten to 20 left over after this pairing is paired with a child under ten of the same sex. If this is not possible, that person has a separate bedroom. In Canada young people aged five to 17 of the same sex are permitted to share a room.

2.3 Research definitions

Persons per room is the definition of crowding most commonly used by researchers, although this choice is rarely supported by any explanation. Most adopt the standard of more than one person per room (Ambrose 1996 b), although a few prefer to use a standard of more than 1.5 people per room (Alwash and McCarthy 1998, Greenfield and Lewis 1973, Moser and Scott 1961). Some studies of crowding have used more complex measures, incorporating variations on the age and gender provisions described above (Memken and Canabal 1994, Moser and Scott 1961) or taking into account the number of individuals in susceptible age groups. In Jakarta, Clauson-Kaas et al (1997) used ten in-house crowding indicators: persons per household; persons per room; persons per

bedroom; household area per bedroom; and bedroom area per person, with each of these five indicators being calculated for children under five. The study controlled for some confounding variables, including biological and social/cultural factors of the child and the mother, socio-economic status of the family, home hygiene and housing standard and environmental factors. The study showed that total number of persons and number of children under five per room were correlated to morbidity caused by diarrhoea or respiratory infections for children under three years. Household area in square metres per person and per children under five was also correlated to such morbidity. The authors acknowledge that confounding factors could have influenced the result. Other studies, such as that by Memken and Canabal (1994) which looked specifically at the composition of Latino households, did not have a health focus. Both the Jakarta study and the Memken and Canabal study may be culturally specific and not necessarily suited to research carried out in other settings.

Mitchell (1976) describes a number of spatial measures used by researchers as indicators of crowding. De Lauwe (1959) in Mitchell (1976), for example, suggested two critical density thresholds. One, based on objective observations of children, was for 90 sq ft per person; the other, based on subjective feelings of satisfaction, called for 155 sq ft per person. Madge (1968) in Mitchell (1976) refers to 170 sq ft per person as the lower limit for mental health. The American Public Health Association set the desirable standard at twice this figure in 1950.

2.4 Regulatory definitions

The World Health Organization (WHO) Expert Committee on the Public Health Aspects of Housing (Ranson 1991) refers to both occupancy standards and space requirements, which are included in most housing regulations. The Committee's statement has a health focus and acknowledges social and cultural differences.

The Committee states that: "One of the fundamentals of a healthful residential environment should be a safe and structurally sound, adequately maintained, separate, self-contained dwelling unit for each household if so desired, with each dwelling unit providing at least the following:

- a sufficient number of rooms, usable floor area and volume of enclosed space to satisfy human requirements for health and for family life, consistent with the prevailing cultural and social pattern of that region and so utilised that living or sleeping rooms are not overcrowded
- at least a minimum degree of desired privacy:
 - for individual persons within the household
 - for members of the household against undue disturbance by external factors
- suitable separation of rooms as used for:
 - sleeping by adolescent and adult members of the opposite sex except husband and wife
 - housing of domestic animals apart from the living room of the dwelling unit.

These needs can be expressed in terms of space requirements to perform household activities and/or occupancy standards."

Three examples of housing regulations have been identified as part of this review. There is no literature illustrating how or where the New Zealand and British standards described below have been applied. The American ordinance is applied in a number of local, state and federal housing policies (Pader 1994).

2.4.1 The New Zealand Housing Improvement Regulations (1947)

The Housing Improvement Regulations (1947) still constitute the legal definition of overcrowding in New Zealand and allow children to share a bedroom up to the age of ten, regardless of their sex, and specify the floor area required per person. They also stipulate that there must be at least one bathroom and one toilet for every seven people in the house. Details of the regulations are set out in Appendix I. Statistics New Zealand (1998) notes that census information cannot be used to measure crowding levels on this basis because bedroom size is not collected.

2.4.2 Standards governing overcrowding in Britain

The *Manual of Housing Law* (Arden and Hunter 1997) discusses overcrowding provisions under the Housing Act 1985. The standard is very similar to the New Zealand housing regulations, in that it includes both a space standard and a reference to appropriate sleeping arrangements. Details are in Appendix 1.

2.4.3 The American Public Health Service/Centres for Disease Control Ordinance

The ordinance recommended by the *American Public Health Service/Centres for Disease Control* of the U.S. Public Health Service spells out the floor space required per inhabitant and adopts the one person per room standard. It contains no reference to the age, gender or relationship of residents, nor does it distinguish between bedrooms and other habitable rooms. It is one of the few regulations that has an explicit health basis in its purpose but the grounds for setting these levels are not clear. The floor spaces are comparable to those specified in New Zealand and British regulations. Details are in Appendix 1.

2.5 Administrative definitions

Administrative definitions of crowding are often used to help establish housing need, usually alongside other measures such as affordability and adequacy of housing. Measures of housing need invariably incorporate social, political and economic dimensions and may or may not include household wishes and aspirations (Niner, nd).

2.5.1 New Zealand

A number of crowding indicators have been used to measure "serious housing need" in New Zealand. In its five-yearly report of 1998, for example, the National Housing Commission (1998) described "overcrowding" as two or more families in the same household not by choice.

In 1994, the Ministry of Housing index adopted a bedroom occupancy standard as a measure of serious overcrowding. A house was considered to be "seriously overcrowded" where there were more than three people per bedroom. The Ministry used the findings of a 1993 survey of 1,000 households in Manukau City¹ (Crothers et al 1993) to help determine the greater than three threshold. In this study, 30 percent of respondents in houses with two to three people per bedroom thought that the number of people living in the house was a major problem. However, in households with more than three people per bedroom, the majority thought strongly that there were too many people and not enough room.

2.5.2 Australia

The monograph, *Towards Indicators of Housing Stress in Australia* (King 1994), discusses a range of factors used to determine eligibility for housing assistance. All states have a system for determining priority for assistance, which includes "overcrowding" along with factors such as homelessness, sub-standard housing, health problems, disability and domestic violence. Measures for determining overcrowding are not specified.

2.5.3 England

An English review of the Generalised Needs Index (GNI) and Housing Needs Index (HNI) describes "overcrowded households" as those which have accommodation that is too small for the size of the household, according to standards based on either the ratio of persons per room or the number of bedrooms available. The review counted overcrowding as more than one person per room. "Severely overcrowded" households were those where either the average number of persons per room was greater than 1.5 or there were two fewer bedrooms than the bedroom standard. The review was carried out in consultation with the Local Authority Associations, the Housing Corporation and the National Federation of Housing Associations (Department of the Environment 1995).

¹ Manukau City, in South Auckland, has a high proportion of Maori and Pacific residents, income levels tend to be lower and unemployment rates higher than for the population as a whole. Family sizes are larger on average and residents in Manukau City are more likely to live in extended families (Crothers et al 1993, Statistics New Zealand 1998).

Crowding is only one of the factors that contribute to the demand measures on the HNI. The full list includes:

• Involuntary sharers/concealed households	25 percent
• Overcrowded households	20 percent
• Severely overcrowded households	20 percent
• Households in worst unfit private sector	10 percent
• Elderly in need of very sheltered accommodation	5 percent
• Disabled in need of specialist accommodation	5 percent
• Households with affordability problems	10 percent
• Need for replacement of local authority stock	5 percent
Total	100 percent

2.5.4 Scotland

Some agencies, like the Scottish Development Department, have attempted to recognise the role of consumer preferences in assessing housing need. The *Scottish Housing Handbook: Assessing Housing Needs* (Scottish Development Department, no date) notes that "Housing need can only be defined in relation to standards which specify what is a decent or satisfactory housing situation for particular types of household.

- (1) Objective standards: - houses 'unfit' or 'below tolerable standard';
- (2) Local authorities will need to take account of the preferences and aspirations of the 'consumers' of housing;
- (3) Local authorities will need to consider the ability of households to realise their preferences - both in private and public sector."

2.5.5 Canada

The Canadian National Occupancy Standard is one of three "norm dwelling standards" used to assess housing need. The Occupancy Standard measures suitability; other standards measure affordability and adequacy. Households whose housing does not meet one or more of these standards and whose income is such that they are unable to obtain housing that does meet the standards are considered to be in serious housing need (Canadian Mortgage and Housing Corporation (CMHC) 1992).

2.5.6 United States

The United States uses a "fair share" formula to measure housing need. The overcrowding indicator is more than one person per room (CMHC 1992). The formula is:

Renter households	20 percent
Poor renter households (below official poverty level)	20 percent
Crowded renter households	10 percent
Extra vacant units needed to raise rental vacancy rate to national average	10 percent
Poor renter households in homes built before 1940	20 percent
Poor renter households with gross rent over 30 percent of income	20 percent
Total	100 percent

2.6 Normative aspects of definitions

2.6.1 Norms and standards

Crowding standards set by statisticians, policy makers or administrators are rarely validated by a comparison with the views of occupants or with specific points that they believe impact on health, and the rationale for adopting one standard over another is rarely articulated.

In effect, definitions of crowding reflect majority standards, the resources available, and the general philosophy about needs and the responsibilities of the state and the individual (Niner, no date). Definitions that make assumptions about appropriate sleeping arrangements reflect moral and value judgements as much as beliefs about health (Mitchell 1976, Winter and Stone 1997). In Mitchell's

view, few scientific data support the basic features of a building or housing code from the viewpoint of health. "We have vague conceptions of germ theories, good homes, and what we personally like and dislike. But it is another thing to claim that there are universal physiological, psychological and social needs that can be translated into minimum standards for the physical environment."

Few studies have been undertaken to explore the reasonableness of the assumptions behind crowding standards and those that have suggest that the assumptions may not be reliable. In a small study in Melbourne, Burbidge and Gondor (1993) used the Australian Living Standards Study, which included questions on sleeping arrangements and on whether parents thought it was important that children should have a separate bedroom. The study did not include questions on when children of opposite sexes should sleep separately. The authors found no clear break in the age at which parents thought a child should have their own bedroom. Generally, the proportion of parents who thought children should have a separate bedroom increased with the age of the child, once children reached the age of four. A majority of parents thought a separate bedroom was important for boys over nine and for girls over eight.

No similar studies have been carried out in New Zealand so there is no validation of assumptions about what constitutes crowding in terms of normative standards here. We do not know at what age parents think children of the same or opposite sexes should have their own room or are able to share rooms. The Crothers et al (1993) study of households in Manukau City cited in 2.5.1 above, suggests that there is considerable variation in occupants' acceptance of and attitudes towards crowding.

The prevalence of dominant values is apparent in the Canadian National Occupancy Standard, which "evolved to reflect today's societal housing expectations" (CMHC 1992). In allocating funds to meet core housing need, "affirmative action policy is taken into account with respect to the native [i.e. American Indian] population", suggesting that the "societal housing expectations" incorporated in the standard are predominantly those of the non-native rather than the native population.

The Australian Bureau of Statistics subsequently adopted the Canadian Standard, because this "was considered by the National Housing Strategy and the Australian Institute of Health and Welfare to conform reasonably to social norms in Australia" (McLennan 1994). The term "social norms" is undefined and unexplained. Although crowding levels in Australia are generally low, the literature on aboriginal housing suggests that a disproportionately high number of aboriginal families live in crowded conditions and experience affordability problems and after-housing poverty (Kent 1993). This suggests that as in Canada, the "social norms" associated with the standard are those of the predominant group and reflect their values about privacy, space, safety and health.

Pader (1994) reiterates the point that while they are often considered universal, definitions of bedrooms and sleeping arrangements are inextricably entwined with societal values. Many seemingly neutral housing policies designed to protect health, safety and welfare, in fact often protect dominant values and morals, not the physical or emotional wellbeing of non-dominant groups. Rigid categorisations assume that physical privacy, independence and individualism are desirable values and that crowding occurs at preset levels.

In her study of Mexican households living in Los Angeles, Padel found that sharing a bed was seen as preferable and normal. It was not uncommon for bedrooms to be left empty while household members chose to share. Such arrangements encouraged the desired values of interdependence and sharing but made Mexican households ineligible to have placements of Mexican foster children, who instead had to be placed in homes that met the dominant standard but were not necessarily culturally appropriate.

2.6.2 Perceptions of crowding

Although it is apparent that more work needs to be done to take account of householders' evaluations of housing conditions, establishing a useful measure may be difficult. In its report on housing statistics, Statistics New Zealand (1998) acknowledges that no single indicator of crowding can adequately measure such a complex and multi-faceted issue.

Reactions to crowding are conditioned by cultural context and by an individual's subjective experience of crowding (Gove et al 1979). Even within a given culture, individual reaction will vary depending on age, gender, ethnicity, the composition of the household, a person's hierarchical position in the dwelling unit and lifecycle stage (Edwards et al 1994). The debate about cultural preferences for and tolerance of different levels of crowding is referred to in the discussion of crowding and mental health (see section 3.3 below). The findings challenge the assumption that members of particular ethnic or cultural groups will respond to household density in a particular way.

2.7 Key questions

2.7.1 Context in which crowding definitions have been developed

Definitions of crowding tend to fall into two groups - those used for statistical or research purposes and those used to regulate housing use or allocate social assistance.

2.7.2 Statistical and research definitions

Statistical definitions are generally used in censuses or surveys and therefore need to be easily interpreted by lay people. They tend to be simple and limited to elements that are in theory, easily countable. However, problems of definition remain.

The relative simplicity of statistical definitions makes them attractive to many researchers, particularly those seeking to establish associations between health effects and crowding. Using simple definitions that do not take account of household composition can limit the effectiveness or usefulness of research. As discussed in section 3 below, there may be differences in health effects for women and children living in crowded housing and a measure incorporating household composition would often provide more useful information than a simple indicator of the numbers of people per room.

Because they do not take account of residents' perceptions, statistical definitions are of less use to researchers investigating the effects of crowding on behaviour. Some researchers have attempted to develop definitions that incorporate both subjective and objective measures.

2.7.3 Regulatory definitions and definitions used in the allocation of social assistance

The rationales behind regulatory definitions of crowding are usually implicit rather than explicit. The same is true for occupancy standards, which are often used to help assess housing need. Because of the lack of information, it is difficult to establish whether standards are set on the basis of beliefs about health, space, privacy, safety, lifestyle or morality or a combination of all these factors. Standards generally reflect the values of dominant groups and do not necessarily incorporate the views of householders or minority groups. Most definitions appear to reflect a belief in what constitutes appropriate living conditions. None explicitly refers to the perceived health hazards of adverse living conditions.

2.7.4 Statistics on crowding

Statistics New Zealand, the Australian Bureau of Statistics and the Office of Population Censuses and Surveys in Britain regularly produce statistics on crowding (see for example McLennan 1994, Office of Population Censuses and Surveys 1995, Statistics New Zealand 1998). While there is no indication that policy changes stem directly from the publication of such statistics, considerable work has been done in Australia, Canada and the United States in reviewing housing need.

In Australia, policy development has been associated with the National Housing Strategy which in late 1992 produced a report entitled *Agenda for Action*. The report identified gaps in the methods and information required to answer questions relating to measuring how well people are housed, the affordability of their housing and establishing acceptable standards. Further research has since been carried out by the Department of Housing (King 1994), the Australian Institute of Health and Welfare (Karmel 1998) and the Social Policy Research Centre (Winter and Stone 1997).

In Canada, the Canadian Mortgage and Housing Corporation includes a Research and International Affairs Directorate that carries out and finances a broad range of research on the social, economic and technical aspects of housing. These responsibilities are undertaken by the US Department of

Housing and Urban Development in the United States, and the Department of the Environment in the United Kingdom.

2.7.5 Summary

However it is defined and measured, crowding is a complex issue. Ultimately, as Gove and Hughes (1980) suggest, "if crowding is to a substantial extent culturally defined, then in the absence of any other criteria, being crowded may be defined as being more crowded than is typical for other persons in one's culture". In a multicultural society, this raises the question of whether it is possible or appropriate to have one definition of crowding, one regulatory standard or one model of housing need. Health and instrumental definitions may be similarly variable.

3. Crowding and health

"Healthy housing is not just concerned with the sanitary and hygienic design of the shelter but with the whole health spectrum of physical health, mental health and social well-being both within the dwelling and the residential environment." (WHO strategy, in Ranson 1991)

3.1 Introduction

According to Fuller et al (1993), the proposition that poor housing and congested living conditions have a detrimental impact on health has been promulgated for 150 years. The proposition has two elements: a) high levels of household crowding can produce stress that leads to illness; and b) through shared physical proximity, household congestion contributes to the spread of communicable disease. Several authors (Ambrose 1996 b, Kearns et al 1992, Lowry 1989, Martin 1976) have challenged Fuller et al's view, pointing out that the relationship between crowding and health is extremely complex and is influenced by a number of confounding variables. These include the condition of housing, particularly the presence of damp, cold and mould, health and hygiene practices and access to health care. Socio-economic factors, including income, employment status and education, are also relevant in the spread of disease.

Myers et al (1996) are among those who conclude that "after a century of debate, it is still in question whether so-called overcrowding is harmful to the people affected, or merely socially distasteful to outsiders who observe its presence".

This section examines some confounding variables in more detail.

3.1.1 The physical condition of housing

The nature and physical condition of housing is one of the most important confounding variables. Many of the reports cited in section 3.2 below refer to the adverse effects of damp, cold and infestations on residents' health. In a recent review of the literature, Wilkinson (1999) concluded that "the highest risks to health in housing are attached to cold, damp and mouldy conditions".

This finding was supported in a New Zealand study by Kearns (1995) who found only a weak relationship between crowding and health, but a strong link between the state of repair of houses and health. British studies have been particularly forthright on the importance of the physical condition of housing, although Lowry (1989) contends that improvements to sanitation in most homes have reduced the dangers to physical health. She believes that threats still exist to mental health through lack of control over the available space.

3.1.2 Type of housing

The type of housing can also affect people's health. Households who live in high-rise units have a very different experience from those living in terrace, single unit or cluster housing. The size of interior and exterior spaces and the nature and state of facilities are also relevant. It is important to remember that much of the literature on housing and physical health comes from the United Kingdom and is based on studies of crowding in older-style terrace housing with small rooms and limited amenities. This style of housing is not common in New Zealand.

3.1.3 The social context

Individual residents' employment status, ethnicity, pre-existing medical history, age, education and role within the household are relevant to their health status and their ability to cope with crowded conditions (Ambrose 1996 b, Kearns et al 1992, Lowry 1989).

The wider social context can also affect the relationship between housing and health. Improved diets, increased resistance to disease, improvements in medical treatment and the availability of medical care, and the state of education of communities affect individuals' ability to deal with crowding (Martin 1976).

3.1.4 Levels of crowding

The level of crowding in New Zealand, as in most areas of the United States and most European countries, is relatively low, although Morrison (1994) notes that the "census figures suggest a marked slowing down in the rate at which crowding is declining". However, the reliability of census figures has been called into question. Kearns and Reinken (1994), for example, found a discrepancy of around 25 percent between 1991 census figures and 1992 registrations with the Hokianga Health Enterprise Trust. The discrepancies were greatest among those aged under 30, which the authors suggest may be due in part to the housing characteristics of the 15-29 age group, namely their transience and the fact that many live in buses or vans rather than permanent dwellings. Similar levels of under-enumeration have also been reported in the United States.

In Western countries, anything more than one person per room is generally considered overcrowded. In Fuller et al's (1993) Bangkok study, the average number of persons per room was 2.1. The authors point out that to have the same level of crowding in the United States (or New Zealand), a 1,500 sq ft house would have 17 people living in it. Despite the apparently high levels of crowding in Bangkok, the authors found that, contrary to expectation, persons per room had "no discernible effect on reported illness, propensity to become ill if another member of the household is sick, or the self-report of health". This suggests that higher levels of crowding in themselves do not necessarily contribute to poorer health. It is still unclear whether and at what level crowding that exceeds the norm for any given society will adversely affect health.

Morrison (1994) attributes the fall in crowding in New Zealand to a decline in average family size and an increase in average dwelling size. However, Morrison notes that between 1976 and 1981, crowding among Maori and Pacific households actually increased, partly due to the larger average household size among Maori and Pacific people. "The measure of crowding used by the Department of Statistics was the number of major rooms divided by the number of occupants (major remaining undefined)" (Morrison).

In the United States, crowding has also increased among some groups and in some locales (Myers et al 1996). The authors found increased crowding among renters, especially those living in high-cost areas and among those aged 35-44, when family sizes are likely to be the largest. Crowding was particularly high among recent immigrants, with Hispanic and Asian immigrants having the highest levels.

As a result of increases in crowding among particular groups, Myers et al propose that normative standards of crowding be reviewed. They do this on the grounds of housing policy (i.e. standards for allocating housing subsidies) not on the basis of presumed health effects. There is little research into whether increased crowding among particular groups has led to increased negative effects on health.

3.1.5 Issues of measurement

Finally, problems in the way health is measured and crowding assessed need to be taken into account. Many New Zealand and overseas studies are anecdotal or rely on self-report of health status rather than on medical records (Butcher 1998, Crothers et al 1993, Hyndman 1998, Kearns 1995, Maori Women's Housing Project 1991, Mortensen 1988, Smith et al 1992). Kearns (1995) acknowledges that this process of rating health is problematic but identifies a number of advantages with self-report. For instance, ailments might be self-medicated and not warrant medical consultation or people with health problems may delay or avoid medical consultations due to cost. In both these cases, information would not be captured in medical records.

As Hwang et al (1999) note in their review of the literature on housing and health:

a causal relationship between density and various health outcomes has still not been established with any certainty by researchers. Most studies on these issues suffer from various methodological difficulties. For example, the bulk of these studies are cross-sectional. Many of the studies do not employ multivariate techniques which allow researchers to control for confounding factors. Of those studies which do use multivariate analyses, the list of confounders controlled for is often incomplete. Others suffer from the use of very small samples, small subgroups, very low response rates, large amounts of missing data, or are aggregate-level analyses. Finally, an issue that goes largely unaddressed in all of these studies concerns the mechanisms, or intervening variables, through which these effects occur.

Wilkinson (1999) notes that part of the problem arises from the strict criteria inherent in bio-medical research clashing with the more qualitative nature of research on social causes of illness. This has led some researchers to take a more pragmatic approach, accepting that proof of causality is not essential in demonstrating the importance of housing for health.

3.2 Crowding and physical health

3.2.1 Infectious diseases

Several reviews of the literature (Ambrose 1996 b, Ranson 1991) assert that regardless of the quality of the accommodation in other respects, crowding and inappropriately high room densities “have been shown to have a number of adverse effects on physical health. The incidence of infectious diseases such as dysentery and other conditions such as asthma and chronic bronchitis are all positively associated with high levels of overcrowding as are accidental deaths” (Barker and Osmond 1987 in Ambrose 1996 b; Kellet 1989 in Ambrose 1996 b). Most reviews are far more cautious, pointing out the difficulty of teasing out other confounding factors such as poverty and nutrition (Hwang et al 1999, Wilkinson 1999).

Crowding has been linked to a number of biological mechanisms that can increase both the risk and the intensity of infection. According to one study, crowding increases:

- the risk of multiple infections because the number of potential transmitters is increased
- proximity and hence the risk of disease transmission
- the risk of infection early in life which may lead to more severe infections
- the risk of prolonged exposure and severe disease
- the risk of long-term adverse effects of infections (Clauson-Kaas et al 1997).

However, an increase in risk is not the same as causality. Most researchers refer to an “association”, “correlation” or “relationship” between the spread of infection and crowding, rather than a direct cause and effect.

Crowding is usually measured by the number of individuals of all ages per room. Some authors, such as Clauson-Kaas et al, suggest that, because the risk of infection may be greater among children, the number of individuals in susceptible age groups may be more important than the total number of individuals in the household.

Unfortunately, there appears to be little agreement on and little research into which age groups are most susceptible to particular diseases or crowding effects. Very few studies compare the relationship between crowding and disease on people of different age groups. Clauson-Kaas et al, for example, looked at the effects of crowding on children under three but not on children of other age groups. In a case-control study of influenza, Vadheim et al (1992) focused on children aged 18-59 months while McCallion et al (1996) considered children aged three to 15 years as a single group in a study of *Helicobacter pylori*. For a more definitive answer to this question, more research is needed to investigate which age groups are most at risk and why.

Colds, asthma, influenza and diarrhoea

Studies in New Zealand (Kearns et al 1992), Jakarta (Clauson-Kaas et al 1997) and England (Martin 1976) gathered data through self-report and concluded that coughs, colds, asthma, influenza and diarrhoea are associated with household size and number of children per household. In the study in Jakarta, the significant factors for diarrhoea and cough/fever for children under three were:

- total number of persons per room
- children under five per room
- household area in sq m per person
- household area in sq m per children under five.

Housing conditions, and especially cold and damp, were contributory factors, particularly for some ethnic groups. Kearns et al found that Maori and Pacific households were more likely to identify colds, running noses, flu and asthma symptoms than Pakeha households. The authors concluded that while

this may reflect some cultural predisposition to illness it is also likely to be the result of the greater discomfort associated with coldness and dampness, especially in Auckland and particularly among Pacific respondents. In a study of conditions on two housing estates in London, Ambrose (1996 a) came to similar conclusions. Bangladeshi households were four times as likely as white households to be living at a rate of more than one person per room. They were also far more likely than other groups to complain of damp, cold, infestation and the need for repairs.

In a case-control study in Los Angeles, Vadheim et al (1992) found that household size of more than six persons was a significant independent risk factor for influenza infections among children aged 18-59 months.

The impact of overcrowding on children is also noted in Hungarian research studies (Rudnai in Ranson 1991). These showed a correlation between crowding and increased respiratory infections, such as bronchitis, rhinopharyngitis and tonsillitis in children aged one to three, especially when the children were subjected to environmental air pollution. Rudnai explained this as "the adverse effect of air pollution on the defence mechanism of the organism and the increased possibility of pathogen transmission which overcrowding brings".

Meningococcal disease

Several overseas studies have considered the relationship between meningococcal disease and crowding with inconclusive results. Crowded housing appears to be only one among many factors that contribute to the spread of the disease.

In a review of the literature on meningococcal disease, researchers questioned the view that overcrowded sleeping accommodation is an important factor in raising carriage rates (Cartwright 1995). Cartwright cites a Brazilian study of an outbreak of serogroup C disease in Sao Paulo. This found that contacts were higher in contacts sleeping within the same room than with other household contacts, although those sleeping in the same room as the index case were no more likely to be carriers than other household members were. Cartwright concluded that crowding has to be severe before the spread of meningococci is facilitated.

An article in *North and South* magazine (Butcher 1998) asserts, without supporting evidence, that "overcrowding stands out as a key risk factor, interwoven with low economic status, lack of home heating, climate, season and possibly shared eating/drinking utensils or food". One scientific study has recently been published relating to crowding and the current outbreak of meningococcal disease in New Zealand. A case control study by the Institute of Environmental Science and Research Ltd for the Ministry of Health and the Health Research Council identified crowding as a major risk factor for the disease (Baker et al 2000).

Tuberculosis

Studies of the association between tuberculosis and crowding have also produced conflicting results (Martin 1976). Those who do identify a clear association between crowding and tuberculosis (Stein cited in Ranson 1991, Elender et al 1998) warn that poverty, poor nutrition and a poor environment may be confounding variables. Most of the recent studies relating to TB refer to working class housing areas in Britain. For example, the Stein studies cited above were undertaken in Glasgow, while Elender et al studied TB in England and Wales.

The Elender study found a strong association between all TB mortality groups and crowding at the household level (i.e. over one person per room). The authors estimated that for each 1 percent increase in the numbers living in crowded accommodation, the average notification rate increases by 12 percent. Crowding was the sole significant variable for women, which the authors suggest may reflect the different roles of men and women and the fact that women are liable to be at increased risk of infection from bacillus for longer periods of time. The authors concluded that ethnicity as a single factor was not helpful. Lifestyle and health-related behaviours were more important.

Recent outbreaks of tuberculosis in New Zealand have been attributed to crowding, poverty and poor housing but if a conclusive answer to this question is required, more research into the nature of the relationships is needed.

Helicobacter pylori

A number of studies in Britain and Ireland have investigated the relationship between *Helicobacter pylori* infection and crowding (Webb et al 1994, Whitaker et al 1993, McCallion et al 1996). *H. pylori* is an infection which can lead to chronic gastritis, peptic ulcers and in some cases, stomach cancer. All showed positive associations between risk of infection and household density, sharing a bedroom and sharing a bed in childhood, although it was not clear whether sharing a bed was a risk factor independently of crowding. Hwang et al (1999) cite a large follow-up study of men and women for whom data on childhood housing conditions was obtainable (Fall et al 1997). The relationship between *H. pylori* infection and living in a crowded house was independent of social class.

Hepatitis

One New Zealand study (Milne et al 1987) has looked at the prevalence of Hepatitis B (HPB) infection in Kawerau. The authors undertook a multiple logistic regression analysis to investigate the association between various factors and HPB markers and children under 15. The authors found that apart from the demographic factors of age, ethnicity and sex, the main risk factors for marker prevalence in children were the number of years spent in Kawerau and having more than five people in the household. Household size ranked fifth out of seven factors analysed. The authors conclude that the finding for size of household is consistent with the suggestion that crowded living conditions may encourage the spread of infection.

In Spanish children, crowding seemed to be the main factor that could explain the difference in the prevalence of Hepatitis A virus (Morales et al 1992).

3.2.2 Lack of sleep

Wilner et al (WHO 1987) noted that one consequence of crowding is lack of sleep for family members, and suggested that this might have an adverse effect on educational attainment of children in particular. The Jakarta study (Clauson-Kaas et al 1997) also recognised that a negative aspect of crowding is in-house living conditions that prevent people from resting and sleeping properly in their own homes. Noise from outside was also a problem. In that study, poorer people were more at risk because of the pressure to keep working and the fact that they had little control over the work they did.

3.2.3 Factors affecting children and child mortality

Many of the studies described above refer to the relationship between housing and the risk to children of infectious diseases, particularly for those sharing a bed. Other studies look at child health in general, childhood behaviour and child accidents and mortality in relation to housing.

Child health in general

A number of reports assert a relationship between children's health and crowding. In support of this view, Ranson (1991) refers to a British national child development study which showed that children in crowded homes were more likely than others to miss school for medical reasons (mainly bronchitis).

Others offer little evidence to support their assertion. In 1998, public health nurses in Auckland "confirmed" reports of crowding among 67 percent of the inner-city clients they surveyed but gave no information on how they measured crowding. They also identified poor health among children in the survey sample, with 40 percent being hospitalised before the age of five, and 26 percent being admitted to hospital for infectious diseases. Two-thirds (64 percent) of their respondents said they could not afford to visit a doctor. The report also comments on the "poor condition" of housing. From the information in the report it is impossible to determine whether crowding, the state of the housing or poverty contributed most to the children's poor health (Mortensen 1988).

Childhood behaviour

A number of studies suggest that crowding may be stressful for children, leading to behavioural problems. These include hyperactive or aggressive behaviour among pre-school children in America

(Maxwell 1995), poor academic achievement and conflict between parents and children in India (Evans 1998), and socially deviant behaviour among American young people (Galle, Gove and McPherson 1972 in Mitchell 1976).

Maxwell (1995) studied 114 children, all aged four, in day care and Head Start classes in New York. She found that pre-schoolers who lived in crowded homes and went to crowded day care centres suffered more severe behavioural and cognitive development problems than children in just one of those crowded settings.

Evans et al (1998) studied the living conditions of working class children aged ten to 12 in urban India. All analyses were statistically controlled for income and compared children living in crowded homes with those living in uncrowded homes. This one-off cross-sectional study measured behavioural adjustment, school performance, blood pressure, social support (from family and friends) and helplessness (as defined by how persistent a person is on a challenging task after a brief experience of failure on an unsolvable task). Family density ranged from 0.6 people per room to five people per room. Boys living in crowded conditions had higher blood pressure than girls in similar surroundings. The authors give no information on whether boys usually have higher blood pressure than girls do but note that the finding is consistent with other (unspecified) studies. Girls in crowded situations felt more helpless than boys did.

In a press release on the research, Evans commented that "The findings are probably applicable to American children because the data are consistent with previous studies on children and crowding. Although some researchers believe that Indians might be more 'crowding tolerant' because of cultural differences, we find no support for that belief - crowded living conditions clearly had negative consequences for these children just as they do in our country" (<http://www.news.cornell.edu/releases>).

Data collected using a large-scale household survey in two areas of West Belfast revealed an association between crowding and psychological distress among children (Blackman et al 1989).

Although research on the relationship between crowding and psychological distress among children tends to show a consistently positive relationship, more research is needed to establish whether crowding does in fact have similar consequences for children in different cultural settings.

Childhood accidents and mortality

Childhood accidents and mortality appear to be more related to social disadvantage than to crowding. Alwash and McCarthy (1988) studied accident rates at home among children under five, for four different ethnic groups. Accidents in the home showed a large and consistent gradient by social class. Accidents to children were significantly more common in shared accommodation than in self-contained accommodation, in accommodation with more than 1.5 people per room and in accommodation rented from the council or housing associations compared with owner-occupied or privately rented housing.

In a New Zealand study, Schluter et al (1997) rated socio-economic factors as the most likely cause for increased relative risk for Sudden Infant Death Syndrome, ahead of housing characteristics.

In Britain, Williams and Lloyd (1990) found weak correlations between crowding (more than 1.5 people per room) and stillbirths and perinatal mortality. They considered that socio-economic characteristics had more effect on pre-natal than post-natal events and that maternal ill-health was likely to be a contributing factor.

A Jakarta study (Clauson-Kaas et al 1997) found that four crowding indicators were significantly associated with low birth weight, but not in the expected direction. Couples with medium socio-economic status, living in less crowded conditions, were more at risk of giving birth to a baby with a lower birth weight. The authors speculate that women living in a "modern" nuclear family, instead of a multi-generation family setting, did not have the benefits of the counselling of the older generation of women.

In another British study, Brennan and Lancashire (1978) found a clear association between housing density (more than 1.5 people per room) and childhood mortality under five years.

An English study (M'Gonigle 1933 in Martin 1976) illustrates some of the inter-relationships between health, housing and other costs. Child mortality increased among a population rehoused from a slum to a housing estate. The average rental on the new estate was roughly double that paid by residents before the move. Further investigation revealed that as a result of economic pressures, diets among the rehoused group had fallen below acceptable levels, which the researchers associated with the increase in child mortality.

Overall, the studies suggest a stronger relationship between child health, child mortality and poverty, than between child health and overcrowding per se.

3.3 Mental or psychological health

While the literature on crowding and physical health comes mainly from the United Kingdom, the literature on mental health comes from a wide variety of countries - New Zealand, the United Kingdom, the United States, India, China, Hong Kong and Thailand.

The reports fall into two groups:

- those that use subjective perceptions of crowding compared with those that use objective or density measures
- those that use clinical measures of mental health compared with those that rely on self-reports or responses to scales developed by the researchers.

3.3.1 The nature of the problem

There are conflicting views on the nature of the relationship between crowding and mental health, although several authors agree with the opinion that “nowadays crowding is seen more as a threat to mental than physical health” (Wilkinson 1999). Wilkinson acknowledges that while overcrowding is associated with psychological symptoms including depression, “the influence of other confounding social and economic problems is agreed to be strong”.

In 1973, Pynoos expressed the commonly held view that “overcrowding may lead to increased stress, poor development of a sense of individuality, sexual conflict, lack of adequate sleep leading to poor work and school performance, and intrafamilial tension”. Wilner and Bauer (1970 in Mitchell 1976) outline the opposing view that “there is no body of convincing evidence that crowding in a dwelling unit contributes materially to mental disorder or emotional instability. Nor is there evidence as yet that crowding (or other housing deficits) interferes with a promotive style of life; that because of crowding, family roles and rituals cannot be satisfactorily carried out or that the development of infants and children is severely impaired”. Certainly, the findings from the literature on psychological health are mixed (Hwang et al 1999).

Altman (1975) summarises some of the mechanisms through which psychological distress may occur. As the number of persons within homes increases:

- the number of social contacts increases
- privacy decreases
- the number of unwanted social interactions increases
- parents may be unable to monitor their children's behaviour
- access to simple goals such as eating or watching television may be frustrated
- activities such as using the bathroom have to be coordinated with others
- sick persons may not receive the care they require.

Pressures arising from these situations may lead to interpersonal aggression, withdrawal from the family, socially deviant behaviour, psychological distress or physical illness.

3.3.2 Objective crowding and psychological distress

One of the most widely quoted studies is that of Gove, Hughes and Galle (1979) in Chicago. This

large cross-sectional study revealed a strong relationship between crowding (persons per room) and poor mental health. The authors developed a series of scales to measure mental health, social relations in the home, physical health and care of children. (They subsequently became engaged in a debate with Booth et al (1980) on the validity of their conceptualisations, but defended their usefulness.) A factor analysis led Gove et al to conclude that:

- crowding results in physical withdrawal, psychological withdrawal, a lack of general planning behaviour and a general feeling of being “washed out”
- the experience of crowding is strongly related to poor mental health and to poor social relationships in the home
- the experience of crowding is strongly associated with a number of characteristics of poor child care, although it is only moderately associated with poor interaction between parent and child.

A study into health differentials in different parts of London showed that crowding was correlated with psychiatric disorders, as measured by hospital episode statistics (Landon 1996 in Hwang et al 1999).

Both Hwang et al (1999) and Wilkinson (1999) discuss a study by Gabe and Williams (1987) which showed a J-shaped relationship between household density and psychological health, with increased psychological symptoms for both low-density and high-density housing. This relationship persisted when variables such as social class, unemployment and the presence of children were controlled. Hwang et al note that the study did not control for other important factors that have been shown to have an impact on mental health, such as marital status, race, and age and it is unclear as to whether the sample was selected randomly.

According to Hwang et al, the existence of a non-linear relationship finds support in other studies. For example, using data from a stratified probability sample of residents in public housing developments in Calgary and Edmonton, Gillis (1979) in Hwang et al (1999) found that respondents in households with the lowest levels of density experienced high levels of psychological strain. There was a weak positive relationship between these two variables among residents in higher-household-density environments. Although income was controlled for in the sampling design of the study, additional factors that have been shown to influence mental health, such as gender and marital status, were not included.

3.3.3 Subjective crowding and psychological distress

This section considers studies from New Zealand, Thailand and Indonesia. While the Asian studies raise the issue of cultural differences in perceptions of crowding, the social and housing environments in Jakarta and Bangkok are very different from those in Auckland and Christchurch. This limits the usefulness of comparisons between the studies.

In a New Zealand study of low-income residents from Auckland and Christchurch, Smith et al (1992) found that colds and running noses were cited most often by Auckland residents as the health problem perceived as caused or exacerbated by housing conditions. Specific mental illness or stress symptoms were ranked only fifth by Auckland residents with 3 percent of respondents mentioning them. They were ranked first equal by Christchurch residents, along with colds and running noses, but were mentioned by only 8.5 percent of residents. A regression analysis showed that the only significant predictor of mental health was the “comfort scale” which measured dilapidation, inability to keep warm, the presence of pests and dwelling-related health hazards. Density, or crowding, did not appear to be a significant source of psychological distress.

Other studies have come up with different conclusions. In Bangkok, Fuller et al (1993) measured lack of privacy, perceived crowding and psychological distress on five, four and ten-point scales respectively, then analysed their relationship with ten health indicators. While persons per room had no discernible effect on reported illness, propensity to become ill if another member of the household was sick or the self-report of health, psychological distress had a significant effect on all but one of the health measures. In most cases, the effect of psychological distress was greater than the total effect of

any other independent variables. The authors conclude that while objective measures of crowding had little net effect on health, psychological factors, including housing satisfaction and a felt lack of privacy, were a "potent influence on the physical health of Bangkokians". This is one of the few studies that specifically explores the relationship between objective and subjective crowding on health.

The Jakarta study (Clauson-Kaas et al 1997) identified a wide range of expressions related to crowding. Four of these referred to the indoor environment, four to the neighbourhood environment and three to social and psychological dimensions. One expression, "ramai", has both positive and negative connotations and is used to describe both indoor and outdoor situations. Negative connotations refer to invasions of privacy through noise, gossip and an unwillingness to take a share of cleaning chores. Stress is enhanced when non-family members share a dwelling. Manifestations of psychological distress include feelings of helplessness, not knowing where to go or how to solve a problem. Positive aspects of crowding described by "ramai" include the ability to meet interesting people and have a good time. However, the positive connotations of the term usually refer to situations outside the home.

3.3.4 Doubling up of households

Research in New Zealand (Crothers et al 1993, Maori Women's Housing Project Report 1991), Hong Kong (Mitchell 1976) and Jakarta (Clauson-Kaas et al 1997) found that doubling up of households can lead to stress.

Mitchell's research was carried out among residents in multi-storey housing in Hong Kong. He concluded that the doubling-up of non-related households tended to "create stressful situations, especially where it was difficult for household members to escape each other easily by retreating outdoors". In his view, large numbers of people in high-density housing can be tolerated more easily where they are related.

In contrast, the Maori Women's Housing Project Report was based on interviews and consultations with Maori women in rural and urban areas, both in their own homes and in hui on marae. The authors conclude that many families in homes occupied by Maori experience crowding. This may be temporary - meaning anything from a week to a month to a few months - or permanent. According to the authors:

many young Maori lead a very nomadic existence, whereby they move from one household to another and have no permanent residence. This life style is not dictated by choice. People stay with family until relationships become strained or overcrowding is at its maximum and then move on to the next house where the cycle is repeated. The effects of overcrowding and homelessness do not help to provide a stable environment for Maori women and their families. On the contrary, it creates extremely stressful situations that become very volatile and often explode. The results of this can be seen clearly in the number of Maori women who become survivors of family violence, which in itself becomes repetitive.

Crothers et al's study in Manukau City also refers to doubled-up households and feelings of crowding, but the report is descriptive rather than analytical.

The literature on the relationship between crowding and psychological health is frustrating in that it is difficult to tell conclusively from published studies whether subjective and objective crowding has independent relationships to psychological health. That is, whether only one of these conditions needs to be met for there to be an effect on health. For example, the Fuller study comes to different conclusions to other studies, the New Zealand study is inconclusive and the Jakarta study suggests that there are several aspects to perceptions of crowding. It is clear that more work needs to be done in this area.

3.4 Key questions

3.4.1 Isolating the effects of crowding from other factors

A review of the literature indicates that it is virtually impossible to separate the effects of crowding from other factors, particularly in relation to physical health. Although individual studies establish associations between crowding and various illnesses, they are rarely robust enough to establish causality. Indeed, some researchers accept that, given the complex nature of social relationships, a strong association is the best that can be expected.

Methodological problems abound. Many studies are small or limited to specific sites or cultural groups. This limits their ability to control for confounding factors such as ethnicity, income, employment status, education or the condition of housing. Very few explore the lifestyles and health practices of residents. Many studies are cross-sectional which precludes any ability to establish causal order. Longitudinal studies have a greater ability to control for prior conditions and to establish matched control groups, as well as to monitor conditions, perceptions and experience over time. This provides greater confidence in statements of association or cause.

While two studies in New Zealand have looked at the incidence of colds, asthma and influenza and the prevalence of Hepatitis B (Milne et al 1987, Smith et al 1992), there is as yet anecdotal comment but no rigorous research into the relationship between crowding and the spread of tuberculosis or meningococcal disease. There is a similar lack of local research into the effects of crowding on mental health, particularly for different ethnic and socio-economic groups. Smith et al's study, which does include mental health among other factors, is inconclusive. Overseas research produces mixed results. As with physical health, studies of crowding and psychological health are plagued by methodological problems with few controlling for gender, age, ethnicity or marital status. Studies in Jakarta, Bangkok, Hong Kong and Chicago may not be relevant in New Zealand.

3.4.2 The nature and intensity of adverse effects of crowding

The literature gives no indication of cut-off points in crowding for health risk, or whether these differ for men and women or people of different age or ethnic groups.

However, the evidence suggests that the spread of some airborne infectious diseases such as coughs, colds, and influenza is likely to be exacerbated by overcrowding. The evidence about other respiratory diseases, such as tuberculosis, is inconclusive. There is no research exploring the relationship between passive smoking and asthma in crowded homes.

While enteric diseases such as diarrhoea and *Helicobacter pylori* do appear more common in crowded homes, it is unclear whether the critical factor is household density, sharing a bed in childhood or sharing a bedroom. With such diseases, lifestyle, socio-economic status and health-related behaviour may be as important as crowding. As with airborne diseases, it is difficult to determine whether younger or older children or adults are more at risk, because few studies compare age groups.

Lack of sleep in crowded households may lead to poor school achievement, poor work patterns and slow recovery from illness but the research exploring this topic is extremely limited.

A number of studies suggest that crowding is stressful for both children and adults, and particularly for women, leading to poor social relationships, poor childcare, aggression or withdrawal. See section 4.3 below for further discussion. However, the field surveys have been somewhat inconclusive on this topic and laboratory-oriented studies exploring reactions to density have come up with inconsistent results (Altman 1975).

3.4.3 The effects of particular types of crowding

Research in this area has found that doubling up of households, particularly unrelated households, leads to psychological stress. Anecdotal studies referring to unrelated households sharing accommodation indicate that such pressures exist in Maori and Samoan households (Macpherson 1993, Maori Women's Housing Project 1991). Providing a clearer picture of the effects of particular types of crowding would require more research. This could usefully investigate the effects of single

parent families sharing housing, and of having high numbers of residents in particular age groups e.g. young children or teenagers in a household.

3.4.4 The mechanisms by which adverse effects occur

Research suggests that adverse effects may occur through a number of mechanisms, although the evidence as to the relative importance of these is inconclusive:

- children sharing a bed or bedroom
- physical contact
- lack of sleep
- lack of ability to care adequately for sick household members
- lack of privacy
- more prolonged contact with carriers
- difficulty in maintaining good hygiene practices.

3.4.5 Factors that mediate the likelihood of adverse effects

Health

Literature on factors that are likely to mediate the adverse effects of crowding is sparse and inconclusive. Clauson-Kaas et al (1997) note that “there has been no study to assess whether it is more important to change crowding or other causal mechanisms in order to improve health.” Wilkinson (1999) agrees, adding that there have been few longitudinal, as opposed to retrospective, studies exploring the effects of housing interventions on health. The studies she identifies considered the effects of improvements to the physical condition of housing on health, particularly through improving insulation and heating. The studies showed mixed results. None looked particularly at reducing crowding or at the role of education to mitigate disease spread in overcrowded houses.

Efforts to rehouse people may in fact have adverse effects unless economic factors are taken into account (M’Gonigle 1933 in Martin 1976). There is little research into the effects of disrupting social networks. Smith et al (1992) found that providing social support helped alleviate the distress of those exposed to moderate levels of housing stress, including small amounts of space per person, but this did not apply to individuals exposed to high levels of housing stress.

Clauson-Kaas et al (1997) comment that the possibility that crowding could be beneficial should not be dismissed. The stimulation of the immune system, at least from some viral infections, could have a protective effect against other infections, but there is little research in this area. They acknowledge that immunisation campaigns can do much to control the spread of communicable diseases.

Task performance

Literature on the long- and short-term effects of crowding on task performance is also sparse. In an experimental laboratory study, Sherrod (in Altman 1975) concluded that crowding is a form of social stress that does not necessarily impair short-term task performance, perhaps because of adaptive strategies. However, costs may gradually accumulate and eventually affect subsequent functioning. Altman stresses the need for more research in this area to explore which coping strategies are most effective.

Immigration

Myers et al (1996) discuss the strong relationship between crowding, ethnicity and immigration in the United States, noting that “these factors alone explain the lion’s share of the variation across metropolitan areas in overcrowding”. Rates of crowding were particularly high for recent immigrants, and all groups, to differing degrees, moved out of crowded conditions as their financial circumstances improved. As discussed in section 4 below, the pattern appears to be similar in New Zealand, especially among Pacific and some Asian groups.

This pattern suggests that to some extent, crowding is a self-correcting situation. Myers et al (1996) call for more research into the duration of exposure to crowding through longitudinal studies. It may

be possible to speed up the process of self-correction by targeting housing assistance to recent immigrants, or more contentiously, by limiting immigration to those who can afford suitable accommodation.

The Myers study also highlights differences among ethnic groups in their tolerance for crowding. They found that crowding remained high among Asian and Hispanic households with incomes more than twice the average of all households. More research is needed in New Zealand to find out whether particular groups in this country have a higher tolerance of crowding than others do, and whether or not they perceive crowding as a problem.

Other issues

Alleviating crowding may occur through a number of mechanisms. It would be useful to carry out research into at-risk groups' preferred options, such as:

- improving the physical condition of existing housing versus moving to new housing
- adding to existing housing versus moving to new housing
- staying in a familiar neighbourhood or moving to improved housing away from friends and social networks
- staying in a familiar neighbourhood but having access to better health services or other benefits.

4. Dynamics of crowding

4.1 Cultural factors

The WHO Expert Committee on the Public Health Aspects of Housing (Ranson 1991) acknowledges that housing should be consistent with the prevailing cultural and social patterns of particular regions and ensure, among other things, that living or sleeping rooms are not overcrowded. As discussed elsewhere in this review, few definitions and measures of crowding reflect cultural differences or take the views of minority groups into account (Barnett and Lowe 1991, Mitchell 1976, Myers et al 1996).

In many societies, minority groups are more likely to live in crowded conditions than the majority group (Kent 1993, Mikelsons and Eschbach 1999, Myers et al 1996, Office of Population Censuses and Surveys 1995, Statistics New Zealand 1998). It is widely acknowledged that reactions to crowding are conditioned by cultural context and by an individual's subjective experience of crowding (Gove et al 1979). Unfortunately, very little research addresses the complexity of cultural responses to household crowding.

The perception that some cultures have a higher tolerance of crowding than others has been challenged by some researchers and supported by others. The debate on this topic tends to be general rather than specific and gives little empirical evidence of comparative levels of tolerance or particular aspects of difference.

Writers who believe there are cultural differences in tolerance of crowding generally refer to differences in the cultural use and meaning of space. Choi (1993) maintains that immigrants to America from Asia and Latin America come from "close contact" societies where living in close quarters is judged voluntary or at least tolerable. Hall (1966, cited in Pader 1994) argues that preferences for personal space correlate with different attitudes toward one's self and one's relations with others, which includes concepts of the importance of privacy or sharing.

Much of the literature on cultural tolerance of crowding cites the Chinese as an example of cultural adaptation to overcrowded conditions. A study of the relationship between crowding, stress, life satisfaction and health in western Beijing (Ekblad et al 1992) specifically discusses the extent to which cultural factors may moderate stress. The authors surveyed three-generation families living in traditional courtyard housing, mid-rise and high-rise blocks, and found that those in traditional housing were least satisfied with their dwellings but most satisfied with their lives. Sleep disturbance from noise and disturbance with privacy were greatest among those living in mid-rise apartments. The authors conclude that housing is only one factor contributing to psychological health and that traditional social bonds are also important. "On the one hand, the process of urbanisation and modern life styles erodes the traditional social bonds and on the other, these same bonds protect against stress and [the effects of] overcrowding."

Lai (1993) questions the methodology of many of the studies claiming higher tolerance of crowding among Chinese people and argues that more attention needs to be paid to people's perceptions of their environment. He notes, too, that findings from one society may not be transferable to the same cultural group in another society.

There are no studies comparing tolerance of crowding among different ethnic groups in New Zealand although Maori and Pacific households tend to live in more crowded households than Pakeha families (Crothers et al 1993, Kearns et al 1992, Smith et al 1992). Studies of Samoan households (Macpherson 1974 and Pitt and Macpherson 1974 in Macpherson 1993) have found that the composition of Samoan households is fundamentally different from and more fluid than the traditional nuclear European household and is ill-suited to the restrictions of typical New Zealand dwellings. Cultural proscriptions add to pressures on available space, leading some families to develop innovative solutions, such as using free-standing garages to mitigate crowding and provide spaces suited to their preferred lifestyle. This study suggests that Samoan families do not tolerate crowding by choice but instead are constrained by the housing options available to them.

The research on crowding and physical health also suggests that health outcomes may vary for different ethnic groups. In New Zealand and England, minority ethnic groups living in crowded housing experienced particular problems with cold, damp and poor housing conditions leading to high levels of colds, influenza and similar illnesses (Ambrose 1996 a, Smith et al 1992). In Kawerau, ethnicity was an important risk factor for Hepatitis B infection, along with household size (Milne et al 1987). In contrast, authors of research into mortality from TB concluded that ethnicity as a single factor was not helpful in explaining incidence (Elender et al 1998). More research is obviously needed to explore the nature of the relationship between ethnicity, crowding and physical health. A small study on housing and health is currently underway among the Wellington Tokelauan community (Howden-Chapman et al 2000).

4.2 Socio-economic differences

Much of the debate on crowding and health acknowledges that socio-economic factors are an important confounding variable. As noted in *New Zealand Now: Housing* (Statistics New Zealand 1998), people living in crowded conditions often have lower-paying jobs, lower personal incomes, higher unemployment and greater reliance on income support than those in less crowded conditions. These factors affect where people live, how people behave, their health status and their ability to cope with crowded conditions (Ambrose 1996 b, Kearns et al 1992, Lowry 1989).

Smith et al (1992) note that "without access to decent and affordable shelter, individuals and households are likely to encounter serious and persistent deprivation." Ambrose included lowered resistance to physical and mental illness through living in a poor, stressful and uncongenial setting among the indirect effects of housing on health.

Socio-economic differences are not necessarily spread evenly within countries. Smith et al (1992) found that housing stress was significantly greater in Auckland than in Christchurch. On the authors' health/comfort and expense scales, Auckland residents were significantly disadvantaged. Similarly, in the United States, Myers et al (1996) observed that housing costs and other expenses vary sharply from state to state. Whatever measures the authors used, the differences in the rate of overcrowding between the lowest and highest income categories were pronounced. Crowding rates did not drop substantially until relative income passed the median level, suggesting that some households may prefer to use their still relatively limited finances for more urgent priorities. The relationship between crowding and economic choices needs further investigation.

Many researchers acknowledge that it is difficult to disentangle affordability from crowding issues in relation to health. Wilkinson (1999) contends that people who already suffer ill-health tend to live in substandard housing due to low income. Kearns et al (1992), for example, found a correlation between the mental wellbeing of people with psychiatric disorders and the quality of their housing. A number of studies have concluded that health outcomes are more related to social disadvantage than to crowding, but more work is needed to establish this link.

4.3 Effects of crowding on women

Many studies refer specifically to the effects of crowding on women. In a general discussion on reactions to crowding, Jazwinski (1998) maintains that women respond more positively to crowding than men. He asserts that men become more physiologically aroused, particularly if they are so close that they touch. Men also respond more negatively if they are with other men. He suggests that this might be because women are more able to show their emotions, which helps relieve stress, while men prefer larger spaces than women.

The specific literature on crowding and housing does not support this view. Instead, there is considerable evidence that the relationship between poor housing conditions, including crowding, and mental health problems affects women especially (Ambrose 1996 b, Maori Women's Housing Project Report 1991, Smith 1989). Both Baldassare (1988) and Gove and Hughes (1980) found that women with young children living in high-density homes were more likely to be dissatisfied with their health. In Gove and Hughes' Chicago study, the relationships between internal crowding and the health of women respondents varied according to household composition and marital status. The

effect of crowding on the mental health of married women was greater if children and other adults (in addition to the spouse) were present in the household. Gabe and Williams (1993) agreed, suggesting that women in high-density housing may find it difficult to control the desired amount of social interaction with other members of the household and that this has consequences for their psychological health.

4.4 Social and economic pressures that give rise to crowding

A number of factors contribute to concentrations of crowding in particular areas and population sub groups. Migration has been clearly identified as one contributing factor. Household size, living in extended families, affordability issues and lack of suitable housing stock are others.

4.4.1 Migration

Immigrant groups with lower socio-economic status have been strongly identified as contributing to crowding in New Zealand, the United States and Britain (Statistics New Zealand 1998, Myers et al 1996, Office of Population Censuses and Surveys 1995, 1996, Schill and Rosenbaum 1998). Both New Zealand and American studies found that crowding was higher among recent immigrants. Further analysis of the Myers' data showed that Asian and Hispanic households were more likely to be crowded than white or black households, even when household income was higher than average, indicating that some households did not see reducing crowding as a high priority.

In New York, Schill and Rosenbaum (1998) found that nearly 30 percent of South Asians (Indians, Pakistanis and Bangladeshis) lived in crowded housing, a higher percentage than any other immigrant group. In commenting on the report, South Asian advocates (cited in Strozier 1998) described the crowding as a result of both economic necessity and cultural tradition. Those living in more crowded conditions tended to come from lower socio-economic groups. Commentators believed that economic factors far outweighed cultural preferences for living in extended families. One explained that "by living together, many families save money and are able to buy their own homes and rent out space or invite more family members to live with them."

Macpherson (1993) discusses the cultural pressures on Samoan families to accommodate relatives, and the financial constraints that limit their ability to move to larger homes or modify their existing housing.

A survey of the incidence of crowding in the United Kingdom between 1991 and 1993 found that households headed by a Pakistani or a Bangladeshi were most likely to be living in crowded conditions, with just under a third of households having insufficient bedrooms (Office of Population Censuses and Surveys 1995 and 1996). While Pakistani and Bangladeshi households have a high level of immigration, the report includes no analysis of length of stay, household composition or economic circumstances.

Literature discussing the effects of illegal immigration on crowding is lacking.

4.4.2 Household size and composition

An analysis of 1996 census figures used the Canadian standard to identify households requiring two or more additional bedrooms (Statistics New Zealand 1998). It showed that Maori and Pacific people, who have larger than average-sized households, were over-represented among those living in crowded conditions, with 75 percent of those requiring two or more bedrooms belonging to these ethnic groups. In a 1986 publication, Statistics New Zealand used one person per room as an indication of crowding and came up with similar results (cited in Morrison 1994). No comparisons have been made with 1996 census figures using the persons per room definition.

Morrison (1994), Myers et al (1996) and Statistics New Zealand (1998) agree that young households, which generally include greater numbers of young children, are more likely to be crowded than older households. Once again, Maori and Pacific people are over-represented among this group and their households are also more likely to include family members from three or more generations. While in theory this may lead to more income coming into the households, high levels of unemployment and

dependency may well reduce the amount of income available for housing. More research is needed into this topic.

The Statistics New Zealand study showed that multi-family households made up 41 percent of crowded homes. Again, little is known about what effect this has on health or affordability.

4.4.3 Affordability

Studies in New Zealand (Smith et al 1992), Hawaii (Mikelsons and Eschbach 1999) and mainland United States (Myers et al 1996) have all identified affordability as a key factor in crowding. However, the relationship between crowding and affordability is not straightforward. Affordability is more of an issue in some locations than others and high housing costs may lead to families choosing to sacrifice space for affordability (Macpherson 1993, Mikelsons and Eschbach 1999).

As noted in section 4.1 above, increases in household income may not immediately translate into improved housing because some households may choose to spend their additional income in other ways.

4.4.4 Housing stock

Myers et al (1996) found that in the United States, housing supply in a metropolitan area seemed to have no effect on the incidence of overcrowding. In particular, areas with higher-rental vacancy rates did not have lower rates of overcrowding. In New Zealand, the issue may be the availability of suitable housing at an affordable cost. As Karmel (1998) points out, the suitability of a dwelling for a family may depend on a range of factors, such as its cultural background or age of family members. Karmel and Macpherson (1993) recognise that in some cultures, it may be particularly important to have a large communal area for family gatherings. The availability of housing stock that can cater for this need is undoubtedly limited.

4.5 Key questions

4.5.1 Social and economic processes that lead to crowding

Research indicates that immigration does contribute to crowding but not for all immigrant groups (Myers et al 1996, Schill and Rosenbaum 1998, Statistics New Zealand 1996). In New Zealand, crowding is most common among Pacific people and some Asian groups, notably Vietnamese and Cambodian households. Obligation towards family members intensifies pressures on household space, especially among low-income groups who cannot afford to set up separate households.

Household size and composition are also associated with crowding. Large households with a high proportion of dependants, either children or older family members, are likely to be crowded. (Morrison 1994, Myers et al 1996, Statistics New Zealand 1996). This may be in part an affordability issue and in part an application of norms that are not universally appropriate.

Low incomes are particularly associated with crowding in high-cost areas. Housing is only one financial pressure on low-income households, and increases in income may not lead immediately to improvements in housing.

4.5.2 The extent to which crowding is transitional or temporary

Research indicates that crowding due to migration is transitory for many households. While the ability to set up new households is undoubtedly affected by affordability and the availability of suitable housing, some families may choose to stay together in order to provide mutual support and to manage migration by other family members.

Crowding for households with high numbers of children may also be temporary as children grow and leave home. However, the demands on space are likely to increase through the teenage years, as teenagers require more privacy than younger children.

5. Conclusion

This review has addressed questions relating to regulatory approaches to defining and measuring crowding, the adverse effects of crowding on those living in crowded conditions and the dynamics of crowding.

5.1 Regulatory approaches to defining and measuring crowding

The report discusses the contexts in which crowding definitions have been developed, and the different approaches to defining and measuring crowding depending on the context.

The review acknowledges the practicality of simple definitions of crowding for research and statistical purposes but identifies a need for definitions that take account of household composition and of subjective perceptions of crowding.

The review concludes that variations in definitions are rife, and it may be inappropriate and unhelpful to try to establish one definition of crowding for all purposes or all groups, or one model of housing need.

5.2 Adverse effects of crowding on those living in crowded conditions

The review highlights the complexity of the relationship between crowding and health. It draws attention to the difficulties of undertaking research in this area, and the virtual impossibility of establishing causality at the level normally accepted in bio-medical research. Strong associations may be the best that can be expected.

The report finds some associations between crowding and poor health outcomes, both physical and psychological. It is apparent that further research is needed, particularly in the New Zealand context, with careful attention to methodology and the experiences of different groups.

5.3 The dynamics of crowding

The report considers cultural factors in relation to crowding, including tolerance of crowding and the cultural use and meaning of space. The relationship between cultural and economic factors is complex and needs further consideration. The effects of socio-economic differences are also examined, as are the relationships between migration and crowding, household size and composition and affordability issues. The report concludes that further research specific to the New Zealand situation is needed. A possible research agenda follows.

5.4 A research agenda

The report concludes that more research is needed in order to be able to answer the key questions with more confidence. In particular, there is a need for more research into:

- what different population groups perceive as socially relevant standards. This would improve the validity of occupancy standards, which are often used to help assess housing need
- the relationship between crowding and health, taking account of different age groups, the experiences and views of men and women, marital and socio-economic status and ethnicity
- the relationship between crowding and health using longitudinal rather than cross-sectional studies
- the relationship between passive smoking and asthma in crowded homes
- the relationship between crowding and such factors as poor school or work performance and slow recovery from illness
- the effects of single parent families sharing housing
- the effect of having high numbers of residents in particular age groups, e.g. young children or teenagers, in a household
- strategies that may help mitigate the effects of crowding, including exploring at risk groups' preferred options
- the duration of exposure to crowding, particularly among immigrant groups
- the tolerance of crowding among different ethnic groups in New Zealand
- the relationship between crowding and economic choices.

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Appendix I – Regulations

1. New Zealand

The Housing Improvement Regulations (1947), which still constitute the legal definition of overcrowding in New Zealand, allow children to share a bedroom up to the age of ten, regardless of their sex, and specifies the floor area required per person. Thus, the overcrowding definition includes any of the following:

- 1. if the number of persons who sleep in any bedroom is such that any two, greater than ten years of age AND of the opposite sex, and not living as husband and wife, must sleep in the same bedroom
- 2. if the number of persons who sleep in any bedroom of a specified area is greater than that specified in the second schedule of the Act (schedule of area of bedroom with number of persons before overcrowding is deemed to take place)
- 3. if the number of persons who sleep in a room exceeds that number permitted under the bylaws of the relevant local authority.

Second schedule: Number of persons permitted to sleep in a bedroom

Area of bedroom	Number of persons
Less than 4.5 sq m	0
Greater than 4.5 sq m and less than 6 sq m	0.5 (existing building), 0 (new building)
Greater than 6 sq m and less than 8 sq m	1
Greater than 8 sq m and less than 10 sq m	1.5
Greater than 10 sq m and less than 12 sq m	2
Greater than 12 sq m and less than 14 sq m	2.5
Greater than 14 sq m and less than 17 sq m	3
Greater than 17 sq m and less than 20 sq m	3.5
Greater than 20 sq m	4 plus 1 for each 5 sq m added

2. The British standard (Arden and Hunter 1997)

There are alternative tests of overcrowding. If either is offended, the premises are overcrowded in law. According to the room standard:

- there is overcrowding whenever there are so many people in a house that any two or more of those persons, being ten or more years old, and of opposite sexes, not being persons living together as husband and wife, have to sleep in the same room (1985, s.325). For these purposes, children under ten may be disregarded. A room means any room normally used in the locality as either a bedroom or a living room. There is no overcrowding when two or more people actually do sleep in the same room, but when they *must* do
- *space standard*: This standard works by the calculation of a permitted number for the dwelling, in one of two ways, and the *lower* number thus calculated is the permitted number for the dwelling (1985, s326). One test is based on the number of living rooms in the dwelling (disregarding a room of less than 50 sq ft): one room, two persons; two rooms, three persons; three rooms, five persons; four rooms, seven and a half persons; five rooms or more, ten persons plus two for each room in excess of five rooms. A child from one to nine inclusive counts as half
- the other test is based on floor areas of each room size: less than 50 sq ft no one; 50 to less than 70 sq ft, half a person; 70 to less than 90 sq ft, one person; 90 to less than 110 sq ft, one and a half persons; 110 sq ft or larger, two persons.

3. The British bedroom standard

A separate bedroom is allocated to each married couple, any other person aged 21 or over, each pair of adolescents aged ten to 20 of the same sex, and each pair of children under ten. Any unpaired person aged ten to 20 is paired, if possible, with a child under ten of the same sex. If that is not possible, that person is given a separate room as is an unpaired child under ten. Where the number of bedrooms is one or more below the bedroom standard, households are classified as overcrowded. Using this measure, the Office of Population Censuses and Surveys (1995) reports that higher proportions of Pakistani or Bangladeshi families lived in overcrowded accommodation than white or Indian households.

4. The Canadian National Occupancy Standard

The Canadian National Occupancy Standard has also been adopted by Australia on the grounds that it conforms reasonably to social norms in Australia (McLennan 1994). It assesses the number of bedrooms required by a household by specifying that:

- there should be no more than two persons per bedroom
- children less than five years of different sexes may reasonably share a bedroom
- children five years or older of opposite sex should not share a bedroom
- children less than 18 years and of the same sex may reasonably share a bedroom
- household members 18 years or over should have a separate bedroom, as should parents or couples.

Households living in dwellings where this standard cannot be met are considered to be overcrowded.

5. The American Public Health Service/Centers for Disease Control Ordinance

The ordinance recommended by the American Public Health Service/Centers for Disease Control of the US Public Health Service contains no reference to the age, gender or relationship of residents, nor does it distinguish between bedrooms and other habitable rooms. The floor spaces are comparable to those specified in New Zealand and British regulations. The ordinance recommends that:

- maximum occupancy of any dwelling unit shall not exceed the lesser of the following requirements:
 - first occupant, at least 14 sq m habitable floor area; second and subsequent occupants, at least 9.4 sq m
 - permitted number shall be less than times the number of habitable rooms within the dwelling unit
- every dwelling of two or more rooms occupied for sleeping purposes by one occupant shall contain at least 6.6 sq m of floor space for the first occupant and every room occupied for sleeping purposes by more than one occupant shall contain at least 4.73 sq m of floor space for each occupant thereof.