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

For the Massachusetts Department of Environmental Protection

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Project Scope Objectives

1) To review the sewage flow design criteria for larger multi-residential systems to determine whether design flows should be decreased at a certain number of bedrooms.

2) To evaluate the design flows of other states to determine best practices and deviations from the conventional gallons per day (GPD) per bedroom model.

3) To review bedroom occupancy in Massachusetts for different types of residential structures and how these may vary depending on demographic characteristics.

Study Components

Component 1: State by State Comparison

- Scan other states' design flow per capita/bedroom usage
  - Investigate states that deviate from the people per bedroom model

Component 2: Data Scan

- Using PUMS data from the U.S. Census Bureau, calculate the average number of residents per bedroom, crosstabbing data with various demographic indicators

Gallons per Day (GPD) per Bedroom for Multi-residential Buildings

Deviations from Conventional Model

- While uncommon, some states deviate from the conventional GPD model utilized by most states, some examples include:
  - **New York**; Varies based on age of plumbing fixtures. Flow rates are reduced for buildings with post 1994 plumbing fixtures.
  - **Minnesota**; Classifies dwellings based on number of square feet per bedroom and presence of appliances, adjusts GPD based on number of bedrooms accordingly
  - **Texas**; Based on square footage, number of bedrooms, and usage rate. In developments serving families with children, rates are increased, and vice versa for retirement communities.

Study Components

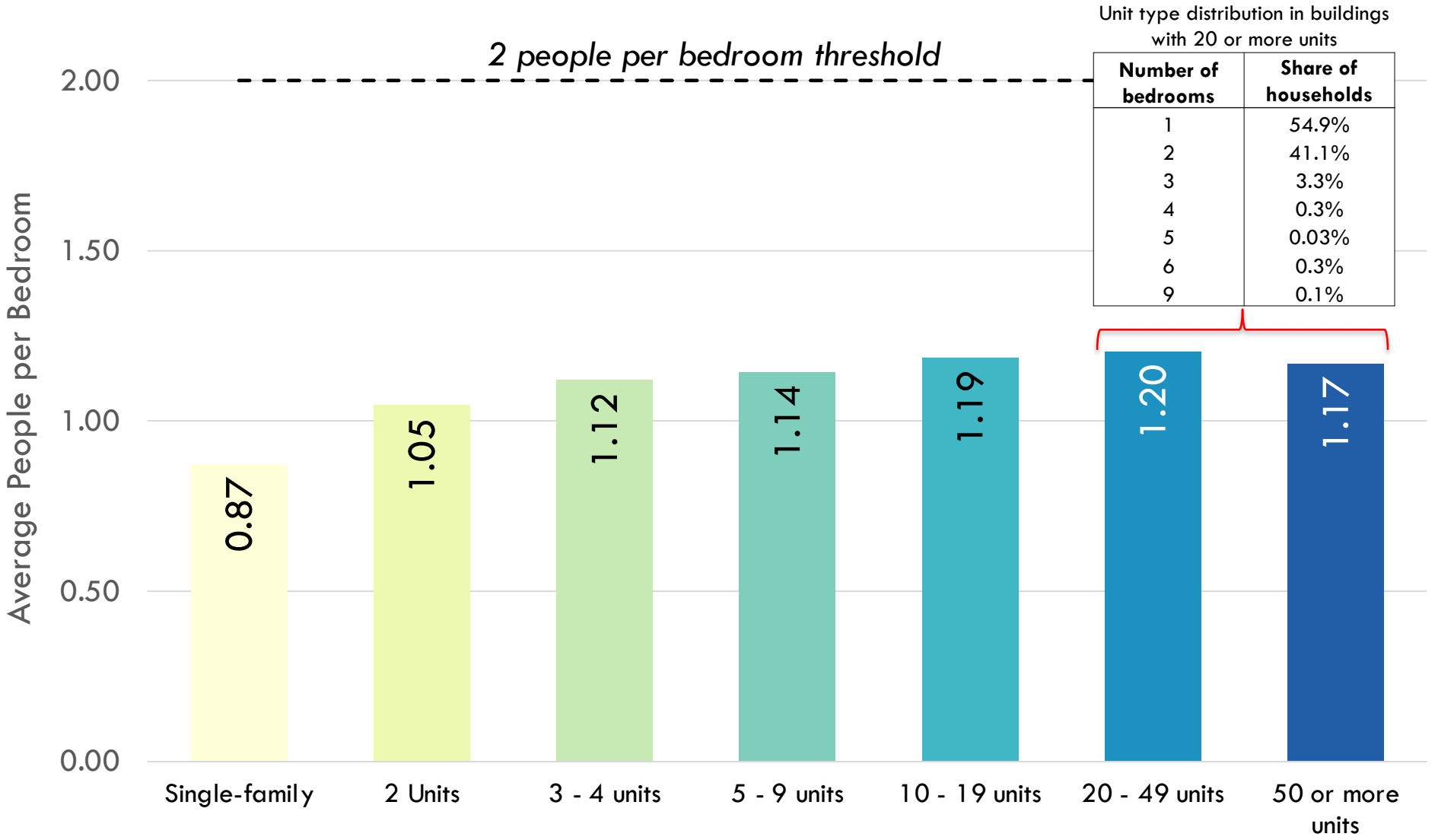
Component 1: State by State Comparison

- Scan other states' design flow per capita/bedroom usage
  - Investigate states that deviate from the people per bedroom model

Component 2: Data Scan

- Using PUMS (Public Use Microdata Sample) data from the U.S. Census Bureau, calculate the average number of residents per bedroom alongside various demographic indicators

Average Number of People per Bedroom in MA by Building Type

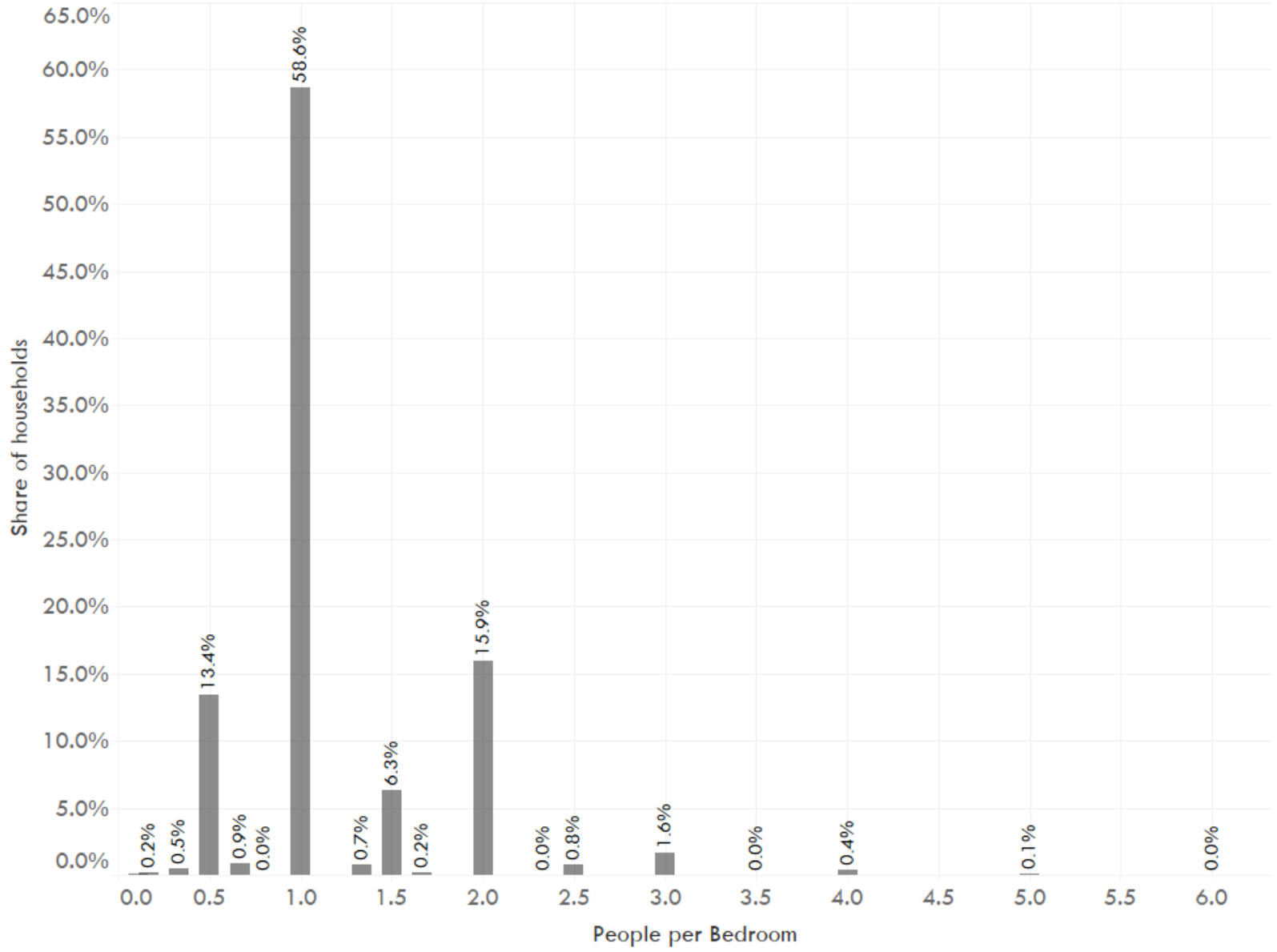


Unit type distribution in buildings with 20 or more units

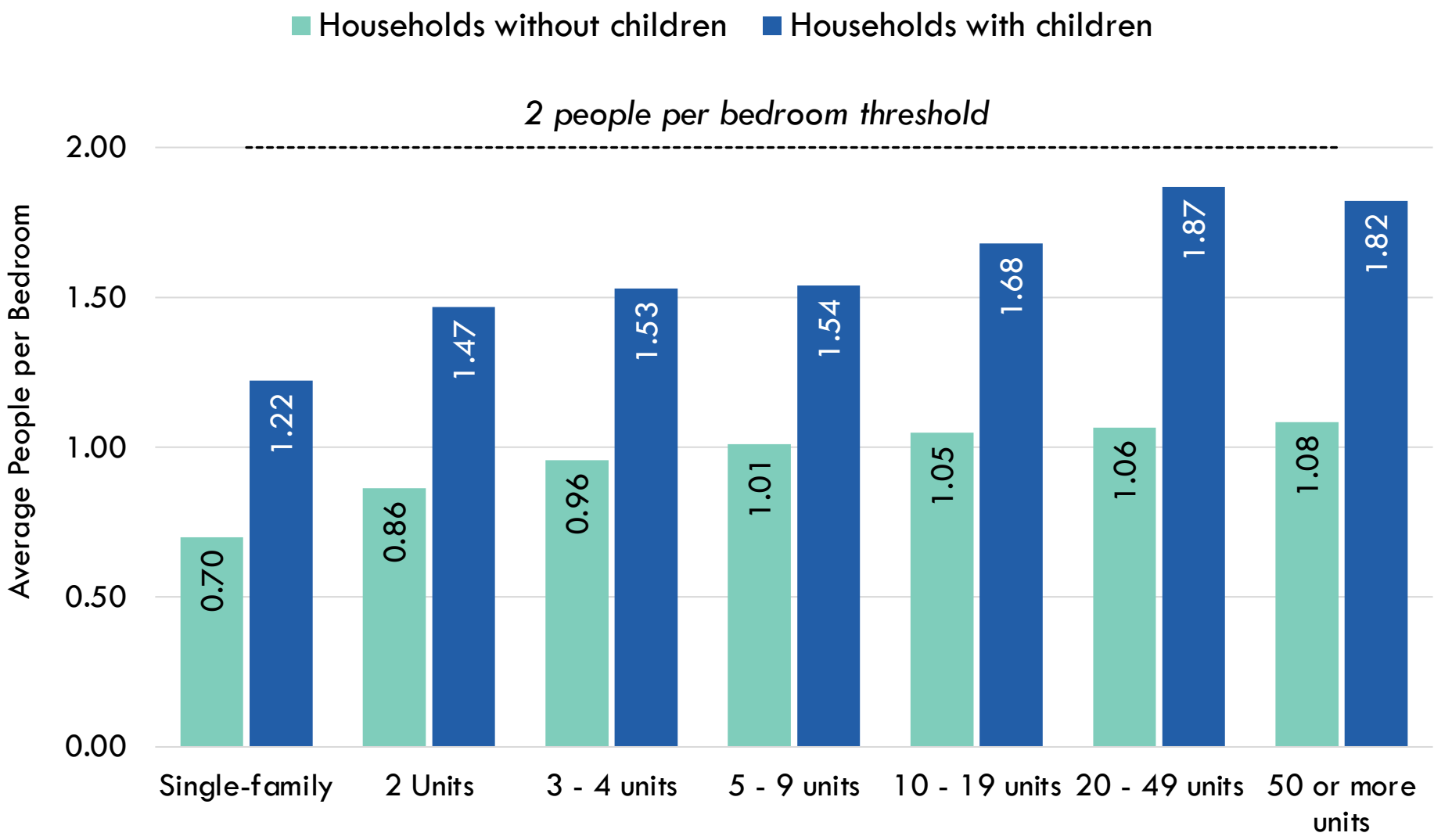
Number of bedrooms	Share of households
1	54.9%
2	41.1%
3	3.3%
4	0.3%
5	0.03%
6	0.3%
9	0.1%

Source: ACS PUMS 2014-2018

People per Bedroom in Buildings with 20 or More Units

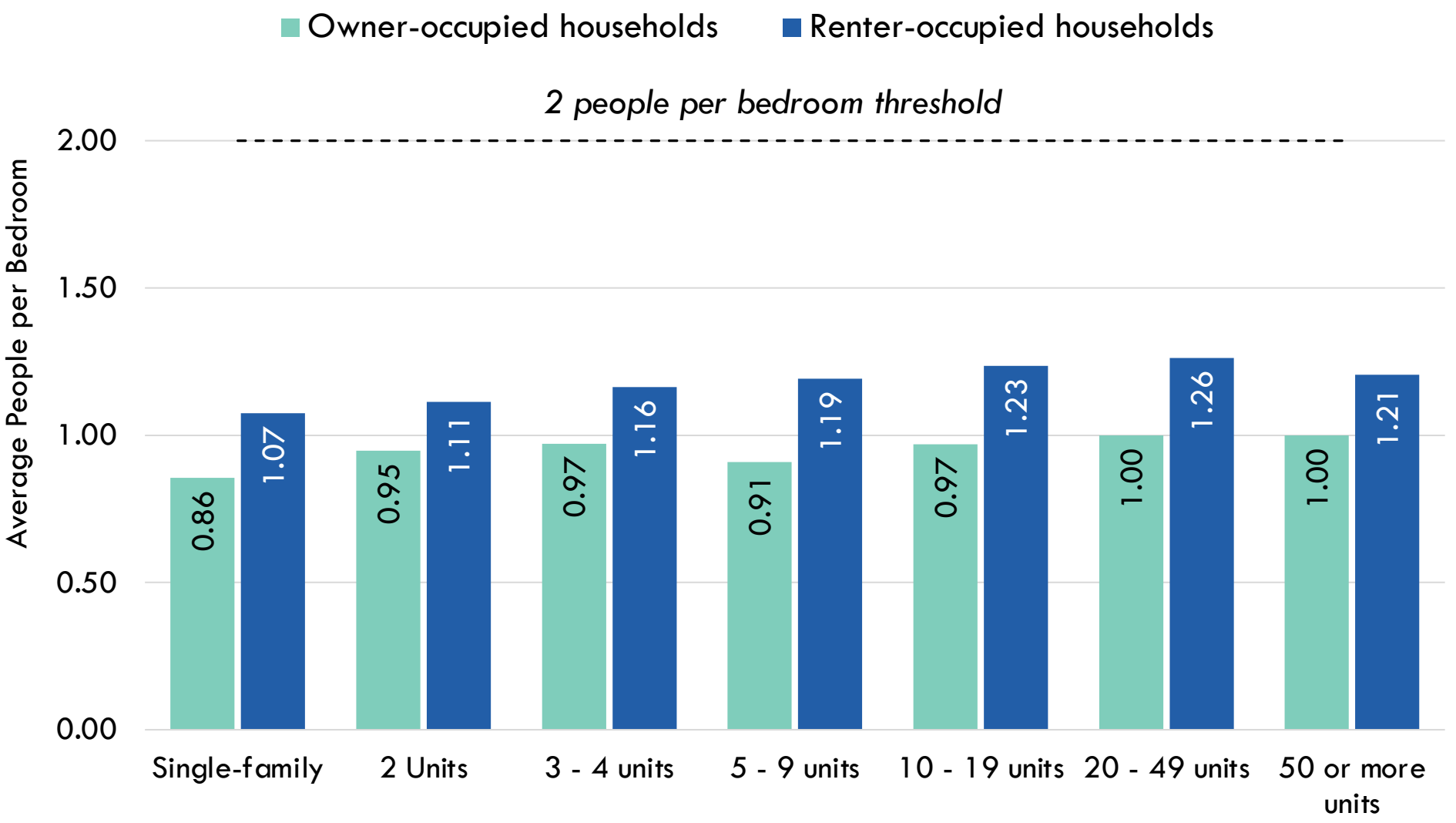


Average Number of People per Bedroom in MA by Presence of Children



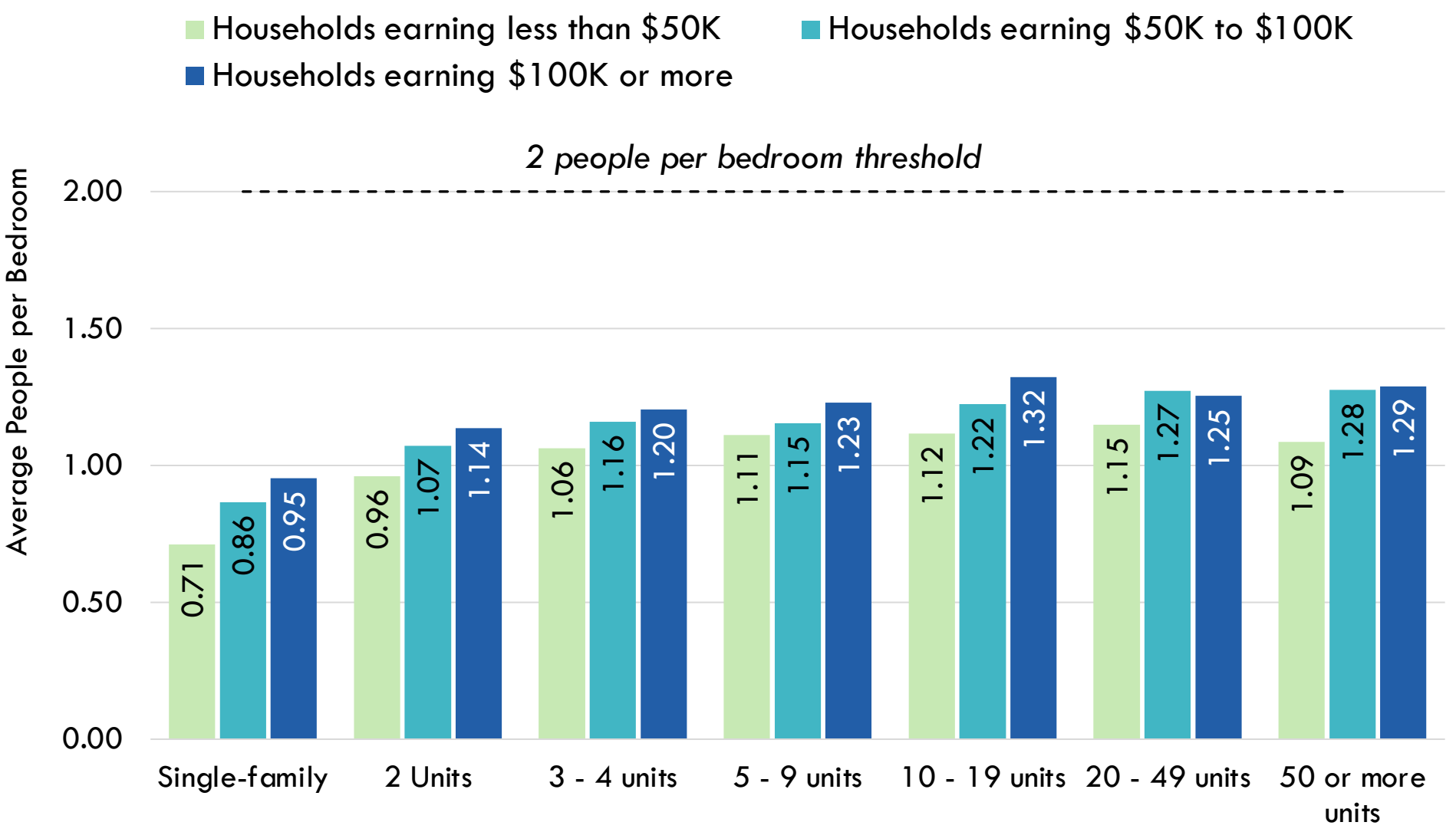
Source: ACS PUMS 2014-2018

Average Number of People per Bedroom in MA by Occupancy Type



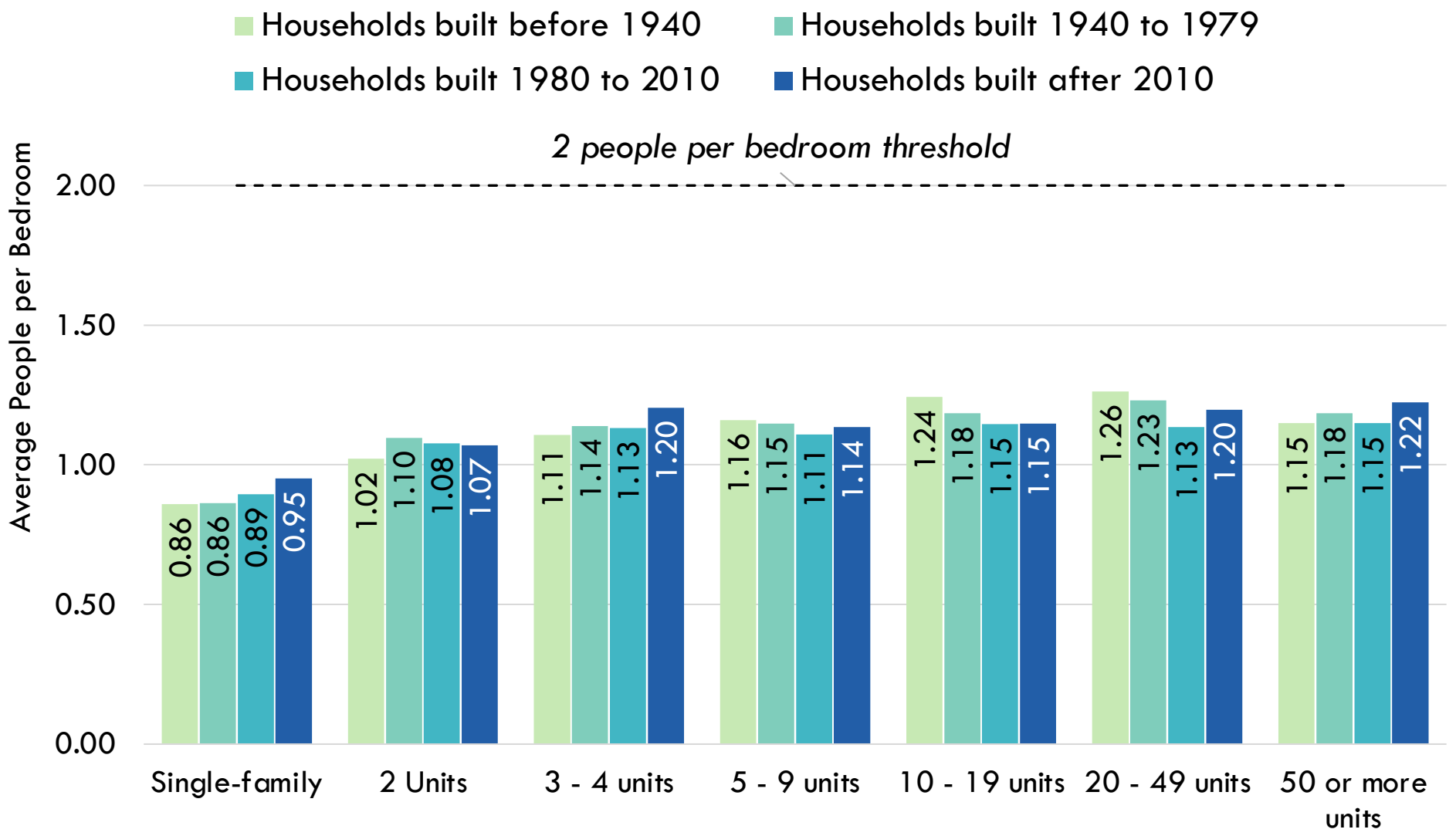
Source: ACS PUMS 2014-2018

Average Number of People per Bedroom in MA by Household Income



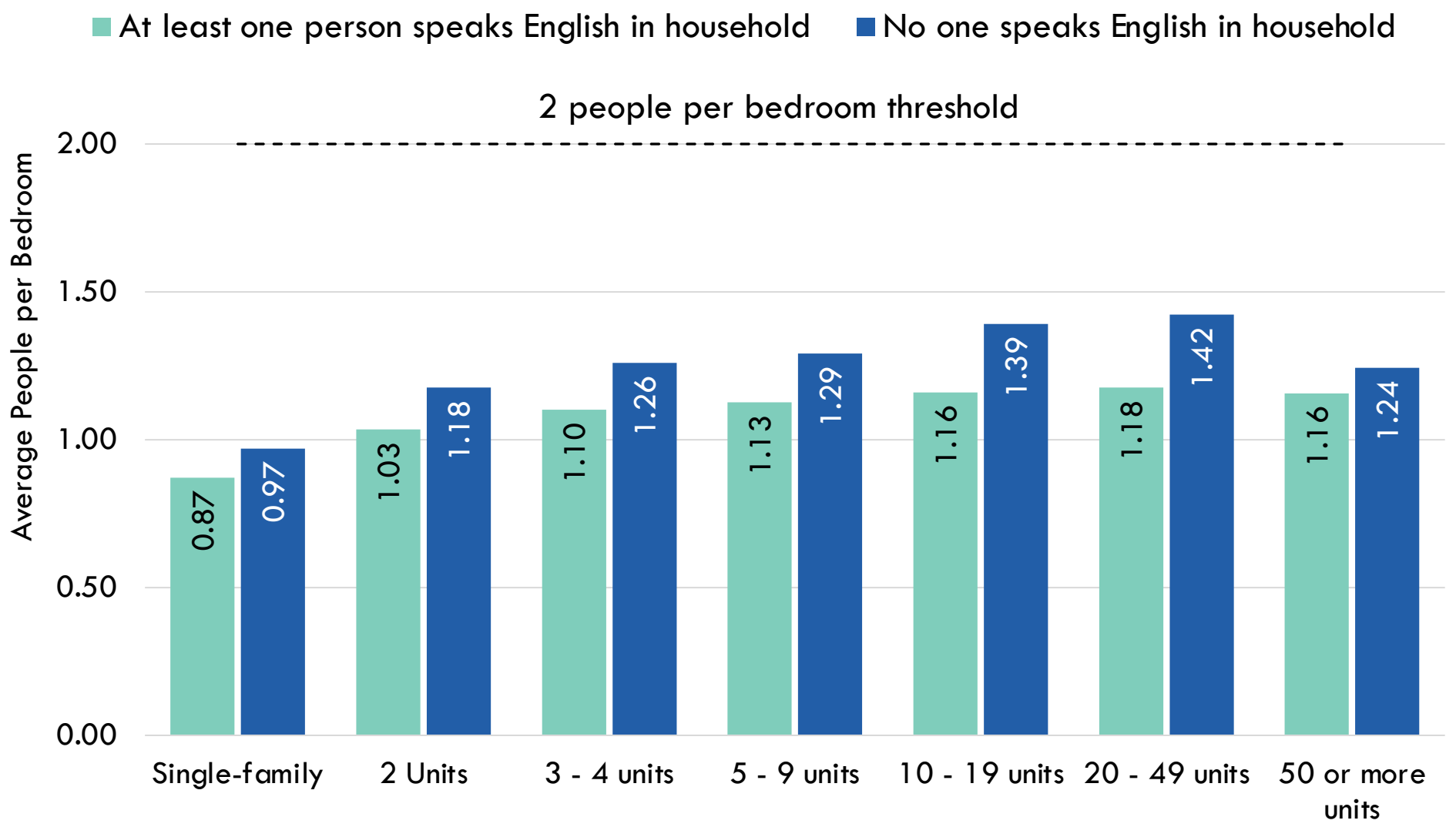
Source: ACS PUMS 2014-2018

Average Number of People per Bedroom in MA by Year Built

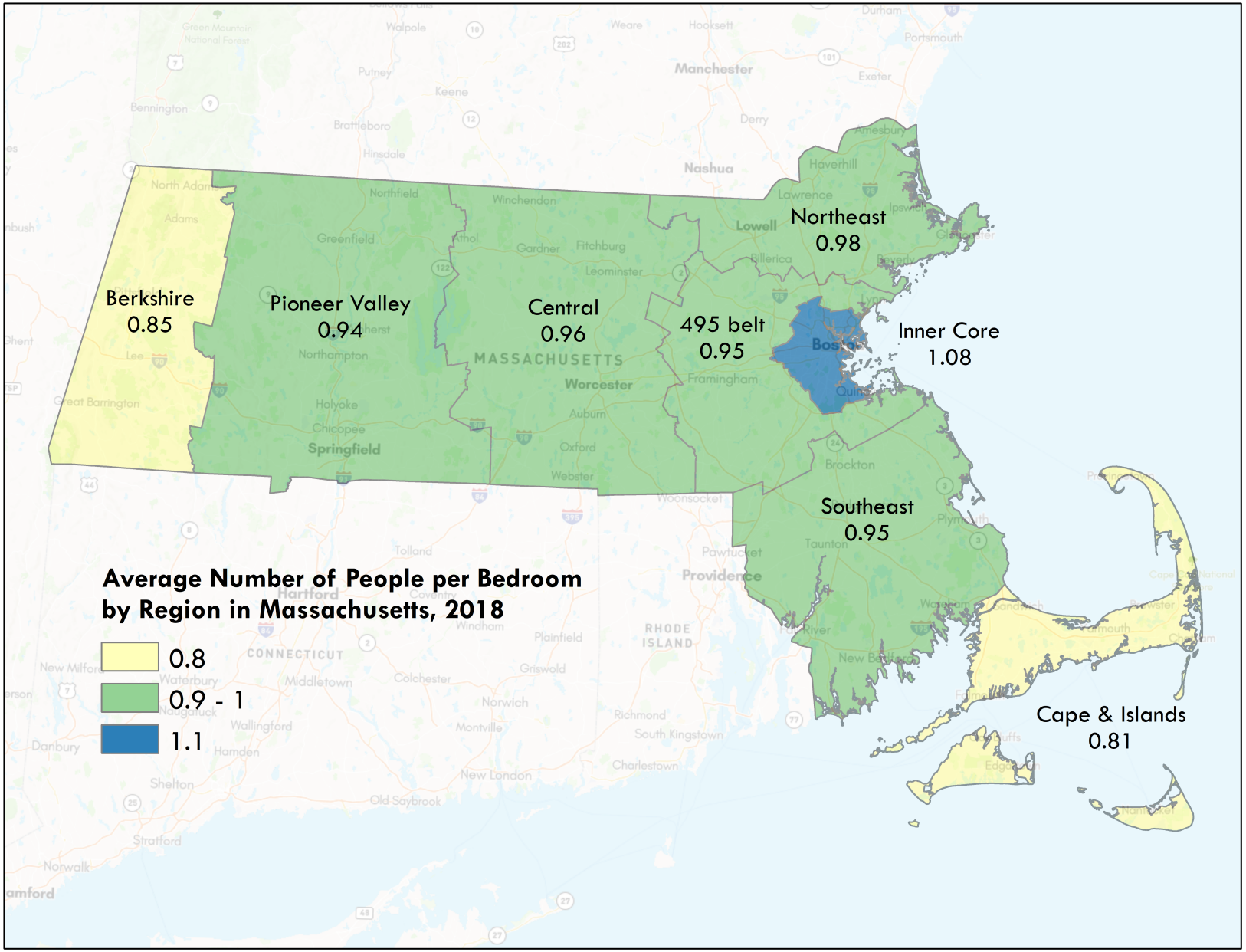


Source: ACS PUMS 2014-2018

Average Number of People per Bedroom in MA by Linguistic Isolation



Source: ACS PUMS 2014-2018


Berkshire
0.85
Pioneer Valley
0.94
Central
0.96
495 belt
0.95
Northeast
0.98
Inner Core
1.08
Southeast
0.95
Cape & Islands
0.81
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
Average Number of People per Bedroom
by Region in Massachusetts, 2018
0.8
0.9 - 1
1.1

Conclusions

- 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.
- 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.
- The presence of children, renter occupancy, higher household incomes, and limited English proficiency all significantly increase the number of people per bedroom for all types of housing and is an even more prominent factor in multi-residential buildings.
- MassDEP's two person per bedroom assumption maintains its integrity when applied to large multi-residential buildings.

Contact

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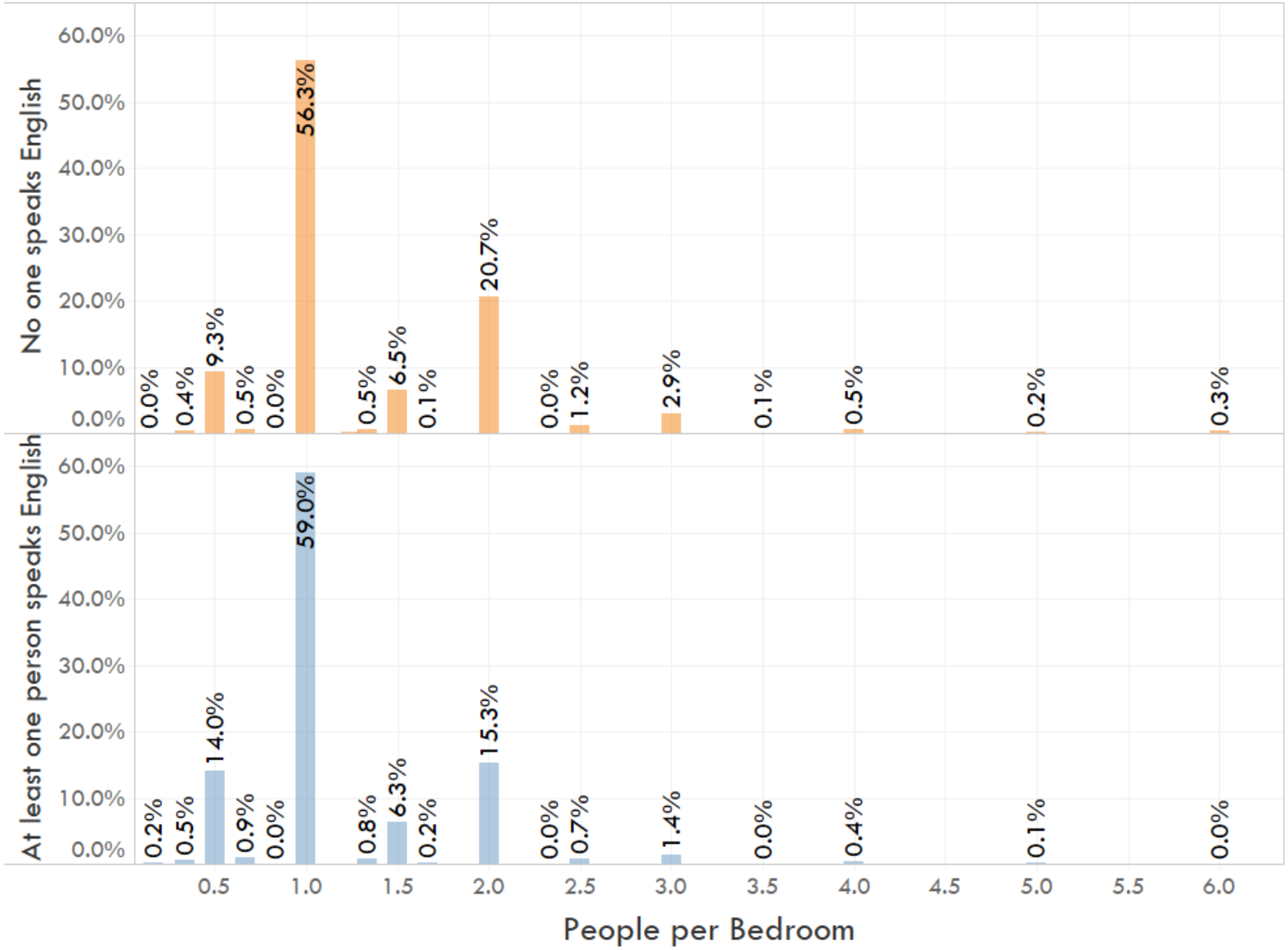
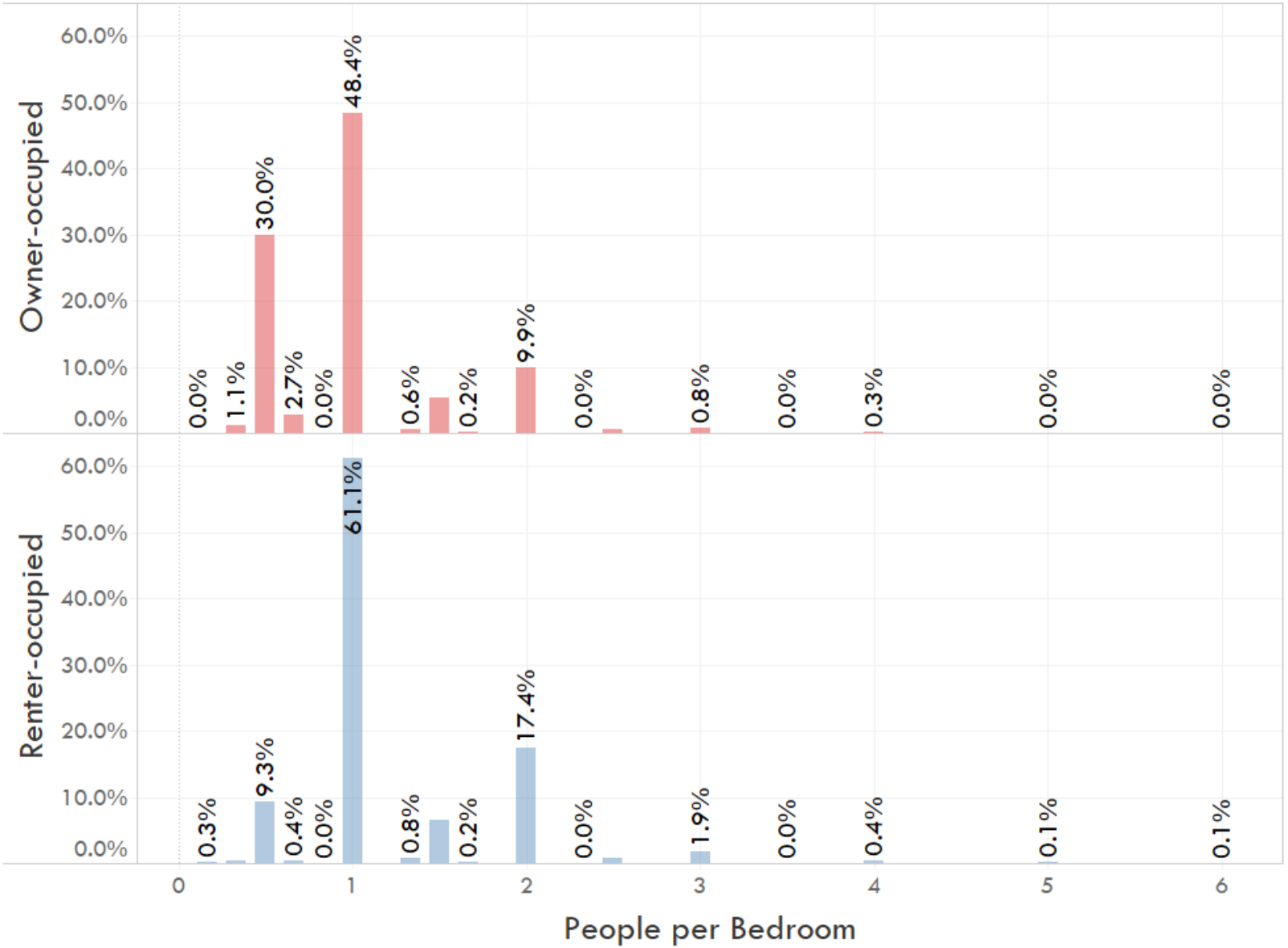
People per Bedroom by Linguistic Isolation in Buildings with 20 or More Units



People per Bedroom by Housing Tenure in Buildings with 20 or More Units



People per Bedroom by Presence of Children in Buildings with 20 or More Units