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Housing space and occupancy standards: developing evidence for policy from a health and wellbeing perspective in the UK context

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ABSTRACT

Issues of domestic space standards and occupancy levels rarely receive much attention in debates about UK housing and planning policies. This is exemplified by examining the history of space and occupancy standards as applied in England, demonstrating that standards have been under-specified, partial in coverage, and applied inconsistently. The outcomes are seen in the production of relatively small homes, overcrowding and (perversely) extensive under-occupation, residential dissatisfaction and mobility. Evidence for the health and wellbeing impacts of space shortages highlights the consequences for infectious diseases, particularly respiratory illness, mental health and stress, and educational attainment. Moreover, the mediating and moderating roles of domestic space upon the impacts of the Covid-19 pandemic show the crucial importance of space and occupancy standards for health, wellbeing and learning in a future where more time is spent at home. Areas of future research are identified which together could help address a probable underestimate of the current health sector costs of inadequate domestic space, this being an important lever for policy action. Such evidence, including crucially more from the UK itself, has an important role to play if stronger, more effective policies are to be developed and implemented in this area in future.

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Introduction

Space standards and occupancy rates are rarely mentioned as key issues to be addressed in UK housing, too often and understandably eclipsed by other issues. At the present time, the focus of commentators on the UK housing situation is mainly on issues of housing shortage and affordability, often referred to as the ‘housing crisis’ (Osborne et al., 2021) with the Government responding with an intention to tackle the ‘under-supply’ of housing (Barton & Wilson, 2021). These problems are seen as exacerbated by the two main events of the last few years, namely Brexit and Covid-19, resulting in shortages of materials and labour (Stephens, 2021; Inside Housing, 2021), with the latter also having had a notable effect on the perpetual problem of homelessness (Fitzpatrick et al., 2021). When housing conditions are attended to, the attention has shifted somewhat (though not entirely) from the meeting of minimum standards of quality – be it the Decent Homes standard, Tolerable Standard or Unfitness, although these are still routinely measured – to the twin issues of the energy efficiency of the housing stock and the move towards carbon neutrality (Committee on Climate Change, 2019). Where the relationship

between households and dwellings is considered, this tends to be in terms of the (mis)match between household growth and housing supply in aggregate terms (Perry, 2021) rather than through any discussion of space standards or occupancy.

At the same time, the moved towards evidence-based policy from the New Labour period onwards in the UK is observed to have waned somewhat, with the question raised ‘whatever happened to evidence-based policy making?’ alongside a call for its restoration (Banks, 2018) or for the improvement in the use of evidence in policymaking (Panjwani, 2017). The advent of Covid-19 in January 2020 and the use of scientific evidence in the policy response has if anything deepened concerns about the use or misuse of evidence in policy-making (Abbassi, 2020). However, in the area of concern here, it is not that evidence has not been used to aid the development of policy on space standards and occupancy levels but that it could be used much better and with potentially more effect. Evidence has thus far been used to define space standards on two grounds: the need to accommodate every-day activities at home or to maintain a certain standard of living through the

allocation of space to certain items of furniture or equipment; or on moral grounds in terms of acceptable levels or configurations of sharing space between adults and/or children.

Although there has been acknowledgement of the role of space and occupancy standards for the suitability of dwellings for accommodation purposes, as we shall see, they have tended to be under-specified, partial in coverage, and applied inconsistently over time. Furthermore, since the early days of space standards and occupancy regulations, research has moved on but, despite this, evidence is less often considered around the health and wellbeing impacts of space and occupancy, in particular for mental health, ‘social harms’ (see below) and child learning and educational attainment, nor on the effects of space needs on residential mobility and the functioning of the housing system.

Reviewing space and occupancy standards and their effects in the UK context

In the following two sections we review the development and application of space and occupancy standards in the UK (specifically England) over time and the consequences of these for the housing system in terms of dwellings and mobility behaviour. The starting point for this review is the historical account given by Park (2017), although it is worth recalling some of the distinctive characteristics of the UK housing context. UK housing tends to be older than that in many other countries, with nearly two-in-five dwellings pre-1940; these tend to have larger useable floor area and larger plots (Rottier, 2018), which may influence space norms for the UK population. UK house construction rates are low, with a completion rate over the past decade of 2.2–3.0 dwellings per 1000 people, compared with a rate of 3.0–6.0 for several European countries and 6.0–8.0 for USA and Australia (Stephens et al., 2020, Table 118); this means that adjusting UK space standards may be more difficult and take longer than elsewhere. Although home ownership is slightly lower in the UK than across the EU (65% vs. 70%), many more UK owners have mortgages (38% vs. 27%) and more UK households incur an ‘excessive housing cost burden’, paying 40% or more of disposable income on housing (16% vs. 10%) (*ibid.*, Tables 119 and 122); again, this may mean that responding to space shortages may be more difficult, through moving or home extensions.

The following section examines the available evidence for the health and wellbeing impacts of space shortages, the starting point being the World Health Organisation’s Housing and Health Guidelines (WHO, 2018). The final main section looks at the additional

evidence and implications for the future arising from the recent Covid-19 experience, for which two initial sources are used, evidence assembled by the UK Office for National Statistics (ONS, 2020) and by the UK Health Foundation (www.health.org.uk). For each of the main sections, studies cited in the main review sources were supplemented by items identified through google scholar, and by the author’s own knowledge. Thus, this is a literature review or expert opinion/policy review rather than a systematic review (Munn et al., 2018). Another limitation is that country-specific studies of the relationships between health and dwelling space, occupancy levels or confinement effects do not identify the national space or occupancy standards at the time, leaving their relevance to be inferred.

In the discussion, we review recent calls to tackle poor-quality housing and to improve housing standards for health-related reasons before setting out why and where more and better evidence would support the case for space and occupancy standards being prioritized within the emerging agenda.

Space and occupancy standards

In this section, we look at how housing space and occupancy standards have developed over from time 1918 to 2020 in England, and been applied and enforced in different parts of the housing market. We then consider the outcomes of these policies in housing terms such as dwelling size, overcrowding and residential mobility.

A brief history of space standards in England¹

Not since the heyday of housing construction in the early to mid-twentieth century has the UK had space standards that applied to the majority of new housing construction, being public sector at the time. After the first world war, the Tudor Walters Committee was the first body to set out minimum space standards for dwellings as a whole and for bedrooms, living rooms and ‘parlours’ or sitting rooms (Local Government Board, 1918). Adherence to the Tudor Walter standards only lasted around three years before subsidies and standards were cut in 1923. After the Second World War, designs provided in the government’s Housing Manual specified internal floor areas for houses and flats with different numbers of bedrooms (MHLG, 1949). Later, Design Bulletin 6 (MHLG, 1963) laid out the space standards from ‘Homes for Today and Tomorrow’ which became known as the Parker Morris Standards (MHLG, 1961). These were based on a functional analysis of furniture layouts per room, circulation space, and storage needs. Minimum floor areas for different

Table 1. Change in space standards: Tudor Walters, 1918 to Parker Morris, 1961.

	5-person house plans (m ²)				
	TW (All)	TW (Parlour)	PM	% Change: TW All	% Change: TW Parlour
Total: living, dining, parlour	21.3	29.2	25.1	+18%	−14%
Total: bedrooms	34.5	38.9	29.1	−16%	−25%
Maximum dwelling size	102.8	—	89.3	−13%	—

Source: Adapted from Powell (1974).

dwelling types with different numbers of occupants were stated, which in effect became maximum sizes for dwellings built with public subsidy. A comparison of Parker Morris standards with Tudor Walters's recommendations from forty years earlier indicates that PM standards were slightly lower, particularly compared with parlour houses (Table 1). This 'lack of influence of the increasing wealth of occupants' upon space standards has been partly attributed to the shift from suburban to inner city building under slum clearance programmes (Powell, 1974). However, although the Parker Morris requirements were abolished in 1980, they remain influential and an important yardstick by which space standards and dwelling sizes are judged (Franklin, 2006; Howard, 2018).

Since 1980, the two main areas where space standards have been developed have been for housing associations (providing the majority of social housing developments at this time), by the Housing Corporation (HC) and Homes and Communities Agency (HCA), and for housing in London, by the Greater London Authority (GLA). The HC set out ranges in dwelling size acceptable for state subsidy for units of specified numbers of bedspaces and storey heights; this was done in 1983 ('Design and Contract Criteria'), 1993 ('Scheme Development Standards'), 1997 ('Housing Quality Indicators') and 2007 ('Design and Quality Standards') (Housing Corporation, 1983, 1993, 1997, 2007). At the same time, the National Housing Federation, the trade body for housing associations, developed its own recommended space standards for housing association developments 'Standards and Quality in Development' published in 1998 and updated in 2008 (Drury, 1998, 2008). The first version included guidance on dwelling layouts to accommodate furniture of specified types and sizes while the second version included 'indicative minimum dwelling areas'. While the former was adopted in the sector as good practice, the latter were not widely used due to the 'minimum dwelling areas' exceeding HCA minimum standards for funding (Park, 2017). At this time, the HCA also recognized that its minimum space standards were probably insufficient, consulting on a set of higher standards

in 2010 (Homes & Communities Agency, 2010). However, the Coalition Government at the time, concerned about higher costs and with an intention to cut grant funding, chose not to proceed with the updated standards, and in 2014 abolished the existing space standards for housing association developments.

The twentieth century has also seen attempts to protect space standards in London due to concerns about falling dwelling sizes in the capital. The GLA commissioned a report from HACT which recommended the use of minimum room areas supplemented by minimum dwelling areas (Drury, 2006). The GLA subsequently published a London Housing Design Guide (LHDG) in 2009, which was incorporated into its Housing Supplementary Planning Guidance (HSPG) (Greater London Authority, 2012). Minimum dwelling floor areas (for different types of unit, with storage and private open space) were applied to all new housing in the capital, while minimum room areas and widths were applied to developments on London Development Agency (LDA) land or with public funding support. In the HACT report, it was the minimum room areas that were to be the main safeguard with the minimum dwelling floor areas set low as a result, yet it was the latter that was more widely applied.

Housing standards review 2012–2015

In an effort to boost the housing sector following the Global Financial Crisis of 2008–2010, the coalition government launched a de-regulation exercise, the Housing Standards Review, to meet industry demands to be free of variable local housing requirements. The eventual result was a uniform set of Nationally Described Space Standards (NDSS) in 2015, comprising minimum Gross Internal Floor Areas (GIAs) for flats and houses with different numbers of bedrooms and bedspaces, plus minimum sizes and widths for bedrooms and minimum floor areas for built-in storage (DCLG, 2015). The floor areas for flats met a Lifetime Homes standard (capable of adaptation), while those for houses were at a slightly lower, basic accessibility standard.

Table 2. Change in space standards (m²): Parker Morris (1961) to nationally described space standards (2015).

		PM (1961)	NDSS (2015)	% Change
1 person	1 storey	30	37	+23%
2 person	1-bed, 1 storey	45	50	+11%
3 person	2 bed, 1 storey	57	61	+7%
4 person	2 bed, 1 storey	70	70	0
4 person	2 bed, 2 storey	72	79	+10%
5 person	3 bed, 2 storey	85	93	+9%
6 person	3 bed, 2 storey	92	102	+11%
6 person	4-bed, 2 storey	92	106	+15%

Source: Adapted from Park (2017).

NDSS were slightly larger than the Parker Morris Standards of the 60 and 70 s, representing on average about a 10% increase in recommended dwelling sizes, with larger increases for one-person and six-person dwellings (Table 2) and they applied to all housing tenures. However, there were several important caveats to their implementation. Most notably, the space standards were to be applied at the discretion of planning authorities, *i.e.* optional, not compulsory. Furthermore, in order to apply the standards, a local authority had to show that they were needed and would not undermine the viability of a development. This twin requirement was considered a major difficulty to the adoption of the standards, leaving them open to challenge by developers on a case-by-case basis (RIBA, 2015). At the same time, an unwelcome consequence of the introduction of the NDSS was the withdrawal of the minimum space standards that had been a requirement of funding for housing association developments and for s.106 affordable housing provision within private developments (Park, 2017).

Occupancy standards

Space standards attempt to influence the size of new housing developments according to their intended use, but in order for that to work effectively, there would also need to be controls over subsequent occupancy, but this is an area where policy has been weak from at least the 1930s to the present day. In an earlier era when the private rented sector was more significant than it has been subsequently (although it is growing again today), and when overcrowding was a major problem, the Housing Act 1935 attempted to introduce controls on occupancy within the sector. Two definitions were introduced in order to do this: overcrowding was defined using a 'room standard' (effectively, where two people of opposite sex, over ten years old, had to sleep in the same room); further, maximum occupancy numbers were defined according to the number and size of 'living rooms' in a dwelling. These standards were intended to be improved upon but were replicated fifty years later in the Housing Act

Table 3. Space occupancy standard, Housing Act 1985.

Permitted number of people is the lower of the result of each of two tests			
Living room test ^a		Floor area test	
No. of rooms	No. of people ^b	Room floor area	No. of people
1	2	10.22 m ²	2
2	3	8.36–10.22 m ²	1.5
3	5	6.5–8.36 m ²	1
4	7.5	4.65–6.5 m ²	0.5
5	2 per room	No. rooms of each size	Total no. people

^aNumber of living rooms in dwelling, excluding rooms of <50 sq.ft (4.65 m²).

^bChildren under 1 year do not count; children under 10 years = 0.5.

1985 space standard (Table 3), even though they were considered to be 'even lower by contemporary standards' (Park, 2017, p. 27).

The result is that statutory overcrowding is considered by government to be 'rare' (ODPM, 2004), and policy for, and action on, enforcement lacking. It was also noted recently that local authorities do not prepare reports on the extent of overcrowding in their areas (which legislation enables) and that legal action to address overcrowding in council housing rarely proceeds to court (Wilson & Barton, 2021). In response, official statistics have adopted a measure of overcrowding using the 'bedroom standard' rather than relying on the statutory 'space standard' definition or data on enforcement: the bedroom standard compares the number of bedrooms required by a household according to the age, sex and relations of its members against the number of bedrooms in the dwelling (Table 4), with overcrowding and underoccupancy recorded accordingly (MHCLG, 2020).

Application of standards over time

There are a number of observations we can make about the use of space standards over the years. Rarely have space standards been applied equally across all housing tenures, the exceptions to this being the GLA's standards of the 2010s – although even here, the secondary standards on rooms sizes were not enforced in the private sector; and the more recent post-2015 standards, although applying to all tenures, are not mandatory. There have been two recent and stronger applications of space standards to small parts of the private sector. After reviewing the NDSS in 2017, the government decided to tackle the worst parts of the private rented sector by setting out minimum bedroom room sizes – albeit at a very low level – for houses in multiple occupation (HMOs), stipulating minimum sleeping room sizes of 4.64 m² for one child under ten years, 6.51 m² for one person over ten years and 10.22 m² for two persons over ten years

Table 4. Definition of the 'Bedroom Standard' for measuring overcrowding.

Notional bedroom requirement per household:

Separate bedroom needed for:

Each married or cohabiting couple

Any other person aged 21 or over

Each pair of adolescents aged 10–20 of same sex

Each pair of children under 10

Any unpaired person aged 10–20 is paired with a child under 10 of same sex

Remaining unpaired persons aged 10–20

Remaining unpaired children under 10

Definition of overcrowding:

Fewer bedrooms available to the household than the notional number required

(MHCLG, 2019). Also, in response to criticisms about new forms of housing provision in the form of offices converted into flats, the government declared in 2020 that homes created through Permitted Development Rights would have to meet the NDSS (Pitcher, 2020).

In general, governments have been reluctant to apply space standards to private sector housing developments, and in contrast to other countries, dwelling size is not a common currency in the housing market. This despite the fact that analysts have suggested that estate and letting agents be required to state the internal floor area of dwellings being sold or let (Morgan & Cruickshank, 2014) and that responses to the government's consultation on space standards showed overwhelming support for the idea of 'space labelling' for new homes (DCLG, 2014). In contrast, the social housing sector, predominantly council housing last century and mostly housing association developments in recent decades, is the sector where space standards have been most often applied, but even here the use of space standards has become a voluntary code used to maintain the sector's distinction from others rather than something guaranteed by policy.

The calculation of space standards has become more sophisticated over time, including both total dwelling area plus bedroom sizes, room widths and storage space. Statutory overcrowding measures, in contrast, are crude and require updating to current circumstances in the private rented sector in order to be adequately applied. Space requirements, however, have developed based on functionality as well as more recent considerations such as accessibility, adaptability over time, Lifetime Homes requirements, sustainability and health (Goodman, 2011). Nevertheless, the standards implemented tend to be simply stated for practical reasons, and secondary standards such as for room sizes, etc. are less often applied and serve more as recommended good practice. Space standards have tended to be implemented through state funding for social housing (the National Affordable Housing Programme), less often through planning, and never through building regulations. The withdrawal of the HCA space standards in 2014 together with the low rate of housing association building means that the application of space standards through funding requirements has become less significant.

The adoption of space standards in local planning is non-mandatory and subject to the twin tests of need and viability; their application is often down to the discretion of the planning officer in a particular case, although they can be placed as conditions in planning approvals (Crosby, 2015). Strict enforcement, however, would have to come via the conversion of space standards

into building regulations, which has not been an option in England. Interestingly, Park (2017) suggests that one reason for this is that in order for space standards to be incorporated as building regulations, there would need to be stronger evidence of the harms to health and well-being that come from insufficient space, as has happened in the case of sound transmission.

Housing outcomes

Dwelling size

The long history of weakly applied space standards has contributed to a number of outcomes across the housing system. The first, most obvious observation is that the housing stock in the UK (and England) comprises relatively small dwellings. A comparison of fifteen European countries showed that the UK had the smallest dwelling sizes, with the UK average size being 32% below the highest average size for all dwellings, in Luxemburg, and 45% below the highest average size for new dwellings, in Denmark (Evans and Hartwich, 2005). Both this research and the RIBA reported that homes were getting smaller, with the average size of new dwellings being 11% lower than that for existing dwellings (RIBA, 2010). The problem with new dwellings was confirmed in an analysis of newly marketed homes in London and the South East which found that all dwellings were smaller than those recommended for the housing association sector and for London as a whole at the time, with 60% of one-bedroom flats having no storage and 91% of two-bedroom flats below the recommended standards by an average of 10 m² (HACT, 2010). The fact that new homes are getting smaller was confirmed by a study of the floor plans of homes given warranties which showed that compared with the heyday of the 1970s, living rooms were 32% smaller, master bedrooms 9% smaller and food preparation areas 13% smaller on average. The average number of bedrooms per new build home had dropped below three for the first time since the 1930s (Collinson, 2018), which may reflect developer profit motives but is less clearly a response to changing average household size which has remained stable over the past two decades (Sharfman & Cobb, 2021).

A larger analysis, published in this journal, compared 16,000 dwellings in the English Housing Survey with the GLA's Housing Design Guide Standards to find that between 21% and 55% of all dwellings failed to meet the space standard, the latter assuming a uniform occupancy of 1.6 persons per bedroom (Morgan & Cruickshank, 2014). The authors summarized the situation as '55% of houses in England are too small, but due to

low occupation rates (people per bedroom) only 21% of households have a shortage of internal space' (p. 722). Another significant finding, and potential consequence of small dwellings, is the extent of apparent under-occupation. The analysis of EHS data found that 21% of dwellings were under-occupied and small, *i.e.* below the GLA space standard, implying 'that residents may be compensating for a lack of space by under-occupying the house, *e.g.* using a spare bedroom as a study or storage space' (Morgan & Cruickshank, 2014, p. 717). The overall under-occupation rate in England is reported as just under two-in-five households at 38% (MHCLG, 2020).

Overcrowding

At the other end of the spectrum, a less common problem, though more severe in its effects, is overcrowding. However, there is no direct or automatic link between dwelling sizes and overcrowding, not least because the statutory definition of overcrowding is very low (Table 3). Moreover, the aggregate assessment of overcrowding uses a bedroom standard that reflects norms about the mixing of household members by age and sex (Table 4); this is therefore more influenced by the relationship between household structure and room configuration, rather than by minimum aggregate floor area or recommended room sizes. Nonetheless, the latter space standards could lead to feelings of being overcrowded and to statutory action in the most extreme cases. This lack of association between space standards and overcrowding is also revealed in a comparative analysis of European countries where the UK, along with Denmark, was identified as a rare jurisdiction without legally enforced minimum space standards, and yet it also had one of the lowest rates of overcrowding (4.8%), whereas Italy had 'among the strictest' regulations but also a high rate of overcrowding (28.3%) (Appolloni & D'Alessandro, 2021). There is also a problem of 'hidden overcrowding' whereby households would be considered overcrowded by social norms but they do not breach the statutory definition due to a low official standard and evident loopholes including: there is no limit on the number of people of the same sex who can share a room; a kitchen can be considered suitable for sleeping if large enough; children under ten can share; and overcrowding is permissible due to 'natural growth' or people coming to stay for a 'short time' (London Assembly, 2011).

Currently, overcrowding using the bedroom standard is reported at 4% in England or 829,000 households (MHCLG, 2020), but twice as high in London (8%) and much higher for Black African (16%),

Pakistani (18%) and Bangladeshi (24%) households (Wilson & Barton, 2021). Overcrowding is higher in the rented sectors, at 7% of private renters and 9% of social renters, the latter having nearly doubled in the past twenty years (*ibid.*, p. 11). This may reflect the small size of social sector dwellings in general and their inability to accommodate growing households over time: a quarter of social sector dwellings have a useable floor area of less than 50 m² (*ibid.*, Figure 2.4). The Health Foundation has remarked on the steady rise in overcrowding in both rented sectors over the past two decades, considering this one of the drivers of health inequalities (Health Foundation, 2021a).

Residential mobility

The consequences of occupying relatively small homes can be dissatisfaction and mobility. In the period leading up to the Housing Standards Review, a number of studies of home buyers' attitudes to space in new homes were carried out. A survey of prospective buyers found that a third of those considering new homes and two-in-five of those buying second-hand homes were deterred by overall space shortages and wanted more living space and larger bedrooms in particular. A lack of storage space compared with older homes was also noted (CABE, 2005). A further survey of purchasers of new homes in London and the South East reported that half (51%) were limited in furniture layouts by space, nearly three-in-five (57%) did not have enough storage, and over a quarter (28%) were unable to get away from the noise of other occupants (HATC, 2009). In the government's consultation on reforms, this dissatisfaction with the size of new homes was reflected in the fact that four-fifths of respondents supported a national space standard (Park, 2017, p. 48).

Although residential mobility is mostly understood to be a consequence of the family life cycle (Rossi, 1955) or changing life-course trajectories (Geist & McManus, 2008), it is clear that space-needs also play an important role. Examination of longitudinal data from the British Household Panel Survey (BHPS) over eighteen years revealed that housing reasons were the most commonly reported reasons for moving among couples under age 55, including in particular a desire for a larger or smaller dwelling. Moreover, in predictive models of moves over time 'Roomstress' (number of persons per room) was positively associated with moving for those aged under 35 (Coulter & Scott, 2015). These results concur with an earlier study also using the BHPS but adopting a different measure of space needs, namely the difference between current number of rooms and number of rooms required per household,

where underconsumption of space was found to be a significant predictor of moving (Clark & Huang, 2003). Data from the conveyancing industry also confirm the importance of space to residential mobility. A survey of house buyers by estate agents Strutt and Parker reported that 30% moved due to needing more space (Today's Conveyancer, 2014), while data from finance company Zurich revealed that 46% of those who moved to a larger home did so for space reasons (Policy Expert, undated).

Recent evidence from the UK Millennium Cohort Study² for the period 2000–2015 also shows that house moving is more common and has greater well-being impacts among those in the private rented sector and those living in poverty. Of families with children up to age 14, 20% of those living in private renting had moved three or more times compared with 2% of those in owner occupation. Moreover, among this frequent-mover group, 26% of parents reported less-than-good self-rated health compared with 14% of parents with no moves by the time children were age 14 (Health Foundation, 2021b). Longitudinal research from Australia over a similar period (2003–2015) reports the impacts of house moving upon children's health. Defining residential instability as two or more moves in a two-year period, the study found such instability to have a negative effect upon children's psychosocial health across the spectrum but to only have a negative effect upon the physical health of those children with the lowest initial physical health (Baker et al., 2019). We consider the relationship between space and health and wellbeing in more depth in the next section.

Health and wellbeing effects of space shortages

As well as the immediate consequences of space and occupancy standards for dwelling size, overcrowding, residential satisfaction and mobility, we are particularly interested in the direct and indirect effects upon health and wellbeing, which we consider in this section. A WHO review of the evidence on crowding, defined as a mismatch between household size and dwelling size, and health identified three main areas of impact: infectious disease, mental health and stress, and educational attainment (WHO, 2018).

Infectious disease

Over fifty studies examining the relationships between overcrowding and respiratory infectious diseases were reviewed by the WHO, with the vast majority showing

a positive association between crowding and risk of disease among occupants. The largest body of evidence exists in relation to tuberculosis (TB) but there is also a body of evidence for flu, pneumonia and acute respiratory illness, with single studies of a range of other infectious diseases. One study found a proportionate relationship between an increase in crowding and the case-rate of TB, although this was conducted at an area level rather than at household level (Baker et al., 2008). A high certainty of evidence for negative impacts of crowding was also found for gastroenteritis and diarrhoeal diseases, but with some studies showing these impacts only at higher levels of crowding of three or four persons per room or more (Okour et al., 2012; Etlinger et al., 2004).

Mental health

There is far less certainty about the relationship between crowding and mental health outcomes, with the relationship potentially mediated by 'perceived crowding' which may have independent and combined effects alongside physical overcrowding. Perceived crowding has been studied in non-domestic settings, particularly leisure, sport and retail (Kim & Kang, 2021; Zehrer & Raich, 2016; Tran, 2020), in which negative feelings, anxiety or stress are generated by several factors, all of which may apply in different ways within the home. Psychological safety is eroded when others encroach on a person's personal space or required social distance, *i.e.* 'they are too close' (Kennedy et al., 2009). When the level of use of resources within a space exceeds the design or intended norms, there is a negative effect upon people's experience, *i.e.* 'there are too many users' (Jurado et al., 2012). Negative feelings can also be generated by excessive external stimuli, *i.e.* 'there is too much going on' (Kim & Kang, 2021). Finally, 'spatial crowding' can occur due to the quantity and layout of fixtures, fittings and furniture within a space, *i.e.* 'there's not enough space' (Eroglu & Harrell, 1986).

In addition to the above, a social-psychological effect specific to domestic settings arises where family relations are negatively impacted by either lack of privacy for family members due to perceived crowding or as a result of conflicting activities taking place in the same space(s) (Reynolds & Robinson, 2005).

Although there will be cultural differences in the optimum levels of social interaction and in the normative regulation of privacy, Gove et al. (1979) argued that some people in all societies will face the highest relative demands and lowest relative privacy and thus experience perceived crowding, irrespective of physical levels of crowding within each society; whilst agreeing with

this argument, it is nonetheless likely that the threshold for perceived crowding to have effects will be culturally distinct. Their analysis of survey data for residents in Chicago, USA showed that perceived crowding, measured in terms of excessive social demands and lack of privacy, was related to poor social relations within the home, and associated with poor mental health. Moreover, a measure of physical crowding, in the form of persons per room, explained more of the variation in perceived crowding than a range of other sociodemographic variables, thus confirming that objective and subjective crowding are linked and that the latter mediates the impacts of overcrowding on mental health. A more recent study of 28 European countries found that the relationship between perceived crowding and an objective measure of overcrowding based on either a room-standard (similar to Table 4) or on persons per room, varied across the continent, suggesting moderation of the relationship by culture: in more advanced West European countries perceived crowding was higher than objective overcrowding, whereas in post-socialist countries the opposite was true (Sunega & Lux, 2016).

The balance of evidence generally points more towards an association between overcrowding and mental health and sleep disorders than not: of sixteen studies reviewed by WHO, ten (conducted in Brazil, Canada, Greenland, India, Iraq, UK and USA) found an association between crowding and the outcome of interest but six did not so that the certainty of adverse effects was considered moderate-to-low (WHO, 2018). Increased likelihood of negative effects in crowded household conditions has been reported for a range of outcomes including psychological distress, feeling depressed, psychiatric disability and shorter sleep duration. There is a possibility that the effects of crowding are gender specific: a longitudinal study in Toronto, Canada found that the female response to crowding manifests as depression and the male response as withdrawal and aggression (Regoeczi, 2008). It is worth noting that of the sixteen studies included in the WHO review of crowding and mental health, only one used evidence from the UK (Barnes et al., 2011).

Educational attainment

A review by the UK government in 2004 identified only one recent study of the effects of overcrowding on educational attainment, conducted in France (Goux & Maurin, 2005). There have been several studies since then, for example in the USA (Lopoo & London, 2016), across fifteen Latin American countries (Contreras et al., 2019) and in Norway (von Simson &

Umblijs, 2020). A variety of measures of overcrowding are used in the analyses, such as whether or not a child shares a bedroom and for how long, but most studies use a persons per room ratio, either as a continuous measure or as a categorical variable with a threshold, e.g. >1.0 or >2.5 persons per room. The study in the USA, however, used a mean ratio, either computed across an entire childhood from birth to age 18, or for different stages of childhood such as age 15–18 (Lopoo & London, 2016). In addition, this study used a cumulative crowding measure comprising the proportion of childhood years where the persons per room ratio exceeded 1.0.

Although the effects of the different measures of overcrowding varied, all studies found a negative relationship between overcrowding and educational attainment, and this was true for a range of educational outcomes including: the probability of having to repeat a year of school; whether or not a student graduated from high school; a pupil's achieved grades in language and maths assessments in grade 6; a pupil's achieved GPA in national exams aged 16; and a pupil's maximum value of educational attainment at age 19. The studies concur that the effects of overcrowding are greater for older versus younger children, being especially stronger in the latter stages of high school, as revealed by the mean crowding ratio for the fourth stage of childhood (Lopoo & London, 2016). However, the studies differ in the relative effect of overcrowding versus housing tenure, with one study finding that overcrowding had a stronger effect on educational attainment than living in public housing (Goux & Maurin, 2005), while another found that renting had a stronger effect than overcrowding (von Simson & Umblijs, 2020).

A number of theories have been put forward to explain the link between overcrowding and educational attainment, including that: children's health is at greater risk in overcrowded conditions and their capacity for concentration is therefore diminished (Goux & Maurin, 2005); overcrowding is disruptive to studying patterns, particularly for older pupils when studying demands are greater (Lopoo & London, 2016); older children in crowded homes take on more caring/parental responsibilities and this limits their study time (Gennetian et al., 2008); and that in crowded situations, older children seek to spend more time outside the home and engaging in risky activities, reducing study time and performance (Gennetian et al., 2008).

The Covid-19 pandemic and domestic space

The impacts of a lack of space upon people's health and wellbeing have been brought to the fore once again by

the Covid-19 pandemic, which has resulted in varying requirements to stay-at-home and/or self-isolate for extended periods of time. These effects have been associated with a number of housing factors, including both unit sizes and occupancy levels. Studies of the effects of 'lockdown' have tended to identify new versions of old problems known to be associated with overcrowding such as disease transmission, mental health impacts and impaired educational attainment. However, they have also highlighted, in particular, issues of racial and income inequalities.

Medics and urbanists agree, based on past experience of epidemics, that aspects of the urban built environment that raise population densities also increase the risk of Covid-transmission. Attention has been paid to prisons, worker dormitories (such as in Asia), and informal urban settlements (such as in Southern Asia and Africa) as hot spots for infection (von Seidlein et al., 2021). Evidence for this density effect has been presented through analysis of Covid-19 data alongside housing conditions across US counties. It was found that a 5% increase in poor housing conditions per county was associated with a 59% increase in the relative risk of Covid-19 infection and a 63% increase in the relative risk of Covid-19 mortality, with the most important housing conditions being overcrowding and a lack of adequate plumbing and sanitation, both of which led to risks of repeated exposure and a higher viral load (Ahmad et al., 2020).

Similar concerns exist in the UK at the level of neighbourhoods and communities within towns and cities. In seeking to understand why Black and South Asian people were more likely to suffer the effects of Covid-19, having age-adjusted mortality rates for the disease 2–3 times higher than for White people, the Office for National Statistics, as well as noting that ethnic minorities were more likely to live in deprived urban areas and to work in jobs that posed higher risks of infection (such as health and social care, transport and cleaning), highlighted several aspects of domestic space (ONS, 2020). First, ethnic minorities were more likely to live in multi-generational households, making it more difficult for older people in larger households to shield and prevent infection from younger people. Of households containing someone over 70, 56% were multi-generational among Bangladeshi households, 35% among Pakistani households, 11% among Black Africans, and 2% among White households (*i.e.* containing someone aged 19 or under, plus someone aged 20–69, as well as the person aged 70 or over). As part of this same scenario, Black and Minority Ethnic (BAME) households are more likely to contain at least one person more vulnerable to COVID-19 infection (Abbs & Marshall, 2020).

Second, BAME households were more likely to be overcrowded and thus further prone to intra-household infection: this was true for 24% of Bangladeshi households, 18% of Pakistani households, 16% of Black African households and 2% of White households. Third, fewer BAME households have access to a garden or outside space in which to spend time with others while adhering to social distancing and thus experiencing a lower likelihood of infection. Those without access to outdoor space comprise 36% of Black households, 22% of Asian households and 8% of White households.

A number of commentaries on the impacts of housing on health and wellbeing during the pandemic have highlighted the risks to mental health associated with lockdown or quarantine and from spending more time in overcrowded conditions (Centre for Ageing Better, 2020), without access to outdoor space (Tinson & Clair, 2020), or in homes that cannot guarantee privacy and the regulation of interpersonal distances (D'Alessandro et al., 2020). Some of the available evidence comes from elsewhere in Europe. An online survey of adults (16 or over) in France during lockdown found that mental wellbeing (using the WEMWBS scale³) was lower among those with very small homes (<30 m²) or without an outdoor space; the study notably controlled for whether or not someone was working and their frequency of social contact (Haesebaert et al., 2020). An online survey of university students in Italy found that moderate-to-severe depressive symptoms were associated with both dwelling size <60 m² and a poor-quality indoor area, which comprised several components including the presence or absence of privacy (Amerio et al., 2020).

Research has also considered the effects of imposed quarantine, with two reviews having been published. The larger review, of 24 studies across ten countries, identified a range of psychological impacts including post-traumatic stress symptoms, depressive symptoms and symptoms of psychological distress (Brooks et al., 2020). These were related to demographic characteristics such as being younger, female and having lower educational qualifications, but the review did not report on their relationship to housing conditions. The smaller review, of eight studies in China, did, however, report that the main psychological problems associated with quarantine – anxiety, depression and loneliness – were associated with a smaller isolation space, and the isolation of the surrounding environment (Luo et al., 2020). Both reviews reported that one cause of negative psychological effects was a fear of infecting others, particularly family members, although the likely relationship of this fear to small spaces and overcrowded conditions was not remarked upon. A further review

focused on socially-structured, ‘social harms’ that have resulted from lockdowns (Gurney, 2021), including domestic violence, mental health harms, and health-damaging behaviours, all of which were found to have been exacerbated according to length of confinement. Interestingly, neither the review nor the studies covered had much to say about the mediating effects of space upon the harms in question.

Another major concern during the pandemic has been the effects of lockdown on studying by children and young people, and its unequal impacts. A large-scale survey of parents in England has supported these concerns, showing that income differences in learning time worsened during the lockdown in spring 2020, particularly for primary school children (Andrew et al., 2020a). A primary school child in the 90th percentile (*i.e.* higher income) of the family income distribution was found to engage in 1 h 10 min more learning time per day (combining time in online classes and non-class time) than a child in the tenth percentile (*i.e.* lower income). For secondary school pupils there was a smaller worsening in inequality, with a child in the 90th family income percentile engaging in 30 min more non-class learning per day than a child in the 10th percentile. While a number of factors could explain differences in learning time at home, the study examined three of these: provision of active learning resources by schools (online classes, video conferencing and live chat); access to a computer or tablet; and availability of a home study space. We are particularly interested in the last of these factors, as it reflects the amount of domestic space available to a family.

Around a third of primary school children shared a study space, with just over a fifth having no study space at all. Rates of access of study space were higher for secondary school pupils, with one-in-six having a shared space and one-in-ten having no access to study space (Andrew et al., 2020a). Moreover, having access to one’s own study space or desk was found to be positively associated with study time at home: this was true for both ‘class-time’ learning and ‘non-class time’ learning for primary pupils and for ‘non-class time’ learning for secondary pupils; notably, the study did not report on gender differences in the effects of study space. For primary pupils, access to home study space also helped explain a significant proportion (13%) of the difference in learning time between the richest and poorest pupils. The key message is that time spent at home during a pandemic has served to widen educational inequalities, and differences in domestic space are part of the reason for this.

The effects of COVID-19 and associated lockdowns on population health and wellbeing have been related

to several housing factors including overcrowding, dwelling size, dwelling layout (particularly its ability to offer privacy and study space), and access to a garden or outside space. These factors are likely to interact – for example, outside space may ameliorate some of the effects of shortages of indoor space; the amount of indoor space will influence dwelling layout and provision of privacy – though this is less well studied. While we cannot say that minimum unit sizes or recommended occupancy rates have been causal in COVID-19’s impacts, the evidence emphasizes their general relevance to a range of outcomes and also suggests that such policies could be of future importance if periods of full or partial confinement recur.

Discussion

We have seen that over the past eighty or so years in England (and to a large extent the UK as a whole) policies on housing space standards and dwelling occupancy have been either absent or poorly implemented for long periods. Space standards for construction of new dwellings have not applied to all sectors of the housing market, nor to all developments within any sector; they have sometimes only been applied where public land or direct subsidy is involved in support of development, circumstances which have declined over time (Park, 2017). Occupancy standards have only been applied statutorily to the private rented sector, although the social rented sector generally adheres to good practice guidelines that serve to preserve reasonable occupancy. For the most part, space standards are not mandatory and can only be applied by planning authorities where housing need is demonstrated and development viability is not threatened. This often results in their application being the result of a negotiation between planning authorities and developers, wherein any requirements are watered down, in a similar way that affordable housing requirements are reduced or avoided by developers due to the weak negotiating position and poor negotiating skills of planners (Whitehead, 2007). Occupancy standards on the other hand are mandatory for the private rented sector at least, but have not been updated recently in a way that would encourage contemporary enforcement: a case perhaps of the ‘unexpected weakness of apparently strong policy’ (Greer, 2011, p. 199).

Our review of the research indicates a number of reasons why the ‘implementation gap’ around planning and space standards (Gilg & Kelly, 1997) and the under-specification of occupancy standards matter, particularly for the health and wellbeing of occupants. The immediate impacts are seen in relatively small homes

being built, often below recommended space standards; overcrowding, especially in the rented housing sectors; apparent underoccupancy or alternative use of domestic spaces in the owner-occupied sector; and secondary effects of lack of space on increased residential mobility. The evidence identifies three main consequences of either overcrowding or shortage of space in terms of: higher transmission of infectious diseases within households, most notably respiratory and digestive illnesses; psychological distress, often manifest as depression among women and aggression among men; and lower educational attainment, with the effects being greatest when it most matters, among high school pupils. Some of these effects are no doubt context-dependent relating to norms, culture and stage of economic development (e.g. around education, or mental health), but other effects are more likely to be universal (e.g. around communicable diseases) albeit moderated by context. Many of the impacts of space shortages and overcrowding appear to have been exacerbated recently by the Covid-19 pandemic, and to some extent, those effects may extend into the future if shielding or self-isolation remain commonplace, temporary 'lockdowns' recur, 'work from home' advice stays in place, or 'hybrid working' takes extensive hold across society and the economy. What is more, the pandemic has highlighted how health inequalities are exacerbated by differences in available space and occupancy.

An overall estimate of the costs to the NHS of poor-quality housing found that overcrowding was 16th out of 26 hazards⁴ in terms of the potential savings to the NHS from risk removal (Nicol et al., 2015). However, although the total NHS savings from the most expensive risk, eradicating cold homes, was 369 times that from removing overcrowding, the savings per dwelling were only 6.6 times greater. Moreover, overcrowding as measured by the bedroom standard (used in the analysis) is a far less common occurrence than space shortages, and the effects on mental health are far more difficult to estimate than the impacts on infectious disease. Furthermore, the kinds of social harms resulting from space shortages as discussed by Gurney (2021), particularly domestic violence and health harming behaviours, are yet to be attributed to space shortages or the more restricted risk category of 'overcrowding'. If it were made possible to take these other effects of space on health into account, the estimates of their consequences for the health service and the priority for tackling them may both be increased.

The UK All-Party Parliamentary Group for Healthy Homes and Buildings has advocated that the research and evidence base should be 'grown' to develop the case for standards for new build housing that would

'maximize occupants' health and wellbeing' (APPG, 2017). In response, the Government referred the Group to its planning policies for healthy, inclusive and safe places (mostly concerning public space and infrastructure) and to further consideration of minimum standards for health and safety in rental accommodation, with no mention of space or overcrowding (Wilson et al., 2019). As we have seen, there are at least three points where the state can intervene in this area: applying space standards to new construction through both planning and building regulations; promoting space and occupancy norms through housing transactions, for example by mandatory space labelling; and through the regulation of occupancy in all tenures, and not only in the most extreme cases of overcrowding. In all three cases, the required standards and regulations would need re-examination to be suitable for today's households and lifestyles.

As Park (2017) observed, in order for space or occupancy standards to be applied with serious intent, *i.e.* consistently and with suitable incentives and sanctions, there needs to be stronger evidence around their health impacts. Looking at our review, we can identify a number of areas where research could strengthen the evidence base for policy, particularly in the UK where relevant research is sparse.

First, there is a need to identify the health and wellbeing impacts of domestic space, separating the effects of overcrowding from those of space shortages, and taking into account the availability of outside space and amenities. These can be assessed in different ways and through point-in-time and cumulative-over-time measures of exposure, in this way helping us to focus on which aspects of space matter for who in what circumstances, akin to realist evaluation (Pawson, 2006). In this endeavour, a mixture of outcome measures could also be used, including for example self-reported health and wellbeing (using established scales) and – using data linkage – primary health care data for mental health (e.g. GP consultations and prescriptions for sleeping pills, antidepressants, antipsychotics and anti-anxiety medications), and hospital outpatient and inpatient data for respiratory and gastro/digestive conditions. The investigation of the health and wellbeing impacts of domestic space should extend the recent study of social harms during Covid-19 to ascertain whether some of the observed effects of lockdown – e.g. on physical activity, sleep, smoking and alcohol consumption (Stanton et al., 2020) – exist for people who experience space shortages or overcrowding, irrespective of the pandemic.

Second, there is very little evidence in a UK context, beyond that which has appeared during Covid-19

(Andrew et al., 2020a), on the effects of space shortages (especially a lack of study space) and overcrowding (including bedroom sharing) on learning and educational attainment. We know that during lockdown there were income inequalities in learning time at both primary and secondary levels, with pupils from richer households studying around a third more than pupils from poorer households (Andrew et al., 2020b). However, we also know that for secondary pupils, there was an income-inequality of nearly a fifth in learning time even before lockdown (*ibid.*); what we do not know is the role that space played in this inequality. Thus, there is a need to study the consequences of space shortages and overcrowding on learning and attainment at different stages of pupils' educational careers and in different scenarios of school-based, home-based and 'blended learning'. Moreover, to better understand the effects of space, researchers should investigate the hypothesized mechanisms involved, be they individual, family or neighbourhood effects (Lopoo & London, 2016; Gennetian et al., 2008).

Third, the role that space plays in residential mobility is little understood beyond its broad identification as a push factor in moving, although which aspects of space shortages or overcrowding prompt mobility is unknown. Whilst frequent mobility has been shown to have negative wellbeing impacts (Health Foundation, 2021a), the moderating effects of changes in available space (positive or negative) upon the health and wellbeing impacts of moving remain uncovered. This is a different version of the call to understand residential mobility as more than a product of life-course trajectories, but rather to use linked, longitudinal data both retrospectively and prospectively to understand such mobility as a confluence of demographic processes and spatial structures (Coulter et al., 2016); and, as argued here, not only to comprehend its causes but also its effects. Indeed, across all three areas considered here – health and wellbeing, learning and attainment, and mobility/residential instability – the challenge is to understand the distinct effects of overcrowding (current and cumulative) and the separate and combined effects of shortages, reductions and gains in living space, bedroom space and storage space upon health and wellbeing. Moreover, this requires to be done separately for those living in flats and houses, and with and without a garden or outside space.

Whilst this paper has focused on the role of space and occupancy standards from a health and wellbeing perspective, there are other ways of considering policy. A libertarian view would be that people should be allowed to live how they wish and to consume very small dwellings if they so choose (Breach, 2020). From this

perspective, space standards do more harm than good: limiting the production of small homes and homes overall, thus raising prices; forcing people to share; making larger homes unaffordable to families. However, allowing or encouraging the occupation of 'micro-homes' below the current recommended standard looks, on the basis of this review, short-sighted in health terms. The fact that people consume very small homes, or share homes, under the current circumstances of market distortions due to foreign capital investment particularly in London, and nationwide under-supply of new homes, is not a basis for allowing this to continue unabated due to its alleged status as a revealed preference. What it does suggest, however, is that the net-social-benefit of policy change should be assessed (Addae-Dapaah, 2012), accepting that there are likely to be winners and losers from any policy affecting a large part of the population and that there may be transitional impacts until a new policy regime is established and accepted as 'normal' (Bovenberg & Smulders, 1996).

Conclusion

Lack of evidence is not the main or only reason why policy on space standards and occupancy levels have been historically weak or absent in the UK. There are likely to be other reasons for this situation including a lack of political will to intervene in private property and housing markets and a preference for demand-side rather than supply-side policies (Cheshire & Hilber, 2019) and the need to develop effective policy instruments to promote and apply such standards. However, given the legacy of partial or reluctant intervention in this area, better evidence is part of the way forward to strengthening policy. In the ways set out above, research findings could be provided which would support the development of more rigorous, enforceable standards of domestic space and occupancy for the benefit of quality of life, health and wellbeing, and the productivity of society in the future. The recent impacts of the Covid-19 pandemic on inequalities in health and human capital make this even more relevant for the future.

Notes

1. The first half of this section draws upon the detailed review of housing space standards by Julia Park (Park, 2017).
2. The Millennium Cohort study follows c.19,000 families with children born in 2000.
3. WEMWBS stands for the Warwick-Edinburgh Mental Wellbeing Scale.

4. The 26 hazards were all items contained in the Housing Health and Safety Ratings System (HHSRS) a national evaluation tool introduced by the Housing Act (2004); see MHCLG (2006).

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