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LARGE HOUSING IN NEW ZEALAND: ARE BEDROOM AND ROOM STANDARDS STILL GOOD DEFINITIONS OF NEW ZEALAND HOUSE SIZE?

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Abstract:

Globally censuses and crowding indices use number of bedrooms/rooms (bedroom/room standards) as a measure of house size although the average house size varies in different countries. According to Statistics NZ and studies by BRANZ, in recent years New Zealand houses have changed in terms of overall size and types of rooms. Results of a floor plan study of 189 New Zealand houses shows that new houses have many specialized rooms and common room types (sleeping bedrooms, living rooms) are also bigger. Though bathrooms/laundries are never considered habitable rooms, in new houses some are bigger than a bedroom in a 3-bedroom NZ state house. The study shows the floor area of a 3-bedroom house in New Zealand varies from 79-256m^2, thereby questioning whether existing census data could be underestimating house size in New Zealand and other developed countries. This study presents evidence to suggest that censuses and crowding indices need more complicated tools for predicting house size and discusses what form these might take.

Key words: Room standard, Bedroom standard, New Zealand, House, Large housing, Crowding index.

1. Introduction:

All over the world statistics are used to investigate the condition of housing as an indicator of quality of life (Statistics New Zealand, 2016). House size is regarded as an important parameter for showing the quality of housing as well as reflecting the wealth and social aspirations of occupants. Measuring the floor area of a house is a time consuming and expensive process, and would be very difficult for big census samples. It also requires a degree of expert knowledge to have confidence in the results. To simplify this process house size is normally estimated by using the reported number of rooms and bedrooms in census data. Where room sizes are relatively constant this is reasonable as houses with more rooms and/or bedrooms are bigger than those with fewer rooms and/or bedrooms, although as discussed later, this is not the case for all houses.

According to Statistics New Zealand (2014a) "a room is defined as a space in a dwelling which is used, or intended for habitation, and is enclosed by walls reaching from the floor to the ceiling or roof covering." Regarding floor area, "habitable rooms should be at least two metres in height and of at least four square metres in area". Service areas such as pantries, hallways, spa–rooms, walk–in wardrobes, corridors, verandas, garages, laundries, toilets and bathrooms are excluded even if they meet the minimum floor area criteria (Statistics New Zealand, 2014a). If a dwelling has an open-plan,

then room equivalents should be counted as if they had walls between them (i.e. a combined living room/dining room/kitchen is counted as 3 rooms). These criteria set the room standard. Statistics New Zealand (2014a) defines a bedroom as "a room in a dwelling which is used, or intended for sleeping in." It is also classed as a bedroom only if it is furnished as such and includes items such as a bed or mattress, dresser and chest of drawer even if it is not being used for sleeping at the time of the data collection. These criteria set the bedroom standard. This suggests definitions of bedrooms are highly dependent on the way occupants furnish their houses.

The New Zealand housing regulations 1947 2013 reprint (Freyberg, 2013) remains the only official document which include sizes for some room types. In this reprint the minimum acceptable floor area for kitchens of houses with two or fewer residents is $3m^2$ and $4m^2$ for all other households. In addition, the minimum floor areas of bedrooms in new and existing houses are respectively 6 and $4.5m^2$. There is no standard for the minimum floor area of other rooms although there is a minimum height standard of 2.1m for existing houses and 2.4m for new houses. These minimum dimensions differ from those of Statistics New Zealand above.

According to Statistics New Zealand (2014b) the average floor area of new New Zealand houses has increased from 108.7 m^2 in 1974 to 191.6 m^2 in 2011, a 76% increase in 37 years. Studies by BRANZ (Page, 2007) also show new NZ houses are bigger than in the past. At the same time average household size has decreased from 3.7 in 1951 to 2.6 in 2011 (Statistics New Zealand, 2008) meaning fewer people are living in larger houses (the latter is termed large housing in this study). Large housing seems to be a new phenomenon not only in New Zealand but also in other developed countries such as Australia (Fuller and Crawford, 2011). A comparison of New Zealand houses with 15 European countries (Dol and Haffner, 2010) indicates the former are larger in terms of average floor area, average number of rooms, and average room size (Table 1). A survey of 285 owner occupied houses in New Zealand in 2014 indicates some features of these large houses are double/triple garage, double/triple living rooms, extra bedrooms with no usual occupant, specialized rooms (i.e. study/office, play room, games room/rumpus room, studio/workshop), and more than one bathroom (including en-suites).

Country	Average floor area	Number of rooms	Average room size
New Zealand	149	6.3	23.7
Luxembourg	125	5.5	22.7
Denmark	113	3.8	29.7
Ireland	104	5.6	18.6
Netherlands	98	4.2	23.3
Italy	96	4.2	22.8
Austria	94	4.1	22.9
Sweden	91	4.2	21.6
France	90	4.0	22.5
Germany	90	4.4	20.5
Spain	90	5.0	18.0
UK	87	4.7	18.5
Portugal	83	4.3	19.3
Belgium	81	4.7	17.2
Greece	81	3.8	21.3
Finland	77	3.6	21.3

Table 1 Average floor area, number of rooms, and room size for New Zealand and 15 European countries (source: Dol and Haffner (2010) and Statistics New Zealand (2014b)).

The types of houses are also changing in New Zealand. According to Statistics New Zealand (2002, 2011 and 2014c) the number of 1, 2 and 3 bedroom houses have respectively decreased by 7,

19 and 14% from 1986 to 2013 (Figure 1). Over the same period, the number of 4, 5, 6, 7 and 8-8+ bedroom houses has increased by 51, 123, 175 and 100% (Figure 1).

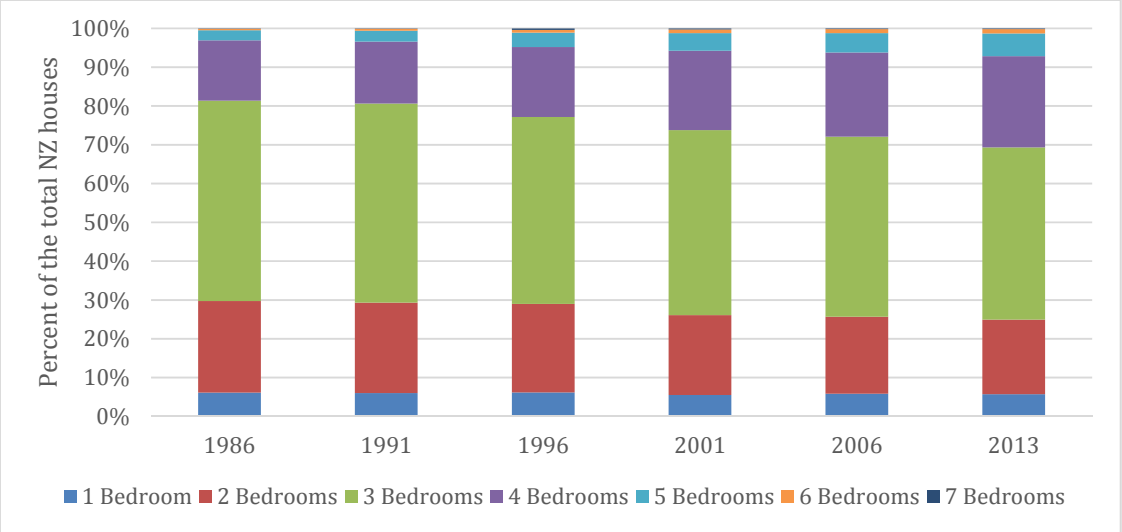

Figure 1 House size as a percentage of total NZ houses 1986-2013 (Source: Statistics New Zealand (2002, 2011 and 2014c))

Houses size as determined from the census is used to estimate the level of overcrowding in different household types and parts of the country. Statistics New Zealand (2014d) define crowding as "a theoretical concept about the acceptable number of people per household. Crowding in households relates to situations where the number of people residing in a household exceeds the ability of the dwelling to provide adequate shelter and services to its members." Living in overcrowded houses is proved to lead to problems: mental (Harker (2006) and Robert-Hughes et al. (2011)), physical (Harker (2006) and Robert-Hughes et al. (2011)) and social (Murray (1974), UCL (2010), Reynolds et al. (2004), Reynolds and Robinson (2005) and Friedman (2010)). Studies by Harker (2006) have shown a negative relationship between educational achievements and overcrowding.

2. Crowding indices:

Crowding indices are tools used to measure the level of crowding in the household. There are six common ones in use in the world: The American crowding index (ACI) or People Per Room (PPR), Equivalised Crowding Index (ECI), Canadian National Occupancy Standard (CNOS), British bedroom standard (BBS), Occupancy Rating standard, and People per floor area index (Goodyear et al. 2011). The ACI is the most popular index while a version of CNOS is used by Statistics New Zealand and in Australia and seems to be the best fit for the New Zealand situation (Goodyear et al. 2011). Crowding indices are usually calculated according to the number of residents, number of rooms, type of room, sex of residents, and age of residents (Goodyear et al. 2011).

Different crowding indices consider room or bedroom numbers when measuring house size and also different age/gender conditions for sharing bedrooms. Table 1 compares three popular crowding indices. Table 1 shows the number of rooms/bedrooms is a key parameter in all these crowding indices and an inaccurate figure for the number of rooms/bedrooms could lead to misleading crowding rates. Crowding indices are mainly used for measuring overcrowding although

they can also help in measuring under-use of houses, which in turn could be linked to wastage of the resources and energy that go into housing. However, it seems that while all crowding indices are relatively precise for measuring overcrowded houses, none are good for measuring the level of under-utilization in large houses, as will be discussed below.

<table>
<tr><th rowspan="3"></th><th rowspan="3">House size basis</th><th colspan="3">Which pairs should share a bedroom?</th><th rowspan="3">Age which needs separate bedroom</th><th colspan="5">Crowding condition</th></tr>
<tr><th rowspan="2">Couples</th><th rowspan="2">Young children of any gender if</th><th rowspan="2">Children of same gender if</th><th colspan="2" rowspan="2">Crowded</th><th colspan="3" rowspan="2">Not crowded</th></tr>
<tr></tr>
<tr><td rowspan="2">ACI</td><td rowspan="2">Rooms</td><td rowspan="2">NA</td><td rowspan="2">NA</td><td rowspan="2">NA</td><td rowspan="2">NA</td><td>Severely crowded</td><td>Crowded</td><td colspan="2">Not crowded</td><td>underutilized</td></tr>
<tr><td>1.5<PPR</td><td>1<PPR<=1.5</td><td colspan="2">0.5<PPR<=1</td><td>PPR<=0.5</td></tr>
<tr><td rowspan="2">BBS</td><td rowspan="2">Bedrooms</td><td rowspan="2">Yes</td><td rowspan="2">Age<10</td><td rowspan="2">Age<21</td><td rowspan="2">Age>21</td><td colspan="2">Overcrowded</td><td>Equal to standard</td><td>1 above standard</td><td>Under-occupied</td></tr>
<tr><td colspan="2">1+ extra bedrooms</td><td>0 extra bedrooms</td><td>1 extra bedrooms</td><td>2+ extra bedrooms</td></tr>
<tr><td rowspan="2">CNOS</td><td rowspan="2">Bedrooms</td><td rowspan="2">Yes</td><td rowspan="2">Age<5</td><td rowspan="2">Age<18</td><td rowspan="2">Age>18</td><td>2+ extra bedroom needed</td><td>1 extra bedroom needed</td><td>No extra bedroom needed, none spare</td><td>1 bedroom spare</td><td>2+ bedrooms spare</td></tr>
<tr><td colspan="2">Crowded</td><td>0 extra bedrooms</td><td>1 extra bedrooms</td><td>2+ extra bedrooms</td></tr>
</table>

Table 2 Comparison of 3 crowding indices and their categorization of being overcrowded (prepared based on data from Goodyear et al. (2011))

3. Large housing and room/bedroom standard:

When considering large housing, three concerns regarding the accuracy of room and bedroom standards as tools for measuring house size emerge. The first problem is that specialized rooms such as study/office/library, games room/rumpus room/gym, play room and studio/workshop are considered as a room in the room standard but they are not considered as a bedroom(s) in the bedroom standard. For instance a house with 3 bedrooms, 1 study and 1 games room will be counted as a 3 bedroom house while a house with only 3 bedrooms and no specialized rooms will also be counted as a 3 bedroom house although the actual size and floor area of two houses could be quite different. The second problem is the presence of multiple bathrooms (including en-suites) and walk-in wardrobes in new NZ houses. Service areas are not counted either as rooms or bedrooms in room and bedroom standards. Our studies show some new NZ houses have en-suites as large as 14m^2 (Navigation homes, 2015), walk-in wardrobes as large as 9m^2 (House plans, 2016) and laundries as large as 17m^2 (New Zealand Home and Building, 1979), meaning some of these service rooms are bigger than a bedroom, but are never considered in room and bedroom standards. The third problem is inconsistency between different countries when discussing house size and crowding. According to the Housing Statistics for European Union 2010 (Dol and Haffner, 2010) the average floor area of UK houses is 82.7m^2 compared to 196.8m^2 for New Zealand in 2008 (Statistics New Zealand, 2014b). A comparison of figures for both countries in Table 1 reveals that while the average number of rooms in NZ houses is 34% more than the UK, the average floor area of NZ houses is 71% more than the UK, indicating the number of rooms is perhaps not a good tool for measuring house size when it comes to comparison between countries.

According to Statistics New Zealand (2014e) and based on census 2006 data, while the problem of crowded housing affects 10.4% of NZ households, 64.5% of the NZ population live in what might be called large housing (Figure 2). Figure 2 also shows the central Otago district has the largest and Auckland the smallest houses in New Zealand.

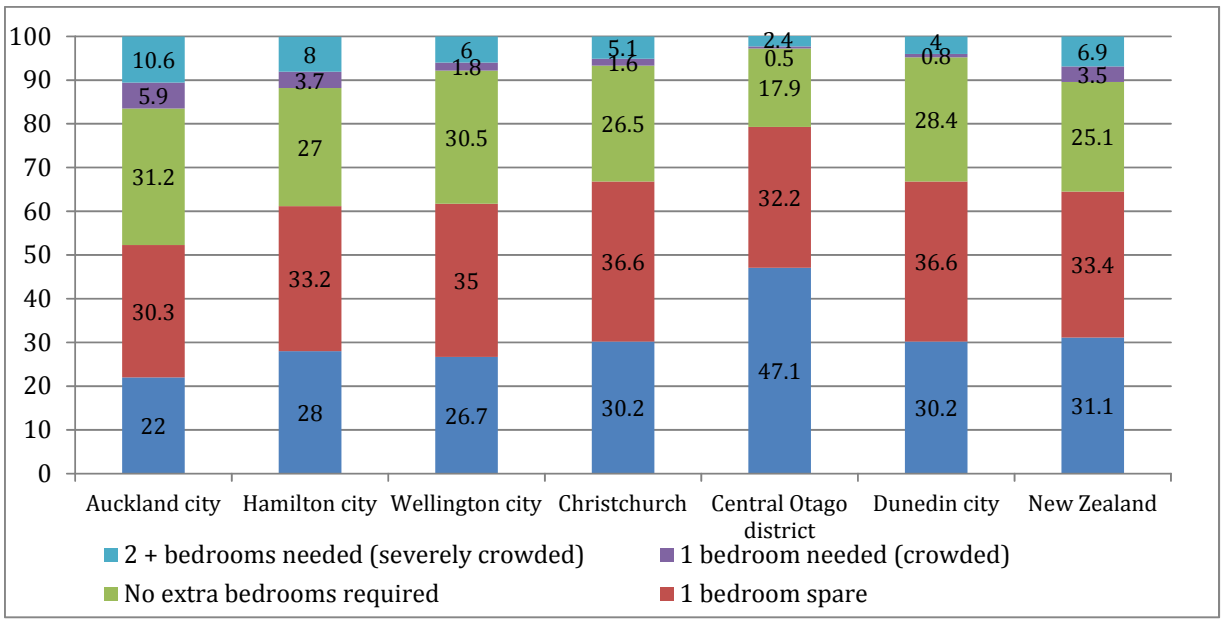

Figure 2 Percentages of crowded and not crowded houses in New Zealand and its major cities based on census 2006 data (prepared based on data from Statistics New Zealand (2014e)

4. Study design:

A PhD study was designed to discover more about different aspects of large housing in New Zealand. This was further broken down into four sub-studies. The first was a preliminary study of New Zealand houses advertised on Trade me, currently claimed as "the leading online marketplace and classified advertising platform in New Zealand" (Trade me, 2014). This study was undertaken to find out more about the types of rooms in New Zealand houses along with overall house size and types of furniture. The written descriptions and random photos of 60 houses (10 each of 1-6 bedrooms) were examined to collect information on which to base the questionnaire for the main survey. The number of bedrooms was used as an indicator of house size.

The second sub-study was a pilot study for the main survey. A questionnaire was prepared based on the findings of the TradeMe study, and was undertaken by 7 households (14 individuals) living in Wellington. Of the seven participating households, 2 were single person (1 living in a small and 1 living in a large house), 3 were couples (1 living in a small and 2 in large houses) and 2 were couples with one child (1 living in a small and 1 in a large house). The survey asked about their household composition, house features and furniture. Based on house layout, a time-use diary was prepared for each person to report the time he/she spent in each room as well as "out of home" for 14 consecutive days in winter. A full description of this study and the results are presented elsewhere (Khajehzadeh and Vale, 2015a).

The third and main study was an on-line survey administered in February-April 2015 in New Zealand. The survey was limited to single people, couples and couples with 1 or 2 children living in owner occupied houses. The survey asked about family members, house features (number and names of rooms), furniture (type, number and location) and time-use in different rooms of the house (for each family member for 1 day). Overall 445 households took part in the survey with 285 (64.0%) finishing the house/furniture part and 212 households (538 individuals) the time-use part. Results of this study gave a better understanding of what large housing mean in terms of house features and furniture. In addition, this study showed how long various rooms in New Zealand houses are really used and who uses these. A part of this study and the results are presented elsewhere (Khajehzadeh and Vale, 2015b).

The fourth and final study was designed to investigate the size of rooms in New Zealand houses. Houses were selected of different sizes and from a variety of periods. Houses were taken from old NZ journals and catalogues of new houses constructed in different parts of New Zealand. To standardize the data floor plans of 189 New Zealand houses were drawn using Auto-Cad 2015 and the floor area of each room was measured. For each room, the area occupied by internal walls was shared proportionally between appropriate rooms. A spread sheet was created showing the floor area of each room type for all houses. It should be noted that as this part of the research is still under way, the results here are based on analysis of 189 houses (an average 11 houses of each size). This paper uses these results to show how a change in the average floor area of NZ houses can influence the accuracy of using room/bedroom standards.

5. Results:

The floor plan study of 189 NZ houses showed that rooms in larger houses are bigger than rooms with the same function in small houses. For instance, the average floor area of the master bedroom in a 9-9+ room house is 77% bigger than the master bedroom of a 4 room house. The same pattern can be seen in all room types. Table 3 compares the average floor area of selected room categories, the total floor area of the house (garage excluded) and the floor area per room for different sized NZ houses. According to Table 3, the average floor area per room in 9-9+ room NZ houses is 48% more than that of 4 room houses.

	Master bedroom	Other bedrooms	Kitchen	Living room	Dining room	Combined L/D/K	Bathroom /Toilet	Total floor area	Floor area per room
4 room houses	13.6	11.5	13.2	19.3	NA	NA	4.3	70.8	17.7
5 room houses	17.0	12.7	12.5	22.2	14.6	39.4	4.4	97.1	19.4
6 room houses	17.1	12.8	11.5	24.9	16.3	46.8	6.1	115.8	19.3
7 room houses	21.5	15.1	15.1	27.2	17.9	49.0	7.2	163.2	23.3
8 room houses	22.9	15.7	16.3	28.5	16.8	51.2	7.1	186.3	23.3
9+ room houses	24.1	18.1	18.7	29.3	16.6	47.4	7.7	236.2	26.2

Table 3 Average floor area of selected rooms, total floor area (garage excluded) and floor area per room for different sized houses based on the floor plan study of 189 New Zealand houses

The floor plan study also indicates a big difference between the minimum and maximum floor area of houses with the same number of bedrooms (see Table 4). Usually older NZ houses have a smaller total floor area compared to a new NZ house with the same number of rooms. So date of construction can be important when it comes to estimation of NZ house size based on number of rooms.

	Average floor area (m^2)	Minimum floor area (m^2)	Maximum floor area (m^2)
2 bedroom houses	93.9	55.3	157.3
3 bedroom houses	134.5	78.9	255.7
4 bedroom houses	186.5	94.9	331.2
5 bedroom houses	252.8	203.1	308.4

Table 4 Average, minimum and maximum floor area of different sized New Zealand houses

House size also affects the number of rooms of each type. Figure 3 presents the average number of bedrooms, bathrooms, living rooms, dining rooms, kitchens and specialized rooms in different sized houses. Although the number of kitchens stays constant in all house sizes the number of bathrooms, living rooms, dining rooms and specialized rooms increases as houses become larger. The number of living rooms is similar in small houses (4-6 room houses) but increases in houses with 7 and more rooms. According to Figure 3, the average number of specialized rooms and the average number of bathrooms in 9-9+ room houses is 1400% and 82% more respectively than in 6 room houses (the standard 3 bedroom house). This could be important because specialized rooms, extra bathrooms and extra living rooms which are mainly seen in larger houses are not counted in CNOS and BBS.

Figure 3 Average number of bedrooms, bathrooms, living rooms, dining rooms, kitchens and specialized rooms in different sized New Zealand houses

6. Discussion:

The results of this study show that as in other developed countries, New Zealand houses have increased in size over the last few years. In addition, the occupancy rate has decreased in most of these countries including New Zealand. This shows fewer people are living in larger houses. Having more bedrooms with no usual occupants, multiple living rooms, double/triple garaging, multiple bathrooms (including en-suites) and specialized rooms (i.e. study/office/library, games

room/gym/rumpus room, play room, media room and studio/workshop) are features of large housing in New Zealand.

Crowding indices are highly dependent on house size and either use number of rooms or number of bedrooms as indicators of this. Rooms and bedroom standards are widely used by statistics for counting the number of rooms and bedrooms for census reasons. While some features of large houses like extra bedrooms are reflected in all crowding indices others such as extra living rooms and specialized rooms (like a study or play room) are never reflected in CNOS and BBS and can only be seen in ACI. For instance, assume a couple with two children (both boys with age 6 and 19 years old) live in a house with 1 combined living room/dining room/kitchen, 2 bedrooms and 1 study. Their crowding condition as measured by different crowding indices is presented in Table 5. This shows the same house for the same household is crowded in CNOS but not crowded in ACI or BBS. On the other hand, similar houses with different furnishing plans might be categorized differently in CNOS and BBS. Other features such as double/triple garaging and extra bathrooms will not be reflected in any of the crowding indices. This could be important as the time-use part of this study shows that many people use their garages for things other than parking cars (such as a games room or workshop).

	ACI	**BBS**	**CNOS**
Number of rooms	6	NA	NA
Number of bedrooms	NA	2	2
Number of occupants	4	4	4
Person per room	4 ÷ 6 = 0.67	NA	NA
Number of needed bedrooms	NA	2 (1 for couple + 1 for both boys)	3 (1 for couple + 1 for each boy)
Crowding condition	Not crowded (0.67 < 1 PPR)	Not crowded- equal to standard (2 = 2)	Crowded - 1 extra bedroom needed (2<3)

Table 5 The crowding condition of a couple with two children (2 boys age 6 and 19) living in a house with 1 combined living room/dining room/kitchen, 2 bedrooms and 1 study in various crowding indices

Service spaces like bathrooms, en-suites and laundries are not counted as rooms in the room standard or as a bedroom in the bedroom standard. Although the floor plan study of NZ houses indicates that some New Zealand houses have bathrooms, en-suites and laundries as big as a bedroom and even bigger than a standard double bedroom in UK houses (Vale and Vale, 2009). These spaces are not counted in any crowding index.

This study also shows that similar types of room have very different floor areas in large and small houses. This means that when a 6 room house is compared with a 4 room house, the difference is greater than just the 2 additional rooms. The problem becomes more significant when comparing houses with similar numbers of rooms in various countries. For instance the floor area of a 5 room house in the UK is much smaller than a 5 room New Zealand house although both are treated the same in most crowding indices. How big rooms are is, as yet, not seen as being important.

7. Conclusion:

Recent changes in the size and layout of New Zealand houses (and those of other developed countries) has questioned the validity of room and bedroom standards to the point that these perhaps need revision. Crowding indices are precise in terms of measuring overcrowded houses but less so when it comes to measuring the level of underutilization or number of spare bedrooms. Crowding indices with a room basis (ACI) are perhaps of more use than those that are bedroom

based (BBS and CNOS) because regardless of room name and furniture all habitable rooms are captured. A combination of ACI with BBS and CNOS could be more useful for the new housing stock. For instance, the benefits of CNOS and BBS such as age/gender limits for sharing bedrooms can be combined with the total number of rooms in ACI.

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