



Office of the
Deputy Prime Minister

Creating sustainable communities

The Impact of Overcrowding on Health & Education:

A Review of Evidence
and Literature

May 2004

housing



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Deputy Prime Minister

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Evidence and Literature

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Office of the Deputy Prime Minister: London

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CHAPTER 1

Introduction and Summary of Findings

Background

- 1.1 In late 2003, the Office of the Deputy Prime Minister commissioned this review from the Centre for Comparative Housing Research and the Health Policy Research Unit at De Montfort University, Leicester.
- 1.2 The aim was to identify the known impacts of overcrowded housing on people's health and education. To achieve this aim, the review identified, and critically assessed the research evidence.
- 1.3 This report presents the findings in relation to physical health (chapter two), mental health (chapter three), childhood growth, development and education (chapter four), and other impacts including personal safety and accidents (chapter five).

Research approach

- 1.4 The approach to the review of evidence focused on the objective and measurable impacts of overcrowding from primary research studies. Wherever possible the study reviewed primary studies rather than secondary material. A small proportion of the analysis, however, is based on 'reviews of reviews'.
- 1.5 The approach comprised three elements, which are outlined below. Further details can be found in Annex One.
 - Searching a range of databases to identify articles for initial review. A variety of search terms were used, reflecting the diverse nature of the terminology on overcrowding (see below).
 - Agreeing and implementing selection criteria to identify relevant studies. For example, setting parameters on the choice of countries – only research undertaken in OECD countries and written in English was used.
 - Extraction and analysis of information from the study for use in assess the findings and quality of the primary research.

Issues of measurement

- 1.6 In considering the findings of the review, it will be useful for readers to be aware of a number of issues relating to the measurement of the relationship between overcrowding and health and education. These issues have served to limit the extent to which the review can easily draw conclusions from the studies. These issues, discussed in detail below, include the range of definitions of overcrowding, the possibility of direct and indirect effects, selection effects, the variety in type and quality of evidence and the difficulty discerning the impact of overcrowding from that of other housing and deprivation related variables.
- 1.7 Firstly, drawing conclusions about the evidence on the effects of overcrowding is difficult because of the range of definitions used for overcrowding. Some authors make a distinction between overcrowding (a normative judgement about the adequacy of personal space in a dwelling) and crowding (an objective measure of number of people per room in a dwelling). The measurement of the extent of crowding and overcrowding also varies considerably. Some studies measure the number of people per dwelling whilst others focus on the number of people per room or persons per bedroom. The threshold whereby a property is deemed to be overcrowded also differs between studies.
- 1.8 Secondly, overcrowding may have both direct and indirect effects. The latter are of course less easily measured. For example, children's education may be affected by overcrowding directly, through a lack of space for homework, as well as indirectly because of school absences caused by illness, which may be related to overcrowding.
- 1.9 Thirdly, findings on the impact of overcrowding may also be subject to possible 'selection effects' (1). This can happen in two main ways. People with poor health may have difficulty holding down or securing employment and may not be able to afford housing appropriate to their needs. As a result they may end up living in overcrowded housing (2). Additionally, people with illnesses may live in overcrowded conditions as a result of their need for care and support from relatives. This was evident in Kempson's (3) study of overcrowding in Bangladeshi households in Tower Hamlets.
- 1.10 Fourthly, the evidence on physical health is often medium or large scale and quantitative whilst some of the evidence found relating to mental health is based on smaller scale and often, qualitative studies. The result is that in relation to physical health, it is easier to make statements about the relationship between overcrowding and health due to the consistent and robust quantitative studies. In respect of mental health, (and to some extent childhood development and growth), the nature of the research base makes it more difficult to reach general conclusions.
- 1.11 Fifthly, and most importantly, disentangling the effects of other variables adds considerable complexity to the analysis of studies. Overcrowding is one of several aspects of housing conditions that studies have been found to be related to outcomes in health, education and childhood growth and development. Others include damp, mould growth, lack of basic amenities, housing type and tenure (4). Socio-economic factors, such as social class or deprivation are also often found to be related. Because these factors may be related to one another (for example deprivation and overcrowding), it is not easy to assess which factor is responsible for creating the effect, unless a study has specifically controlled for these other factors.

- 1.12 To conclude, there is little in the way of evidence to conclusively demonstrate impact. The evidence found in this review generally enables statements to be made about possible relationships or associations, but the kind of evidence required to demonstrate that ‘A causes B’ is not necessarily available. To do this would require a large-scale longitudinal study that compared two groups of households – one group where overcrowding had been alleviated with a group where overcrowding remained. Such a study would also need to take full account of confounding variables.

Presentation of the evidence

- 1.13 In presenting the evidence in the following chapters, the material has been sub-divided into a series of specific themes. For example, physical health is sub-divided into children’s health, overcrowding in childhood and later adult health and mortality, and adult health. Within each of these sub-sections, the research is presented specific ‘effect areas’. For instance, childhood health is further sub-divided into child mortality, sudden infant death syndrome, respiratory conditions, meningitis and tuberculosis.
- 1.14 Within each effect area, the most robust evidence is provided first, followed by those studies that provide less clear evidence of effect. In relation to physical health, the best research evidence was regarded as being provided by larger scale studies of randomly selected individuals exposed to overcrowded housing conditions at some stage in their lives. The most robust of these attempted to match cases that had experienced overcrowded housing with those who had not been exposed to such conditions and measured the outcomes in each group. Another characteristic of the best quality studies was the extent to which they measured possible confounding factors, such as other housing conditions and socio-economic factors. Such studies generate high levels of confidence in their findings. Studies that provide less robust evidence are those that were smaller scale or which made limited attempts to consider confounding factors.
- 1.15 In relation to mental health and childhood growth and development, wherever possible, a similar hierarchy of evidence has been adopted. There are, however, a number of small-scale qualitative studies that are based on a different research tradition. These are highlighted in chapters three and four. These studies help us to understand some of the potential means by which overcrowding may affect mental health, through the analysis of behaviour or the views of individuals.
- 1.16 In presenting the evidence on the individual studies, the terms ‘significant association’ are used only where this refers to a statistically significant association. Where a significant association has been found in a study, this means the effect found is very likely to hold true in the wider population beyond those included in the study. A non-significant association indicates that the effect found in the study may be due to the way the sample was selected, and it cannot be concluded that the effect is likely to hold outside the selected sample.
- 1.17 Many studies have explicitly controlled for other variables that may also explain poor health or educational outcomes (such as other housing related variables or deprivation). These studies help to reduce the uncertainty about the likely causes of an observed effect. For example if deprivation is controlled and overcrowding continues to have an effect, it is possible to be more confident that there may be an independent overcrowding effect. Where studies have controlled a range of related factors, and a significant association between overcrowding and the outcome remains, it is stated that the association is significant and ‘independent’. The label ‘independent’ must still be treated with caution, as studies may not always identify and measure all potentially confounding variables.

- 1.18 In summarising the overall effects, the term ‘relationship’ has been used where there is a body of robust supporting evidence that overcrowding is related to an outcome. Where the evidence suggests that this is independent of other possibly confounding factors, this is stated.

Summary of findings

- 1.19 There is a good evidence base (40 studies) on overcrowding and physical health. The evidence points towards a small relationship between overcrowding and aspects of the health of both children and adults. Additionally, there is evidence to suggest that overcrowding in childhood affects aspects of adult health.
- 1.20 A smaller evidence base (25 studies) was found relating to mental health. There is mixed evidence of a relationship between overcrowding and mental health.
- 1.21 Eighteen studies were found on overcrowding, childhood development, growth and education. There is limited evidence of an effect in these areas.
- 1.22 A limited number of studies were found which focused specifically on understanding the experience of black and minority ethnic groups, particularly where there are high levels of overcrowding. No studies were found however, which specifically drew out the differential effects of overcrowding on the health or education of people from different ethnic backgrounds.

Physical health (See chapter 2)

OVERCROWDING AND CHILD HEALTH

- 1.23 **CHILD MORTALITY:** studies suggest that there may be an independent relationship between overcrowding and child mortality, but the evidence is limited.
- 1.24 **SUDDEN INFANT DEATH SYNDROME:** It is not possible to conclude whether a relationship exists between SIDS and overcrowding due to a lack of robust research.
- 1.25 **RESPIRATORY CONDITIONS:** A range of large scale and robust studies were found that attempted to adjust for the main confounding variables. Overall, the balance of the evidence from five studies indicates a small relationship between overcrowding and respiratory conditions in children. However, the possible relationship between deprivation and overcrowding in the context of respiratory conditions requires further investigation, as does the relationship between overcrowding and other housing conditions (for example, damp and mould growth).
- 1.26 **MENINGITIS:** Three studies have yielded good evidence of a relationship between meningitis and overcrowding. These suggest a relationship between childhood overcrowding and meningitis. The strength of the relationship appears to be small. A number of potentially confounding variables were controlled. The three research projects were medium-sized case control studies, which enabled a comparison of those exposed to overcrowding and those that were not.

- 1.27 TUBERCULOSIS (TB): Studies have found evidence of an independent relationship between childhood TB infection and overcrowding in deprived areas, such as the Bronx in New York (5), as well as in adults.

OVERCROWDING IN CHILDHOOD AND ADULT HEALTH

- 1.28 HEART DISEASE AND STROKES: There is evidence to suggest that a relationship between overcrowding in childhood and mortality from heart disease and stroke is unlikely.
- 1.29 STOMACH CANCER: There is a small body of evidence to support a relationship between childhood overcrowding and stomach cancer in later life but the evidence is fairly weak, and confounding variables have not been adequately controlled for.
- 1.30 *HELICOBACTER PYLORI*: The research suggests a strong possibility of an overcrowding effect on *H. Pylori* infection in childhood, which is independent of other factors. However, more research is needed to confirm the relationship between overcrowding, *H. Pylori* infection in childhood, and the development of stomach cancer and other gastric conditions in adulthood.
- 1.31 ADULT RESPIRATORY CONDITIONS: The evidence suggests that respiratory conditions in adulthood arise from a range of childhood housing-related factors. Evidence from good quality large scale studies points to a relationship between overcrowding in childhood and respiratory conditions in adulthood, but indicates that children are affected differently depending on age. However, the strength and independence of the relationship is unclear, due to lack of evidence on possible confounding variables.
- 1.32 SELF-RATED HEALTH: A large-scale study showed that overcrowding in childhood increased the likelihood of poor self-rated health in adulthood. The relationship was weaker than that between housing tenure and poor self-rated health, but nonetheless significant.

ADULT OVERCROWDING AND ADULT HEALTH

- 1.33 MORTALITY RATES: Two studies provide some limited evidence of an independent relationship between overcrowding and adult mortality rates, particularly for women.
- 1.34 SELF-RATED HEALTH: The limited evidence suggests there is a relationship between overcrowding and self-rated health. The strength and independence of the relationship is less clear.
- 1.35 RESPIRATORY DISEASES: Studies reveal a relationship between overcrowding and adult respiratory diseases. It is possible that other housing or deprivation factors provide more powerful explanations.
- 1.36 TUBERCULOSIS (TB): There is strong evidence to support an independent relationship between overcrowding and TB. However, each of the four studies reported (in addition to a study of TB in children) are of aggregate populations i.e. the studies are of populations within a particular area rather than groups of randomly selected individuals.

MENTAL HEALTH (SEE CHAPTER 3)

- 1.37 GENERAL ADULT MENTAL HEALTH: As a result of the diverse range of types of evidence and their differing results, it is not possible to conclude whether or not there is a relationship between overcrowding and general adult mental health.
- 1.38 WOMEN: Limited evidence suggests that there may be a relationship between overcrowding and mental health problems among women. It is not clear from the evidence whether this relationship is independent.
- 1.39 MENTAL HEALTH AND BLACK AND MINORITY ETHNIC COMMUNITIES: Two relevant but small-scale studies on the relationship between overcrowding and the mental health of black and minority ethnic households were found. There is insufficient evidence however to conclude that there is a relationship.
- 1.40 SCHIZOPHRENIA: There is limited evidence on household overcrowding and schizophrenia. The evidence is however, inconclusive in this area.
- 1.41 CHILD MENTAL HEALTH: There is recent evidence of a relationship between overcrowding and children's mental health. In many of the studies however, there was limited control of confounding variables and as a result it is not possible to conclude the independence of this relationship.

CHILDHOOD DEVELOPMENT, GROWTH AND EDUCATION (SEE CHAPTER 4)

- 1.42 SOCIAL AND EMOTIONAL DEVELOPMENT: There is some limited evidence to support a relationship between overcrowding and social and emotional development in children although it is not clear whether this is independent of confounding factors. Some earlier studies from the 1970's do not support a relationship.
- 1.43 PHYSICAL STATURE: There is mixed evidence on the relationship between overcrowding and physical stature and growth. However, one recent study found household overcrowding during childhood to be significantly and independently associated with slow growth rate. It is not possible on the basis of the available evidence to draw conclusions about the relationship between overcrowding and poor physical stature and growth rates.
- 1.44 EDUCATION: The very limited evidence available points to an independent relationship between overcrowding and educational attainment. This conclusion is drawn mainly from a single study in France and although it is supported by earlier research, it needs to be treated with care.

OTHER IMPACTS INCLUDING PERSONAL SAFETY (SEE CHAPTER 5)

- 1.45 This review identified four relevant studies on accidents and child maltreatment.

- 1.46 ACCIDENTS: The limited amount of good quality research on overcrowding and accidents in the home makes findings inconclusive. There is evidence of a relationship, but its strength is unclear. Other factors, such as social class and tenure, appear to be more strongly associated with accidents in the home.
- 1.47 CHILD MALTREATMENT: A single study found a significant association between overcrowding and child maltreatment, but other factors were found to be of equal or greater significance.

Further Research

GAPS IN THE EVIDENCE

- 1.48 A significant gap in the evidence on overcrowding relates to educational attainment. Only one recent study was found. It would be extremely valuable to replicate the single recent French study in England.
- 1.49 Additionally, very little is known about the relationship between overcrowding, children's mental health, educational attainment and childhood growth and development. This review identified that there was some research on mental health and childhood development and two studies on childhood development and education. However, none of these covered all three elements and their interconnecting relationships.

ASSESSING THE IMPACT OF ALLEVIATING OVERCROWDING

- 1.50 A study of the impact of housing improvements, in particular overcrowding, on health and education would be extremely useful to understanding the relationship. This would enable policy makers to understand the potential impact of specific interventions in housing in respect to these outcomes, and therefore focus their interventions on those likely to have the greatest impact. This would involve one group of people living in overcrowded housing, matched with another group where overcrowding has been alleviated. Such a study would need to take account of confounding variables.

CHAPTER 2

Physical Health

Introduction

- 2.1 Over 40 studies were found on the impact of overcrowding on the physical health of adults and children. These varied considerably in their approach. The vast majority of studies were quantitative and most were based on diagnosed illness rather than on self-reported health. There is therefore little evidence on people's own perceptions of the impact of overcrowding on their health and well being.
- 2.2 Very strong evidence, in the form of experimental studies linking interventions to reduce overcrowding with health improvements, was absent. Several longitudinal studies were found, in which the health and subsequent socio-economic experiences of a randomly selected group of individuals were followed up. Some studies looking at individual cases attempted to compare the health of those experiencing overcrowding with those who had not. Some studies explored the relationship by looking at individual cases to see if people's exposure to overcrowding had an impact on their health. A number of studies examined the relationship between overcrowding and health by comparing health, illness or mortality rates for different populations or areas. For example, some studies compared levels of ill health in areas that had high levels of overcrowding with those that had lower levels.
- 2.3 The implication of this is that there is evidence to discern potential relationships, and often to identify whether these are independent, but there is a lack of very strong evidence required to demonstrate the *impact* of overcrowding on the physical health of individuals.
- 2.4 The following themes are considered in this chapter:
 - Children's Health.
 - Overcrowding in Childhood and Later Adult Health and Mortality.
 - Adult Health.

Children's health

CHILD MORTALITY

- 2.5 The studies suggest that there may be an independent relationship between overcrowding and child mortality, but the evidence is limited.
- 2.6 Although studies using data collected before 1939 provide evidence of a relationship between overcrowding and child mortality (1), little recent evidence relating to Britain or other industrialised countries was identified. A recent study of the spatial variation of infant mortality in England did identify a widening gap in infant mortality between areas with high or low levels of overcrowded housing (defined as >1.5ppr) (2,3) after controlling for other variables. Furthermore, a Scottish study (4) found significant associations between overcrowding (>1.5ppr) and both stillbirths and perinatal mortality (stillbirths and deaths within the first week of life) but not for infant mortality. However, the study did not control for important confounding factors.

SUDDEN INFANT DEATH SYNDROME (SIDS)

- 2.7 It is not possible to conclude whether a relationship exists between SIDS and overcrowding due to a lack of robust research.
- 2.8 Investigations into the causes of Sudden Infant Death Syndrome have identified overcrowding as a potential factor. According to Blair *et al.* (5), overcrowding could be a contributory factor when associated with bed sharing between infants and parents. Against this, the same study reports raised risks resulting from babies occupying separate bedrooms from parents, an option available in less crowded dwellings. There are many other possible causes of SIDS (such as deprivation, cultural factors, lifestyle factors such as smoking and alcohol consumption). Therefore, the relationship between overcrowding (in terms of persons per room) and SIDS is extremely complex and difficult to unpick.

RESPIRATORY CONDITIONS

- 2.9 A range of large scale and robust studies were found that attempted to adjust for the main confounding variables. Overall, the balance of the evidence from five studies indicates a small relationship between overcrowding and respiratory conditions in children. However, the possible relationship between deprivation and overcrowding in the context of respiratory conditions requires further investigation, as does the relationship between overcrowding and other housing conditions (for example, damp and mould growth).
- 2.10 In relation to respiratory conditions, Marsh *et al.* (6) using cohort data from the National Childhood Development Study (NCDS) found that children who had been overcrowded at birth (defined as >1ppr) were more likely to have some form of respiratory disease at seven years old but not for older children.
- 2.11 Similarly, poor respiratory health in Bristol children aged six-months was found by Baker *et al.* (7) to be significantly associated with overcrowding (defined as >1ppr), but not the severity of wheezing. The study adjusted for some confounding variables including housing

tenure and maternal smoking, but not deprivation, which the authors suspected was the crucial factor. They thought that overcrowding was one of a number of deprivation related mediating factors, leading to ill health.

- 2.12 Mann *et al.* (8) investigated the possible causes for respiratory symptoms in children aged two years. Using robust data from the 1946 Medical Research Council National Survey of Health and Development, they found that overcrowding (>1ppr) at two years of age was an important independent factor. The researchers did adjust for possible confounding variables including parental smoking and social class. They concluded that while overcrowding was a significant and independent factor, it was small compared to others such as parental smoking, parental bronchitis and social class.
- 2.13 Further research was undertaken by Essen *et al.* (9). Using data from the National Child Development Study (NCDS) in England, Wales and Scotland (1958), they found that childhood bronchitis was higher in overcrowded homes, (defined as >1.5ppr) after controlling for social class.
- 2.14 Research by Platt *et al.* (10) did not place much importance on overcrowding as a factor in respiratory conditions in children. Instead, this study placed greater emphasis on the impact of damp housing and mould growth on respiratory illness (as well as headaches and fever) in children, and treated overcrowding as a possible confounding variable. They found that, after controlling for factors such as smoking in the household, there was a significant association among children between living in damp and mouldy dwellings and respiratory conditions.

MENINGITIS

- 2.15 Three studies have yielded good evidence of a relationship between meningitis and overcrowding. These suggest a relationship between childhood overcrowding and meningitis. The strength of the relationship appears to be small and a number of potentially confounding variables were controlled. The three research projects were medium-sized case control studies, which enabled a comparison of those exposed to overcrowding and those that were not.
- 2.16 In a study of children under five in Australia, Clements *et al.* (11) found that there was a small but significant association between overcrowding (defined in terms of persons per bedroom) and meningitis infection. The authors, however, concluded that other variables (for example, day care attendance and recent illness in a sibling) were stronger explanatory factors.
- 2.17 Another study by Baker *et al.* (12) of meningococcal disease in New Zealand, found that the incidence of the disease was independently associated with overcrowding (in terms of persons per room) after controlling for socio-economic factors.
- 2.18 Research by Stanwell-Smith *et al.* (13) in the West of England revealed that meningococcal disease was significantly associated with overcrowding (>1.5ppr), particularly in children under five. This study also adjusted for socio-economic class.
- 2.19 A further study by Rees-Jones *et al.* (14) adopted a different method involving a comparison of bacterial meningitis rates in different wards in the North East Thames Region. This found that that among white children under 5 years of age, bacterial

meningitis rates were twice as high in the most overcrowded wards compared with the least overcrowded. This provided additional evidence of a relationship between overcrowding and bacterial meningitis infection.

TUBERCULOSIS (TB)

- 2.20 Studies have found evidence of an independent relationship between childhood TB infection and overcrowding in deprived areas, such as the Bronx in New York (15) as well as in adults. The link between TB and overcrowding is discussed further in the context of adult health, below.

Overcrowding in childhood and later adult health and mortality

CHILDHOOD CROWDING AND ADULT MORTALITY

- 2.21 There is some evidence that childhood living conditions can affect mortality in adulthood, an example of which is the study by Leon and Davey Smith of 27 industrialised countries (16). They found a significant association between infant mortality rates (an indicator of childhood living conditions) in the period 1921 and 1923 and adult mortality rates for stomach cancer and strokes in the period 1991 to 1993. It is however, far more difficult to establish a relationship between specific conditions (such as overcrowding) and specific causes of death.

CHILDHOOD OVERCROWDING AND ADULT HEART DISEASE AND STROKES

- 2.22 There is evidence to suggest that there is unlikely to be a relationship between overcrowding in childhood and mortality from heart disease and strokes. A study of a randomly selected group of English children in 1948 (17) did not find a significant association between heart disease and strokes and childhood overcrowding. Nor did it find a significant association between childhood overcrowding and cancer (but see below).
- 2.23 A larger scale study in Helsinki (18) also failed to find a significant association between overcrowding in childhood and deaths from coronary heart disease.

CHILDHOOD OVERCROWDING AND ADULT STOMACH CANCER

- 2.24 There is a small body of evidence to support a relationship between childhood overcrowding and stomach cancer in later life but the evidence is fairly weak, and confounding variables have not been adequately controlled for.
- 2.25 Some studies of overcrowding in childhood and stomach cancer have identified a significant association. A study in England and Wales by Barker *et al.* (19) discovered that the most overcrowded areas (overcrowding being defined as >1ppr) in the 1930s had the highest stomach cancer mortality rates between 1968 and 1978. Although this study did not control fully for possible confounding variables, such as socio-economic factors, it

found that in certain areas, notably North West Wales, subsequent deaths were higher than would have been predicted on the basis of its population size and structure.

- 2.26 Swerdlow *et al.* (20) also found that areas with the highest stomach cancer rates in England and Wales (in the period 1968 to 1981) had the highest levels of overcrowding in 1936. They concluded, however, that other indicators of poor social circumstances (including inadequate diet) were more powerful explanatory factors than overcrowding.
- 2.27 A retrospective study was carried out of mortality from stomach cancer amongst a group of people in Chesterfield whose housing circumstances had been recorded in 1936 (21). It found that although death rates were higher among those people who, as children, lived in houses that were overcrowded (defined in terms of numbers of people per bedroom) or lacked a hot water tap, there was no significant association with stomach cancer. However, the number of deaths from stomach cancer among people who had lived in overcrowded conditions was small, which inevitably limits the robustness of this study. The authors acknowledged that further investigation of the group should take place. Other variables have also been identified as possible factors in the development of stomach cancer. For example, one study found that the risk of developing stomach cancer was substantially higher in adults who as children and young people had lived in homes with inadequate food storage facilities (22).

CHILDHOOD OVERCROWDING, HELICOBACTER PYLORI AND ADULT STOMACH CANCER

- 2.28 There has been considerable research into possible risk factors that cause stomach cancers and other gastroduodenal conditions. Overcrowding has been suggested as a possible factor. *Helicobacter Pylori* (*H. Pylori*) has been identified as a possible cause of gastritis and peptic ulcers (23) as well as stomach cancer (24). The research suggests a strong possibility of an overcrowding effect on *H. Pylori* infection in childhood, which is independent of other factors. However, more research is needed to confirm the relationship between overcrowding, *H. Pylori* infection in childhood, and the development of stomach cancer and other gastric conditions in adulthood.
- 2.29 Several studies have explored the prevalence of *H. Pylori* in children and adults and the possibility of a link with living conditions, including overcrowding (25-32). Most have found significant associations between overcrowding and *H. Pylori* infection, even after controlling, for example, for socio-economic class.
- 2.30 However, other factors have been identified as playing a part in childhood *H. Pylori* infection. There is considerable dispute over their relative importance (25). These include:
- sharing a bed or bedroom as a child (26,27);
 - large families (28) or single parent households (29);
 - ethnic status (30);
 - absence of a fixed hot water supply (31); and
 - rented homes (29).

- 2.31 Some studies have, therefore, cast doubt on the strength of the overcrowding factor. It is also suggested that infection may also occur outside the home, in schools and childcare facilities (29 32).
- 2.32 *H. Pylori* has also been associated with reduced rates of growth among girls (29), and delayed growth in older children (33). The relationship between overcrowding and child development is discussed in more detail in chapter four.

CHILDHOOD OVERCROWDING AND ADULT RESPIRATORY CONDITIONS

- 2.33 Overall, the evidence suggests that respiratory conditions in adulthood arise from a range of childhood housing-related factors. Evidence from good quality large scale studies point to a relationship between overcrowding in childhood and respiratory conditions in adulthood, but affecting children differently depending on age. However, the strength and independence of the relationship is unclear, due to lack of evidence on possible confounding variables.
- 2.34 Significant associations have been found between childhood overcrowding and respiratory conditions in adulthood. A study of the 1946 Medical Research Council National Survey of Health and Development cohort, found that those in overcrowded conditions at two years of age were more likely to have chronic cough and low peak expiratory flow rate at age 36 (34).
- 2.35 The study by Mann *et al.* (8) found that overcrowding at two years of age was an independent and significant factor for various respiratory symptoms in adulthood (phlegm, wheeze/asthma, reduced expiratory peak flow rate, but not lower respiratory illness). Other factors, however, were regarded as more powerful explanations of adult respiratory illness (such as atmospheric pollution, parental bronchitis, smoking, and social class).
- 2.36 Another large-scale study of randomly selected individuals found that current overcrowding is a significant factor in predicting risk from respiratory illness in adults (6). The same study found that no clear pathway emerged regarding the exposure of children to overcrowded conditions and their risk of developing respiratory diseases at age 33. However, those overcrowded at age 11 and at birth did have a significantly greater risk of respiratory disease in adulthood.

CHILDHOOD OVERCROWDING AND ADULT SELF-RATED HEALTH

- 2.37 A large-scale study showed that overcrowding in childhood increased the likelihood of poor self-rated health in adulthood. The relationship was weaker than that between housing tenure and poor self-rated health, but nonetheless significant.
- 2.38 The study also found that sharing or lacking amenities in childhood had a weaker relationship with perceived adult health compared with overcrowding (defined as >1ppr). The implication of this is that overcrowding may be a more important factor in such infections as *H. Pylori*, than a lack of amenities, contradicting some other studies noted earlier. This provides support for further research in this field.

Overcrowding in adulthood and adult health

MORTALITY RATES

- 2.39 Overall, two studies provide some limited evidence of an independent relationship between overcrowding and adult mortality rates, particularly for women.
- 2.40 Fox and Goldblatt (36) examined the association between adult standardised mortality ratios (SMRs) and aspects of housing in England and Wales. They found that overcrowding had a strong independent association with female mortality, irrespective of housing tenure. The higher the level of overcrowding the greater the risk of mortality. For example, among women in local authority rented accommodation, those living in houses with 1.5 persons per room or more had a much higher SMR compared with those living at a density of less than 0.75 persons per room. However, the independent association between overcrowding and male mortality was weaker.
- 2.41 A study of District Health Authorities (37) found that the variation in SMR under 65 was associated with a range of socio-economic factors. These included deprivation, rates of unemployment, numbers of unskilled workers, and the level of overcrowding. The latter was found to be an independent and significant factor.

SELF-RATED HEALTH

- 2.42 The limited evidence suggests there is a relationship between overcrowding and self-rated health. The strength and independence of the relationship is less clear. Three studies that use a range of different approaches are contradicted by a single less reliable study from Vancouver.
- 2.43 In a large-scale study in the West of Scotland, MacIntyre *et al.* (38) identified that several features of a dwelling impacted on mental and physical health status. It revealed that overcrowding had a small impact on some aspects of health status, independently of other factors such as age, gender, marital status, and housing tenure. Aspects on which overcrowding had an effect included self-rated health, limiting long term illness, symptoms of anxiety and depression.
- 2.44 A qualitative study in the USA found overcrowding (in terms of persons per room) was related with mental and physical self-rated ill-health (39). A qualitative small-scale study, of overcrowded Bangladeshi households in Tower Hamlets, found similar evidence of self-rated health problems (40).
- 2.45 Dunn's (41) study of households in Vancouver did not find a significant and independent association between overcrowding and self-rated physical health. However, this study was based on a random telephone survey and therefore involved considerable sample bias.

RESPIRATORY DISEASES

- 2.46 Studies reveal a relationship between overcrowding and adult respiratory diseases. But it is possible that other housing or deprivation factors provide more powerful explanations.
- 2.47 Marsh *et al.* (6) found that overcrowding was significantly associated with increased risk of respiratory illness in adults at age 33. A study in Sydney, Australia (42), that compared local authority areas, found overcrowding was significantly and independently associated with bronchitis and emphysema for hospital in-patient cases but not asthma. In a study of variations in hospital admissions for asthma within three West London Boroughs (43), overcrowding, was however, identified as a significant factor. Respiratory symptoms were also reported in the Tower Hamlets study mentioned earlier (40).
- 2.48 Research by Platt *et al.* (10) investigated the impact of damp housing and mould growth on respiratory illness in adults and children. Overcrowding was considered to be related to respiratory illness, but the authors considered it to be one of a number of confounding factors, others included smoking and household income. The study found that, after controlling for these confounding variables, adults living in damp and mouldy dwellings were likely to report more respiratory diseases.
- 2.49 A study of US hospital admissions among the elderly population found that areas with higher levels of overcrowding had significantly higher admission rates for pneumonia, chronic obstructive pulmonary disease and asthma but not acute respiratory infection (44). Finally, a study of respiratory mortality in Copenhagen found that for men, overcrowding was a significant independent factor (45). However, the authors suspected that underlying social and economic conditions might have more explanatory power.

TUBERCULOSIS (TB)

- 2.50 There is strong evidence to support an independent relationship between overcrowding and TB. However, each of the four studies reported (in addition to the earlier reviewed study of TB in children (15)) is of aggregate populations (i.e. the studies are of populations within a particular area rather than groups of randomly-selected individuals). Studies that explore the impact of overcrowding as a risk factor for TB at the individual case level, controlling for other factors, would be needed in order to strengthen conclusions in this area.
- 2.51 There have been several studies of the relationship between TB and overcrowding in adults. An analysis of London boroughs found that TB rates were independently and significantly associated with overcrowding (46). Similar findings were revealed in a study of three West London Boroughs by Landon (43). Cantwell *et al.* (47) found that overcrowding explained some of the ethnic variation in TB rates in the USA. However, Elender *et al.* (48) in a study of England and Wales reported that overcrowding was a highly significant factor in explaining the variation in TB rates, particularly for women, after controlling for other potential confounding variables such as social, demographic and ethnicity measures.

CHAPTER 3

Mental Health

Introduction

- 3.1 The review identified nearly 25 studies that cover, directly or indirectly, the impact of overcrowding on adult or child/adult mental health. Many of these have not been reviewed in previous secondary analysis.
- 3.2 A wide range of research approaches has been used. There were some large-scale studies that considered the relationship between housing conditions and mental health for individuals and groups. Some of these focused on differences between geographical areas. In a few cases, confounding factors were considered including other housing conditions and socio-economic variables. A number of studies incorporated overcrowding within broader indices of housing quality and living conditions, and did not distinguish between the relative importance of the individual factors. We consider these to be less useful. There were a number of small-scale qualitative projects that made little attempt to consider confounding variables. These studies, nevertheless, provide some detail on the processes affecting the relationship between people with mental health problems and overcrowded living conditions. In addition, they usefully focused on the perceptions and behaviour of individuals.
- 3.3 The implication is that the conclusions drawn in this chapter are more tentative than for physical health as they are not based on a high number of objective, large scale studies that have taken into account confounding variables.
- 3.4 Evans *et al.* (1,2) reflects these caveats about the overall assertions that can be made from the evidence. They contend that there are a number of methodological concerns. Firstly, the studies fail to consider the 'health selection' effect i.e. whether housing, including overcrowding, affects mental health or whether mental health affects housing choices. Secondly, in contrast to the research on physical health, there has been a general over-reliance on respondent self-reporting (usually referred to as 'mono-method bias') in the absence of professional diagnoses.
- 3.5 Various definitions of 'mental health' have been used including psychological distress and psychiatric disorders. They have been measured in various ways.
- 3.6 This chapter focuses on the evidence of a relationship between overcrowding and mental health with respect to adults, and children and adolescents.

Adult mental health

GENERAL ADULT MENTAL HEALTH

- 3.7 Nearly a dozen studies on overcrowding and general adult mental health since the 1970s were identified. A range of approaches was used. These included large-scale studies focusing on the differences between geographical areas, specific detailed research on a single council estate, and an analysis of psychiatric admissions to hospital. The findings are contradictory. Five of the studies suggest a relationship, whilst five suggest a limited or no relationship. As a result of the diverse range of types of evidence and their differing results, it is not possible to conclude whether or not there is a relationship between overcrowding and general adult mental health.
- 3.8 A study in North-West England found a direct association between social deprivation and the prevalence of psychiatric morbidity (3). Overcrowding was shown to be significantly associated with mental health (as were many other social disadvantage related factors). However, omitting the three most deprived districts in the region, it was found that these associations (including overcrowding) were not significant. The justification for excluding the three districts was because of low response rates to the health questionnaire. The authors concluded that extreme deprivation (including overcrowding) may be related to markedly higher rates of psychiatric morbidity.
- 3.9 Hopton and Hunt (4) in a study of a single council estate in Glasgow made use of the General Health Questionnaire (GHQ) that incorporates an assessment of mental health. They concluded that dampness (rather than other housing quality factors including overcrowding) was a crucial factor. This factor was significantly and independently associated with mental health problems after controlling for possible confounding variables.
- 3.10 Sadowski *et al.* (5) considered whether childhood disadvantage may contribute to later mental health problems. Using data from the 'Newcastle thousand family study' (1947-1980), they concluded that social and family disadvantages in childhood predispose individuals to an increased risk of major depression in adulthood. Specific individual factors (including overcrowding) of childhood disadvantage, however, were not significantly associated with adult depression.
- 3.11 Earlier research (6) indicated that there was a range of contradictory findings on the impact of overcrowding on mental health. Gove *et al.* (7) and Gove and Hughes (8), in a survey of households in Chicago found that the number of persons per room was strongly associated with poor mental health – psychiatric symptoms, irritation, low self-esteem and nervous breakdown. They identified an independent association of overcrowding and took into account objective (>1ppr) and subjective measures of overcrowding. However, Booth and Cowell (9) in Toronto found that overcrowding (defined as >1ppr and the amount of contact between family members) had a marginal effect on mental health – thus suggesting a small relationship.

- 3.12 Other studies from the 1970s were similarly contradictory in their findings. For instance, Galle *et al.* (10) suggested that there was only a small relationship between overcrowding and mental health, whilst research in Britain by Bagley *et al.* (11) and Bagley (12) suggested a significant relationship between psychological illness/neurotic conditions and housing quality (including overcrowding). The latter study, however, made little attempt to consider the relative significance of specific housing factors (such as overcrowding).
- 3.13 Schweitzer and Wen-Huey (13) in a study of psychiatric admissions in New York found that overcrowding was a poor predictor of mental illness, especially for white households. They used four measures of population density – one of which was household overcrowding (>0.75ppr). They also took into account a range of other variables including socio-economic status, ethnicity and migration.

WOMEN'S MENTAL HEALTH

- 3.14 Limited evidence suggests that there may be a relationship between overcrowding and mental health problems among women. It is not clear from the evidence whether this relationship is independent.
- 3.15 Gabe and Williams (6,14,15) have explored the relationship between overcrowding, women and mental health. Overcrowding was assessed by an objective banding of persons per room, while mental health was measured by psychological symptoms through the General Health Questionnaire. It was concluded that low as well as high levels of overcrowding were detrimental to the psychological health of women. This finding was found to persist after some other variables were controlled for, but the authors acknowledged other housing attributes needed to be considered such as property condition. The quality of these findings was also limited as they extracted information from a dataset that was collected for other purposes – a community survey in West London in 1977 on the impact of aircraft noise on health.
- 3.16 Wells (16) undertook a limited small study of housing quality and women's mental health in Michigan. It focussed on a two-stage approach – a pre-move interview while the 31 women were living in overcrowded conditions and a post-move interview that took place at least five months after moving to a new property. The study concluded that overcrowding and indoor climate were associated with poor psychological well being.

BLACK AND MINORITY ETHNIC (BME) HOUSEHOLDS

- 3.17 Two relevant but small-scale studies on the relationship between overcrowding and the mental health of black and minority ethnic households were found. There is insufficient evidence however to conclude that there is a relationship.
- 3.18 Kempson's (17) in-depth interviews with Bangladeshi households in Tower Hamlets indicated a wide range of difficulties associated with overcrowding including lack of privacy, broken sleep and conflicts over the use of rooms.
- 3.19 A small-scale study of stress among BME households in Glasgow found that Muslims and limited English speakers were particularly susceptible. They found that experiences in the workplace and experience of assault were significantly associated with stress, whilst overcrowding was not (18).

SCHIZOPHRENIA

- 3.20 There is limited evidence on household overcrowding and schizophrenia. Torrey and Yolken (19) reviewed a small number of studies. The evidence is however, inconclusive in this area.
- 3.21 The literature review suggested that there is a relationship with between schizophrenia and overcrowding. Their review was, however, selective and drew heavily on Galle *et al.* (10) and Schweitzer and Wen-Huey (13). We have already considered these studies under general mental adult health and noted that they both in fact suggested that overcrowding was a poor predictor for mental health problems.

Children and adolescents

- 3.22 There is recent evidence of a relationship between overcrowding and children's mental health. In many of the studies however, there was limited control of confounding variables and as a result it is not possible to conclude the independence of this relationship.
- 3.23 The studies found adopted a range of approaches including large-scale population studies, and comparisons based on different geographical areas.
- 3.24 Four studies in the USA point to a significant association between overcrowding and children's mental health. Additionally three British studies each indicate a significant association between children's mental health and both housing conditions and deprivation, though the evidence from these studies on overcrowding is less clear.
- 3.25 Recent studies by Evans *et al.* (20, 21) and Evans and English (22), in the USA, have generally concluded that housing quality predicts psychological health issues. They indicate that overcrowding is significantly associated with children's mental health. Evans *et al.* (20), in their study of 300 children in a rural part of upstate New York, commented that 'children living in lower-quality housing, independent of household income, have greater symptoms of psychological distress' (p394). This study was supplemented by focussing on overcrowded households incorporating an urban population sample. The results demonstrated a significant association between the number of persons per room and an index of psychological health. Research by Obasanjo (23) in the USA reveals a similar significant association for a study of nearly 700 African American adolescents.
- 3.26 Blackman *et al.* (24) in a study of two housing areas in Northern Ireland, and Hunt (25) in a study of England and Scotland, found that symptoms of psychological distress among children were significantly associated with housing problems. The former involved a comparison of two deprived estates. The authors found that children on one estate that had more severe housing problems had higher rates of self-reported psychological distress. Overcrowding was one of a number of housing factors, but the research did not assess the relative importance of each factor. The latter showed that emotional problems (such as bed-wetting and temper tantrums) among children were related to housing problems. However the specific relationship between overcrowding and mental health was not explored.

- 3.27 Rutter *et al.* (26) undertook a comparative study of ten-year old boys and girls in the Isle of Wight and a London Borough. They identified four sets of variables, which were associated with emotional disorders, conduct issues and reading retardation. They concluded that in the London Borough there was a relationship between overcrowding and mental health. However, the study was not sufficiently robust to identify the relative importance of overcrowding compared with other deprivation factors. In addition, the research made no attempt to assess the relative significance of each of the four variables – family discord, school characteristics, parental deviance and social deprivation.

CHAPTER 4

Childhood Development, Growth and Education

Introduction

- 4.1 The review found relatively little research on overcrowding and childhood development and growth. In total, 17 studies were identified. The majority of recent research (especially on socio-emotional development) is from the USA (1,2). A range of research methods has been adopted. These included longitudinal studies, where, for example, the height or growth rate of a cohort of people was followed up. Other studies involved comparing the relationship between overcrowding and childhood development among different populations. There was a tendency for a number of studies to incorporate overcrowding within broader indices of housing quality and living conditions. Often, these did not distinguish between the relative importance of the individual factors. As such, these are considered to be less robust.
- 4.2 Limited research on the relationship between overcrowding and educational attainment was found. There are some policy oriented studies that suggest potential links between housing quality and educational attainment (see for example Furley (3) and Power *et al.* (4)). The difficulty of completing homework in overcrowded housing is frequently noted. But there is no robust research base. However, a single recent and robust French study on overcrowding and educational attainment was found.
- 4.3 Evans *et al.* (1,2) note that childhood development may overlap with mental health, physical health and educational attainment. Studies suggest that overcrowding might indirectly affect childhood development because of physical or mental health issues. This could subsequently affect educational attainment. However, no research has been undertaken into the inter-linkages.
- 4.4 This chapter focuses on three areas: social and emotional development, physical stature, and educational attainment.

Social and emotional development

- 4.4 Overall, there is some limited evidence to support a relationship between overcrowding and social and emotional development in children although it is not clear whether this is independent of confounding factors. Some earlier studies from the 1970s do not support a relationship.

- 4.5 Recent studies by Evans *et al.* (1,2) have pointed to a relationship between housing quality and learned helplessness and distress. In one study (5) they identified an independent association, but in others (6, 7) housing quality was found to be significant. However no attempt was made to identify the relative importance of overcrowding compared to other housing quality factors.
- 4.6 In a study of secondary data from a language acquisition project in Kansas, Evans *et al.* (8) found that that parents in overcrowded homes speak in less complex and sophisticated ways to children compared with those not in overcrowded accommodation. They conclude that there is a relationship between overcrowding and delayed cognitive development in children.
- 4.7 Based on a small sample of primary school children in Dundee, Murray (9) found that children from overcrowded homes tended to be more aggressive, impulsive and extroverted. The study did not adequately disentangle possible confounding variables, such as, for example, socio-economic status.
- 4.8 Research in Toronto by Booth and Johnson (10) in the 1970s showed only a limited association between overcrowding and the physical and intellectual development of children. Their study compared children living in overcrowded and non-crowded conditions. This involved consideration of both neighbourhood density and household overcrowding. It was based on a large-scale stratified sample of over 550 households. The authors commented that 'parental health and socio-economic status are much more momentous in child health and development than household crowding' (p746).

Physical stature

- 4.9 There is mixed evidence on the relationship between overcrowding and physical stature and growth. However, one recent study found household overcrowding during childhood to be significantly and independently associated with slow growth rate. It is not possible on the basis of the available evidence to draw conclusions about the relationship between overcrowding and poor physical stature and growth rates.
- 4.10 Kuh and Wadsworth (11) studied childhood environment and subsequent adult height. The Medical Research Council's longitudinal survey of health and development was used. The authors found that living in overcrowded circumstances in childhood (in the 1940's) was significantly associated with adult height in later life. However, they also noted that birth weight, number of surviving younger siblings, a low level of maternal education and a low level father's occupation were also significantly associated with adult height in later life. They commented that environmental conditions have improved markedly since the childhood of this cohort in the late 1940s and early 1950s, and suggest that there are now likely to be improved chances of overcoming issues of poor height attainment.
- 4.11 Montgomery *et al.* (12) utilised the National Childhood Development Survey (NCDS) in investigating the reasons for slow growth in childhood. They took account of the effects of a range of variables including deprivation and concluded that both family conflict and household overcrowding during childhood were significantly and independently associated with slow growth to age seven years.

- 4.12 Previous research in the 1970s and 1980s provides little support for these findings. Booth and Johnson (10) concluded that overcrowded conditions had a minor effect on physical development. A study by Essen *et al.* (13, 14) supports this finding. Research carried out by Gulliford *et al.* (15) on the social environment and height of primary school children in England and Scotland in the late 1980s also concluded that there was only a limited relationship between overcrowding and physical development.

Educational attainment

- 4.13 The review identified that there are few studies on the relationship between overcrowding and educational attainment and only one recent study. There are a number of policy-orientated reports that suggest potential links between housing quality and educational attainment – see, for example, Furley (3) and Power *et al.* (4) in which the difficulty of completing homework in overcrowded housing is frequently noted.
- 4.14 The very limited evidence available points to an independent relationship between overcrowding and educational attainment. This conclusion is drawn mainly from a single study in France and although it is supported by earlier research, it needs to be treated with care.
- 4.15 A high quality study by Goux and Maurin (16) found a very strong significant relationship between overcrowding and school performance. The findings were that children who grew up in a home with at least two children per bedroom are both held back and drop out of school much more often. More than 60 per cent of children at age 15 living in overcrowded conditions have been held back in primary or middle school. The relationship between educational attainment and housing conditions (especially overcrowding) can only partially be explained by other variables such as differences in income and number of children.
- 4.16 This study is supported by findings from earlier studies. In the 1970s, Essen *et al.* (13,14) found that on reading and mathematical tests, children in overcrowded conditions (>1.5ppr) performed less satisfactorily than their counterparts in non-crowded conditions. Tenure was found to be a better predictor of educational attainment.
- 4.17 Conley (17), in an American study investigated the relationship between socio-economic status (including family background), household living conditions (including overcrowding) and educational attainment. The study found that tenure and overcrowding each have an impact on educational attainment but that housing quality is less significant. The study made no attempt to analyse the relative significance of different aspects of household living conditions.

CHAPTER 5

Other Impacts Including Personal Safety

Introduction

- 5.1 The secondary literature suggests that overcrowding may have a wide range of additional impacts. These include personal safety and accidents, domestic violence and fire risk.
- 5.2 Most studies on accidents do not explicitly focus on overcrowding. The emphasis is on property conditions, basic amenities and the neighbourhood environment. We, however, identified three studies on overcrowding and accidents in the home. Each of these were centred on a specific geographical area and focused on the factors that might be associated with particular types of and/or severity of accidents in the home.
- 5.3 The review identified a single study on overcrowding and child maltreatment but no studies that focused on the relationship between overcrowding and domestic violence or fire safety.
- 5.4 There is a considerable discussion in the literature on fire safety at home (1, 2, 3). This identifies that properties most at risk of fires include houses in multiple occupation (HMOs).

Accidents

- 5.5 The limited amount of good quality research on overcrowding and accidents in the home makes findings inconclusive. There is evidence of a relationship, but its strength is unclear. Other factors, such as social class and tenure, appear to be more strongly associated with accidents in the home.
- 5.6 Alwash and McCarthy (4) carried out a study of 400 children attending an accident department in a West London hospital over a twelve-month period. They concluded that there was an association between accidents in the home and overcrowding (>1.5ppr) for all ethnic groups. However, there was a much stronger association between accidents in the home and social class, unemployment of mother, and tenure.
- 5.7 A study in the USA found similar results. Anderson *et al.* (5) undertook a study of Hispanic and non-Hispanic children in California. This showed that injuries to children with a non-Hispanic background were higher in neighbourhoods with major levels of household overcrowding (defined as >1ppr).

- 5.8 One small study examined the incidence of traumatic dental injuries to 14-year-old children in Newham (6). It noted that there had been a major increase in the prevalence of these types of injuries between 1995/6 and 1998/9. The study found that there was a relationship between deprivation measures including overcrowded households and this type of injury. They, however, reached no conclusions as to the significance of relationship. No attempt was made to consider the independent effect of overcrowding.

Child maltreatment

- 5.9 A single study found a significant association between overcrowding and child maltreatment, but other factors were found to be of equal or greater significance.
- 5.10 Using the Avon Longitudinal Study of Parents and Children (ALSPAC), the researchers identified 115 children who had been placed on the child protection register (7) The authors concluded that four deprivation indicators (including overcrowding) independently showed significant associations with registration (defined as >1ppr). There were stronger associations between the other indicators of deprivation (maternal unemployment, high mobility and a poor social network) and child maltreatment.

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ANNEX ONE

Methodology

1 Data Sources

A number of sources were used to identify articles for the review. They included academic and policy-related databases, websites of key research bodies and other internet sources such as Google and Amazon. The sources accessed in the study are summarised in Table 1 below.

Table 1: Sources Accessed in Literature Review
<p>Databases</p> <p>ASSIA (1987 to date); Australian Education Index (1976 to date); British Education Index (1976 to date); British Humanities Index (1962 to date); Childdata; Education Research Abstracts (1995 to date); ENHR 2000; ERIC (1966 to date); Expanded Academic ASAP (Infotract) (1980 to date); Health Management Information Consortium; International Bibliography of the Social Sciences (1951 to date); Medline (1950s to date); Social Sciences Citation Index, Science Citation Index (1981 to date); Ubadisc; Zetoc (1993 to date)</p>
<p>Internet Sources</p> <p>Amazon; British Library; British Medical Journal; Housing Studies; Google; Ingenta; Social Science Information Gateway; SwetsWise; Taylor & Francis (including Health, Risk & Society and Housing, Theory & Society; The Policy Press)</p>
<p>Key Organisations</p> <p>Building Research Establishment; Centre for Housing Policy; Centre for Health Services and Policy Research – Vancouver; CITTA (government information service); Cochrane Reviews; Child Poverty Action Group; Crisis; European Commission; Faculty of Public Health of the Royal College of Physicians; Health Development Agency; Health Survey for England; Joseph Rowntree Trust; King’s Fund; National Centre for Social Research; Shelter; World Health Organisation</p>

2 Search Strategy

The initial task for the search strategy was to define the potential nature of the health and educational effects of overcrowding. This involved classifying the likely impacts e.g. physical and mental health, child development, educational attainment and other considerations.

Prior to the search of the above sources being undertaken, a scoping study was undertaken to explore the range of definitions of ‘overcrowding’, appreciate the policy context of the research, and identify key journals and research terms.

Depending on the database/source in question, a number of search terms were used such as 'overcrowding', 'crowding', 'houses in multiple occupation', 'health', 'physical health', 'mental health', 'child development', 'academic achievement', 'educational attainment', and 'deprivation'. The search term words were checked against the thesaurus of the databases prior to searching to ensure the most appropriate term was used. In a number of cases 'overcrowding' or 'crowding' were deemed to be too specific and 'housing' was used.

In addition to searching databases, a snowballing research technique was adopted, by which potential additional sources identified in reference lists of key journal articles or bibliographies of books were followed up. The research team also undertook a citation search of key articles to identify other potential sources of data.

3 Study Selection

The search identified over 250 articles not accounting for overlap between databases) and the citation analysis of key papers retrieved over 800 articles (again not accounting for overlap).

It was decided to focus on studies undertaken in OECD countries. Given the time constraints of the review, articles in languages other than English were excluded, as were book reviews, newspaper articles and policy reports. Publications, which merely reported on levels of overcrowding in particular areas, were also excluded.

The titles and abstracts of papers were scanned and checked in relation to household overcrowding for initial inclusion. In total, over 150 papers were read and once the quality of studies was assessed using the data extraction form shown below, just over 80 were included in the final review. Over 70 papers were rejected – mainly because they were either policy reports rather than primary research or failed to meet other selection criteria (especially research undertaken in OECD countries)

Due to the time constraints of the project, it proved difficult to access 'grey literature' such as dissertations and conference papers.

4 Data Extraction and Analysis

A data extraction form was developed to record details of the evidence identified in the review of the 80 studies. The form documented information relating to the study methods and location, and the findings and impact of each study. Given that the review was also assessing the quality of evidence of the health and education impact of overcrowding, a system for classifying the relevance and quality of each study was devised drawing on the work of Thomson *et al.* (1), Khan *et al.* (2), and LSDA (3). The analysis of each paper took account of the conceptual framework, study design, sampling, results, analysis and conclusions. These factors have been used in assessing the quality of the individual studies as either high, medium or low quality. A copy of the data extraction form and assessment criteria is provided below.

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DATA EXTRACTION FORM

Reviewer:	TB	RB	RH	KJ	Article No:	Review Date:	
Title:							
Author(s):				Publication Date:			
Publisher:				Place of Publication:			
Journal:				Volume:		Number:	Page No:
Study Methods and Location:							
start/end date (length) of research project:							
location of study:							
study context (education, health etc):							
type of sample (random, convenience, quota, purposeful, census, not stated):							
number of participants (type of participants, housing type)							
type of research (primary, secondary research):							
how the study was undertaken:							
definition of overcrowding used							
intervention used (if relevant):							
Findings/Impact:							
what outcomes are measured:							
impact on health:							
impact on education:							
impact on other factors:							
evidence of how overcrowding effects the above?							
Author Conclusions:							
Overall Assessment:							
Rating: Quality of Research				Rating: Relevance to Study			
A	High Quality			1	Extremely Relevant		
B	Medium Quality			2	Quite Relevant		
C	Low Quality			3	Marginal Relevance		
D	Remove			4	Remove		

Conceptual framework:	Yes	No	Results and analysis:	Yes	No
Aims clearly stated Research questions clearly identified Clearly linked to existing body of knowledge			<i>Quantitative</i> Results valid and reliable Results clearly described All relevant outcome measures included Analysis clearly described Statistical significance tested Statistics accurate		
Study design:					
Methods appropriate to stated aims Methods clearly and adequately described Context of study described and accounted for Design takes into account possible bias Design takes into account confounding factors Limitations of research explicitly identified			<i>Qualitative</i> Results valid and reliable Results clearly described All relevant outcome measures included Sufficient evidence to demonstrate results grounded in the data Analysis clearly described Analysis systematic and reliable Validity of findings assessed		
Sampling:			Conclusions:		
Sample clearly described and justified Sample adequate (e.g. size) Response rate adequate			<i>Quantitative</i> All possible influences on the observed outcomes considered Conclusions linked to aims of study Conclusions linked to analysis and interpretation of data		
			<i>Qualitative</i> All possible influences on the observed outcomes considered Conclusions linked to aims of study Conclusions linked to analysis and interpretation of data		

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