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EXPLORING DWELLING OVERCROWDING MEASURES: OBJECTIVE APPROACHES AND PERCEIVED CROWDING

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ABSTRACT

Dwelling overcrowding is a complex issue not only measured by standard guidelines but also by subjective perceptions of crowding. It extends beyond physical dimensions to encompass human factors such as psychological and social experiences. While intervention policies often focus on addressing spatial constraints, integrating objective approaches with subjective measures can provide more effective and holistic solutions, especially in sustainable housing intervention. This study aims to address the complexity of dwelling overcrowding by reviewing existing objective approaches and exploring perceived crowding as a complementary measure. The methodologies used for this study are literature searches and review analysis, guided by standard guidelines from multiple countries. A comprehensive literature search with selection criteria focusing on overcrowding measures, contributing factors, and housing policies. The literature was categorized into three key themes: objective measures of overcrowding, perceived crowding as a subjective measure, and intervention strategies. Findings highlight the importance of integrating objective and subjective measures in housing policies to address both physical and experiential aspects of overcrowding. This study provides the foundation for evidence-based policy recommendations. Future research should test the variables through real-world case studies to assess factors influencing overcrowding and the effectiveness of proposed housing interventions.

Keywords: Dwelling Overcrowding, Crowding Measures, Perceived Crowding, Physical Crowding, Social Crowding.

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1. INTRODUCTION

According to Evans (2003), 'Dwelling Overcrowding' refers to a situation where there are too many individuals living in a single dwelling unit compared to its size or intended capacity, whether measured in terms of rooms, bedrooms, or floor area, leading to negative physical and mental health consequences. While "Housing and Health Guidelines" by the World Health Organization (2018) describes dwelling overcrowding is a mismatch between a single dwelling unit and the household members that accommodate in. This definition explains that dwelling overcrowding is influenced by the layout and dimensions of dwelling, household composition, size, and requirements within the household members (Lorentzen et al., 2022) including the number of individuals, age, gender, relationship, and social expectations (Kumari & Dubey, 2023). Therefore, overcrowding occurred in a single dwelling unit is not just only to a matter of physical space, but also the inability of capturing the diverse needs of individuals in term of privacy, functionality, and comfort (Wimalasena et al, 2022). Thus, dwelling overcrowding leads to negative impacts on physical and mental health, which reduces quality of life among individuals.

Moreover, Bahadori et al (2017) explains that dwelling overcrowding means inadequate living space, where household members must share available bedrooms in a single dwelling unit and living areas within the dwelling. This may cause them to be unable to accommodate comfortably in the dwelling (Friesinger et al., 2019) such as experience sleep disturbances (Lim & Kim, 2020) and a lack of privacy (Torshizian & Grimes, 2020). Ruiz-Tagle et al (2021) further explains dwelling overcrowding creates negative issues in daily life such as causing conflicts among the individuals due to inadequate space and insufficient resources or amenities, which highlighting that overcrowded dwelling affects social interactions between the household members. Similarly, Ruiz-Tagle et al (2021) stated inadequate living space means inadequate personal space, where individuals may feel a lack of privacy, discomfort and reducing the sense of control over the living environment. These conditions lead to poor mental health, which affects social and well-being among household individuals.

Researchers have proven dwelling overcrowding commonly measured by specific benchmarks such as people per room, people per bedroom, floor area per people, etc based on national or international guidelines. Some developed countries have established dwelling crowding standards, taking into account living wages, especially when creating low-cost housing for low-income household communities (Anker & Anker, 2017). Besides, according to World Health Organisation (2018), the measures of dwelling overcrowding and housing policies can be vary depending on local regulations, cultural norms, and living standards, which may change over time alongside economic conditions and social expectations. These considerations highlighting the dwelling overcrowding is a complex issue that requires to take accounts of both physical and human factors due to the definitions of dwelling overcrowding, which goes beyond just physical space. Therefore, Park & Seo (2020) suggested in order to fully capture dwelling overcrowding, it is important to understand the negative impacts that affect individuals' health, well-being, and social relationships, where perceived crowding is important to understand the subjective experience of overcrowding.

As highlighted above, dwelling overcrowding is a complex issue that can be assessed through both objective approaches and subjective perspectives in term of health, well-being and social relationships. This paper aims to address this complexity by reviewing existing objective approaches while exploring perceived crowding as a complementary measure. It highlights the importance of integrating both perspectives in intervention policies to achieve a balanced approach that considers tangible and intangible factors, thereby improving living conditions.

2. METHODOLOGY

The methodology for this study is derived from literature searches based on established international standard guidelines to assess dwelling overcrowding. The process involves literature searches, selection criteria, and comprehensive review analysis. The literature search was conducted using reputable academic database. Google Scholar were chosen for its extensive coverage of scholarly publications related to built environment research and dwelling overcrowding. To enhance the comprehensiveness of the search, relevant journals in urban housing and public policy were also manually screened. The selection criteria were defined to ensure the relevance and quality of the selected literature, focusing on crowding measures, contributing factors to dwelling overcrowding, and housing policy in addressing dwelling overcrowding. Once the relevant literature is identified, the review analysis process begins. In review analysis process, the literature is categorized into themes such as objective approaches, perceived crowding as subjective measure, and intervention policy as strategies to address the complexity of

dwelling overcrowding. By organizing the literature into these distinct categories, the review offers a structured way to explore different perspectives on overcrowding. Objective approaches provide quantifiable data, while subjective measures help capture the lived experiences of residents. Finally, the focus on intervention policies by integrating objective approaches and perceived crowding draws attention to existing and proposed strategies for addressing overcrowding.

Overall, this approach ensures that the literature review is comprehensive, critical, and aligned with the aim of study. The findings from the review will provide a strong foundation for formulating evidence-based recommendations to address dwelling overcrowding.

3. OBJECTIVE APPROACHES TO MEASURE DWELLING OVERCROWDING

There are several objective approaches found from housing research studies, standards, and guidelines to determine if a dwelling is overcrowded such as Occupancy Rate Index (ORI), People per Room, People per Bed, People per Bedroom, Bedroom Standard, Equivalized Crowding Index (ECI), Floor Area per Person, and House Size Below Threshold. The following explains these approaches and their applications in housing research and policy.

Table 1: Dwelling Overcrowding Objective Measures

Study	Dwelling Overcrowding Measures							
	Occupancy Rate Index (ORI)	People per Room	People per Bed	People per Bedroom	Bedroom Standard	Equivalised Crowding Index	Floor Area per Person	House Size Below Threshold
Gray (2001)	✓	✓		✓	✓			
Blake (2007)		✓		✓	✓		✓	
Goodyear et al. (2011)		✓		✓	✓	✓	✓	
Baker et al. (2013)	✓	✓	✓	✓	✓		✓	✓
Anker & Anker (2017)				✓	✓		✓	✓
Ramalhete et al. (2018)	✓	✓		✓	✓		✓	✓
WHO (2018)				✓	✓		✓	✓
Hosseini (2021)				✓	✓	✓		
OECD (n.d.)				✓	✓			
UN Habitat (2019)		✓		✓	✓			

3.1 Occupancy Rate Index (ORI)

In 1990s in New Zealand, the Occupancy Rate Index (ORI) is known as ‘People per House’ measure which to assess to a dwelling and quantify the number of people per house. It was introduced to limit the capacity or intended occupancy of the dwelling. Therefore, if the number of occupants exceeds the limit, the house is deemed to be overcrowded. This approach has been criticized for its limitations, due to it does not take considerations for the variations in dwelling size and household compositions (Gray, 2001). This means that households of different sizes and compositions are treated the same, leading to potential inaccuracies in assessing overcrowding. As a result, the ORI has not been widely used in defining or measuring overcrowding in housing research and policy (Baker et al., 2013).

3.2 People per Room

People per Room is known to be the most common crowding measure for overcrowding and can be used to establish occupancy standard (Goodyear et al., 2011). But, to define what considered a 'room' poses challenges this is due to the definition of a room can be subjective, which influenced by cultural norms, building codes, and

individual interpretations (Torshizian & Grimes, 2020). What qualifies a room in one context may not be universally recognized elsewhere. For example, under the General Regulation for Building in Angola (RGEU) counts all rooms except bathrooms and closets in their crowding measure (Ramalhete et al., 2018). Additionally, within the European Union, all rooms are considered except the kitchen and bathroom, whereas Sweden's crowding measure all rooms excludes both the kitchen, bathroom and living room (Rollings & Evans, 2019). In the non-European countries such as United State, Mexico, Japan, Korea and Canada, the presence of a kitchen is assumed and counted as a room (OCED, 2020).

The American Crowding Index (ACI) adopts People per Room measure, it considers crowded with more than one person per room and those with over 1.5 people per room are deemed severely crowded (Blake, 2007). The ACI defines a "room" as habitable spaces within a dwelling, excluding areas such as bathrooms, balconies, porches, foyers, hallways, and half-rooms (Historical census of housing tables: crowding, 2001). These varying definitions of "room" highlight the importance of establishing a clear and consistent standard when using crowding measures in housing research and policy (Cable & Sacker, 2019). While American Crowding Index (ACI) provide a basic indication of space adequacy, it fails take considerations for factors such as room size, layout, and functional use, which affect the true experience of overcrowding.

3.3 People per Bed

People per Bed used to measure dwelling overcrowding by focusing on the number of individuals for each bed within a dwelling Baker et al (2013). There are limitations of using People per Bed to access overcrowding in a dwelling due to culture aspects in every family, where some families may share beds, while others may sleep on couches, mats, or other non-bed surfaces, Yuen et al (2006) studies in Southeast Asia also noted that communal sleeping is a norm in many low-income households. Moreover, the purpose of crowding measures is to access the adequacy of space for living, not just sleeping emphasized by Solari & Mare (2012), which crowding is more about the total space inadequacy rather than just sleeping arrangement. Thus, People per Bed fail to accommodate diverse lifestyle for the residents as Evans and Saegert (2000) highlighted the need crowding measure is to better capture household functionality. Thus, People per Bed is not encouraged to use in housing research and policy.

3.4 People per Bedroom

People per Bedroom is similar to People per Room, but it focuses more on the 'bedroom' or sleeping quarters within the dwelling (Xu et al., 2021). Therefore, it measures the level of crowding within the sleeping spaces of the household, while measuring the living conditions and quality of life. According to Gray (2001), People per Bedroom used to set the bedroom occupancy standard with more than 2 people per bedroom is considered overcrowded. This applied in countries such as the United States, United Kingdom, Canada, Australia, and many EU nations (UN-Habitat, 2019). In some countries with higher population densities, for example Hong Kong, overcrowding is more common and may exceed 2 people per bedroom, as many families living in subdivided flats share one-bedroom spaces or equivalent (Housing situation and housing supply in Hong Kong, 2022). Meanwhile, 3 people per bedroom is typically considered the threshold for overcrowding in countries with higher family according to UN-habitat and ANISC guideline. Moreover, Singapore has a more rigid approach to public housing, with clear regulations ensuring 2 people per bedroom (Housing & Development Board, 2021).

3.5 Bedroom Standard

Bedroom Standard adopts People per Bedroom by taking consideration of factors such as age, gender, marital status composition, and the relationships between household members (Wilk et al., 2022). By comparing with People per Bedroom, Bedroom Standard therefore offers more socially aware measure, making it more reflective of actual living conditions and privacy needs but also more complex to implement. As a result, the Bedroom Standard is widely classified as an international benchmark (Greenstein et al., 2016). For example, British Bedroom Standard, Canada National Occupancy Standard, Eurostat Standard, and Equivalized Crowding Index adopts bedroom standard based on specific criteria, including relationship, age, gender and household composition. Table 2 shows a comparison of dwelling overcrowding standards based on the bedroom standard.

Table 2: Comparison of Dwelling Overcrowding Standard Based on Bedroom Standard Characteristics

Comparison of Dwelling Overcrowding International Standard Based on Bedroom Standard Characteristics					
Dwelling Overcrowding Standard	Based on	Uses couple status	Ages when pairs of different gender can share	Ages when pairs of same gender children can share	Ages when own room is required
British Bedroom Standard	Bedroom	Yes	Under 10	0-20	21+
Canada National Occupancy Standard	Bedroom	Yes	Under 5	0-17	18+
Eurostat Standard	Bedroom	Yes	Under 12	0-17	18+
Equivalized Crowding Index	Bedroom	Yes	Under 10	Under 10	10+

(Goodyear et al, 2011)

3.6 Equivalized Crowding Index (ECI)

Equivalized Crowding Index (ECI) is introduced to determine the ratio of required bedrooms to available bedrooms within a single dwelling unit described by Goodyear et al (2011). It provides a standardized measure to assess dwelling overcrowding by looking into the household composition, relationships, and demographics. It also takes considerations of number of individuals in the household, age, gender, and the number of rooms. Thus, the ECI provides accurate comparisons and assessments of dwelling conditions by using equation of ECI as below.

Equation 1: Equivalized Crowding Index Calculations ((Hosseini, 2021)

$$ECI = \frac{\frac{number\ of\ children\ less\ than\ 10}{2} + number\ of\ couples + all\ other\ persons}{number\ of\ rooms}$$

Based on the Equation 1, two children that are under the 10 years old are counted as 1 number of children, which also indicating that they are allowed to share a bedroom. However, individuals that aged 10 years and above are considered adults and require one bedroom each. Additionally, a married couple or cohabiting couple may share one bedroom. According to Hosseini (2021), if a value is exceeding 1, it means that the dwelling is experiencing dwelling overcrowding.

3.7 Floor Area per Person

Floor Area per Person measures the area of physical living space available to the occupants in a dwelling. It offers an estimate of living space, with smaller numbers indicating potential overcrowding. However, it does not account for room layout, or the distribution and usability of space. WHO (2018) defines dwelling overcrowding based on the floor area per person, considering public health concerns such as tuberculosis transmission. To ensure healthy living conditions, the WHO (2018) recommends a minimum of 7.5 m² per person and has established guidelines to prevent overcrowding in dwellings. The table below shows the overcrowding measures established by WHO. Based on WHO guideline, children under 12 months are not counted, while children aged 1 to 10 years are counted as 0.5.

Table 3: WHO guidelines

Bedroom Area (m2)	**No. People**
≥11	2
9-10	1.5
7-9	1
5-7	0.5
<5	0

(World Health Organization, 2018)

According to Angkasa (2018), several countries have established regulations governing the minimum floor area per person within a household. For example, Australia enforces the strictest requirement with 89m2 per person, while Taiwan has the most modest provision ranging from 7 to 10 m2 per person. This highlights that countries have complied with the WHO guidelines which above minimum floor area per people is 7.5m2. The table below shows the comparisons of the minimum floor area per people across different countries.

Table 4: Comparison of Countries in Minimum Floor Area per People

Comparison of Countries in Minimum Floor Area per People		
No	Countries	Minimum Floor Area Per Person
1	Indonesia	$9m^2$
2	Taiwan	$7\text{-}10m^2$
3	Hong Kong	$15m^2$
4	China	$20m^2$
5	Australia	$89m^2$
6	United Kingdom	$37m^2$
7	Germany	$55m^2$
8	Japan	$11\text{-}15m^2$

(Angkasa, 2018)

3.8 House Size Below Threshold

House size below threshold refers to a dwelling unit that provides less living space per person than the minimum standards set by housing regulations, policies, or guidelines, it often used to highlight the dwellings that are too small for their occupants (Baker et al., 2013). Ankar & Ankar (2017) suggests that the recommended living space varies based on the income level of the country. For example, low-income countries require 0-36 m^2 of living space per household, the recommended living spaces for middle-income countries range from $36\text{-}60m^2$, lastly, the high-income countries require $70m^2$ or more of living space per household. This aligns with Ministerial Decree of Settlement and Regional Infrastructure No. 403/KPTS/M2002, where the minimum floor area for an incremental house is $21m^2$, while an adequate house should have a minimum floor area of $36m^2$ (Winarsih et al., 2018). Therefore, dwellings that fall below the recommended size or established standards are considered overcrowded for the occupants, based on this measure in housing research and policy.

4. ANALYSIS OF FINDINGS FOR OBJECTIVE APPROACHES

Table 5: Summary of Findings for Objective Approaches

Approaches	Analysis Review in Housing Research and Policy
Occupancy Rate Index (ORI) Occupancy Rate Index known as 'People per House'. It calculates the average number of people living in a single dwelling unit.	Not encourage to use in defining or measuring overcrowding in dwelling. This is because ORI does not consider the variations in household composition or living conditions (e.g size and layout) within a single dwelling unit.
People per Room People per Room measures the average number of people per room within a single dwelling.	It can be used to establish **occupancy standards** in housing policies to control dwelling overcrowding. According to crowding measure in USA, more than **one person per room** is considered overcrowded. Considerations of adopting this measure required due to People per Room does not consider the type of room (e.g., bedrooms, kitchens, living rooms) and the definition of a 'room' can be vary based on a country's regulations. **Standard & Guideline:** American Crowding Index (ACI)
People per Bed People per Bed measures the average number of people for each bed within	Not use to define dwelling overcrowding. This is because People per Bed have the limitations in reflecting the adequacy of the living space and arrangement.

Approaches	Analysis Review in Housing Research and Policy
a single dwelling.	
People per Bedroom People per Bedroom measures the number of people per bedroom, offering a focused evaluation of crowding in sleeping quarters, crucial for privacy, comfort, and housing adequacy.	People per bedroom, known as most used measure, to develop the **bedroom occupancy standard**. This is because it able to identify current overcrowding issues within the households in a single dwelling unit. The international standard is **2 people per bedroom**, but in countries with larger family sizes, **3 people per bedroom** may be considered the threshold for overcrowding based on **UN-Habitat** and **Argentinian National Institute of Statistics and Censuses (ANISC)** guideline. **Standard & Guideline:** WHO guideline UN-Habitat Argentinian National Institute of Statistics and Censuses (ANISC)
Bedroom Standard The Bedroom Standard measures the number of people per bedroom in each dwelling while considering the factors such as household composition, gender, age, and family relationships for a shared bedroom.	Bedroom standard adopts **People per Bedroom** while considering the factors such as household composition, gender, age, and family relationships for a shared bedroom. It can be an appropriate measure for establishing **overcrowding standards** to control overcrowding. **Standard & Guideline:** Eurostat Standard British Bedroom Standard Canadian National Occupancy Standard (CNOS) OECD guideline Equivalized Crowding Index
Equivalized Crowding Index Equivalized Crowding Index (ECI) determines the ratio of required bedrooms to available bedrooms in a single dwelling unit based on Bedroom Standard.	The ECI formula is used to determine whether a dwelling is overcrowded, by considering factors such as the number of children, couples, other individuals in the household, and the number of rooms. **A value exceeding 1 indicates that the dwelling is overcrowded.** **Standard & Guideline:** Equivalized Crowding Index
Floor Area per People Floor area per people is referring to the floor space in a dwelling unit allocated to each individual that accommodating in that space. It was developed due to public health considerations (World Health Organisation, 2018).	According to the WHO (2018), the minimum floor area required for healthy living conditions is **7.5 m² per adult** and **bedroom area required more than 11m2 if 2 adults.** Each country has its own regulations for establishing standards for the minimum floor area per person. **Standard & Guideline:** WHO guideline Measure Overcrowding in Housing (USA) National regulations, guideline, and policies
House Size Below Threshold It refers to a dwelling where the physical size of dwelling is below a certain minimum standard or threshold that has been established as necessary for adequate living conditions. This measure depends on the **minimum standards set by housing regulations, policies, or guidelines**.	Depending on the countries' regulation and standard for minimum area per person, studies suggested adequate house should have a minimum floor area of **36m2** (Winarsih et al., 2018). **Standard & Guideline:** WHO guideline National regulations, guideline and policies

5. INTERNATIONAL STANDARDS & GUIDELINES TO CONTROL DWELLING OVERCROWDING

International and national organizations have developed standards and guidelines which adopted objective approaches to measure and assess overcrowding. These frameworks are essential for policymakers, urban planners, and researchers to define the severity of overcrowding and implement targeted interventions. Global institutions such as the United Nations (UN), World Health Organization (WHO) and Organization for Economic Co-operation and Development (OECD) have established indicators such as number of people per room, minimum floor area per person and acceptable bedroom sharing arrangements. These indicators serve as the benchmark to define overcrowding and guidance on housing policies.

Moreover, national standards such as the Eurostat Standard, British Bedroom Standard, Canadian National Occupancy Standard (CNOS), Equivalized Crowding Index (ECI), and Argentinian National Institute of Statistics and Censuses (ANISC) incorporate cultural and regional factor to tailor guidelines to specific contexts. These standards serve not just quantify overcrowding but do consider the factors like household composition, privacy and functionality of living spaces. Table 6 shows the comparison of dwelling crowding international standards and their crowding definitions.

Table 6: International and National Crowding Standard

<table>
<tr><th colspan="6">Dwelling Crowding International Standards and Their Crowding Definitions</th></tr>
<tr><td>Crowding Standard and Guideline</td><td colspan="2">Crowded</td><td colspan="3">Not Crowded</td></tr>
<tr><td rowspan="3">Measure Overcrowding in Housing (USA)</td><td>Severely Crowded</td><td>Crowded</td><td colspan="3" rowspan="2">Not crowded <= 1.0 person per room</td></tr>
<tr><td>>1.5 people per room</td><td>>1.0<=1.5 people per room</td></tr>
<tr><td colspan="2">-Floor area per people <15.32m2</td><td colspan="3">Floor area per people >15.32m2</td></tr>
<tr><td colspan="2">Not comply the combination between the People per Room and Floor Area per People</td><td colspan="3">Comply with combination between the People per Room and Floor Area per People</td></tr>
<tr><td rowspan="2">Eurostat Standard</td><td colspan="2">Overcrowded</td><td colspan="3">Not crowded</td></tr>
<tr><td colspan="2">1 or more extra bedrooms needed</td><td>Equal to standard</td><td>One above standard</td><td>Underoccupied</td></tr>
<tr><td rowspan="2">British Bedroom Standard</td><td colspan="2">Overcrowded</td><td colspan="3">Not crowded</td></tr>
<tr><td colspan="2">1 or more extra bedrooms needed</td><td>Equal to standard</td><td>One above standard</td><td>Underoccupied</td></tr>
<tr><td rowspan="2">Canadian National Occupancy Standard</td><td colspan="2">Crowded</td><td colspan="3">Not Crowded</td></tr>
<tr><td>2 or more extra bedrooms needed</td><td>1 extra bedroom needed</td><td>No extra bedrooms needed; none spare</td><td>One bedroom spare</td><td>Two or more bedrooms spare</td></tr>
<tr><td>Equivalized Crowding Index (ECI)</td><td colspan="2">Crowded >1.0</td><td colspan="3">Not crowded <=1.0</td></tr>
<tr><td>UN-Habitat</td><td colspan="2">> 3 people per habitable room</td><td colspan="3">< 3 people per habitable room</td></tr>
<tr><td>Argentinian National Institute of Statistics and Censuses (ANISC)</td><td colspan="2">> 3 people per room (exclude kitchen & bathroom)</td><td colspan="3">< 3 people per room (exclude kitchen & bathroom)</td></tr>
<tr><td rowspan="3">World Health Organisation (WHO)</td><td colspan="2">Overcrowded</td><td colspan="3">Not Crowded</td></tr>
<tr><td colspan="2">>2 people per bedroom and bedroom area less than 11m^2</td><td colspan="3"><2 people per bedroom and bedroom area more than 11m^2</td></tr>
<tr><td colspan="2">< 7.5m^2 Floor Area per People</td><td colspan="3">>7.5m^2 Floor Area per People</td></tr>
</table>

6. PERCEIVED CROWDING TO MEASURE DWELLING OVERCROWDING

Perceived Crowding refers to the negative subjective experience, perception or evaluation, and assessment of individuals regarding the density levels in a specific surrounding (Zehrer et al., 2016; Kim et al., 2021). It is known as individual's psychological perception on crowding which influenced by a combination of physical, environmental, social, and personal factors (Chang et al., 2021; Zhang et al., 2023). According to Blut & Iyer (2020), perceived crowding can be divided into two dimensions which are physical crowding perception and social crowding perception. The physical crowding perception may refer to as spatial crowding, the non-human factors in environment, where the number of individuals present is not high in a dwelling, but individuals feel uncomfortable (Sawang et al., 2019). In the context of dwelling, it relates to feeling restricted by the dwelling layout and distribution of dwelling spaces such as having trouble to move around, feeling uncomfortable and cramp due to small dwelling space, and facing difficulty to position furniture and room arrangement (Simanjuntak et al., 2020). On the other hand, social crowding perception means human crowding, which focusing on human factors (Sawang et al., 2019). Therefore, social crowding influenced by the number of individuals in a single dwelling unit and the level of social interactions and engagements (Mousavinia et al., 2019; Qiu et al., 2022). For example, individuals feel uncomfortable due to the presence of large crowd in the dwelling and excessive social interaction (Engelniederhammer et al., 2019).

Next, perceived crowding does not align with objective approaches of overcrowding (Hirvonen et al., 2021), this is because perceived crowding able to capture on individuals' understanding of the adequacy of room, bedroom sizes and arrangement which objective approaches unable to identify (Torshizian et al., 2021). As it is based on individuals' feelings, opinions, or assessments of their dwelling and living conditions. Instead, it reflects individuals' subjective assessments of whether they have enough space to carry out daily activities comfortably and maintain a sense of privacy and well-being within their dwelling, this, in turn to impact the mental health and quality of life of the residents (Sawang et al., 2019).

Additionally, a dwelling is considered to be overcrowded if an individual perceives insufficient personal space to comfortably carry out daily activities due to the dwelling being too small (Torshizian et al., 2021), perceives insufficient space for finishes, furnishings, hosting visitors, mechanical and ventilation systems, household storage, and gathering areas for household members (Campagna, 2016), experiences excessive noise and disruption from other occupants due to overcrowding with limited space (Kim et al., 2021), or encounters psychological discomfort, clutter, unhappiness, or dissatisfaction in their living environment (Kumari et al., 2023; Storer er al., 2024), where privacy is compromised (Torshizian et al., 2021). In fact, cultural and social norms contribute to the main factor to shape Perceived Crowding (Easthope et al., 2017). This is due to acceptable levels of crowding may vary across different cultural and social contexts. For instance, it is culturally normative for families with specific cultural and linguistic backgrounds to reside together, leading them to feel more comfortable living with family members in crowded conditions (Dockery et al., 2022). Although they are perceiving crowding, they prefer this arrangement due to personal preferences (Hotwani, 2017).

Overall, perceived crowding can be divided into two categories which are physical crowding and social crowding. Physical crowding relates to dwelling layout and space distribution or arrangement. On the other hand, social crowding is influenced by the human factors which involves the number of individuals and social interaction within a dwelling. As discussed, perceived crowding is shaped by cultural and social norms, hence personal preferences and acceptable crowding level may differ in different communities. Therefore, it is important to fully understand the aspects of perceived crowding, this is because it captures the overcrowding experiences that not just focusing on physical comfort but consider the emotional well-being and social dynamics. Through understanding the perceived crowding aspects, policymakers and urban planners to better design of spaces for a dwelling and inform housing policies. Table 7 shows the perceived crowding aspects within a dwelling from different studies, highlighting the factors that influence individual's perception of crowding.

Table 7: Summary of Perceived Crowding Aspects

Study	Perceived Crowding Aspects							
	Physical Crowding		Social Crowding					
	Dwelling layout	Space distribution	Inadequacy space	Noise	Psychological factor	Individual factor	Privacy	Utilities, Lighting, Ventilation
Ditton et al., 1983			✓		✓	✓	✓	
Stokols et al, 1978			✓		✓		✓	✓
Machleit et al., 2000	✓	✓	✓				✓	
Simanjuntak et al., 2020	✓	✓	✓				✓	
Arnberger et al., 2007			✓	✓	✓	✓	✓	
Schluter et al., 2007			✓	✓	✓	✓	✓	✓
Campagna, 2016	✓	✓	✓	✓	✓	✓	✓	✓
Easthope et al., 2017.						✓		
Hotwani, 2017						✓		
Engelniederhammer et al., 2019			✓	✓	✓	✓	✓	
Kim et al., 2021			✓	✓				
Dockery et al., 2022	✓	✓	✓		✓	✓		
Qiu et al., 2022			✓	✓	✓	✓		
Khera et al., 2023					✓	✓		
Simard et al., 2024	✓	✓	✓	✓				

7. INTEGRATING OBJECTIVE APPROACHES AND PERCEIVED CROWDING IN INTERVENTION POLICY

Sunega and Lux (2016) suggested a good measure of dwelling overcrowding should integrate objective approaches and subjective perceptions of crowding. This, in turn, has a double advantage due to the precision of the assessments of housing needs increases with the consideration of different institutional contexts across countries. A further key benefit relates to improved efficiency in public resource allocation (Gori et al., 2020). Similarly, Torshizian and Grimes (2020) argue that policy interventions are to consider both objective approaches of crowding and subjective perceptions due to the complex multidimensional nature of dwelling overcrowding as discussed.

Crowding can be quantified through objective approaches such as People per Room and Floor Area per Person. The measure is paramount as far as standard setting and regulation of housing is concerned whereby it assumes central place in public policy in urban planning and house development, and these may not capture the subject feelings of residents living under those decrees. By contrast, perceived crowding concerns an individual's subjective feelings of being crowded, such as discomfort, stress, or intrusion into one's personal space (Khera et al., 2023). It becomes entwined with factors like societal norms, expectations placed on a person, and experiences

at previous living conditions (Ul Ain & Ellahi, 2022). Thus, the psychological and social aspects of overcrowding are more satisfactorily explained than could be inferred from objective measures (Sawang et al., 2019).

Together, these approaches permit a more rounded understanding of overcrowding (Pedica et al., 2021). For instance, a household might meet the objective standards of housing density and still perceive a high level of crowding because of poor layout, lack of storage space, or inadequate soundproofing that heightens the sensation of a cramped, uncomfortable living environment (Simard et al., 2024). On the other hand, some dwellings may meet the threshold of being objectively overcrowded but fail to develop negative perceptions among residents, possibly because of rational use of space or some cultural norms that prefer to keep people closer to each other (Cable & Sacker, 2019). Such a recognition of disparity between objective and perceived crowding on the part of the policy maker is important for devising interventions which address both the physical and psychological needs of the population (McCartney et al., 2020). It would also allow for an integrated approach that may enable a better resource allocation strategy to ensure that interventions either increase the housing stock or improve the living space in such a manner that it positively influences the psychological and social well-being of the residents (El-Didy et al., 2023). This finely tuned understanding of the objective and subjective dimensions of crowding could lead to more relevant and effective housing policies, which is very important in densely populated urban settings (El-Didy et al., 2023). By doing so, policymakers will be able to adopt a balanced approach to tangible and intangible measures of dwelling crowding when conceiving more sustainable and livable urban environments.

Next, the challenge lies in the precise application of these integrated measures. Objective approaches are easy to define, yet they cannot capture the subtlety of daily living: space distribution within a dwelling, functional usability of rooms, and environmental factors related to light and ventilation, among households (Xu et al., 2022). These elements weigh high in the perceived quality of living spaces, which can vary widely between households and building designs (Wimalasena et al., 2022). Therefore, policy evaluations will have to include various data points which account for such diverse experiences.

Perceived crowding also reveals the personal and cultural dimensions of space utilization (Wang & Liu, 2023). For example, multi-generational living is common in many parts of the world; such arrangements have social benefits that may outweigh the physical limitations in terms of space (Wang & Liu, 2023). An understanding of these cultural contexts is vital for developing appropriate and respectful housing policies toward the needs of diverse populations. Moreover, according to the OECD (n.d), subjective measures provide information that objective measures sometimes cannot capture, which is indispensable in policy evaluation and potential problem identification.

Furthermore, it requires integration for these perspectives through the continuous process of dialogue among the policymakers, town planners, residents, and researchers based on taking into consideration everything for community needs in planning the necessary measures (Macmillan et al., 2016). This can also result to innovative solutions from not only the quantitative dimension of the housing but also from the qualitative response per aspects in home and community life (Lowe et al., 2018). The findings are useful in developing any housing policy that includes the objective with perceived crowding measures, promoting healthier, happier communities that may be routinely more cohesive than just the personal living environment (Giles-Corti et al.,2022).

8. CONCLUSION & RECOMMENDATION

Dwelling overcrowding can be measured through both objective approaches and subjective perceived crowding. Objective approaches unable to fully capture the nuances of lived experiences in term of psychological, health and well-being aspects and social impacts of crowding, which perceived crowding able to identify. A comprehensive understanding of dwelling overcrowding by integrating both objective and subjective aspects required to the development of effective framework in addressing the problem of physical space and well-being of individuals, which direct and indirectly addressing the dwelling overcrowding. Also, through integrated approach may guide the formulation of effective housing policies and strategies, thereby improving living conditions for individuals that are suffering in overcrowded environments.

For future research, testing the variables from both objective approaches and perceived crowding aspects in real case studies could help to identify the most significant factors contributing to dwelling overcrowding. Such studies would provide practical findings on how these factors interact and influence living conditions. Additionally, future research could explore the development of new crowding standard to better assess crowding

risks and evaluate the effectiveness of intervention strategies. The collaboration between researchers, policymakers, and housing authorities would be beneficial in conveying research findings into actionable intervention policies that promote healthier and more sustainable living environments.

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