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An Evaluation of Residential Septic Design Flows and Multi-Family Occupancy in Massachusetts

A REPORT FOR THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

UMASS DONAHUE INSTITUTE
Economic & Public Policy Research

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Executive Summary

This study addresses a request from MassDEP's stakeholder group to review the sewage flow design criteria for larger multi-family / multi-user systems to determine whether design flows should be decreased at a certain numbers of bedrooms, thereby lowering construction costs.

310 CMR 15.000, The State Environmental Code, Title 5 requires that septic systems for residential buildings of most types be designed with a wastewater flow rate of 110 gallons per day per bedroom (15.203(2)). This is based on generating 55 gallons per capita per day of wastewater assuming two occupants per bedroom. As the requirement is based on the two person per bedroom occupancy assumption, a question arises about whether all housing – single family or multi-residential buildings follow similar occupancy patterns.

This study compares the Massachusetts design flow rate to other states and utilizes detailed U.S. Census Bureau data, to evaluate bedroom occupancy in Massachusetts for different types of residential structures and how these may vary depending on demographic characteristics.Highlights include:

- Massachusetts has one of the lowest residential design flow rates in the country.
- Multi-residential buildings of all types have more people per bedroom than single family homes, with occupancy rising as the number of units within a building increases (from 2 units to 20-49 units), with a 0.03 occupancy decrease in the over 50 units category.
- The average bedroom occupancy for a single family home in Massachusetts is 0.87 while multi-residential buildings with 20 to 49 units have an average of 1.2 people per bedroom.
- 95 percent of the units in multi-residential buildings (20 units or more) in Massachusetts have two bedrooms or less.
- The presence of children significantly increases the number of people per bedroom for all types of housing and is an even more prominent factor in multi-residential buildings. While single family homes with children average 1.22 individuals per bedroom, large multi-residential buildings in the 20-49 unit and more than 50 unit categories show 1.87 and 1.82 people per bedroom, respectively, if there is a presence of children.
- Renter-occupied units in all housing types tend to have a higher number of people per bedroom than owner-occupied housing. Renter-occupied housing in larger multi-residential complexes also have more people per bedroom than either single-family homes or smaller multi-residential buildings.
- Households with low levels of English proficiency also have more people per bedroom. Again, this trend is clear with larger, multi-residential buildings, notably in the 20 to 49-unit range.

- As housing gets closer to Boston's urban inner core, the number of people per bedroom, on average, increases. The inner urban core has an average of 1.08 people per bedroom (average for all housing types) while the Berkshires and Cape Cod and the Islands have the lowest. While the wastewater needs of the Boston area is served by the centralized wastewater treatment plant owned by the Massachusetts Water Resources Authority, the data suggest that there are more people occupying each bedroom in the more urban areas of Massachusetts.

- A main finding from this research is that MassDEP's two person per bedroom assumption maintains its integrity when applied to large multi-residential buildings. This finding is supported by an in-depth analysis of the number of people per bedroom in Massachusetts across different building types, as well as when assessing wastewater flow criteria from similar government entities around the country.

1. Introduction

This study addresses a request from MassDEP's stakeholder group to review the sewage flow design criteria for larger multi-family / multi-user systems to determine whether design flows should be decreased with certain numbers of bedrooms, thereby lowering construction costs.

The Massachusetts design flow rate as established in 310 CMR 15.000 or Title 5 for the design of residential wastewater treatment/disposal systems is 110 gallons per day (GPD)/bedroom. This design flow rate is one of the lowest in the country (see **Figure 1**) and is based on generating 55 gallons per capita per day of wastewater assuming two occupants per bedroom. This study focuses on occupancy for different types of residences.

In evaluating occupancy MassDEP is reviewing whether a change to the 110 GPD/bedroom design flow rate for multi-residence buildings is warranted without increasing the risk of hydraulic or treatment failure of the onsite Title 5 system and while maintaining an appropriate margin of safety.

MassDEP engaged the Economic and Public Policy Research group (EPPR) at the UMass Donahue Institute (UMDI) to build on a review, previously conducted by DEP, of analytical practices regarding multi-residence design flow rates from other states, as well as a review of available secondary data, notably from the U.S. Census Bureau, that can help answer design flow questions.

2. State-by-State Comparison

In a 2002 report on wastewater treatment systems around the country, the U.S. Environmental Protection Agency (EPA) laid out guidelines by which state agencies could design their wastewater flow criteria.[1] The agency encouraged the utilization of U.S. Census data to guide design flow criteria by investigating the number of people per bedroom. As of 2002, 34 out of 50 states follow the assumption of two people per bedroom and a flow rate of 75 to 100 gallons per person per day, resulting in an approximation of roughly 150 to 200 gallons per bedroom per day. Residential occupancy typically ranges from 1.0 to 1.5 persons per bed room. Although it provides for a conservative estimate, the current practice is to assume that maximum occupancy is two persons per bedroom. As an alternative to this, the EPA mentions the use of metered water flow data in order to assess true wastewater flow rates more accurately.

In May of the same year, the Washington State Department of Health released its own report exploring the EPA's two person per bedroom assumption as well as alternatives to this model.[2] It concluded that the two people per bedroom assumption model provides a limited factor of safety, and also concluded that having additional criteria seems reasonable, particularly in regard to the square-footage of the unit.

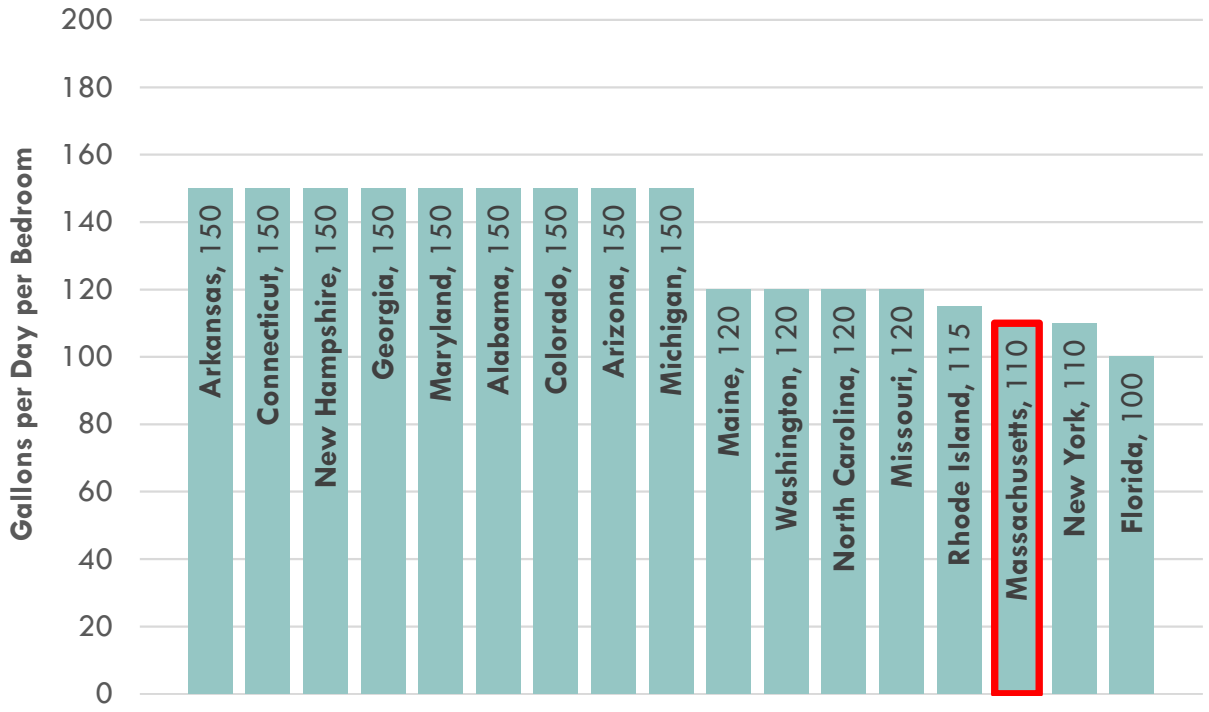
In this section, UMDI reviewed 19 states' design flow criteria, contacting Texas, Minnesota, and New York, for further information, because they utilize alternative methods to the EPA's guidelines.

Figure 1 shows the gallons per bedroom per day assumption for several states including Massachusetts. When compared to these states, Massachusetts has one of the lowest gallons per bedroom per day assumption. While Massachusetts utilizes the two person per bedroom assumption that the EPA outlined in 2002, it uses a lower gallons per day per person requirement than most states (55 GPD), resulting in a lower gallons per day per bedroom estimate (110 GPD per bedroom based on double occupancy, as compared to 150 GPD in many other states).

[1] Otis, R., J. F. KREISSL, R. FREDERICK, R. GOO, P. Casey, AND B. Tonning. ONSITE WASTEWATER TREATMENT SYSTEMS MANUAL - REVISED FEBRUARY 2002. EPA/625/R-00/008 (NTIS PB02-108560), 2002.

[2] Benfield, L. RESIDENTIAL FLOW RATES. Washington State Department of Health, 2002.

Figure 1. Residential Wastewater Design Flows for Multifamily Buildings, MA and Select States



Source: UMDI analysis of wastewater design flow rates

Texas

The Texas Water Quality Division determines residential wastewater flow rates using a per person model, assuming 3.5 people per unit and 75-100 gallons per person per day. These assumptions do not vary based on the number of units in the structure. However, the Texas Water Quality Division does adjust the gallons per person per day assumption based on criteria specific to each development. In the case of a development that will serve families with children, the design flow rate is increased, and vice versa for developments that will serve retirement communities. Flow rates are becoming a secondary consideration to the state of Texas, with more consideration given to the strength of the waste being treated.

Minnesota

Minnesota has also taken an alternative approach to assessing residential wastewater flow rates by classifying homes based on their size and number of water-using devices. While they still assume two people per bedroom, the gallons per person per day assumption varies based on the classification of the dwelling, with class I homes having the highest gallons per day usage, and class IV homes having the lowest. Class I homes are those which are in excess of 800 square feet per bedroom or utilize two or more water-using appliances. Class IV homes are graywater systems that must uphold certain design

criteria.[3] Minnesota reduces design flow rates for multifamily dwellings, allowing designers to utilize a formula that acknowledges variations in wastewater flow rates as the number of units increases. By doing so, they control for the reduction in the probability that each unit will produce peak flow rates at the same time, allowing for a decrease in the system design flow.

New York

New York adapts the EPA's guidelines by adding criteria that pertain to the age of the buildings' plumbing fixtures, reducing the flow rates for buildings with post 1994 plumbing fixtures. They also utilize metered water flow data from existing structures when available to help guide design flow criteria.

[3] Revisor of Statutes, State of Minnesota. Pollution Control Agency Chapter 7080 Part 7080.2240 https://www.revisor.mn.gov/rules/7080.2240/

3. Analysis of the Number of Individuals per Bedroom in Massachusetts

To investigate Mass DEP's two people per bedroom assumption, UMDI utilized Public Use Microdata Series (PUMS) estimates, a product of the U.S. Census Bureau. PUMS is a dataset of un-tabulated records for individuals and households taken from the American Community Survey (ACS), also a product of the U.S. Census Bureau. Unlike ACS data, which is published in a series of pre-aggregated tables covering numerous subject matters, PUMS data is published in its rawest form, allowing for custom queries and cross-tabulations while still preserving the original sample size. PUMS data are provided at the Public Use Microdata Area (PUMA) geographic level, which can then be aggregated into larger, custom regions. Each PUMA contains at least 100,000 people and in Massachusetts, they are geographically smaller in the eastern part of the state and much larger in the less densely populated western section of the state.

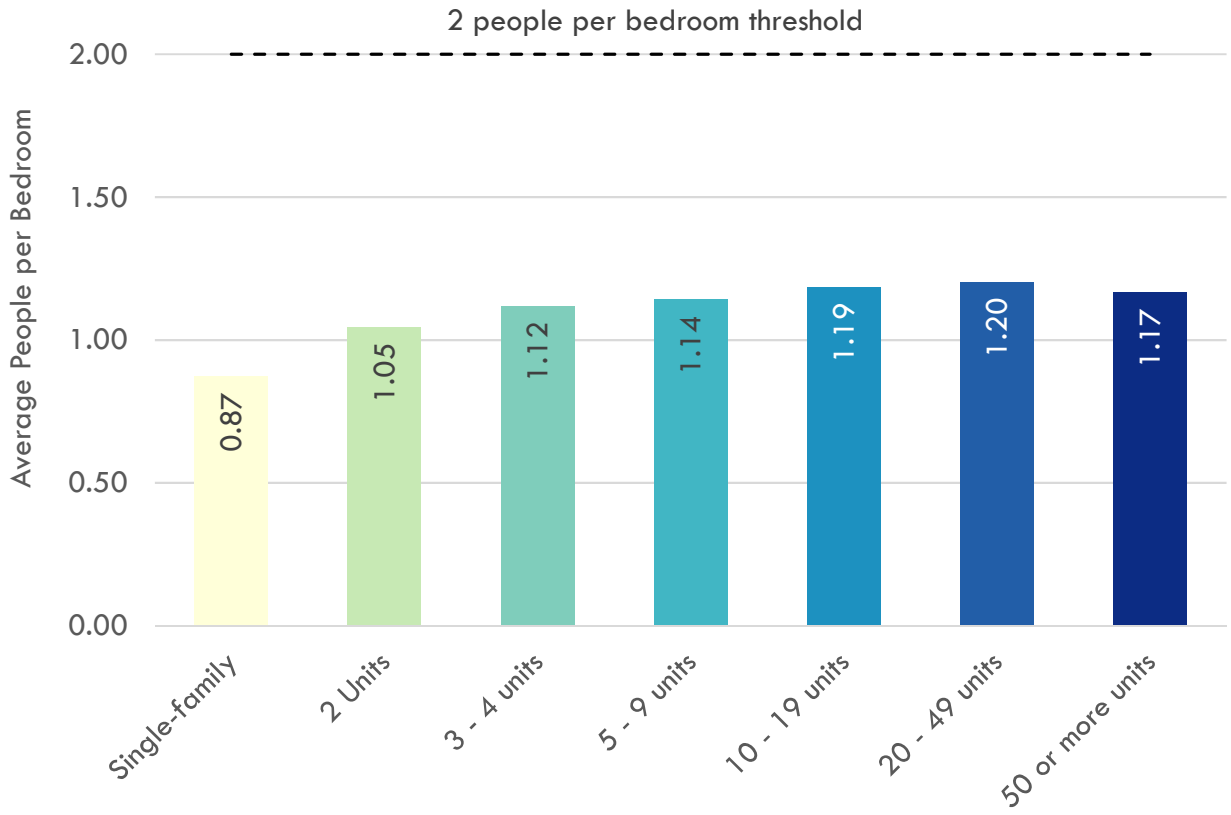
By using the unweighted PUMS data, UMDI was able to calculate the people per bedroom ratio by housing type and analyze how this differs based on such variables as household income, linguistic isolation (whether or not someone in the household speaks English), the presence of children, region, and others. Our analysis is particularly concerned with large multifamily buildings (50 units, plus), though we include smaller multifamily and single-family homes as references.

While there is some variation in the number of people per bedroom, the data underscore that the vast majority of housing units in the state have fewer than two people per bedroom. Although it provides for a conservative estimate, an assumption of two people per bedroom is appropriate for large multifamily residences.

Figure 1 below illustrates the average number of people per bedroom across the number of units in a single or multi-family residence. A horizontal reference line shows how closely each category compares to the reference point of two people per bedroom. The average number of people per bedroom does not surpass two, though it is higher for large multifamily residences when compared to single-family units. For the most part, the number of people per bedroom slowly increases based on the number of housing units within a building.

Given the need to apply an appropriate safety factor and be consistent with national standards this is the first and most broad indicator that the Department's two person per bedroom assumption is appropriate for large multifamily residences.

Figure 2. Average Number of People per Bedroom in MA by Number of Units



Source: U.S. Census Bureau, ACS PUMS, 2014-2018

As illustrated in **Table 1** below, 96% of units in larger multi-residential developments in Massachusetts are one or two bedroom units. The share of dwelling units with three or more bedrooms in multi-residential buildings with 20 or more units is low in Massachusetts—only accounting for 4 percent of the total.

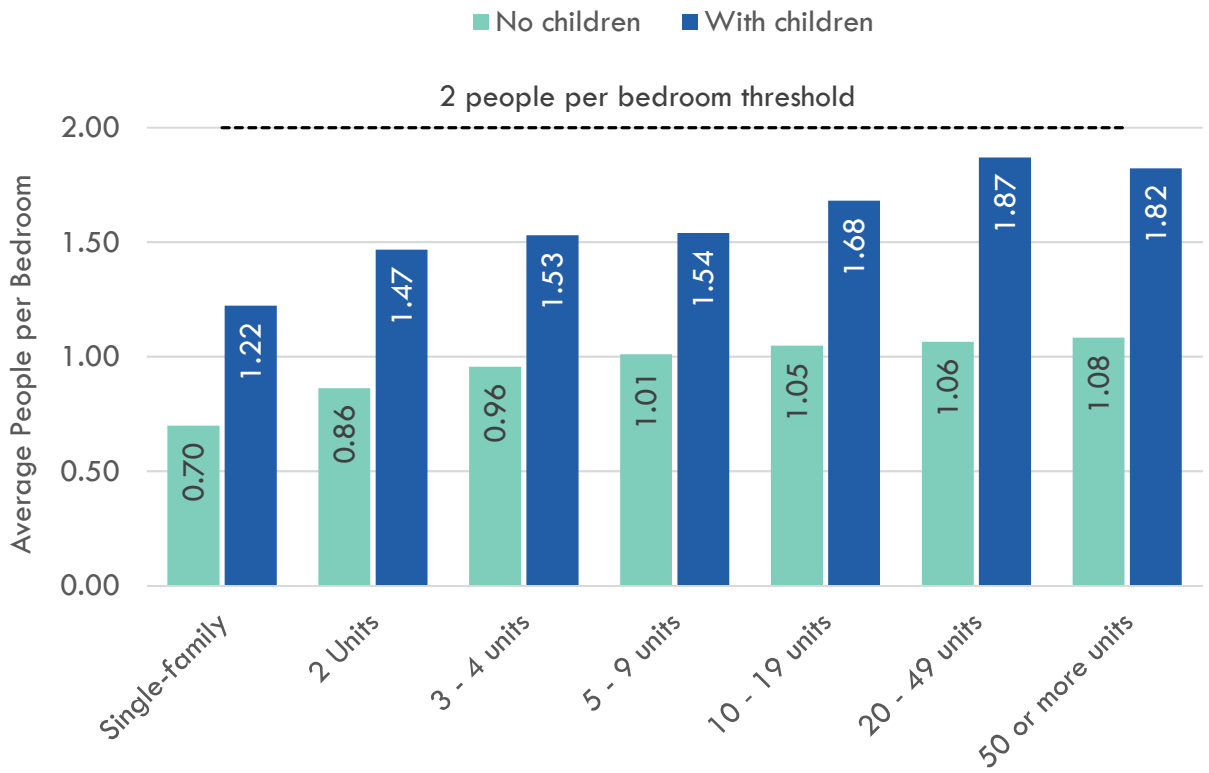
Table 1. Share of Housing Units by Number of Bedrooms for Multi-Residential Buildings in Massachusetts

Number of bedrooms	Share of units
1	54.9%
2	41.1%
3	3.3%
4	0.3%
5	0.03%
6	0.3%
9	0.1%

Source: U.S. Census Bureau, ACS PUMS, 2014-2018; reflects buildings with 20 or more dwelling units

As shown in **Figure 2** below, the average number of people per bedroom reaches closer to two in large multifamily residential buildings when controlling for presence of children. For the most part, as building size increases, the average number of people per bedroom for households with children also increases. As seen in **Appendix A**, households with children in the 90th percentile have on average three people per bedroom. This is logical, given that the presence of children is expected to increase the number of people in a household, without necessarily increasing the number of bedrooms. As mentioned in the State-by-State comparison in **Section 2**, this finding was also affirmed by the Texas Water Quality Division, detailing how criteria are modified based on the demographics of the occupants, including whether or not a unit is likely to be occupied by a family with children.

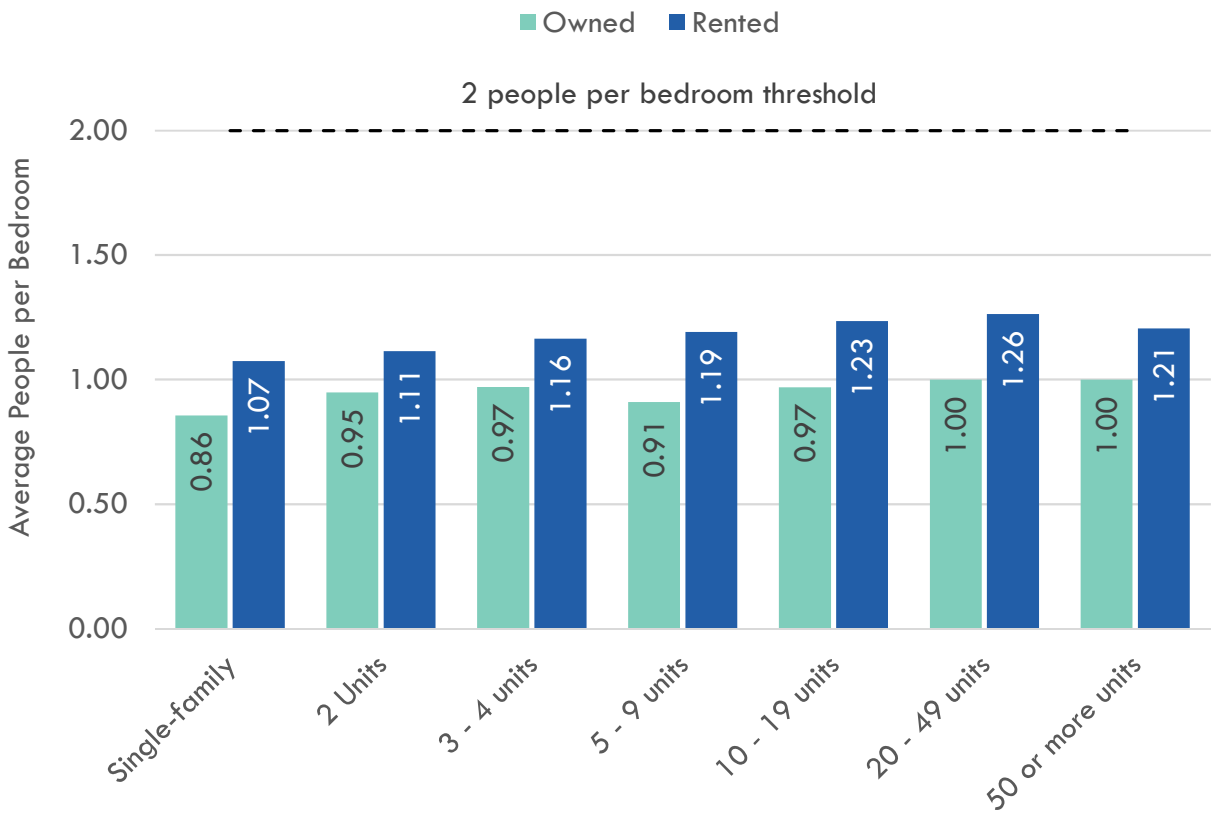
Figure 3. Average Number of People per Bedroom in MA by Presence of Children



Source: ACS PUMS, 2014-2018

Like the "presence of children" concept, differences by housing tenure-type (e.g., "owned" or "rented") also illustrate a clear trend (see **Figure 3**): Renter-occupied housing units tend to have more people per bedroom than owner-occupied units, regardless of the number of units in the building. **Figure 11** in **Appendix A** shows that owner-occupied units are more likely to have an excess number of bedrooms, as the share of owner-occupied units with fewer than one person per bedroom is roughly three times that of renter-occupied units.

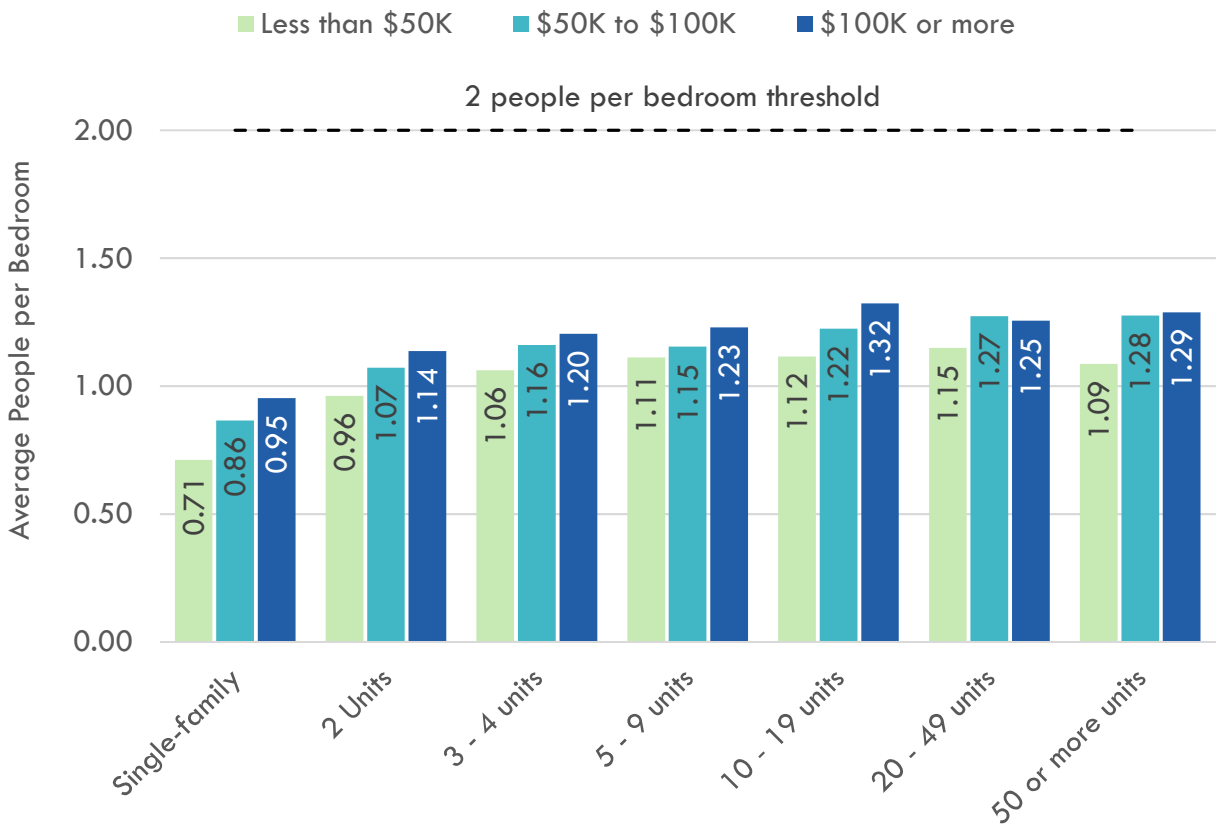
Figure 4. Average Number of People per Bedroom in MA by Housing Tenure



Source: ACS PUMS, 2014-2018

Figure 4 shows the average number of people per bedroom by household income, indicating that the number of people per bedroom trends upwards as household income increases. While the relationship between more people per bedroom and a higher household income may seem counterintuitive; given the high home values and rents, a higher income may still not afford many families enough space, especially when children are present. **Figure 12** in **Appendix B**, which shows that the people per bedroom ratio is highest in the Greater Boston area, corroborates this observation. Single people are also more likely to live in a one-bedroom housing unit while also being "single income," hence the lower income levels, throughout, for housing units that have a low number of people per bedroom.

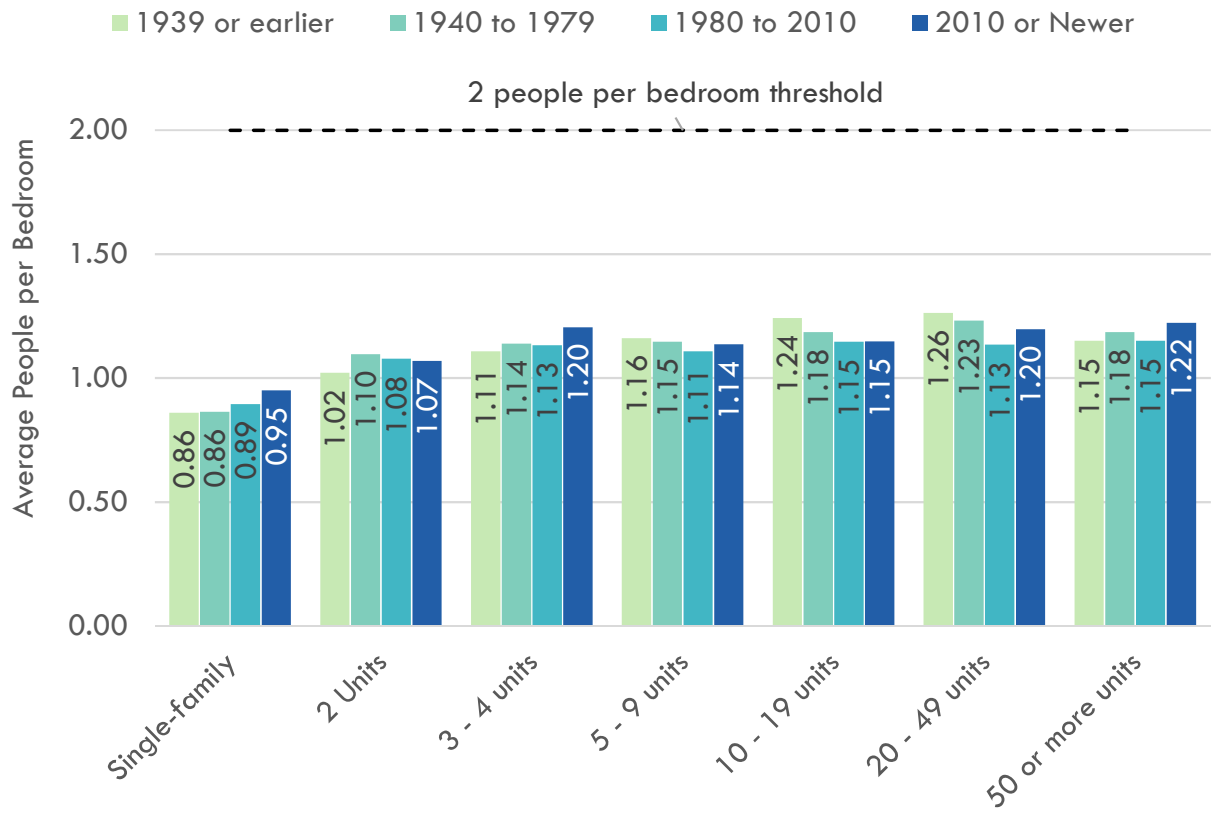
Figure 5. Average Number of People per Bedroom in MA by Household Income



Source: ACS PUMS, 2014-2018

As seen in **Figure 5**, the trend in people per bedroom is somewhat negligible when controlling for the year the housing structure was built. From these data, the newest large multi-residential buildings (50+ units and completed 2010 or later) emerge as the building-type with the most people per bedroom (1.22). As detailed in Section 2, some states use data on the age of housing when formulating design flow criteria. For example, New York utilizes the age of plumbing fixtures to determine daily minimum flow rates, allowing for higher flow rates in older buildings that also tend to have obsolete plumbing fixtures.

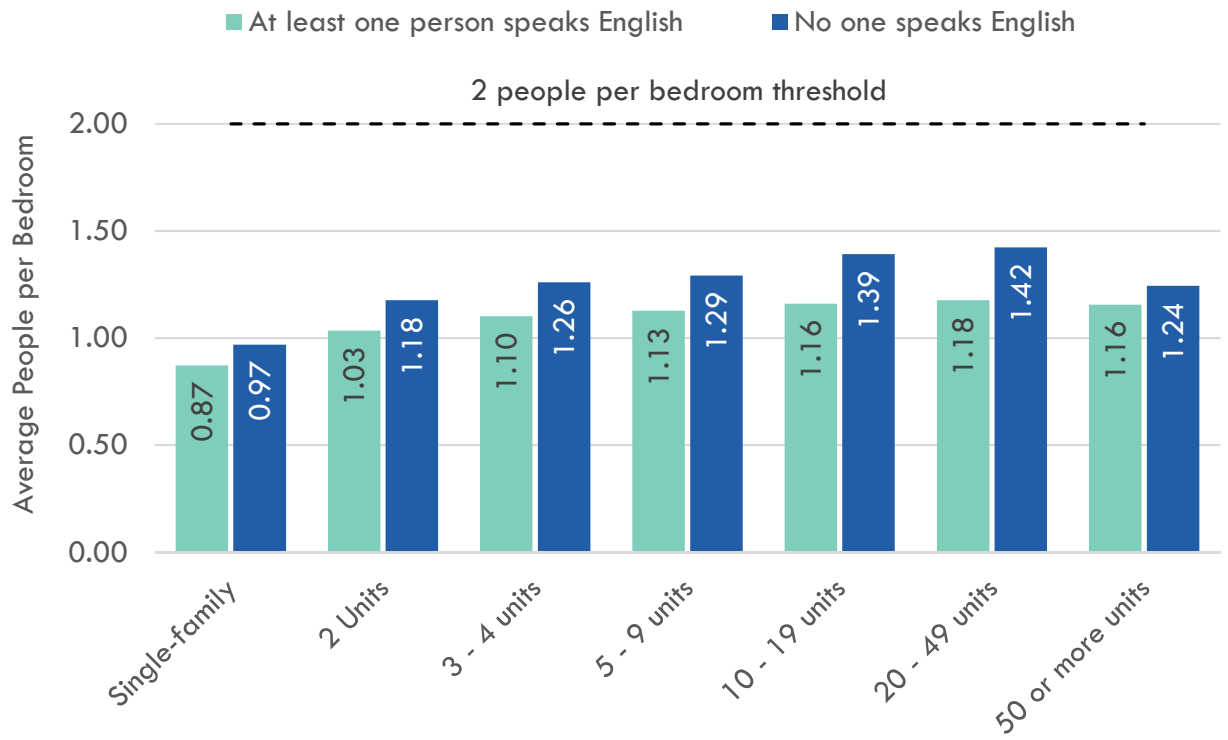
Figure 6. Average Number of People per Bedroom in MA by Year Built



Source: ACS PUMS, 2014-2018

Lastly, **Figure 6** illustrates the number of people per bedroom by linguistic isolation (i.e., whether or not at least one person in the household speaks English). Across the board, non-English speaking households tend to have more people per bedroom. This is unsurprising, given the cities and towns across the state with large immigrant populations, and limited access to affordable housing. According to a separate analysis completed by the UMass Donahue Institute on overcrowding, Chelsea is the most overcrowded city in the state in terms of people per room, but also has the state's 2nd largest Hispanic/Latino population by share. Cities like Lawrence and Lynn follow a similar pattern.[4]

Figure 7. Average Number of People per Bedroom in Massachusetts by Linguistic Isolation



Source: ACS PUMS, 2014-2018

While this analysis exclusively utilized Census data, it may also be beneficial for DEP to draw on other reports that analyze water use data. One such report, published by The Water Research Foundation (WRF) in 2018, develops strategies for estimating multi-family water use.[5] In conjunction with Census data, the WRF also worked with several municipal water divisions around the country to leverage actual water-use data to develop methods for estimating water usage in multi-family residences.

4 http://www.donahue.umassp.edu/our-publications/donahue-data-dash-inequalities

5 KIEFER, J. C., and L. R. Krentz. 2018. Water Use in the Multi-Family Housing Sector. Project 4554. Denver, Colo.: The Water Research Foundation.

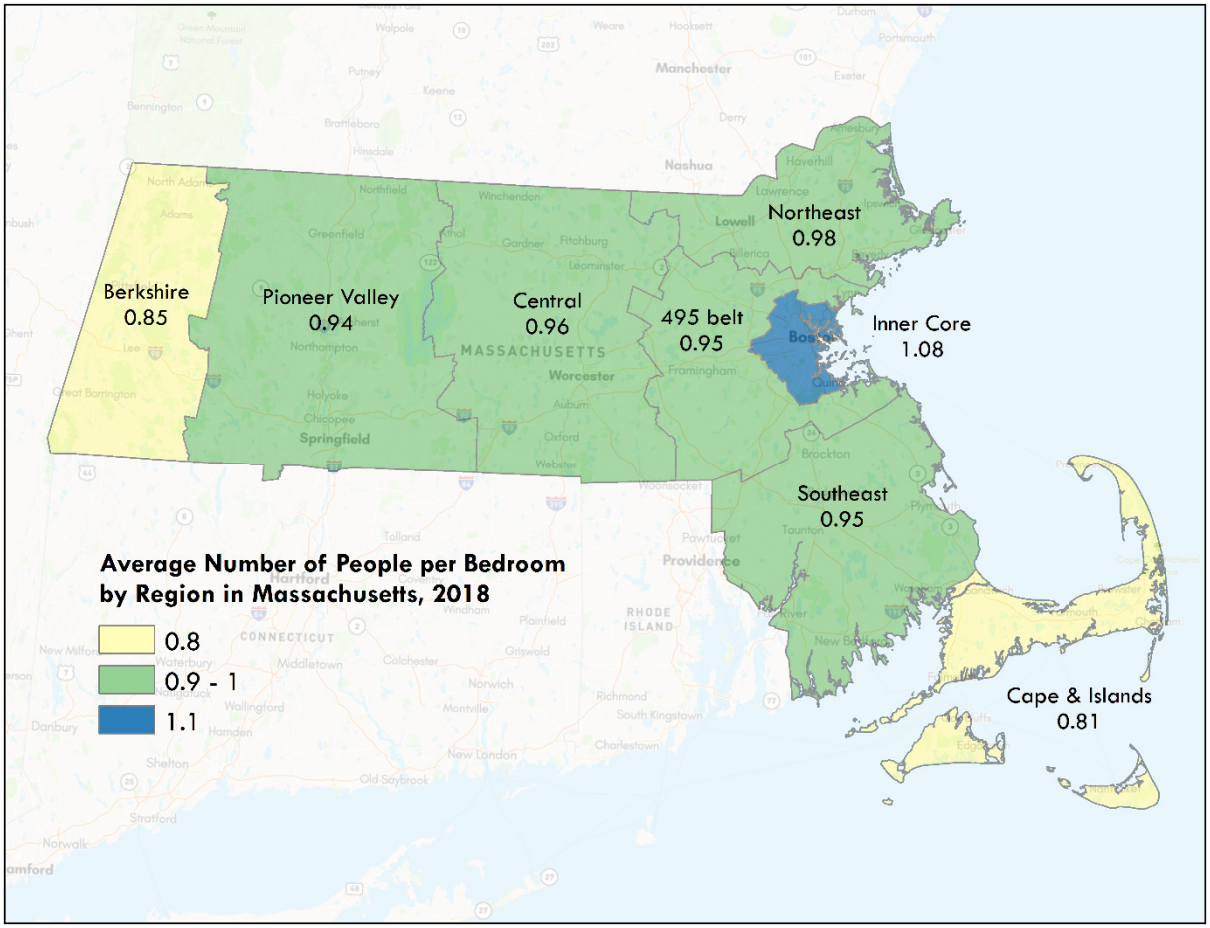
Conclusion

Based on the findings detailed above as well as those in the appendix section, MassDEP's two person per bedroom assumption maintains its integrity when applied to large multi-residential buildings. This finding is supported by an in-depth analysis of the number of people per bedroom in Massachusetts across different building types, as well as when assessing wastewater flow criteria from similar government entities around the country. When analyzing the distribution of the people per bedroom ratio in Massachusetts by several key variables, it is clear the majority of housing units have a people per bedroom ratio below two. Although it provides for a conservative estimate, the current practice is to assume that maximum occupancy is two persons per bedroom. The average bedroom occupancy for a single family home in Massachusetts is 0.87 while multi-residential buildings with 20 to 49 units have an average of 1.2 people per bedroom. This finding, based on U.S. Census data, holds true regardless of the number of units a structure has. What seemed to be most impactful is the presence of children, with households in large multifamily structures with children having a 90th percentile people per bedroom ratio of three. Importantly, UMDI found that the number of people per bedroom increased with the size of the building (as measured by the number units). The average number of people per bedroom in larger structures (20 plus units) is higher than in structures with nine units or less.

When compared to other states, Massachusetts has one of the lowest gallons per bedroom per day requirement. While most states also assume 2 people per bedroom, a few states have adopted additional criteria to control for the variance in wastewater flow rates by adjusting their assumptions based on factors including square footage, the age of plumbing fixtures, and the demographic characteristics of the occupants.

Appendix A. Detailed Findings from the Data

Figure 8. People per Bedroom by Massachusetts Region



Source: ACS PUMS, 2014-2018

Table 2. People per Bedroom in MA by Building Type – Summary Statistics

Total N = 129,846	Single-family	2 Units	3 to 4 units	5 to 9 units	10 to 19 units	20 to 49 units	50 or more units
N	82,497	11,881	12,470	6,314	4,561	4,880	7,243
Average *(see graph)*	0.87	1.04	1.12	1.14	1.19	1.20	1.17
Median	0.75	1	1	1	1	1	1
80th Percentile	1.25	1.5	1.5	1.5	1.5	1.5	1.5
90th Percentile	1.34	2	2	2	2	2	2
Maximum	6	9	10	7	7	6	6
N of Maximum	2	1	1	1	1	1	1

Source: ACS PUMS, 2014-2018, note that all summary statistics are computed using frequency weights, but the sample size is non-weighted

Table 3. People per Bedroom in MA by Presence of Children and Building Type – Summary Statistics

		Single-family	2 Units	3 to 4 units	5 to 9 units	10 to 19 units	20 to 49 units	50 or more units	
With Children	N	25,409	3,204	3,080	1,351	834	682	720	N=35,280
	Average	1.22	1.47	1.53	1.54	1.68	1.87	1.82	
	Median	1.25	1.33	1.5	1.5	1.5	1.5	1.5	
	80th Percentile	1.5	2	2	2	2	2.5	2	
	90th Percentile	1.67	2	2	2	2.5	3	3	
	Maximum	6	9	10	7	6	6	5	
	N of Maximum	1	1	1	1	1	1	3	
Without Children	N	57,088	8,677	9,390	4,963	3,727	4,198	6,523	N=94,566
	Average	0.70	0.86	0.96	1.01	1.05	1.06	1.08	
	Median	0.67	1	1	1	1	1	1	
	80th Percentile	1	1	1	1	1	1	1	
	90th Percentile	1	1.33	1.5	2	2	2	2	
	Maximum	6	6	8	5	7	5	6	
	N of Maximum	1	1	1	1	1	1	1	
	Total N	82,497	11,881	12,470	6,314	4,561	4,880	7,243	**129,846**

Source: ACS PUMS, 2014-2018

Table 4. People per Bedroom in MA by Housing Tenure and Building Type – Summary Statistics

		Single-Family	2 Units	3 to 4 units	5 to 9 units	10 to 19 units	20 to 49 units	50 or more units	
Owner Occupied	N	75,676	5,246	3,196	1,249	981	1,195	1,386	N=88,929
	Average	0.86	0.95	0.97	0.91	0.97	1	1	
	Median	0.75	1	1	1	1	1	1	
	80th Percentile	1.25	1.33	1.33	1	1	1	1	
	90th Percentile	1.33	1.67	1.67	1.5	2	2	2	
	Maximum	6	9	6	5	5	5	6	
	N of Maximum	2	1	3	1	1	1	1	
Renter Occupied	N	5,812	6,354	9,104	5,011	3,537	3,629	5,796	N=39,243
	Average	1.07	1.11	1.16	1.19	1.23	1.26	1.21	
	Median	1	1	1	1	1	1	1	
	80th Percentile	1.50	1.5	1.5	1.5	2	2	1.67	
	90th Percentile	1.75	2	2	2	2	2	2	
	Maximum	5.5	6	10	7	7	6	5	
	N of Maximum	1	2	1	1	1	1	4	
	Total N	81,488	11,600	12,300	6,260	4,518	4,824	7,182	**128,172***

Source: ACS PUMS, 2014-2018, *N is smaller due to the exclusion of a third category, "Not Owned or Rented"

Table 5. People per Bedroom in MA by Income Bracket and Building Type – Summary Statistics

		Single-Family	2 Units	3 to 4 units	5 to 9 units	10 to 19 units	20 to 49 units	50 or more units	
Less Than $50K	N	18,911	4,532	5,996	3,548	2,405	2,540	4,110	N=42,042
	Average	0.71	0.96	1.06	1.11	1.12	1.15	1.09	
	Median	0.67	1	1	1	1	1	1	
	80th Percentile	1	1.33	1.33	1.5	1.5	1.5	1	
	90th Percentile	1.33	1.67	2	2	2	2	2	
	Maximum	5	6	10	7	5	5	5	
	N of Maximum	2	1	1	1	1	3	2	
$50K to $100K	N	22,758	3,777	3,531	1,498	1,236	1,303	1,427	N=35,530
	Average	0.86	1.07	1.16	1.15	1.22	1.27	1.28	
	Median	0.67	1	1	1	1	1	1	
	80th Percentile	1.25	1.5	1.5	1.5	2	2	2	
	90th Percentile	1.5	2	2	2	2	2	2	
	Maximum	5.5	9	7	5	6	6	5	
	N of Maximum	1	1	2	2	1	1	1	
Over $100K	N	40,828	3,572	2,943	1,268	920	1,037	1,706	N=52,274
	Average	0.95	1.14	1.20	1.23	1.32	1.25	1.29	
	Median	1	1	1	1	1	1	1	
	80th Percentile	1.33	1.5	1.5	2	2	2	2	
	90th Percentile	1.5	2	2	2	2	2	2	
	Maximum	6	6	8	5	7	5	6	
	N of Maximum	2	4	1	1	1	1	1	
	Total N	82,497	11,881	12,470	6,314	4,561	4,880	7,243	**129,846**

Source: ACS PUMS, 2014-2018

Table 6. People per Bedroom in MA by Year Built and Building Type - Summary Statistics

		Single-Family	2 Units	3 to 4 units	5 to 9 units	10 to 19 units	20 to 49 units	50 or more units	
1939 Or Earlier	N	20,577	7,697	7,231	2,473	1,115	1,134	1,182	N=41,409
	Average	0.86	1.02	1.11	1.16	1.24	1.26	1.15	
	Median	0.75	1	1	1	1	1	1	
	80th Percentile	1.25	1.5	1.5	1.5	2	2	1.5	
	90th Percentile	1.40	1.67	2	2	2	2	2	
	Maximum	6	9	8	7	7	5	5	
	N of Maximum	1	1	1	1	1	4	1	
1940 to 1979	N	36,030	2,952	3,511	2,321	2,015	1,852	2,637	N=51,318
	Average	0.86	1.10	1.14	1.15	1.18	1.23	1.18	
	Median	0.75	1	1	1	1	1	1	
	80th Percentile	1.25	1.5	1.5	1.5	1.5	2	1.5	
	90th Percentile	1.33	2.00	2	2	2	2	2	
	Maximum	6	7	10	5	6	6	6	
	N of Maximum	1	1	1	3	1	1	1	
1980 to 2010	N	24,387	1,161	1,614	1,432	1,355	1,667	2,932	N=34,548
	Average	0.89	1.08	1.13	1.11	1.15	1.13	1.15	
	Median	0.80	1	1	1	1	1	1	
	80th Percentile	1.25	1.5	1.5	1.5	1.5	1.5	1.5	
	90th Percentile	1.33	2.00	2	2	2	2	2	
	Maximum	5.5	6	6	4	4	5	5	
	N of Maximum	1	1	1	6	1	1	2	
2010 or Newer	N	1,503	71	114	88	76	227	492	N=2,571
	Average	0.95	1.07	1.20	1.14	1.15	1.20	1.22	
	Median	1.00	1	1	1	1	1	1	
	80th Percentile	1.25	1.5	1.5	1.5	1.5	2	2	
	90th Percentile	1.33	1.67	2	1.67	2	2	2	
	Maximum	5	2.33	3	3	2.5	3	5	
	N of Maximum	1	1	1	1	1	1	1	
	Total N	82,497	11,881	12,470	6,314	4,561	4,880	7,243	**129,846**

Source: ACS PUMS, 2014-2018

Table 7. People per Bedroom by Linguistic Isolation and Building Type - Summary Statistics

		Single-Family	2 Units	3 to 4 units	5 to 9 units	10 to 19 units	20 to 49 units	50 or more units	
At Least One Person Speaks English	N	80,916	11,112	11,314	5,759	4,128	4,418	6,354	N=124,001
	Average	0.87	1.03	1.10	1.13	1.16	1.18	1.16	
	Median	0.75	1	1	1	1	1	1	
	80th Percentile	1.25	1.50	1.50	1.5	1.5	1.5	1.5	
	90th Percentile	1.33	1.67	2	2	2	2	2	
	Maximum	6	9	10	5	7	5	6	
	N of Maximum	2	1	1	5	1	5	1	
No one Speaks English	N	1,581	769	1,156	555	433	462	889	N=5,845
	Average	0.97	1.18	1.26	1.29	1.39	1.42	1.24	
	Median	1	1	1	1	1	1	1	
	80th Percentile	1.33	1.67	2	2	2	2	2	
	90th Percentile	1.67	2	2	2	2	2	2	
	Maximum	5	5	8	7	6	6	4	
	N of Maximum	1	2	1	1	1	1	3	
	Total N	82,497	11,881	12,470	6,314	4,561	4,880	7,243	**129,846**

Source: ACS PUMS, 2014-2018

Figure 9. Distribution of People per Bedroom in Buildings with 20 or More Units

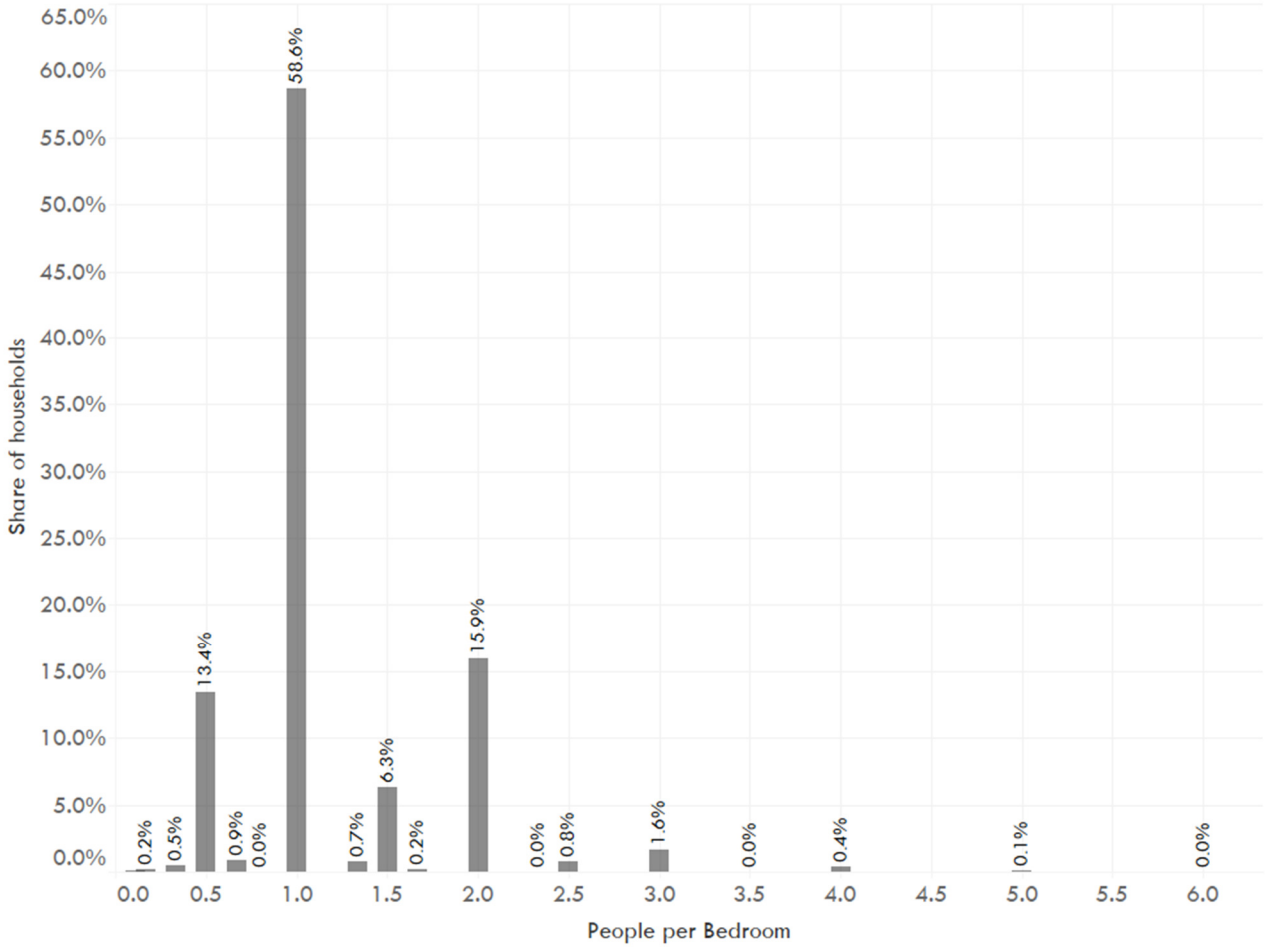
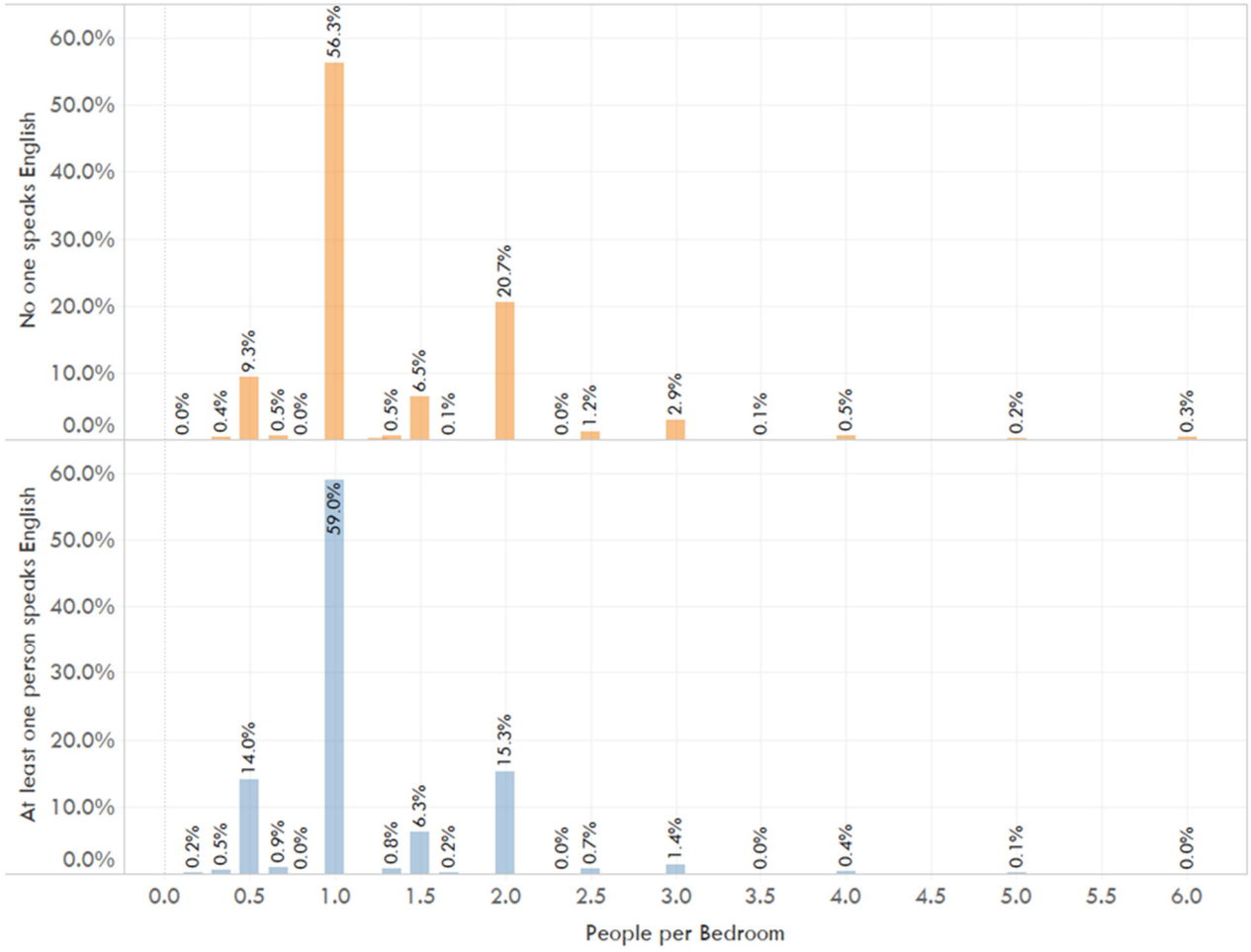
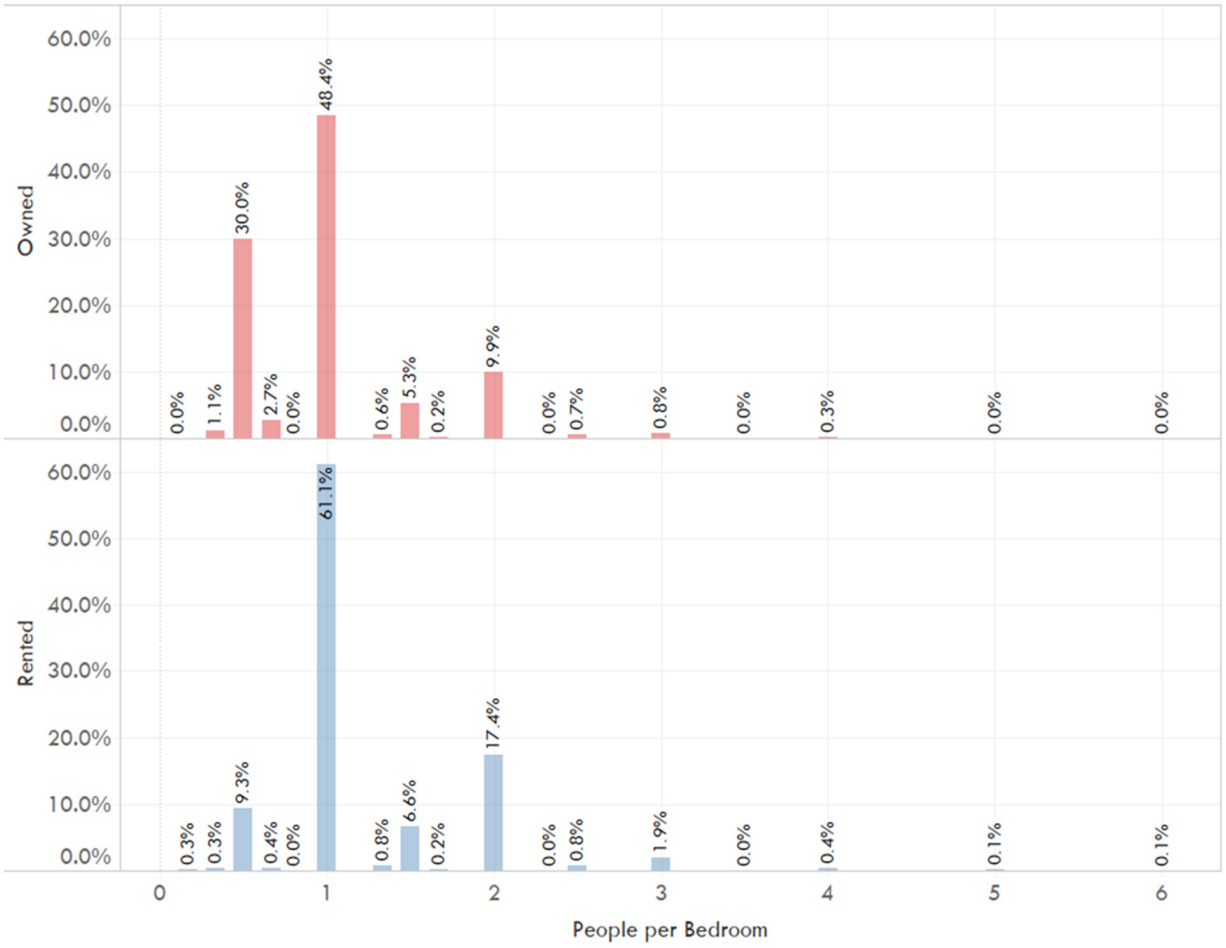


Figure 10. Distribution of People per Bedroom by Linguistic Isolation in MA in Buildings with 20 or More Units



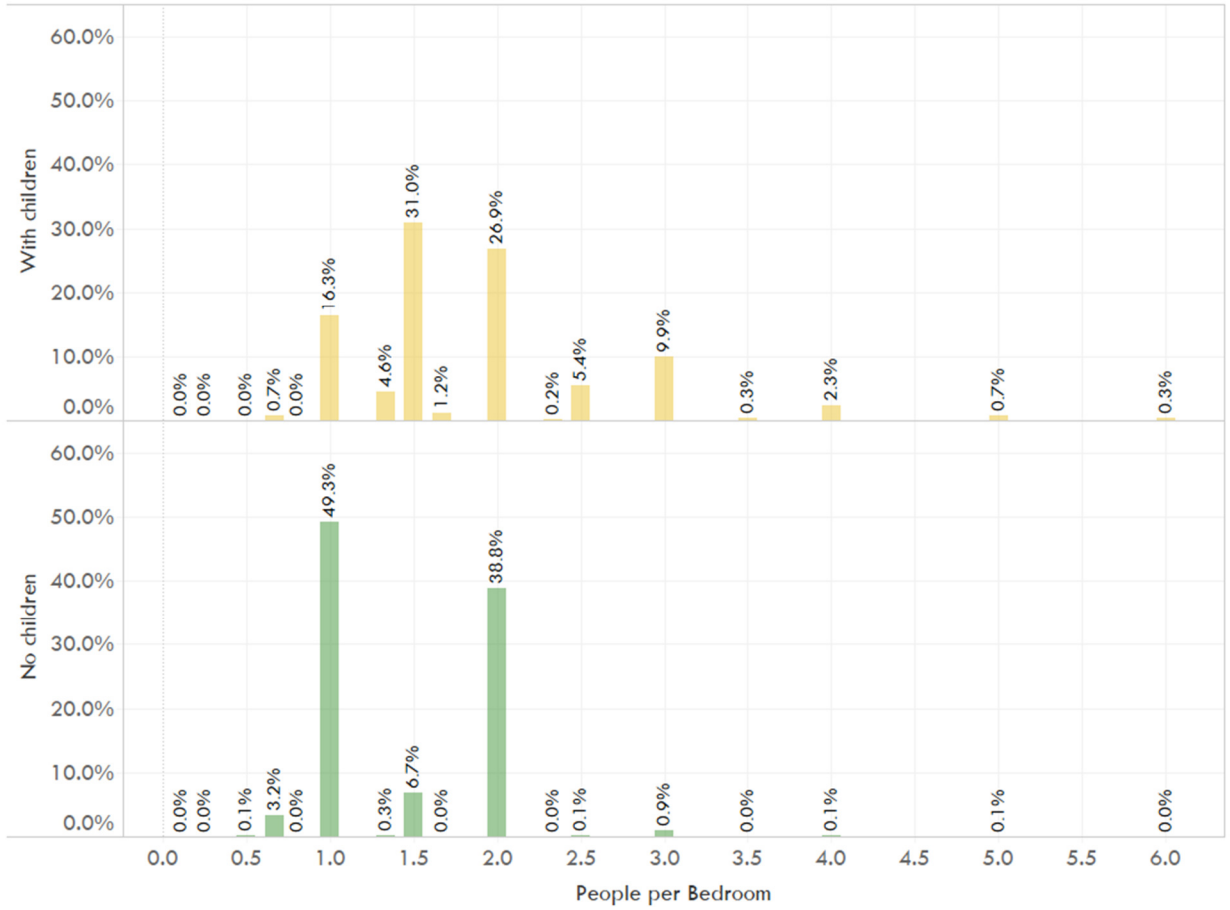
Source: ACS PUMS, 2014-2018

Figure 11. Distribution of People per Bedroom by Housing Tenure in MA in Buildings with 20 or More Units



Source: ACS PUMS, 2014-2018

Figure 12. Distribution of People per Bedroom by Presence of Children in MA in Buildings with 20 or More Units



Source: ACS PUMS, 2014-2018