Towards Universal Rental Assistance: An Empirical Study of Housing Choice Voucher Holders' Relocation Patterns, Neighborhood Quality, and Household Characteristics in Massachusetts

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Abstract

Universal Rental Assistance (URA) aims to establish rental assistance as a fundamental right, ensuring that individuals who qualify for housing assistance are automatically enrolled in the program, rather than subjecting them to lengthy waiting-lists for years. This paper advocates for the implementation of this policy that guarantees housing for all eligible households in Massachusetts, facilitating a stable and better-quality lifestyle. To predict patterns among future Housing Choice Voucher (HCV) holders, this study investigates various aspects of the current HCV holder population. It analyzes their initial locations where they first utilized the voucher, subsequent relocation destinations, and the potential impact on affordable housing demand. Utilizing cluster analysis in ArcGIS Pro, the study reveals spatial clustering patterns on where current HCV are located and their relocation behaviors. Principal Component Analysis (PCA) is employed to construct a Neighborhood Quality Index (NQI), providing evidence that although HCV holders may not immediately move to higher-quality neighborhoods upon receiving a voucher, they do tend to settle in areas with improved socio-economic characteristics over time and, on average, and movers experience higher income growth than non-movers. Additionally, the study also explores the impact of individual and household characteristics on HCV holders' decisions to relocate, utilizing both cross-sectional and panel regression models.

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Section 1: Introduction

1.1 Motivation for the Research

Rapidly rising house prices in Massachusetts which has further put pressure on rent (Hermann 2022) is playing a significant role in worsening the financial pressure on the State's residents. In addition to the problem associated with sky-rocketing house and rental prices, the lack of supply of affordable homes has become a major hurdle for low and moderate-income households to lead a decent quality of life. In 2016, it was found that 79% of extremely low-income renter households in Massachusetts were burdened by rent, i.e. they were paying more than 30% of their income in gross rent. Since a majority portion of their income goes to paying the rent, these households have to forgo spending on other necessities such as health, food, education, childcare, etc. (Chiumenti 2019).

The onset of the COVID-19 pandemic has exacerbated this predicament, with a notable increase in housing and rental costs. Initially, some experts at Freddie Mac predicted that the housing market would collapse, with an anticipated decrease of 0.5% in home prices (The Economic and Research Housing Group 2020). However, an opposite trend was observed. Between March 2020 and March 2021, prices surged by 13.5% and then by an additional 20.6% according to the S&P/Case-Schiller U.S. National House Price Index (FRED Economic Data 2023). The overall housing inventory, including newly built homes, declined by roughly 10% from March 2019 to March 2020 (Hyman 2020). Another analysis conducted by experts at Freddie Mac indicates that the US is grappling with a housing stock deficiency of approximately 3.8 million units as of 2020. This figure represents an increase from the housing supply shortage of 2.5 million units recorded in 2018 (Khater 2021). Additionally, the number of houses built annually in the country has declined compared to historical trends. From 1960 to 1990, the annualized number of

housing starts per 1,000 households was 22.2, but this value plummeted to 12.2 from 1990 to April 2022 (US News 2020). Moreover, the transition to remote work has increased the demand for more living space. However, the active housing listings on the supply side remained stagnant, leading to another factor that drives up house and rental prices. This has intensified the focus on the lack of affordable homes in the US, and a decline in rent affordability has now become a major issue.

Having access to secure and affordable housing is crucial to ensure the well-being of residents, where households can live without having to worry about being at the risk of getting evicted for not being able to pay rent on time. However, hundreds and thousands of families in Massachusetts are living a life of deprivation, where this basic need remains inaccessible (The Center for State Policy Analysis 2022).

On the argument that it is the overall gap in the housing supply that is driving the rise in house prices and rental rates in Massachusetts, people often wonder "why not simply build more affordable homes?". This is difficult. Given the current scenario with a lack of labor and an increase in construction prices, it will take a long time to fill this gap. In addition to this, what is prevalently known as "NIMBY (Not in My Backyard") syndrome has led to a rise in restrictive zoning. And zoning decisions are often determined at the local level leading to what is known as the home-voter hypothesis (Fischel 2005). This has consequently caused limited construction of new housing and a hiked-up price. Furthermore, certain land use regulations such as minimum lot size restriction and single-family-only zoning have had a significant impact on the reduction in the supply of housing and led to a rise in prices (Zabel 2022).

There are certain solutions when it comes to expanding affordable housing, such as establishing inclusive zoning, Low Income Housing Tax Credit (LIHTC), public housing etc. (The Center for State Policy Analysis 2022). This paper examines one such type of assistance provided

to low-income households in Massachusetts, which is the provision of a type of rental assistance voucher: the Section-8 Voucher, also known as the Housing Choice Voucher (HCV).

With an aim to ultimately establish a policy that will ensure the provision of housing for all to secure a stable, safe, and smooth well-being of residents, this research studies the proposed implementation of universal rental assistance (URA), with a focus on Massachusetts, by investigating various aspects of the current HCV holder population and what this might predict about future HCV holders, particularly in terms of where they live when they receive the voucher and where they would move to (if they choose to move), and hence where the demand for housing would increase.

Universal Rental Assistance

The federal rental assistance program currently prevalent in the country is different from other government programs such as Medicaid (where all eligible applicants receive assistance). Unlike Medicaid, funding only exists for a small percentage of eligible recipients and applicants for rental assistance are initially placed on waitlists in which it might take years for applicants to become admitted to the program.

According to a study conducted by the Center on Budget and Policy Priorities (2021), out of 50 largest housing agencies in the country, only two have wait times of less than a year for families on the list, while the longest wait time has been approximately eight years on average. It has been widely observed that families on waitlists have been prone to exposure to homelessness, overcrowding, and eviction to name a few housing related issues (Acosta and Gartland 2021). In addition, millions of other families never receive vouchers because their names never make it to

the top of the waiting list, or because housing agencies in their communities stop maintaining the list (Acosta and Gartland 2021).

The same study also states that due to inadequate funding, housing authorities often prioritize certain groups, such as: veterans, working families, families experiencing homelessness, those escaping domestic violence, etc., for the available vouchers. Although it makes sense to prioritize vulnerable groups in the communities for vouchers, this in turn would mean that other families eligible to receive vouchers may never receive the help they require. In 2019, it was found that around 2 million households utilized housing vouchers, but over 16 million renter households without assistance paid more than 30% of their income towards housing and lived in overcrowding conditions. (Acosta and Gartland 2021)

Statistics show that due to limitations in funding, only 1 in 4 eligible households receive federal rental assistance (Acosta and Gartland 2021). Focusing on just HCVs, in 2018, only 10% of all eligible households receive HCV with an average wait time of less than 1 year for 17% of those applicants, 1-2 years for 34%, 2-5 years for 41% and more than 5 years for 8% (Acosta and Gartland 2021). To make things worse, according to a 2016 survey, 53% of housing agencies had closed their waiting list to new applicants or drop off the list with eligible households still on it, despite waiting for years. (Acosta and Gartland 2021)

The concept of implementing URA in Massachusetts incorporates the idea of making rental assistance a right in the State. In other words, everyone who would be eligible to receive the voucher would automatically receive it, as opposed to being placed in long waitlists. Eligibility to receive rental assistance could potentially be based on various factors. These factors may include: those earning less than 80% of the Area Median Income, those owning less than a certain cutoff of assets, those who do not hold any criminal records, etc.

Under the assumption that all households would be able to use the voucher, landlords would be accepting of voucher holders, right-size housing units are available, rents do not drastically increase in response to increase in demand for affordable housing, etc., URA would assist hundreds and thousands of low and moderate-income households who are currently struggling to afford rent, and in turn be able to focus on allocating their income to other basic necessities such as on food, health, education, childcare, etc. This would gradually help curb other housing-related issues such as homelessness, overcrowding, racial inequities, to name a few.

However, it is true that the implementation of URA comes with a high financial cost. According to a study by The Center of State Policy Analysis (2022), the URA program could help approximately 240,000 new households at an annual cost of $3.2 billion. To make it possible, it would be important for policy makers to make housing one of the core priority areas alongside public schools and health insurance for low- and- moderate income families. Implementing URA could potentially assist in reducing spending money in other areas such as homelessness assistance and emergency housing to name a couple, which normally costs the state $300-$400 million per year. (The Center for State Policy Analysis 2022)

1.2 Rationale of the Study

One of the benefits of the HCV program is that it allows voucher holders to move to better neighborhoods. If URA is implemented, it will be important to know where the new voucher holders will move (for those who choose to move), to be able to see where the demand for housing will increase and hence be able to add housing in these areas.

The purpose of this study is to analyze the behavior of current voucher holders to be able to predict where this new demand will arise. To achieve this goal, this research employs a

methodology that involves mapping the locational distribution of voucher holders after they receive HCVs and analyzing their demographic information. The aim is to identify locations where HCV holders first used the voucher, and where they relocate to over the years, thus increasing the demand for affordable housing. This study also examines the characteristics of current HCV residents to gain insight into potential future HCV applicants. The study then goes on to outline a process for developing a neighborhood quality index (NQI) using principal component analysis (PCA). By conducting this analysis, the study investigates whether HCV recipients move to better quality neighborhoods. Lastly, the research utilizes a regression analysis to investigate the correlation of different neighborhood and household characteristics that are associated with HCV recipients' decision to relocate or remain in the same neighborhood.

1.3 Background and Significance

The federal government's HCV Program offers rent subsidies to tenants. Those who receive HCV can choose to relocate to a different area, where they are responsible for paying about 30% of their income towards rent, while the government covers the remaining housing expenses upto a certain threshold.

History of Section-8 Vouchers

According to a report from the Congressional Research Service (CRS) (2014), federal housing assistance in the US primarily consisted of public housing and subsidized mortgage insurance programs through the Federal Housing Administration (FHA) from 1937 to 1965. However, these programs encountered issues with high costs, profiteering, and slumlords, leading to the imposition of a moratorium on all federal housing programs. During this period, the

Department of Housing and Urban Development (HUD) revised the Section 23 program, which helped low-income families in leased housing by allowing public housing authorities (PHAs) to lease private market housing units and sublease them to low-income and very low-income families at reduced rents. This program was intended to become the primary assisted housing program of the federal government. As Congress debated various options for restructuring subsidized housing programs, a new leased housing approach was ultimately favored, and the Section 8 program was established.

The Section 8 program, which is named after Section 8 of the United States Housing Act of 1937, was originally established by the Housing and Community Development Act of 1974 (P.L. 93-383). It included three parts: new construction, substantial rehabilitation, and existing housing certificates. In 1983, the new construction and substantial rehabilitation parts of the Section 8 program were eliminated, and a new component was introduced: Section 8 vouchers. Finally, in 1998, the existing housing certificates were merged with and converted to vouchers as well.

Private for-profit, non-profit, and public organizations that were willing to build new housing units or renovate existing ones to accommodate low- and extremely low-income tenants entered into long-term contracts with HUD. These contracts ranged in duration from 20 to 40 years, and the tenants received assistance in the form of subsidies where payments went to the landlords, which allowed tenants to pay only 25% (later increased to 30%) of their income towards rent. Today, over 1.2 million housing units with Section-8 contracts that were established under the new construction and substantial rehabilitation program continue to receive these subsidies. (CRS Report 2014)

Today's Section-8 Housing Vouchers

The Section-8 program consists of two programs: the Project-Based Rental Assistance and the Tenant-Based HCV. The CRS Report (2014) has described these programs in detail as summarized below.

Project-Based Rental Assistance Section-8

Section-8 project-based rental assistance comprises of units that were built or renovated under the new construction, substantial rehabilitation, and moderate rehabilitation programs of the old Section-8 program, which are still under contract with HUD today.

In Section-8 project-based units, at least 40% of all available units each year must be rented to extremely low-income families where the families are required to pay 30% of their income towards rent. If a family moves out, the owner of the unit continues to receive Housing Assistance Payment (HAP) from HUD as long as they can move another eligible family into the unit.

HAP payments are calculated based on the difference between the tenant's 30% of income payment and a contract rent agreed upon by HUD and the landlord. The contract rent is usually in line with the rents in the local market and is adjusted annually by an inflation factor established by HUD or based on the project's operating costs. When owners terminate their HAP contract with HUD, tenants living in the building are provided with enhanced vouchers known as "Tenant Protection or Enhanced Vouchers," allowing them to continue living in their units. (CRS Report 2014)

Project-Based Vouchers

Project-based vouchers involve a contract between the landlord and a PHA that requires the landlord to allocate up to 25% of units in a development for low-income families. Families living in these units pay 30% of their household income towards rent. Unlike traditional project-based assistance, these vouchers are portable. After one year, families with project-based vouchers can convert to a tenant-based voucher and relocate, as long as one is available. (CRS Report 2014)

Tenant-Based Housing Choice Voucher

HCV, also known as tenant-based Section-8, is a program funded by HUD's tenant-based rental assistance account and administered by PHAs. Each PHA has a set number of vouchers they can distribute.

The HCV subsidy is attached to the household and not to a particular housing unit. After receiving a voucher, an eligible household must find an appropriate housing unit that meets the minimum housing quality standards (HQS) where the rent does not exceed 40% of their income plus the Housing Assistance Payment (HAP) provided by the PHA. Once the household finds a suitable unit, a contract is signed between the household and HUD, and then between HUD and the landlord. The PHA pays the HAP, and the household pays the difference between the HAP and the rent (which must be between 30% and 40% of their income).

The household can keep the voucher as long as the PHA has enough funding, and the household meets program requirements. Households can move to new units, and if they move to a new area, the two PHAs negotiate which PHA will continue administering the voucher. The voucher program does not have any time limits, and households can leave the program if they choose, do not comply with program rules, or if they no longer meet the eligibility criteria for a subsidy due to increased income (CRS Report 2014). If a household leaves the program, the ability

to re-enter may depend on specific policies administered by the Housing Authority monitoring the program, where they might have to enter the waiting list once again.

1.4 Research Issues

This study investigates various aspects of current Section-8 voucher holders to lay out a foundation for a policy change for implementing URA in Massachusetts. Hence, the study focuses on the following research issues:

a. Map out where Section-8 voucher holders first use their vouchers, and their relocation patterns to understand where the demand for affordable housing will be in the future by using a cluster analysis.
b. Evaluate whether Section-8 voucher holders move to better neighborhoods post receiving vouchers by constructing a Neighborhood Quality Index (NQI) using Principal Component Analysis (PCA) and whether moving to better neighborhoods is associated with improved outcomes such as household income.
c. Examine the relationship between neighborhood and household characteristics and the relocation decisions of HCV holders through a regression analysis.

   For the first research issue, I am placing several assumptions such as:

   - The data used for mapping Section-8 voucher holders' initial unit-city and their relocation patterns is accurate and up-to-date.
   - The distribution of Section-8 vouchers are assumed to be fair and consistent, without any biases, across different geographic areas.
   - There exists stable economic and political environment affecting the housing market.

- Section-8 voucher holders are assumed to have relatively homogenous characteristics that affect their relocation decisions.
- The sample chosen for the study is representative of the larger population, allowing for generalization of the findings.

Section 2 provides a review of relevant literature. Section 3 provides a description of the data used in this research. Section 4 comprises a descriptive analysis of current HCV holders, including their socio-demographic and economic characteristics. Section 5 describes the relocation patterns of HCV holders. Section 6 investigates whether HCV holders move to neighborhoods of better quality. In Section 7, three regression models are introduced to analyze the impact of individual and household characteristics on moving behavior. The empirical analysis of the regression results is presented in Section 8. Finally, the paper concludes in Section 9 with a summary of findings and conclusions.

Section 2: Literature Review

There have been several research studies carried out to understand the relationship between relocation decisions of rental assistance voucher holders and neighborhood characteristics, along with the impact of relocation on voucher recipients.

Chetty et al. (2016) used evidence from the Moving to Opportunity (MTO) experiment and found strong effects of relocation on young kids (below 13 years of age) in terms of long-term outcomes such as higher education attainment and higher earnings. The MTO program was designed to offer randomly selected low- and moderate-income families living in high-poverty communities housing vouchers to move to low-poverty neighborhoods. Another aspect that the study captured was that the effect of relocation on children above 13 years old was negative,

potentially due to disruption effect that the study mentions. Therefore, this study provides evidence that long term positive impacts on children are more prevalent when the duration of exposure to better neighborhood starts at an early age, and therefore, would be beneficial to provide vouchers to families with young children. (Chetty 2015)

Ludwig et al. (2013) found some physical and mental health benefits associated with relocation to lower-poverty neighborhoods but not quite statistically significant. However, it did find statistical significance in some specific individual health outcomes such as ones related to recipients' body mass index and diabetes, to name a couple. However, it found no evidence of impact on adult economic self-sufficiency. (Ludwig et al. 2013)

Similarly, research by Wood et al. (2008) found a significant reduction in homelessness, a reduction in the poverty rate, and an increase in food spending associated with housing choice vouchers. It also significantly impacted crowding, and the incidence of living of friends and relatives. Although it increased housing mobility, a decrease in the number of subsequent moves was also observed, leading to minor improvements in the quality of neighborhoods. (Wood, Turnham, and Mills 2008)

Other prior research such as one by Bergman et al. (2019), has also investigated barriers to neighborhood choices in which they provide evidence that despite the provision of rental vouchers, a general lack of mobility is more associated with a lack of support and information, rather than being driven by preferences. The study uses evidence from two-phased randomized controlled trial with voucher recipients in Seattle and King County. As a provision of proper information to facilitate upward mobility of recipients, the experiment informed participants about high opportunity areas, short-term financial assistance, assistance in housing search processes, and connection with landlords. Results indicated a significantly positive impact on the upward mobility

of housing voucher recipients when given this information, as opposed to when only a fraction of this information was provided to them. (Bergman et al. 2019)

Another study by Leventhal et al. (2003) adopted a 3-year follow-up on the MTO experiment with 550 families in New York. Results showed that parents who moved to better neighborhoods showed significant reduction in distress as compared to parents who did not relocate. In addition, the study also found that a significant reduction in anxiety, depression and dependency problems were observed in boys who relocated to lower-poverty neighborhoods. (Leventhal and Brooks-Gunn 2003)

Schwartz et al. (2020) used the data from New York City to examine the impact of housing choice vouchers on educational outcomes for students whose families receive them. Results showed that children in households living with vouchers performed better in English and Mathematics over the years after receiving the voucher. A significant positive impact was especially seen in children that belonged to Hispanic, Asian, and White households. These effects could potentially have been caused by decrease in rent burden, increased income and greater residential security. (Schwartz et al. 2020)

Ellen, Horn and Schwartz (2016) studied the relationship between housing choice vouchers' residence locations and proximity to better schools. Using large scale administrative data, the study finds that recipients of vouchers are more likely to move to areas with better schools in the year before their oldest child meets the eligibility cut off for kindergarten. Even when proper information is disseminated to the families, these voucher holders only tend to move towards better schools when their children reached school-going age. (Ellen, Horn, and Schwartz 2016)

Varady and Walker (2003) described the success of special mobility programs such as the MTO program to help voucher recipients to move to lower-poverty and safer neighborhoods.

However, the research pointed out the difficulties in establishing a relationship between these programs and social mobility due to lack of research on long-term impacts on children. Although one of the main aims of HCV is to make people move to lower-poverty neighborhoods, it would not be wise to make this mandatory because then, this would contradict another aim of the HCV program, which is to allow free choice of voucher holders to choose where they wish to move. (Varady and Walker 2003)

Katz, Kling and Liebman (2001) studied the short run impact of mobility on section-8 families living in high-poverty public housing projects. These households experienced positive impact in multiple areas such as safety and improved health of head of households. Children in these households also experienced decrease in injuries, and crime victimization. There was however, no significant short-run impact on employment and earnings. (Katz, Kling, and Liebman 2001)

Kim et al. (2022) investigated the impact of the tenant-based HCV program on long-term exposure to better neighborhoods across socio-economic status, health and education among low-income families with children. The study made use of the MTO experiment results with a 10-15 year follow-up of its participants. Results indicated that MTO participants in the experimental group experienced significant improvement in all sectors, with a higher impact seen among the experiment group that received Section-8 vouchers, along with supplemental housing counselling sessions. (Kim et al. 2022)

The research on rental assistance vouchers is an important one as it provides a way for low-income households to afford housing. Research has shown that living in low-poverty neighborhoods, and having a better quality of life has a positive impact on individuals in terms of

long-term outcomes. Therefore, this study advocates for making rental assistance universal and providing vouchers to all those eligible to get the vouchers.

Given the vast range of outcomes associated with rental vouchers covered by prior literature, this study focuses on examining information on current Section-8 voucher holders in Massachusetts that would help lay a foundation to understanding future demand for vouchers, and future demand of affordable homes. This is an area that has not been covered by any prior literature and hence contributes to the novelty of this research. This is an important area of study as it could potentially help policy makers understand the relocation patterns of voucher holders and ascertain where the future demand for affordable homes would be the highest, and what groups of population will be demanding for housing subsidies the most.

Section 3: Data Description

The primary data source for this study is the annual longitudinal data on tenant and project-level Section-8 Voucher holders obtained from HUD. The dataset encompasses information from both the Public and Indian Housing Information Center (PIC) and the Tenant Rental Assistance Certification System (TRACS). The dataset covers the period from 2010 to 2022 and comprises a wide range of variables across categories such as household, income, family, program, and external information for the States of Connecticut, Massachusetts, Maine, New Hampshire, New York, Rhode Island, and Vermont.

Some of the different variables included under the Household Variables category are the different forms of rental assistance such as Section-8 Vouchers, Moving to Work Tenant Based Voucher and Moving to Work Project Based Voucher. It also includes information on the current activities reported by the households such as new admission, annual reexamination, interim

reexamination, portability move-in, portability move-out, and end of participation. Additionally, this category covers other details such as voucher type (tenant-based voucher, project-based voucher, and homeownership voucher), date of initial admission into the program, date the family was placed on the waitlist for the program under which they currently receive the voucher, total number of people in the household, total number of dependents, among others.

Similarly, within the Income Variables category, there is information on the various income sources of the households such as income from their own business, federal wage, PHA wage, military wage, pension, general assistance, child support, medical reimbursement, and more. Additionally, it also includes the sum of all incomes for household members aged 18 years or older.

The Family Variables mainly consist of demographic characteristics of the head of households, spouse of the head of households, and co-heads of the households. This includes data on their ages, elderly status, disability status, race, ethnicity, and information regarding the number of children in the household.

The Program Variables comprise data related to aspects such as the gross rent amount, the HAP amount going to the owner of the property, homeownership expense, maintenance allowance, allowance for repairs, total amount that the family contributes to housing including utility allowance, and more.

Lastly, the External Variables encompass neighborhood characteristics at the census tract level. This includes information such as the percentage of population below the poverty level where HUD assisted households reside, minorities as a percent of total population, racial and ethnicity information, percent of owner-occupied and rented units, percent of households who are owner-occupants of single-family detached homes, etc.

Out of all these variables, the ones considered in my research are defined in Table 1.

Since the data for the different years were initially provided in separate files, it was first appended to create a consolidated dataset spanning thirteen years that would allow me to carry out a longitudinal analysis. The initial dataset consisted of 193 variables and a total of 5,353,863 observations. To streamline the dataset for the study, I decided to keep observations only for the State of Massachusetts. Notably, Massachusetts is home to 21.56% of all HCV holders included in the dataset, or 1,154,143 number of HCV holders. I further limited the data to include only Section-8 Tenant-Based Voucher holders until the calendar year 2021, and those who were admitted to the program after 2010 in the State until 2021, resulting in 273,288 observations. By limiting the data to recipients admitted to the program after 2010, I can examine where these recipients lived when they first received the voucher and track their subsequent relocations until 2021. The Summary Statistics are provided in Table 2 and Table 3.

Having done that, I merged the 5-Year Estimate 2010 Census Data containing neighborhood characteristics at the census tracts level. The variables considered for neighborhood characteristics incorporate census variables as well as some from the annual longitudinal data on tenant and project-level Section-8 Voucher holders, which are defined in Table 4 and their Summary Statistics is provided in Table 5. After this step, any observation with missing city names were dropped from the dataset. Observations with missing values were flagged.

To analyze whether HCV holders relocate to better quality neighborhoods or not, I utilized Principal Component Analysis (PCA) to create a Neighborhood Quality Index (NQI). This index incorporates various neighborhood characteristics, including the poverty rate, minority rate, percentage of the White population, percentage of the Black population, percentage of the Hispanic population, single-family homeownership rate, number of employed civilians, percentage of the

population in the labor force, median household income, median house value to the owner, median gross rent, average commute time to work, and percentage of health insurance coverage at census tracts level. Some of these variables are taken from the Census 2010 5-years average, while some are taken from the annual longitudinal data on tenant and project-level Section-8 Voucher holders from HUD. The NQI was generated using the PCA command in Stata where it took these different characteristics into consideration and based on the data's overall trend, generated weights for each neighborhood characteristic, as shown in Table 6. Positive weights are associated with characteristics that are assumed to reflect higher neighborhood quality, while negative weights are associated with characteristics that are assumed to reflect poorer neighborhood quality. This means that the index is a measure of neighborhood quality. Standardizing the index, we get a mean of 0.00 and standard deviation of 1.

Finally, as a result, the final dataset consists of 225,325 total observations with 47,499 unique household ID groups.

Section 4: Descriptive Analysis of Current HCV Holders

This section explores the socio-demographic and economic characteristics of current HCV holders to inform us about potential future applicants.

General Overview of Socio-Demographic Characteristics

From 2010 to 2021, a total of 47,499 unique households in Massachusetts were admitted to the HCV program based on this dataset.

As seen in Figure 1, in 2010, the number of admitted households was 6,498 which decreased to 3,696 in 2016 and further declined to 1,419 in 2021. Although there were years with

higher admission numbers compared to the previous years, there is an overall downward trend in the number of households being admitted to the HCV program.

Focusing on the demographic characteristics of HCV holders at the time of admission into the program, most household heads were women, accounting for 72.82% of all household heads, while men made up 27.18%. The median age of heads of households was approximately 44 years old. Around 15.91% of HCV household heads were reported as elderly, and 33.84% were reported as disabled. Moreover, 47.62% of HCV households had children present, with an average of 2 children per household.

On the racial front, Whites constituted the largest racial group among the head of households in HCV families, representing 72.58% of all HCV families, compared to White individuals accounting for 79.4% of the total population in the State as per Census Data 2021. Black heads of households accounted for 24.44% of HCV families, compared to 9.5% of the total State population, followed by Asians, Hawaiian or Pacific Islander and those belonging to more than one race. Additionally, it was observed that 69.79% of all head of households in HCV families identified as non-Hispanic compared to non-Hispanic individuals accounting for 86.9% of the total population in the State, while the remaining 30.21% identified as Hispanic, compared to Hispanic individuals accounting for 13.1% of the total population in Massachusetts.

Over the span of 12 years, 18.83% of the 47,499 households were classified as homeless at the time of admission into the HCV program. The highest number of homeless applicants was found in 2012, constituting 15.5% of the total homeless participants, out of the 8,943 recorded as seen in Figure 2.

Cohort-based Overview of Economic Characteristics

To analyze the trend in the overall change in different aspects of HCV households over the years, a cohort-based analysis was carried out. In this analysis, I compared how different aspects of HCV households such as average annual income, assistance provided for childcare, allowance for medical expenses, amount provided for elderly and disabled, to name a few, changed over the years, compared to these households' characteristics in the initial year of admission into the program.

The difference between the two groups used in this comparison is that one group contains information on how the aforementioned factors changed over the years for each cohort, compared to when they were initially placed in the voucher program; and the other group contains information on how the same factors changed over the years for each cohort based on the calendar years. Furthermore, this analysis has been carried out assuming that there were no changes in PHA priorities or preferences that might have affected the initial characteristics, since the dataset does not contain this information.

Based on the results as indicated in Table 7.1 which contains information on HCV holders and how the various factors' trend changed over the years compared to their initial year of admission to the voucher program, we can see that the average adjusted annual real income of HCV households followed an increasing trend over the years, compared to their initial year of admission. Initially, the average annual income started at around $15,668 in the year of admission. Within the first year itself, there was a positive increase to around $16,179. By the twelfth year since the admission, the average annual income reached $21,233. Although we cannot establish a causal explanation for an increase in income over the years for HCV participants, it does suggest that individuals admitted to the HCV program are more likely to experience a gradual improvement in their financial circumstances over time. Table 7.1 also depicts a gradual decline

in the amount of childcare assistance allowed. Initially, the average amount of assistance provided was approximately $170. Although it increased during the early years, it subsequently began to gradually decrease. This decline could possibly be attributed to the assistance being limited to children under a certain age. Once children surpass this age threshold, assistance may cease to be provided. Family allowance provided for medical expenses follows an increasing trend where the amount provided increases each consecutive year, compared to the households' year of admission. This trend seems to be similar for the allowance given to elderly and disabled HCV households.

Now comparing the trend amongst the same HCV holders based on the calendar years to see if there would be any difference noticed, the income path for HCV households also appear to show an increasing trend as indicated in Table 7.2. The average adjusted real income of HCV households began at $13,387 in 2010. Within the first year itself, this increased to $13,960. By 2016, it had reached $16,822 and by the 12^{th} year, it increased to $20,250. According to the census data, the median household real income has shown an increasing trend over this time period. However, the magnitude of the increase has fluctuated over the years. This contrasts with the income paths of HCV households in MA for the calendar years, as well as when compared to the initial year of admission, in which, in each of the subsequent years, the income increase for HCV households has exhibited a consistent rising trend but with decreasing magnitude of growth.

Similarly, the assistance provided for childcare based on the calendar years followed an increasing trend from 2010 to 2019, but dips by almost 30% in 2020 which coincided the COVID year. The allowances provided for medical expenses follows a volatile trend, with the amount fluctuating each year. However, the allowance provided to elderly and disabled HCV households follows a similar trend as the cohort path, showing an overall increase in the allowance provided over the years.

Now, analyzing the change in family contribution to rent over time since admission into the HCV program reveals an upward trend as shown in Figure 3. Initially, in the year of admission, the family's contribution to rent stood at $420 in real terms on average. This accounted for approximately 34.5% of the households' income on average. By the 12th year since admission, the family's contribution reached $537 in real terms on average. This accounted for approximately 34.0% of the households' income on average. This indicates that as the years progress, the amount of money that families are required to contribute towards their rent gradually increased, or almost stayed the same in terms of the absolute rent amount. It is important to note that the increases in contribution are not consistent from year to year, as there are variations observed in the rate of growth. Nonetheless, the general trend suggests an overall upward trajectory in the family's financial responsibility for rent payments, however, this contribution follows a decreasing trajectory in terms of their share of income. A potential explanation for this trend might be that as years progress, families' income rises, and they relocate to more expensive neighborhoods. This, consequently, requires families to increase their contribution towards rent. However, with an increase in income at the same time, it would account for a lesser (or similar) share of their income going towards rent. Alternatively, it could also be that rents are generally rising over time, and since incomes are also rising over this period, households are required to contribute a similar portion of their income towards rent.

Although the rent is believed to be capped at 30% for households admitted into the program, it was seen in the data that the percentage of rent that some families were contributing was more than 30% of their income. Even though the overall mean contribution to rent in percentage amounted to 34.13%, several households were contributing a lot more than 30%.

The HAP amount provided by the government shows fluctuations, with some variations in the amount over the years. However, there seems to be a general trend of increasing housing assistance provided from the initial years to the later years. Furthermore, for 1,370 observations, the amount of HAP received is $0. All 1,370 of these households covered the full amount of rent by themselves.

What does this inform us about potential future applicants?

A study conducted by The Center for State Policy Analysis in 2022 calculated the approximate shares of households that would be eligible for universal housing vouchers, highlighting the potential impact of providing rental assistance to all eligible households on equity. This calculation was carried out based on several eligibility criteria such as including individuals earning less than 80% of the area median income, having no criminal records, being renters instead of homeowners, and, for individuals in school, not being in the labor force, among others.

This study revealed that almost 50% of Black families and 56% of Hispanic families in Massachusetts would qualify for URA. In comparison, White households accounted for 18% of the eligible population. Furthermore, the study's estimates indicated that nearly half of all eligible households in the state had incomes below 30% of the area median income making them eligible for nearly 70% of the total rental subsidies. The findings also suggested that universal assistance would particularly benefit the elderly population, including individuals living alone.

The findings from the HCV dataset align with certain aspects when considering potential future applicants for HCV, assuming we use the same eligibility criteria. On the racial front, given that a majority of residents in Massachusetts belong to White households, it is reasonable to anticipate a higher proportion of HCV applicants from these households, followed by Black

households and then Asian households. Additionally, future applicants will likely have an average age of around 44 years. Moreover, a significant percentage of applicants may also have children in their households since majority of the current HCV holders have an average of 2 children in their households.

Another trend could potentially be the increasing HAP amount provided by the government. With vouchers being expanded to cover new Section-8 voucher recipients, it should be expected that the government would have to set aside a certain portion of their budget to cover this expense.

Section 5: Locational Patterns of Current HCV Holders

The location variable under focus for the relocation pattern analysis of HCV holders consists of a mix of Places and ZIP Code Tabulation Areas (ZCTAs) within different cities in Massachusetts. Although the dataset's codebook labels these places as "unit-city", it is worth noting that the geographic unit is much more granular, consisting of both places and ZCTAs within each city.

Out of the total of 47,499 households with HCVs in the State in this dataset, the unit-city where the highest number of HCV households initially reside is Worcester accounting for almost 7.08% of all households. The unit-city that follows Worcester is Dorchester, comprising of around 6.42%, Springfield with 4.96%, New Bedford with 3.89%, and Lynn with 3.63%.

As of 2021, the top five unit-cities where we find the highest number of HCV holders residing include these same places: Dorchester, Worcester, Springfield, New Bedford and Lynn with Dorchester having the highest share of 7.13% and Worcester with 6.72%.

One of the main goals of the HCV program is to allow voucher holders to have the flexibility to move to different neighborhoods, thereby reducing concentrated poverty. It was observed that 82.18% of all households did not relocate to a new unit-city, while the remaining 17.82% moved to at least one new unit-city. Among those who relocated, 76.52% made one move, 18.10% made two moves, 4.05% made three moves, with the highest number of moves made by a single household being seven.

While a majority of the relocation patterns analyzed for the purpose of this research has been focused on unit-cities, it is worth noting the relocation patterns across census tracts. As was mentioned earlier, we noted that 17.82% of HCV holders moved at least once to a new unit-city. However, this percentage almost doubles to 32.94% when considering moves across census tracts. Among those who relocated, 55.48% moved to a census tract in a different unit-city, while the remaining 47.85% chose to relocate to a different census tract within their initial unit-city of residence.

The dataset provides locations for 350 different unit-cities in Massachusetts. By tracking voucher holders who moved from one place to another, Figure 4 presents a list of the top 50 unit-cities with the highest number of move-ins. The top 10 include Dorchester, where 7.53% of HCV households relocated to, followed by Mattapan with 3.53%, Boston with 3.46%, Lynn with 2.95%, Roxbury with 2.70%, Quincy with 2.21%, Malden with 2.19%, Hyde Park with 2.19%, Randolph with 2.17%, and Worcester with 1.99%.

Additionally, it is worth noting that there are several unit-cities where only one household moved into. Some of these unit-cities include Cheshire, Devens, Heath, Linwood, Newtonville, Russell, Shelburne, Warwick, Westminster, and Woronoco to name a few.

When analyzing the places from which initial move-outs occurred, the top ten locations include Dorchester, from where 9.11% of HCV households who relocated moved out, followed by Mattapan with 3.74%, Lynn with 3.43%, Boston with 2.96%, Worcester with 2.90%, Roxbury with 2.63%, Brockton with 2.39%, Malden with 2.26%, Springfield with 2.06%, and Randolph with 1.95%.

Delving deeper into the characteristics of the unit cities where HCV households move into the most and least, a significant difference can be observed between the two categories, and this pattern seems consistent within each group. It could be observed that (almost all) the unit-cities with the highest number of move-ins by HCV households have a higher percentage of minority population compared to the overall average of 41.68%. The difference is quite dramatic, as the percentage of minority population in the top ten cities ranges from approximately 30% to 97%, whereas in the bottom ten cities, it ranges from approximately 3% to 18%. The percentage of poverty in all of the top ten cities except for Quincy is above the overall average of 19.80% in contrast to the bottom ten cities. Single family homeownership is also significantly lower in the top ten cities compared to the overall average of 30.16%, ranging from 3% to 26%, whereas this range span from 40% to 92% in the bottom ten. On the other hand, the number of renters is higher in the top ten cities compared to homeowners, while the number of renters is lower in the bottom ten cities compared to homeowners. Moreover, the total number of affordable housing units, such as public housing units and Section-8 units, is significantly higher in the top cities compared to the bottom ten. The top ten cities also have a higher number of families whose total annual income is less than 30% or 50% of the area median income.

In addition, the places with the highest move-ins have a higher proportion of Black and Hispanic households compared to White households with an average of 13.7%, 17.91%, and

65.12% respectively. Black households in the top ten cities comprise approximately 12% to 80% of the neighborhood composition, while in the bottom ten cities, it ranges from 0.3% to 7%. On the other hand, White households account for approximately 5% to 68% in the top ten cities and approximately 82% to 98% in the bottom ten cities.

Overall, we can see that HCV participants who relocate to a new unit-city, usually choose to move somewhere that has similar characteristics as their previous city. These cities are usually ones with a higher share of minority population, higher poverty rate, majority black households compared to white households, low percentage of single-family homeownership rate, and higher number of renters relative to those with lower share of minority population, lower poverty rate, lower share of black households compared to white households, higher percentage of single-family homeownership, and lower number of renters.

Figure 5 shows the origin and destination matrix of all movements made by HCV recipients in the data from 2010 to 2021. The map shows that the majority of the movements are concentrated in and around the Eastern Massachusetts area. It indicates the flow of individuals or households utilizing the vouchers, showcasing the patterns of where people are relocating from and where they are moving to within the specified time frame.

Figure 6 illustrates the same relocation paths, but portrays the mean distance travelled by voucher recipients. The map utilizes different colors to represent varying distances. Purple and pink lines represent shorter distances, while the orange and yellow lines represent longer distances. The calculated mean distance travelled by voucher recipients is 16.06 kilometers, while the median distance travelled is approximately 10.60 kilometers.

Figure 7 was generated using the Anselin Local Moran's I geospatial tool to carry out a cluster and outlier analysis in ArcGIS Pro. It identifies spatial clusters of high and low values of

relocation distances. This map shows that short distance relocations are clustered in the eastern part of the State, depicted by light blue lines. Additionally, there is also evidence of long distances traveled shown in pink lines. Notably, a majority of the pink lines originate or end in the eastern side of the State.

Figure 8 displays the census tracts with the number of HCV households. Similarly, Figure 9 displays the census tracts with the number of Section-8 housing units (which incorporates total Section-8 unit count at the PHA level). Notably, we observe HCV households and Section-8 housing units prominently located in Eastern Massachusetts, particularly around Boston. Additionally, significant clustering of these housing units and HCV households can be noticed in Springfield, Worcester, Fall River, and New Bedford.

Again, carrying out a cluster and outlier analysis, Figure 10 shows the clusters of the number of voucher households. High-high clusters, depicted in pink, are clustered around Boston, Springfield, Worcester, Fall River and New Bedford. These areas exhibit a high number of voucher holders in close proximity, suggesting a spatial pattern of clustering. On the contrary, low-low clusters, that represent areas with low number of voucher holders in close proximity are spread across other parts of Massachusetts.

Additionally, Figure 11 highlights the top ten areas with the highest number of HCV holder residents, hence depicting higher demand for affordable housing in those areas.

Figure 12, also created using the Local Moran's I tool, presents a cluster analysis of the number of Section-8 housing units. The map reveals a significant concentration of Section-8 housing units around the Boston area. Conversely, low-low clusters are spread in other parts of Massachusetts, notably in Greenfield, Springfield, Taunton, Ipswich, among others.

While analyzing the spatial distribution of the initial locations of HCV holders when the household first used their voucher, Figure 13 depicts this information . We observe a significant number of households residing in Dorchester Center, Springfield, Worcester, Fall River, and New Bedford areas. This information is further complimented by the cluster patterns related to the initial locations of HCV holders in Figure 14.

After following HCV households over the years, we find evidence that areas where HCV recipients relocate the most are primarily clustered in the eastern parts of the State, particularly around Boston as seen in Figure 15. Although the cluster map, Figure 16, does not depict the move-in locations clearly, the Global Moran's I Report 4 in the Appendix provides evidence of clustering. This report is another geospatial tool in ArcGIS Pro that provides statistical analysis of spatial autocorrelation and indicates where there is clustering or dispersion in the spatial distribution.

In addition to the maps, Figure 4 shows where the highest move-ins by HCV recipients were made and hence provides insight into the most popular destinations of HCV recipients within the State. This suggests where the demand for affordable housing is likely to increase in the near future.

Section 6: Do HCV Holders Move to "Better" Neighborhoods?

HCVs give participants the flexibility to move to a different neighborhood of their choice. Prior literatures, as indicated before, have provided evidence that moving to lower poverty, and higher opportunity neighborhoods contribute to long-run positive impacts on voucher recipients, such as higher income, higher employment opportunities, higher health benefits, etc.

Following HCV recipients over time in the dataset, the mean adjusted annual income of households that move to at least one new census tract versus those that do not move follow an increasing trend. The average adjusted annual income for movers during their initial year of admission stood at approximately $14,172. This income value is lower compared to non-movers whose average adjusted annual income for movers during their initial year of admission stood at approximately $16,430. As seen in Figure 17.1, which shows the annual percentage change in the adjusted income since the year of admission for movers, as well as non-movers, we observe that income is increasing for movers at a much higher rate than for non-movers. While the overall average increase in income for movers stood at approximately 25% in the span of 12 years, for non-movers, it stood at almost half of that rate at 14%.

Figure 17.2 shows the annual percentage increase in income by calendar year for households that moved to a different census tract. We notice that the percentage change fluctuates over the years and sees a dip in 2020 which coincides with the COVID year. There is a peak in 2021 which potentially reflects the recovery period from COVID. The overall average increase in income for movers over the 12-year span stood at approximately 4.6%, and for non-movers, it stood at around 3.2%.

Table 8.1 displays the NQI weights based on the year of admission cohort for all households in the dataset. Cells highlighted in pink reflect a movement to a worse-off census tract. On the other hand, cells highlighted in green reflect movement to a better-off census tract.

From the table, we can see that when considering both movers and non-movers, households mostly start off in better quality census tract as indicated with positive NQI values, with an average NQI of 0.012. For some of the cohorts, these positive NQI values are followed by negative NQI values, indicating that voucher recipients do not immediately relocate to higher opportunity census

tracts, but most of the subsequent moves are to better census tracts. However, we should note that 67% of the households considered in this cohort are non-movers.

Focusing on only the movers, those who relocated to another census tract at least once, we can see the NQI weights based on the year of admission cohort in Table 8.2. From the table, it is seen that most movers initially start from census tracts where the NQI value is negative, with an average NQI of -0.05. Except for in some of the years, on average, HCV households do move to census tracts that have better socio-economic characteristics than their previous census tract of residence. The data also shows that eventually, households do end up in census tracts with a positive NQI value.

The average NQI value of the initial census tracts from where HCV started off from is -0.017 for movers, versus 0.039 for non-movers. From this, we can say that those who initially start off in a better census tract choose to mostly stay around the area. They might have relocated but it would be within the same tract. For us to be certain, it would have been better if the dataset had exact addresses of participants to track their exact relocation patterns, however, due to the absence of this data, we cannot ascertain whether they stay in the same census tract or move to a new one within the same tract.

The depiction of the spatial distribution of census tracts with their NQIs can be seen in Figure 18. This map uses different colors to depict the varying quality of neighborhoods based on their PCA. Dark-colored areas on the map depict neighborhoods with lower PCA weights, representing “lower-quality neighborhoods”. On the other hand, light-colored areas on the map depict neighborhoods with higher PCA weights, representing “better-quality neighborhoods”.

By conducting a cluster analysis on the NQI, clusters of neighborhoods with similar characteristics become apparent as it can be seen in Figure 19. Low-quality neighborhoods

represented by the light blue color, are primarily clustered around the Boston, Springfield, and New Bedford areas. Conversely, the map also reveals high-high clusters represented in a pink color, predominantly found in the eastern side of the State.

Section 7: Model

In order to analyze the relationship between HCV holders' household and neighborhood characteristics and their decision to relocate to a different neighborhood, I use three model specifications.

Impact of Individual and Neighborhood Factors on Relocation Decisions across Individuals

Model 1 is specified as follows:

$$census_ever_moved_i = \beta_0 + \beta_1 NQI_i + \beta_2 I_i + \beta_3 H_i + \beta_4 Y_i + u_i \quad (1)$$

where the dependent variable $census_ever_moved_i$ is binary, indicating whether household i ever moved to a different census tract while they were in the HCV program.

The independent variable NQI_i represents the Neighborhood Quality Index of the census tract that household i is residing in when it enters the HVC program. In addition, I_i is a vector of individual characteristics including female, age, and indicators of elderly status, disability status, White, and Hispanic. H_i is the vector of household characteristics that includes the number of adults in the household divided into different age groups (18 to 21, 22 to 25, 26 to 35, 36 to 49, 50 to 61, 62 to 85, and above 85), the number of children in the household divided into different age groups (0 to 3, 4 to 5, 6 to 12, and 13 to 17), the number of disabled children, the total number of

members in the household, the total number of dependents in the household, the adjusted annual income, the amount of allowance given for disability help, the amount of allowance given for childcare support, the amount of allowance given for elderly help, and Y_i is the year of admission into the HCV program. Lastly, u_i is the error term. All these characteristics are measured at the year of admission.

Impact of Individual and Neighborhood Factors on Relocation Decisions over the Years

Next, I consider a panel model incorporating year fixed effects for the sample. Model 2 is then specified as:

$$census_moved_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 H_{it} + \beta_4 X_{it} + \pi_t + u_{it} \quad (2)$$

where t = 2010, 2011, 2012, …, 2021, and the dependent variable $census_moved_i$ is binary, indicating whether household i moved to a different census tract in year t.

In this model, the year of admission has been removed. Instead, X_i, which indicates the years since admission into the HCV program, and π_t, which is the year fixed effect have been added to the model. Note that NQI has been removed from Model 2 because it does not vary with time. All time in-variant variables such as female, White, Hispanic, and total number of household members have also been removed.

Now, incorporating household fixed effects to Model 2, we now have Model 3:

$$census_moved_{it} = \beta_0 + \beta_1 I_{it} + \beta_3 H_{it} + \beta_4 X_{it} + \pi_t + \eta_i + u_{it} \quad (3)$$

where η_i is the household fixed effect that is added to Model 2.

Section 8: Empirical Analysis

Model 1 is estimated using linear regression and the results are presented in Table 9 Column (1). While the results cannot prove that neighborhood and individual characteristics explain HCV households' relocation decisions, they show a significant correlation between relocation patterns and some characteristics.

The results in Column (1) show that HCV recipients who first use their voucher in a census tract with better socio-economic characteristics (as measured by the standardized NQI) compared to census tract with poorer socio-economic characteristics, are more likely to ever move to a new census tract, by 0.0104 increase in the odds, on average, assuming everything else is constant. This coefficient is statistically significant at 1% significance level. However, this result is economically insignificant with the semi-standardized coefficient value of 8.5% (Appendix C).

This positive association may be attributed to HCV recipients in better socio-economic neighborhoods potentially being more aware of resources such as healthcare, education, and job opportunities in other areas, which could motivate them to move closer to locations with better amenities.

Moving on to individual and household characteristics and their association with recipients' relocation decisions, we observe a positive relationship between a female being the head of the household and the likelihood of that household ever moving to a new location, compared to a male being the head of the household. Although this result is statistically significant, it is economically insignificant. Hispanic households have a higher tendency of relocating, compared to non-Hispanic households. An increase in the childcare allowance provided to families also has a

positive relationship with the relocation decisions of the household. Households with more dependents also have a positive association with relocation decisions. Furthermore, disabled members have a higher tendency of moving to a new place. This result is statistically significant, however economically insignificant.

On the other hand, we observe negative relationships between relocation decisions and some individual and household characteristics. The results indicate that as the head of household grows older, households are less likely to move to a different location. It can also be observed that there is a negative relationship between White households ever moving to a new neighborhood, compared to all other races in the dataset. Households with a higher adjusted annual income are less likely to move to a new neighborhood. In other words, lower income households have a higher tendency of moving to a new place.

Taking into consideration the number of years that households are in the voucher program and following them over time to see whether they relocate to a new location, we examine Model 2 and Model 3, which show panel regressions with time fixed effects in one, and time as well as household fixed effects in another, respectively. While time fixed effects capture the average effect of time-varying variables that are common to all individuals in the panel such as overall economic conditions, individual fixed effects capture unobserved individual level heterogeneity that remains constant over time.

Considering the results for Model 2 in, Column (1) of Table 10, which incorporates only time fixed effects, we observe that as the age of the head of the household increases, we notice a negative relationship with the household's likelihood of moving to a new neighborhood, as seen in Column (1) of Table 10. However, the incorporation of individual fixed effects in Model 3 changes this result to becoming positive but still significant.

Both models also show a statistically significant positive association between households having a greater number of adults between the age group of 36 to 49 and moving to a new neighborhood.

A positive association is also between households with disabled members, and their inclination to relocate with time fixed effects. However, the incorporation of individual fixed effects changes this result to becoming statistically insignificant.

In contrast to the Model 1 results, the incorporation of time and household fixed effects shows a statistically significant negative relationship between having children between the age group of 6-12, and those households moving to a new place.

Like the cross-sectional analysis, the results also show that as the adjusted annual income of the household increases, households are less likely to a new neighborhood as per Model 2 results. However, the incorporation of individual fixed effects in Model 3 changes these results to becoming insignificant and hence no relationship is established between relocation decisions and households adjusted annual income.

For households with elderly individuals, the statistically insignificant positive results in the cross-sectional regression result, and the panel regression result with time fixed effects changes to becoming negative and statistically significant when individual fixed effects are added.

We observed that some of the coefficients remained consistent in terms of their relationship with the dependent variable and their level of significance. As households adjusted annual income increases, their tendency to move out of their current locations decreases (not considering the Model 3 results). This may be because higher income provides them with greater capacity to afford housing in their current neighborhood. It offers more options and flexibility to find suitable housing that meets their criteria without the need to relocate. But this result goes away when

individual fixed effects are included. Therefore, this just indicates that there are unobservable individual characteristics that are correlated with income and moving that drive this result. For example, more stable households may be more likely to have higher incomes and move less.

A consistent pattern was also observed amongst households with disabled members and their inclination towards relocating. Furthermore, an increase in the number of dependents is also associated with relocating to a new place. In addition, an increase in disability allowance provided to households is associated with a negative relation with relocation patterns.

On the other hand, we also observed changes in the coefficients' relationship with the dependent variable and/or their level of significance. Specifically, when individual fixed effects were included in addition to time fixed effects, the relationship between the age of the head of the household and the tendency to move to a new location changed negative to positive (with time and household fixed effects).

Furthermore, families with children, especially between the age groups of 6-12 tend to stay in the same place and not relocate based on the panel models. This could be because they have established a social support network in their current residential area, including schools, childcare facilities, and other amenities that contribute to their stability. However, the cross-sectional model established a positive and insignificant relationship between households with children aged 6-12 and relocation decisions.

A positive and insignificant result for households with elderly changes to becoming significantly negative with time and households fixed effects. Also, a positive and significant association between households with disabled members tendency to move to a new neighborhood change to becoming insignificant with time and households fixed effects.

These changes may have been observed due to controlling or various types of unobservable factors that affect individuals' decisions to relocate. Time fixed effects may account for macro-economic conditions such as the overall economic environment, including economic growth and recession. They may also capture policy changes impacting housing assistance programs, rent regulations, and community development policies. Furthermore, time fixed effects may also consider housing market conditions, such as changes in rental prices and housing affordability, as well as technological advancements that increase access to information about neighborhoods and available amenities, influencing individuals' decisions to move or stay. In fact, the highest likelihood of moving is in 2021 which might reflect the easing of COVID-19 restrictions and household's greater willingness to move with the decline in the severity of the COVID-19 conditions.

The incorporation of individual fixed effects controls for individual-level time-invariant unobservable factors that impact individuals' decisions to move or stay. These factors include preferences towards mobility or housing choice, individual characteristics like personality traits, social support systems such as family and cultural ties in their current community, personal career aspirations, and financial circumstances and constraints affecting their relocation decisions.

Although we cannot establish a causal relationship between the decision of HCV holders to move or stay in the same neighborhood and their individual and household characteristics, there is some level of an overall correlation. It can be observed that individuals who are more inclined to relocate to a new neighborhood include those who initially reside in neighborhoods with better socio-economic characteristics, have a female as the head of the household, the disabled, belong to Hispanic ethnicity, and those that have greater number of dependents in the family. On the contrary, individuals who are less inclined to relocate to a new neighborhood include the elderly,

have older household heads, those belonging to White households compared to other races, those with a child between the ages of 6-12 in the family, those who receive higher disability allowance, and those with higher adjusted annual income. Understanding these correlations in relocation patterns is important when determining characteristics that might be prevalent in households that choose to relocate if URA is implemented, and therefore policies surrounding URA can also be implemented focusing on these correlated characteristics in mind.

Section 9: Conclusion

This research focused on investigating various aspects of the current voucher holder population in Massachusetts to predict future eligible applicants. Assuming that the sample from the dataset is representative of the larger population, if URA is implemented in MA, the findings suggest that most applicants are likely to come from white households, followed by black households. Most households could potentially be headed by females around the age of 44. Disabled individuals and households with children are also significant among applicants.

Evidence for clusters of voucher holders were found in specific locations, indicating where the demand for affordable housing may increase. The places mainly include Dorchester, Boston, Mattapan, Lynn, Roxbury, Quincy, Hyde Park, Malden, Randolph, and Worcester. Although the data showed that most voucher holders choose to stay in the same neighborhood, and not relocate, for those who do move to different census tracts or unit-cities, most of these relocations clustered around Eastern Massachusetts area. Moreover, individuals who relocate sometimes tend to initially move to areas with similar or worse environments due to the urgency of finding housing, but eventually end up in better-quality neighborhoods over time. This suggests potential for upward mobility and improvement in living conditions of HCV holders who choose to move to areas with better socio-economic characteristics.

Based on the dataset, approximately 67% of HCV holders do not ever move to a new location. For those who do move though, we observed a higher number of HCV holders move to a different census tract in the same unit city than to a different unit-city. Although we cannot establish a causal explanation for relocation patterns to better census tracts, it does suggest that individuals admitted to the HCV program are more likely to find themselves moving to areas that provide better opportunities for them and their families over time. However, this process is not instantaneous. Some of the potential reasons that might contribute to the delay in relocation time or households' decision to relocate within the same census tract may be social ties with the neighborhood where they have been living for years and therefore they have a certain level of comfort and familiarity with that neighborhood, which persuades them to stay back than move to a new place. Another potential reason could also be due to the prevalent landlord discrimination in some neighborhoods that restricts HCV holders from renting a house (Langowski et al. n.d.).

Although a causal relationship could not be established, there is an overall correlation between relocation decisions and individual and household characteristics. Factors such as initially residing in neighborhoods with better socio-economic characteristics, having a female head of household, belonging to a Hispanic household, having disabled members, having higher number of dependent household members, and increase in childcare allowance increase the likelihood of relocation. On the other hand, having older household heads, the elderly, white households compared to other races, households with children between the ages 6-12, those receiving higher disability allowance, and those with higher incomes are less inclined to relocate. These correlation lays out an idea of what kinds of households are most likely to relocate to a new census tract and hence help policy makers formulate policies accordingly if URA is implemented.

On the front of some of the limitations of my research, having the exact addresses of where these voucher holders live would have made the study more accurate in capturing their relocation behaviors. However, we only know in which unit-city the voucher was first used. When voucher holders are chosen to receive the voucher, they only have a certain period to time within which they must find rentals that accept vouchers. For this reason, some holders might relocate to a new place just for the sake of using that voucher instead of having the genuine desire to move to that place.

Furthermore, some of the observations with missing unit-cities that were dropped at the beginning of the study contribute to the fact that the findings do not reflect the whole sample, and hence might make it difficult to establish a generalizability to a broader population. In addition, since this study only takes MA voucher holders into consideration, the findings might not be applicable for other states with different housing policies, socio-economic conditions, etc. For this, a separate study would need to be conducted with data that is more state specific.

The NQI constructed for this study is based on the choice of some variables. There might be several other variables, if incorporated, that could impact the overall NQI and hence alter the results accordingly.

Overall, it is highly probable that the implementation of URA would significantly benefit underserved low- and medium-income. If carried out thoughtfully, the implementation of URA would likely be successful in bringing a wide range of positive developmental changes in low quality neighborhoods in Massachusetts, and uplifting the standards of living of low and moderate income households, so that it allows them to not only live a comfortable life but, also open doors for better education, health, and career-oriented employment opportunities; contributing to the long-term and sustainable economic and social change for the better.

Figures

Figure 1: Number of HCV Recipients Admitted to the Program from 2010-2021

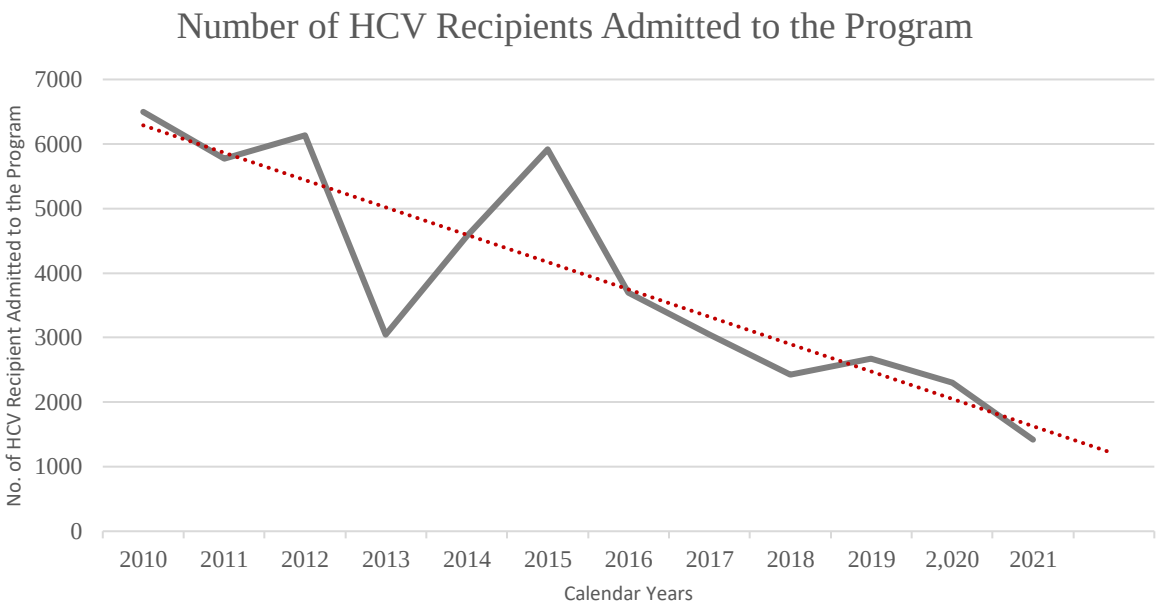


Figure 2: Number of HCV recipients classified as homeless at the time of admission into the program from 2010-2021

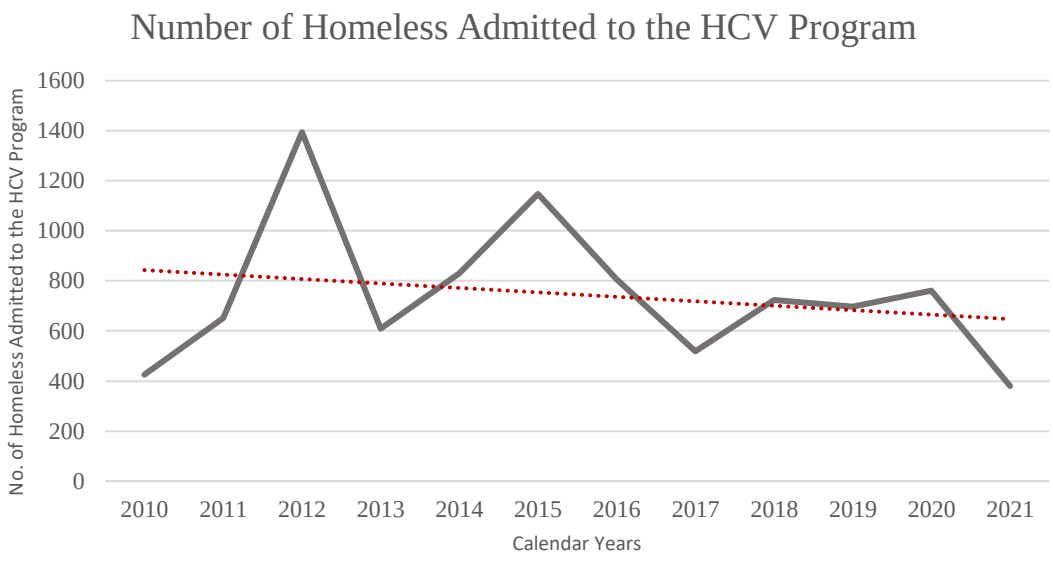


Figure 3: Gross Rent, Housing Assistance Payment (HAP) Amount, and Family's Contribution to Rent (Gross Rent – HAP) compared to initial year of admission

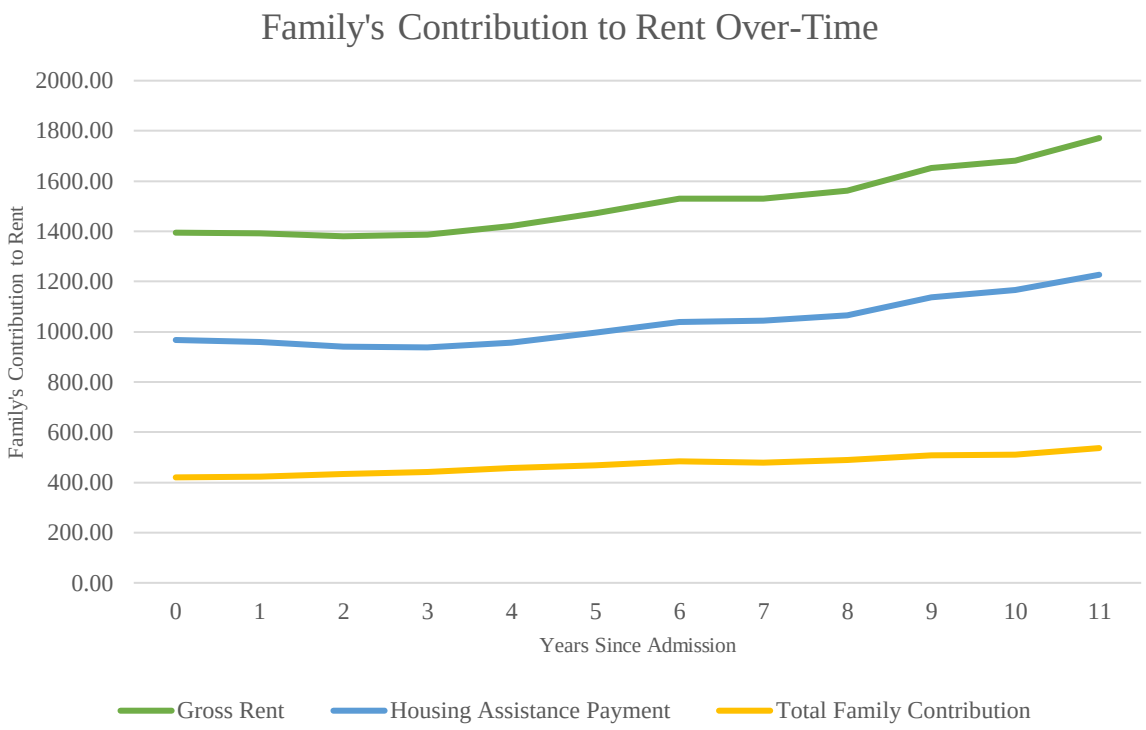


Figure 4: Top 50 Unit-Cities with the Highest Number of Move-Ins

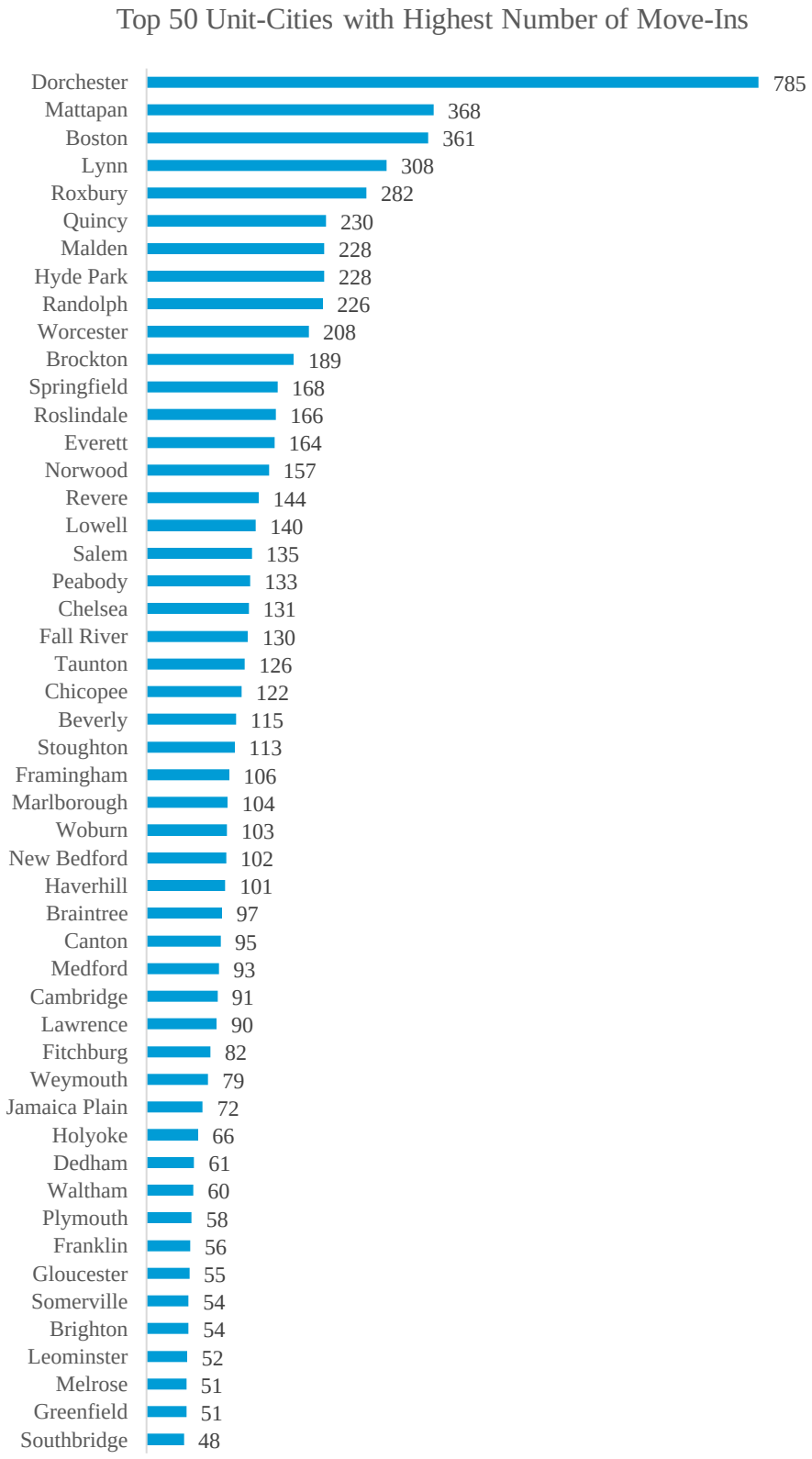


Figure 5: Map of the Origin and Destination of HCV Holders from 2010-2021

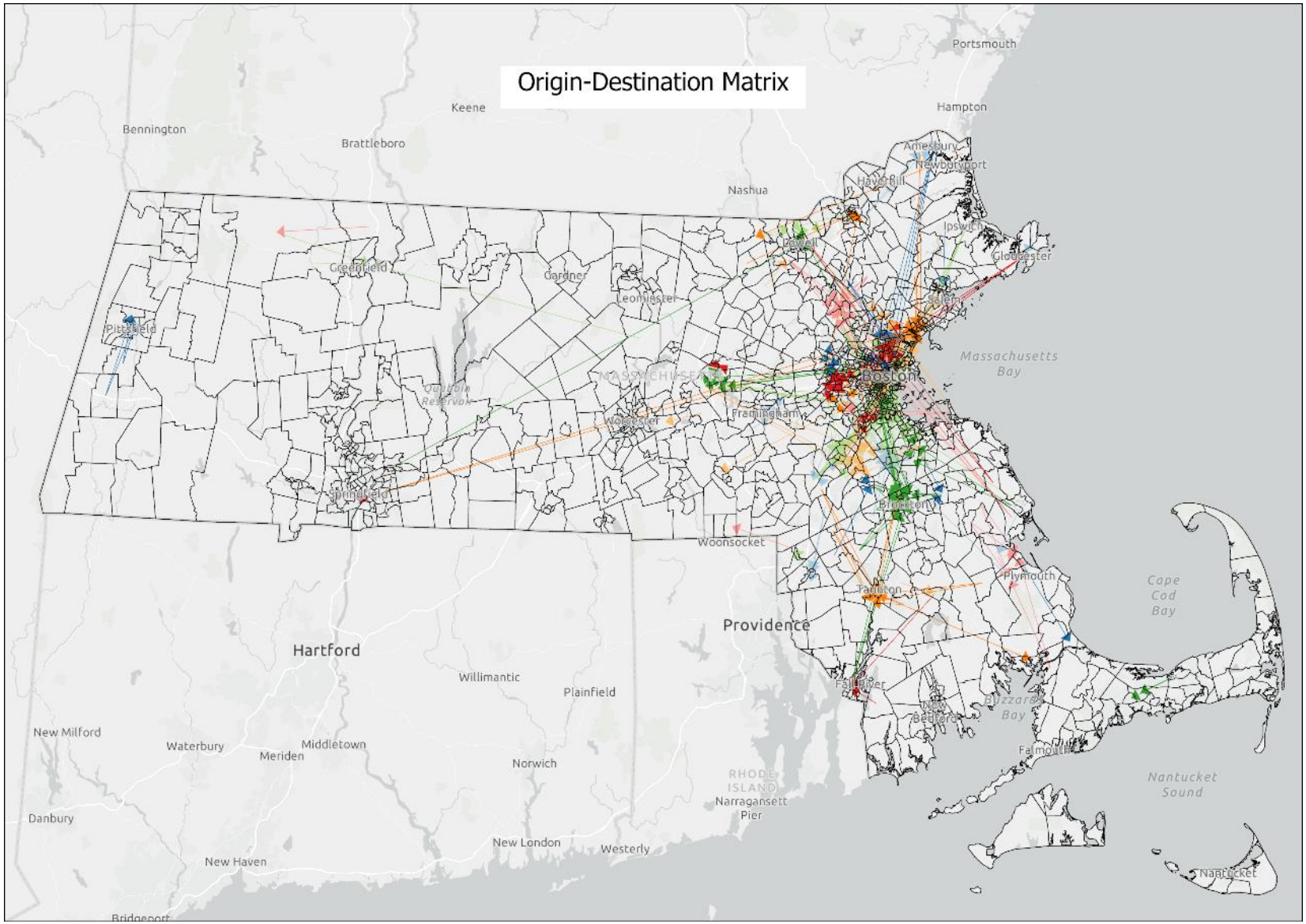
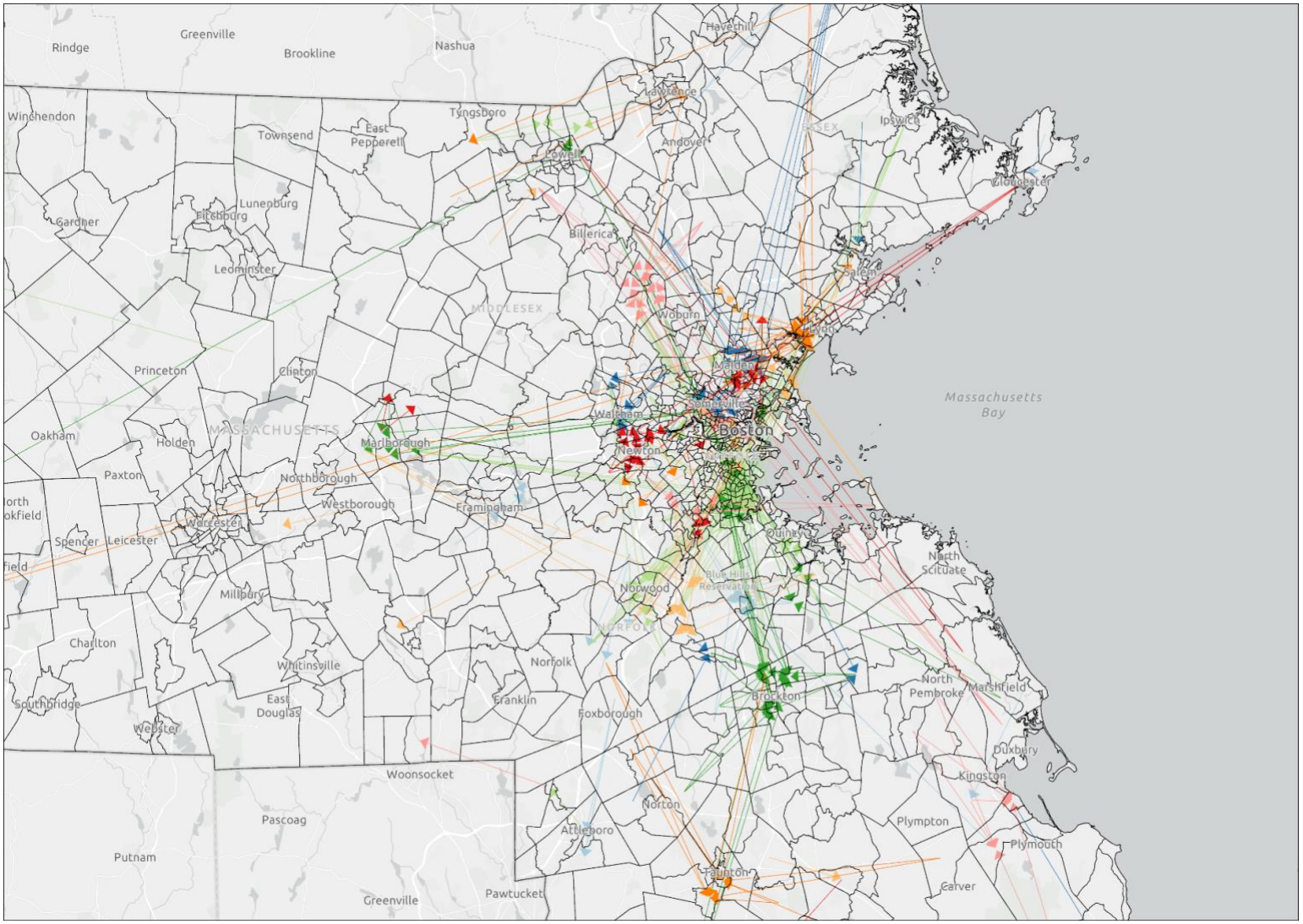


Figure 5.2: Close up of the Origin-Destination Matrix



Note: It appears that HCV holders are leaving downtown areas and moving more towards the peripherals and sub-urban areas

Figure 6: Map of the Mean Distance Travelled by HCV Holders from 2010-2021

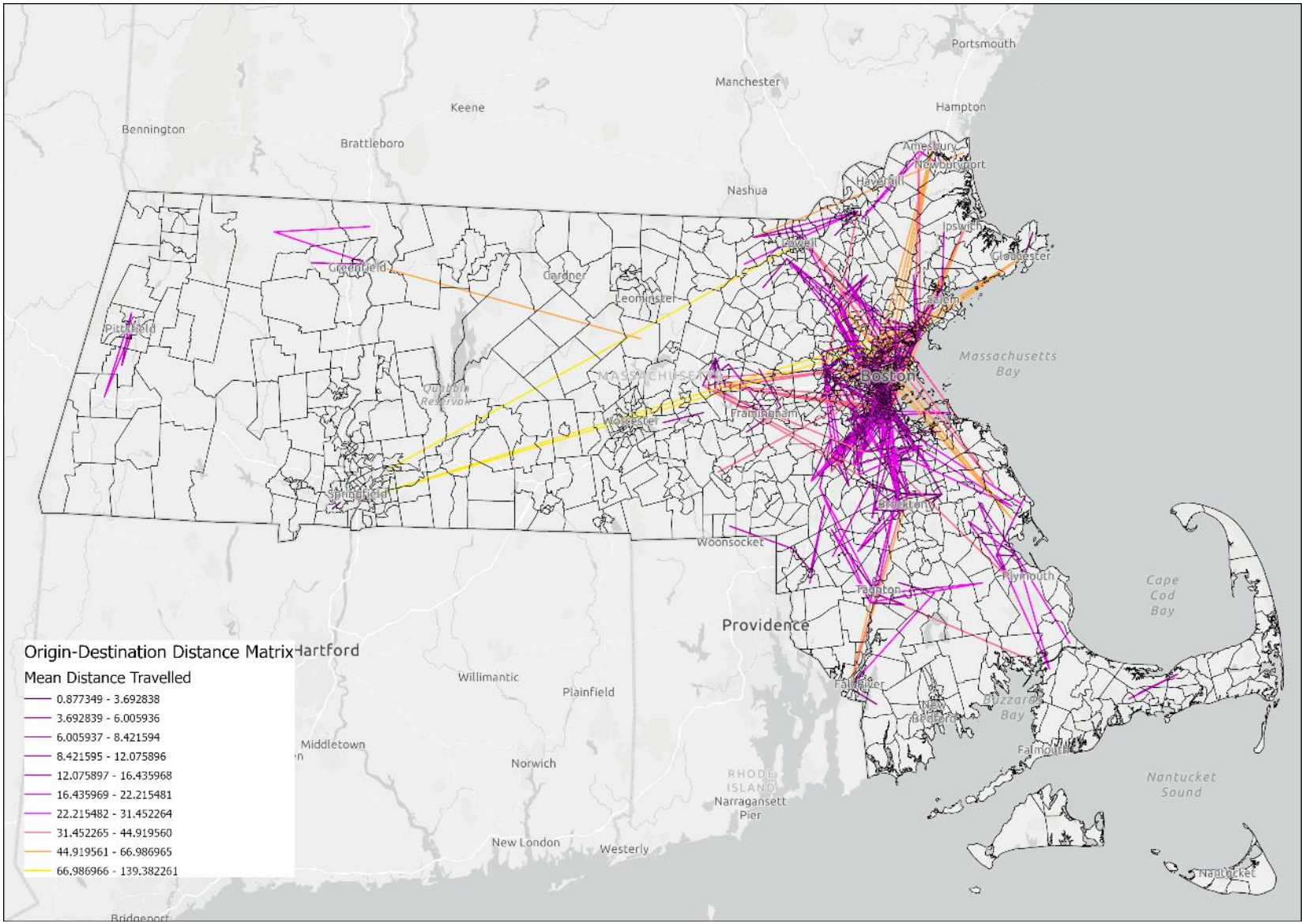


Figure 7: Cluster Map of the Mean Distance Travelled by HCV Holders from 2010-2021

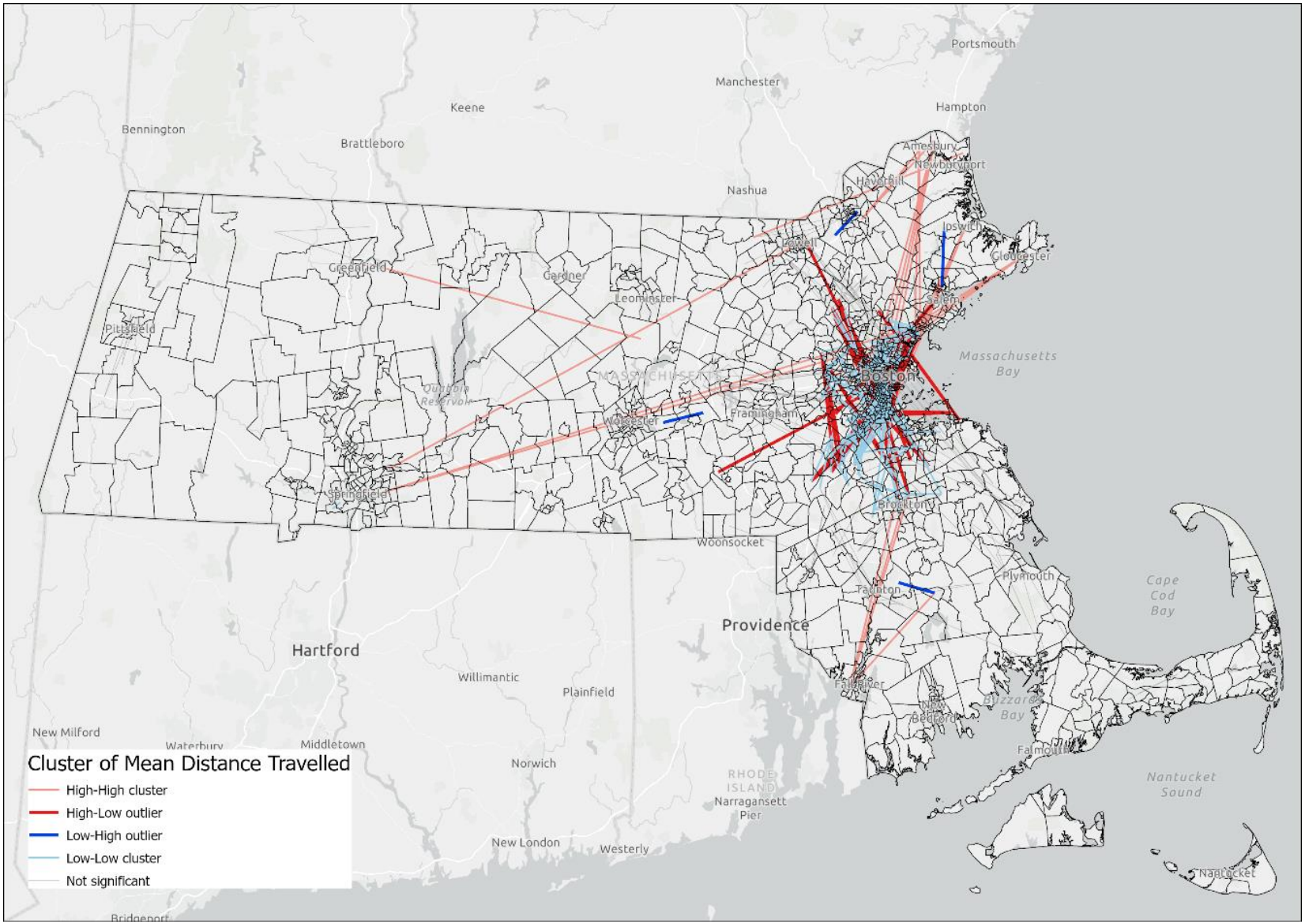


Figure 8: Map of the Number of HCV Holders from 2010-2021

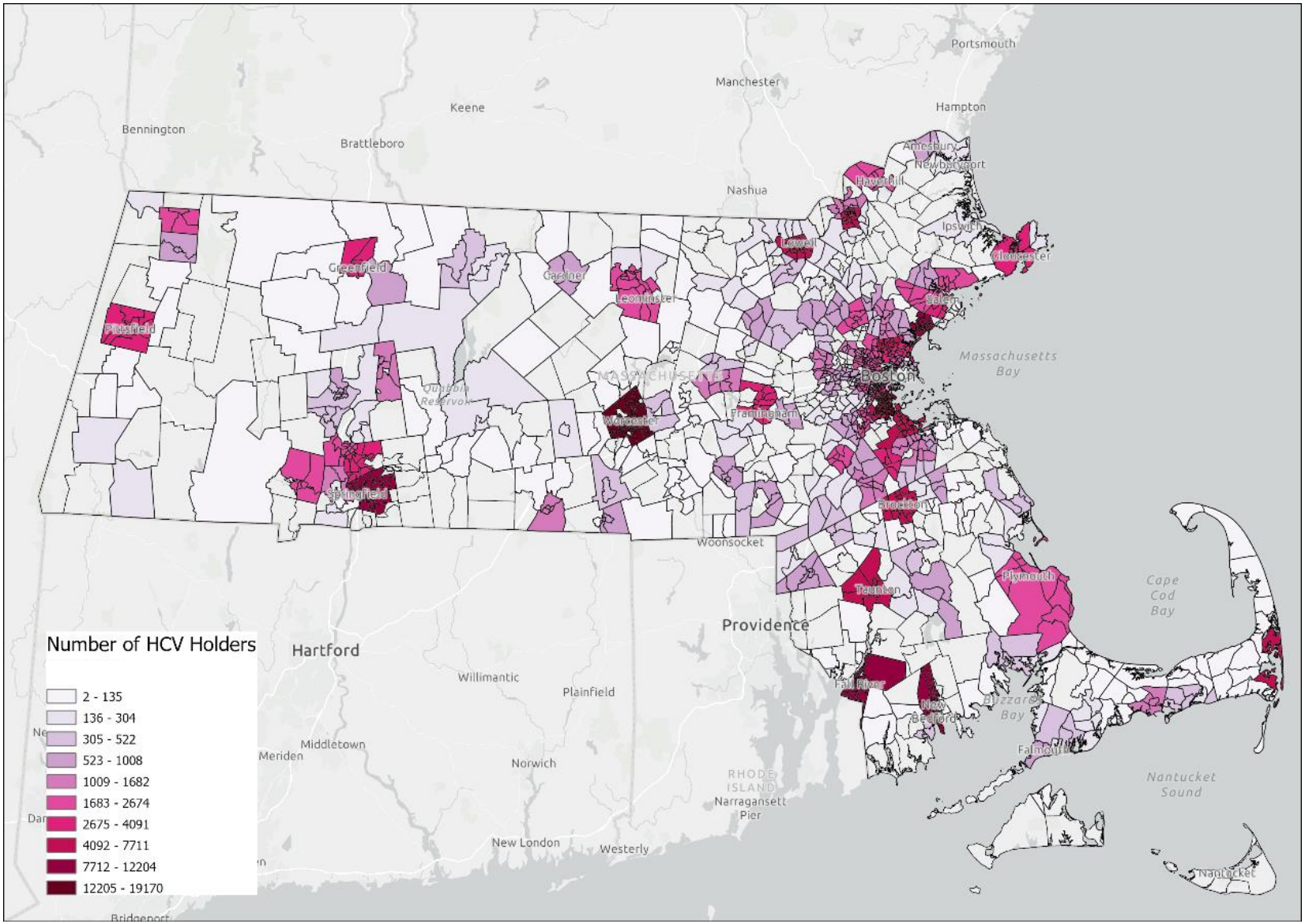


Figure 9: Map of the Number of Section-8 Housing Units from 2010-2021

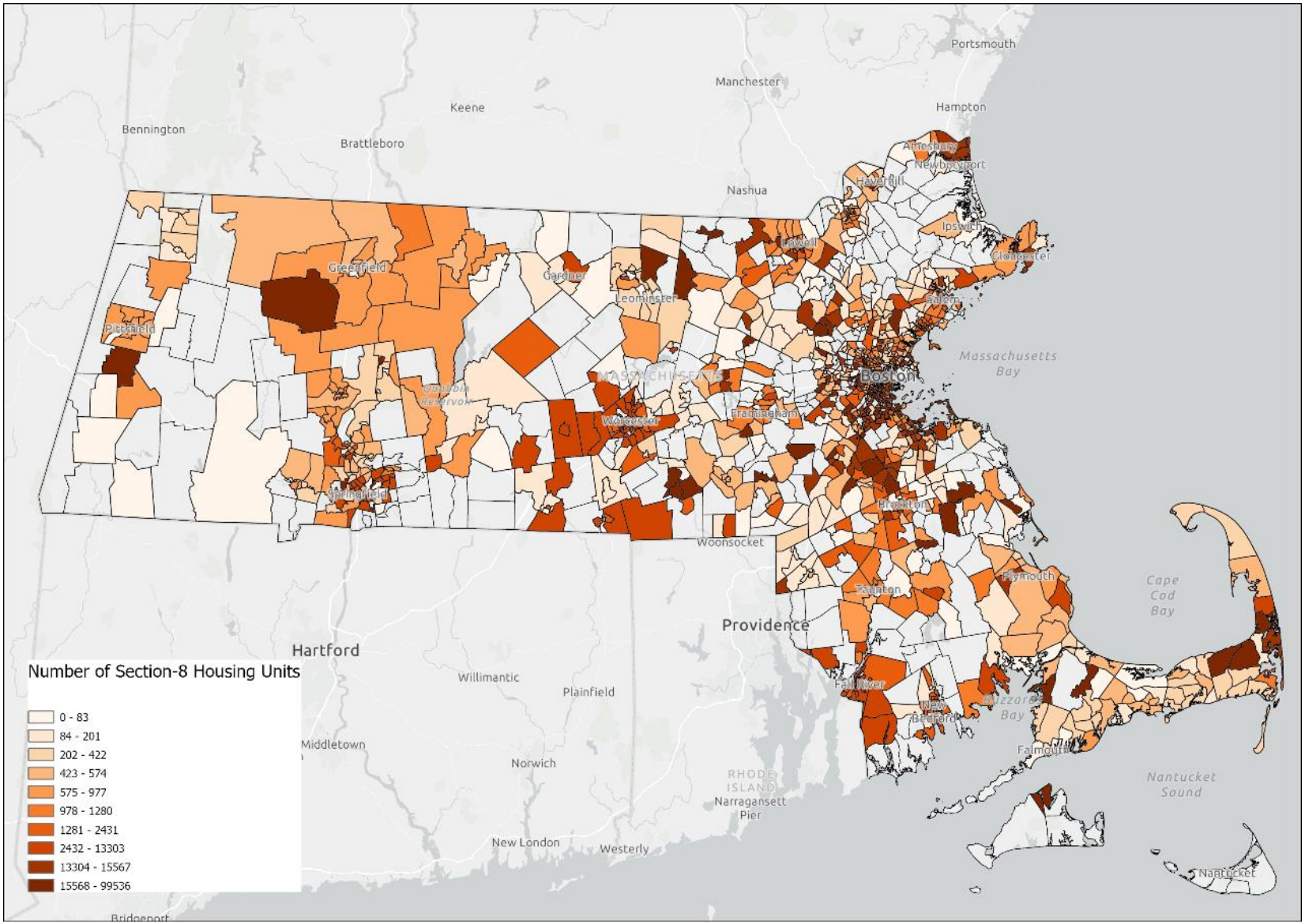


Figure 10: Cluster Map of the Number of HCV Holders from 2010-2021

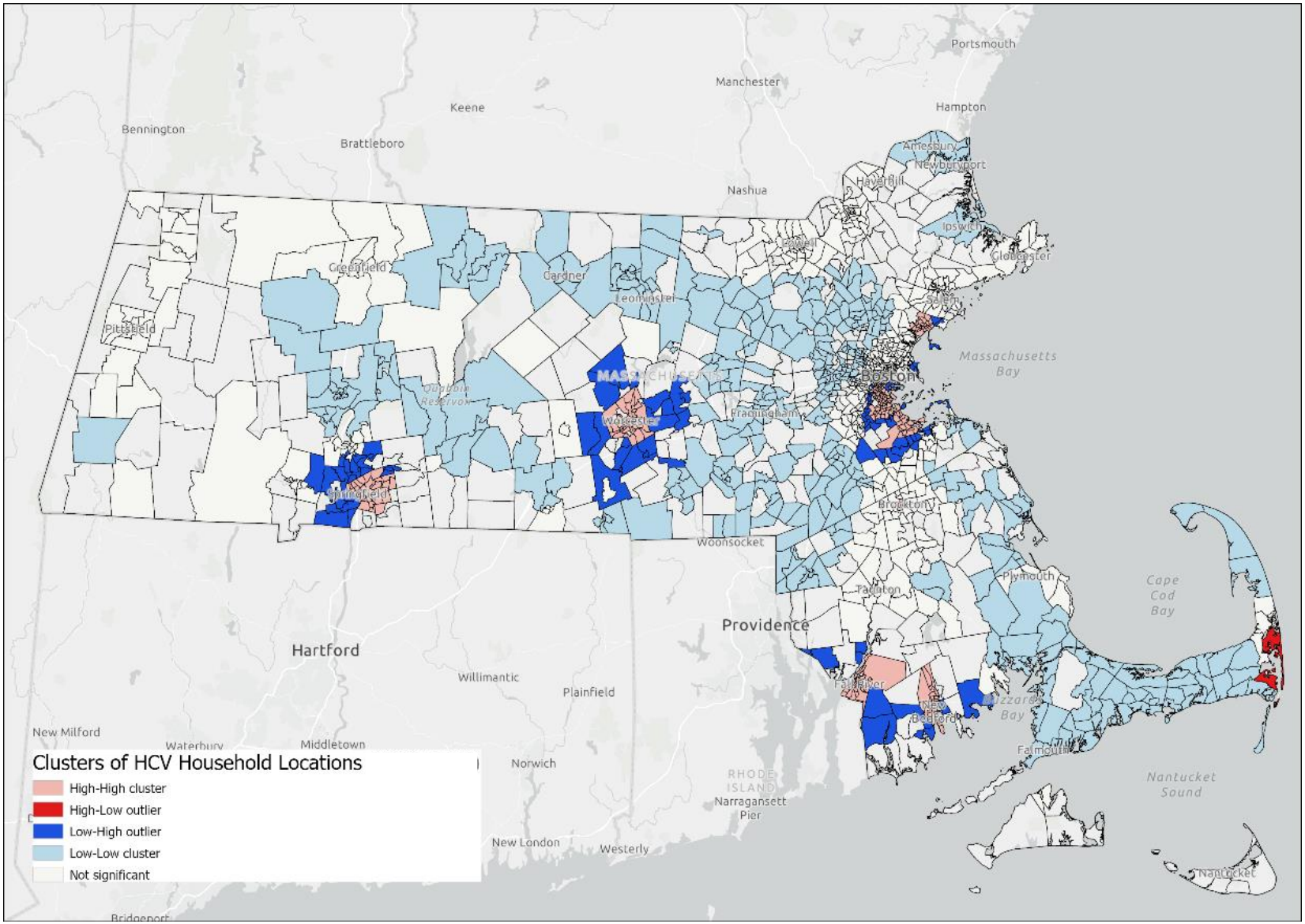


Figure 11: Map of the Top 10 Unit-Cities with the Highest Number of Voucher Holders

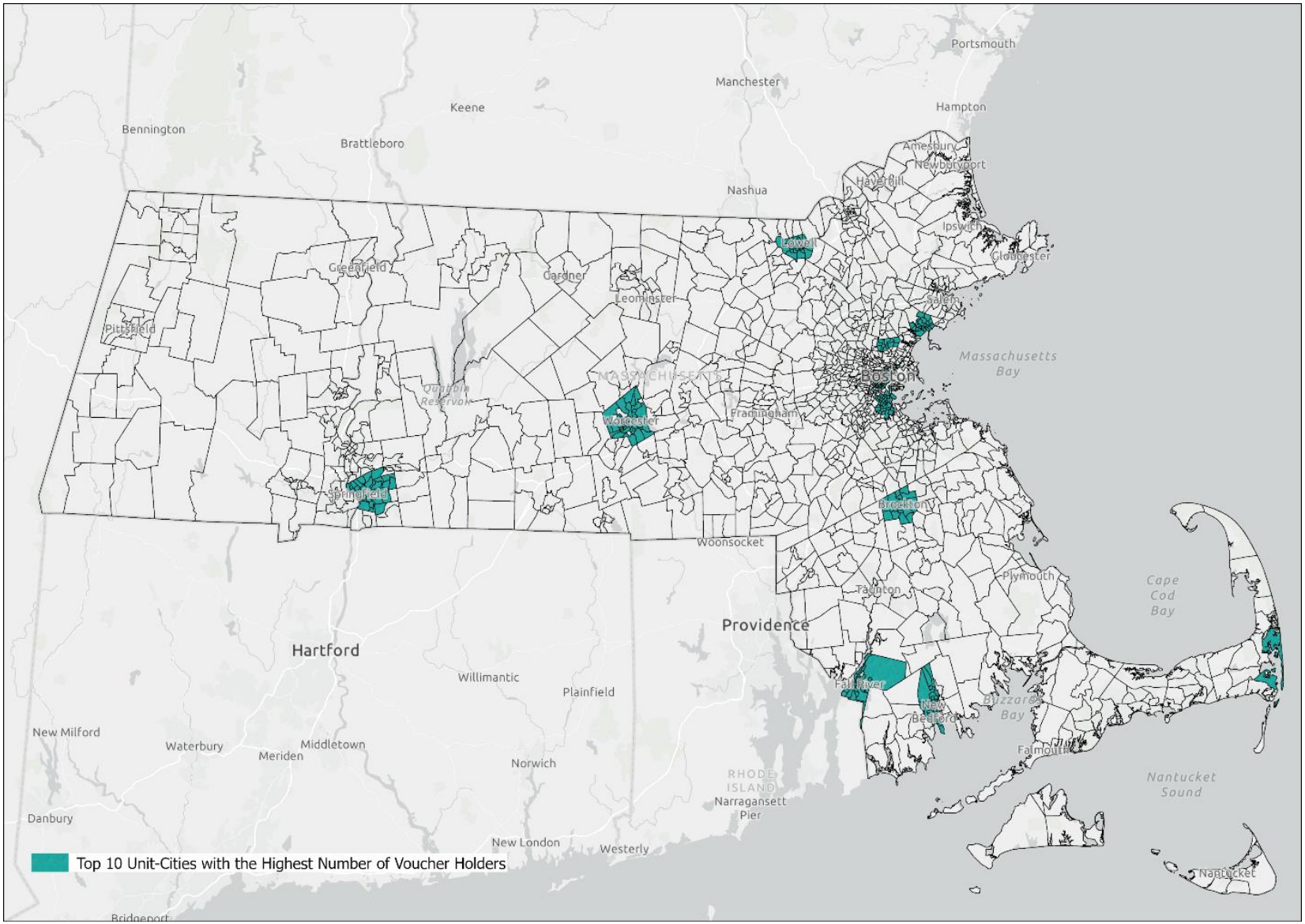


Figure 12: Cluster Map of the Number of Section-8 Housing Units from 2010-2021

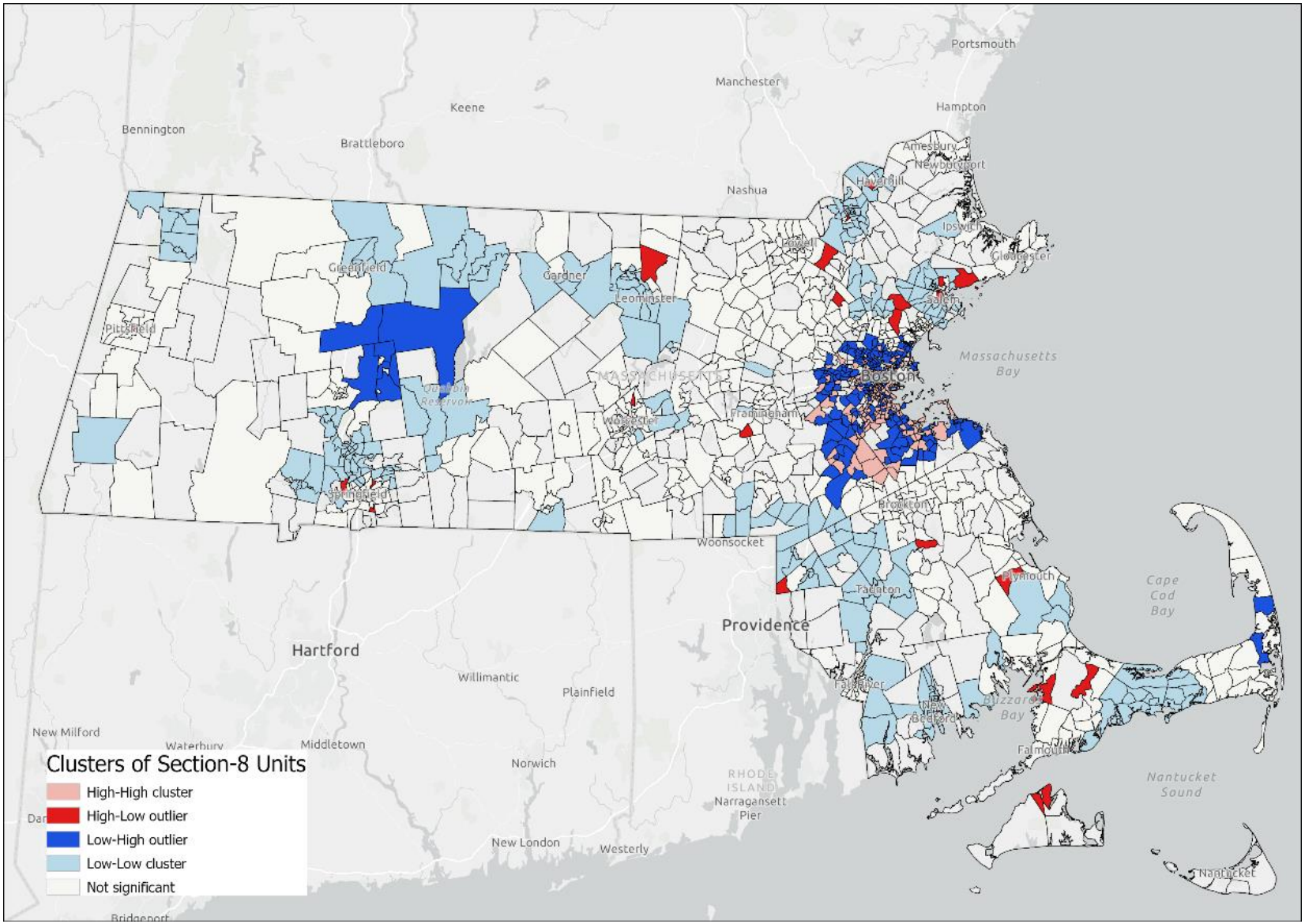


Figure 13: Map of the Initial Locations of HCV Recipients based on their Year of Admission

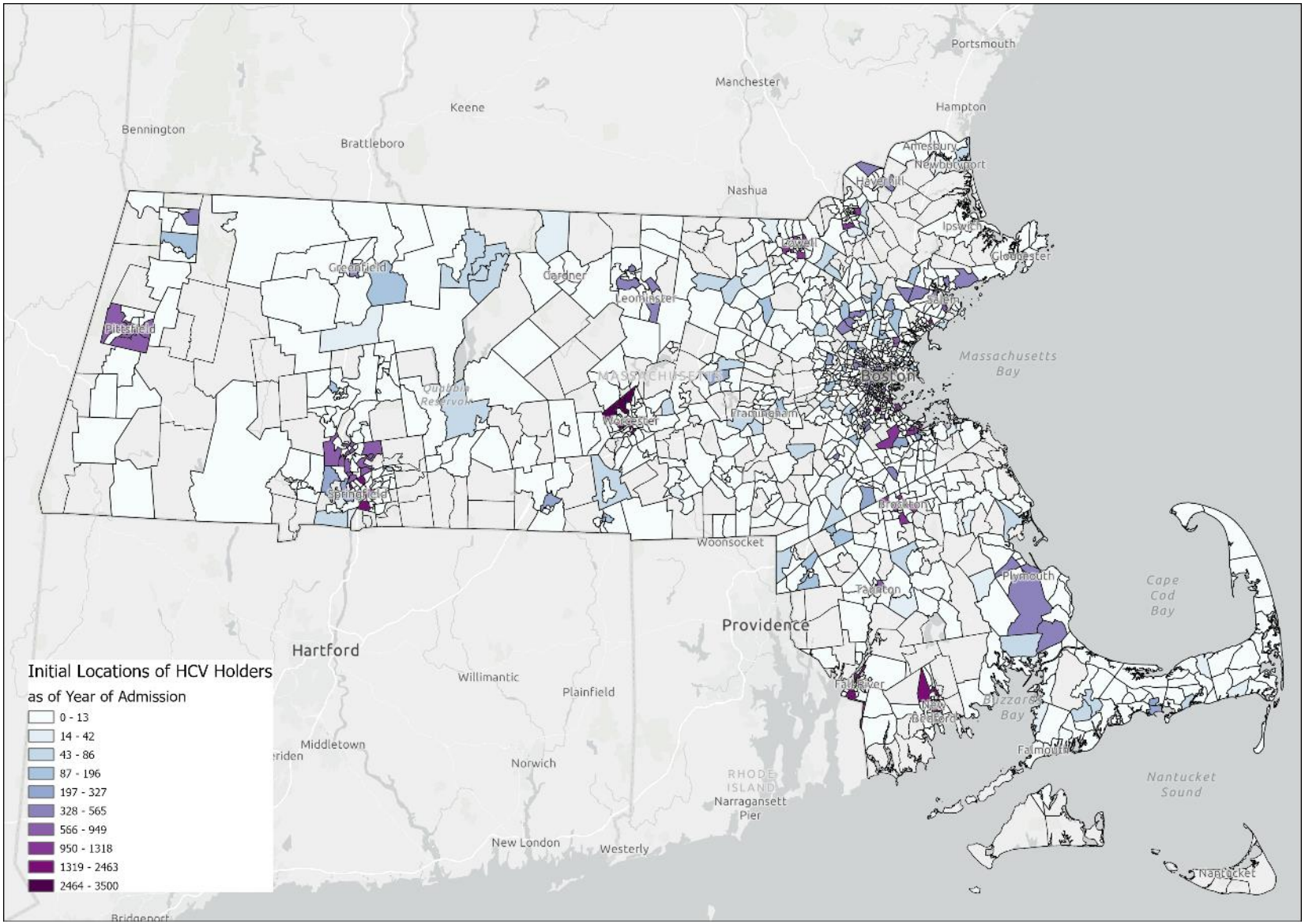


Figure 14: Cluster Map of the Initial Locations of HCV Recipients based on their Year of Admission

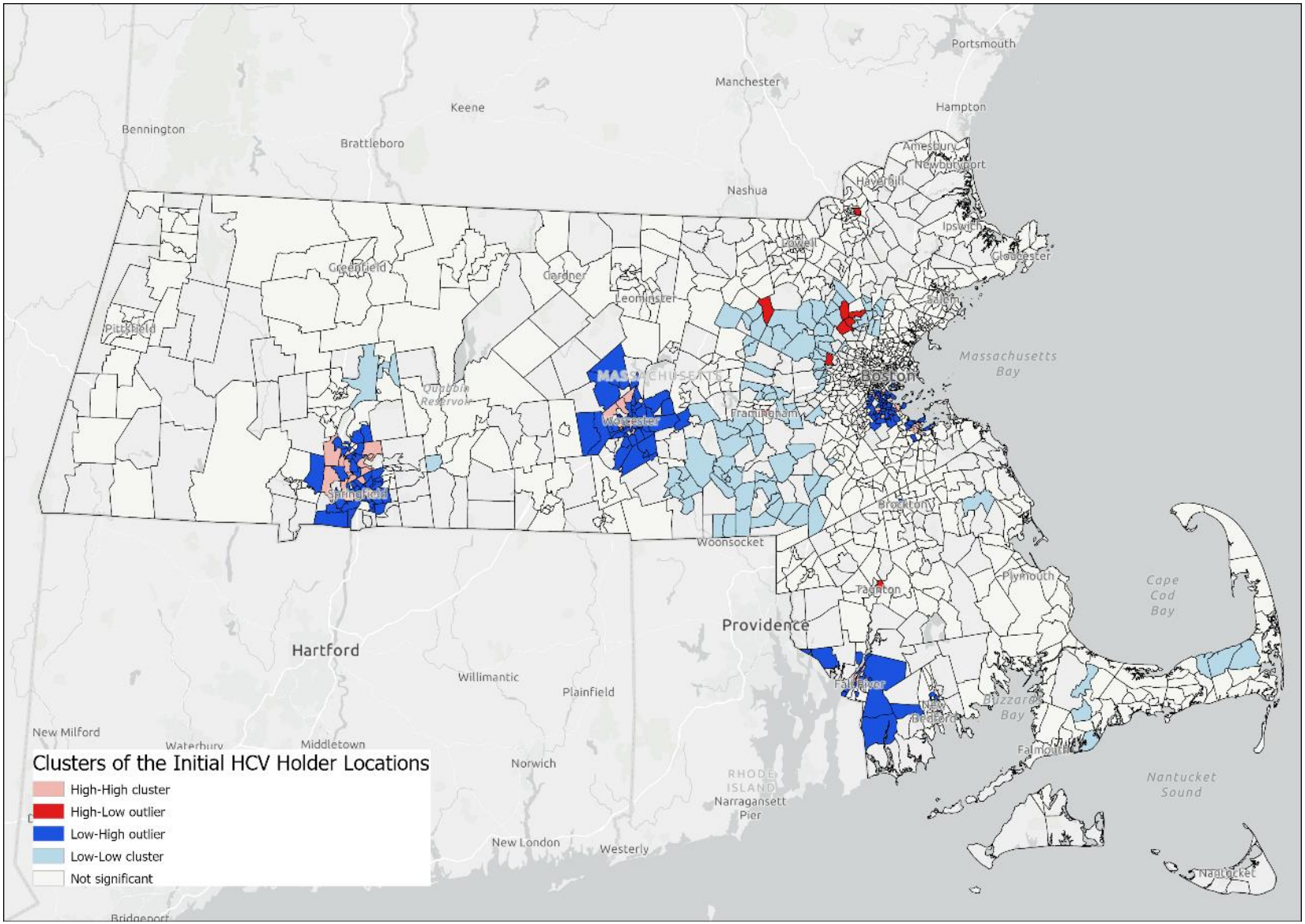


Figure 15: Map of the Number of Move-Ins by HCV Holder from 2010-2021

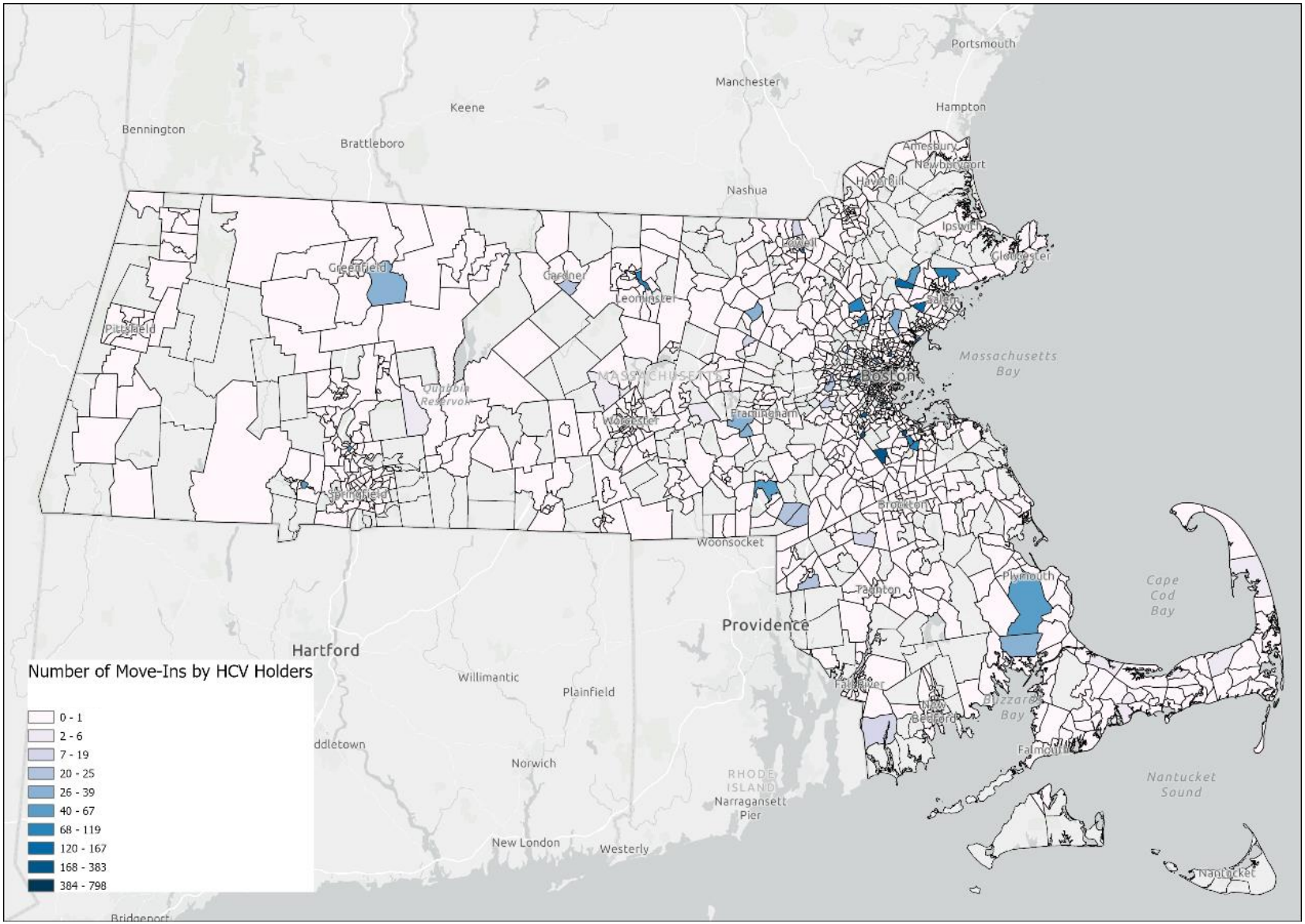


Figure 16: Cluster Map of the Number of Move-Ins by HCV Holder from 2010-2021

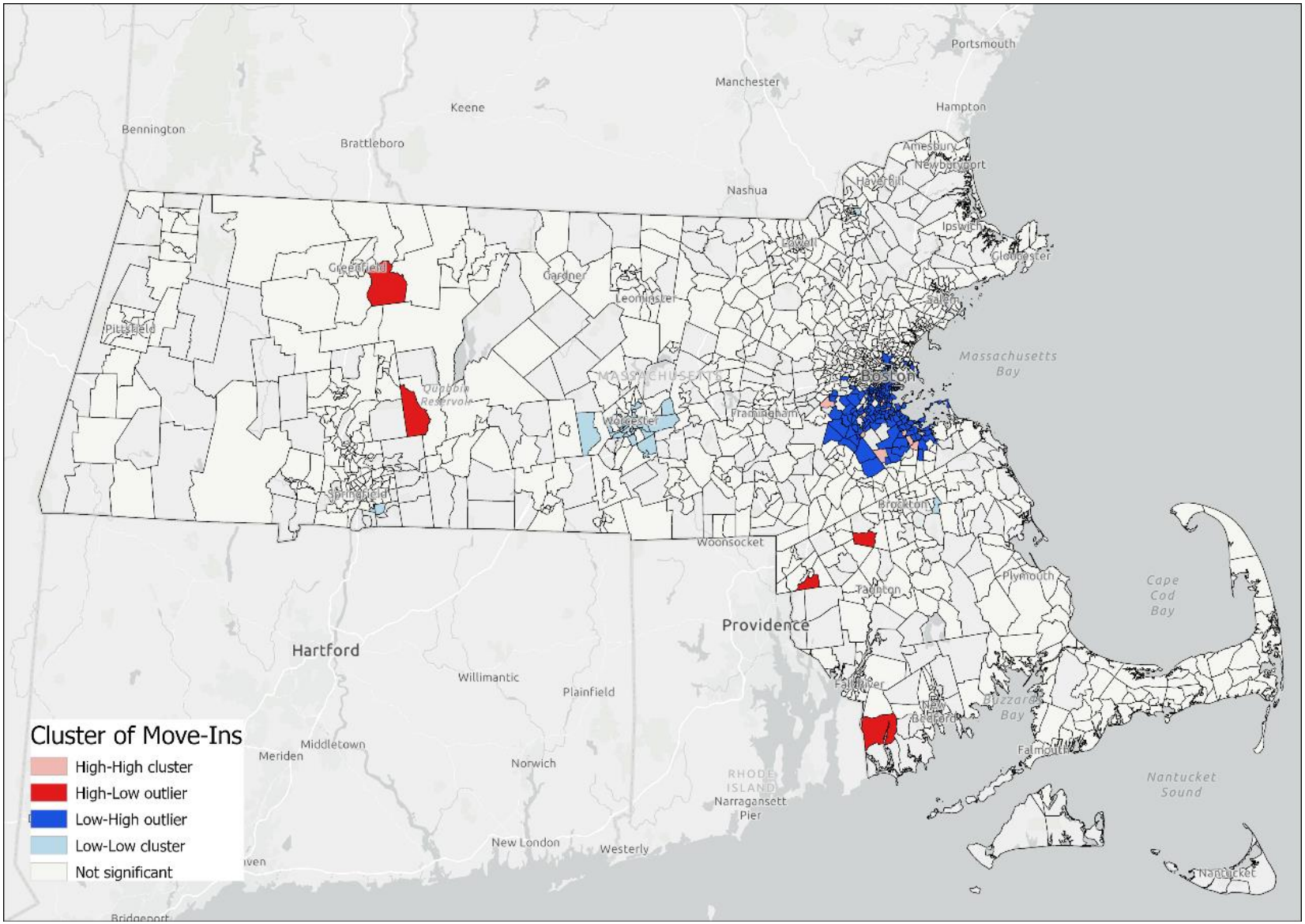


Figure 17.1: Annual Percentage Increase in the Adjusted Income since the Year of Admission

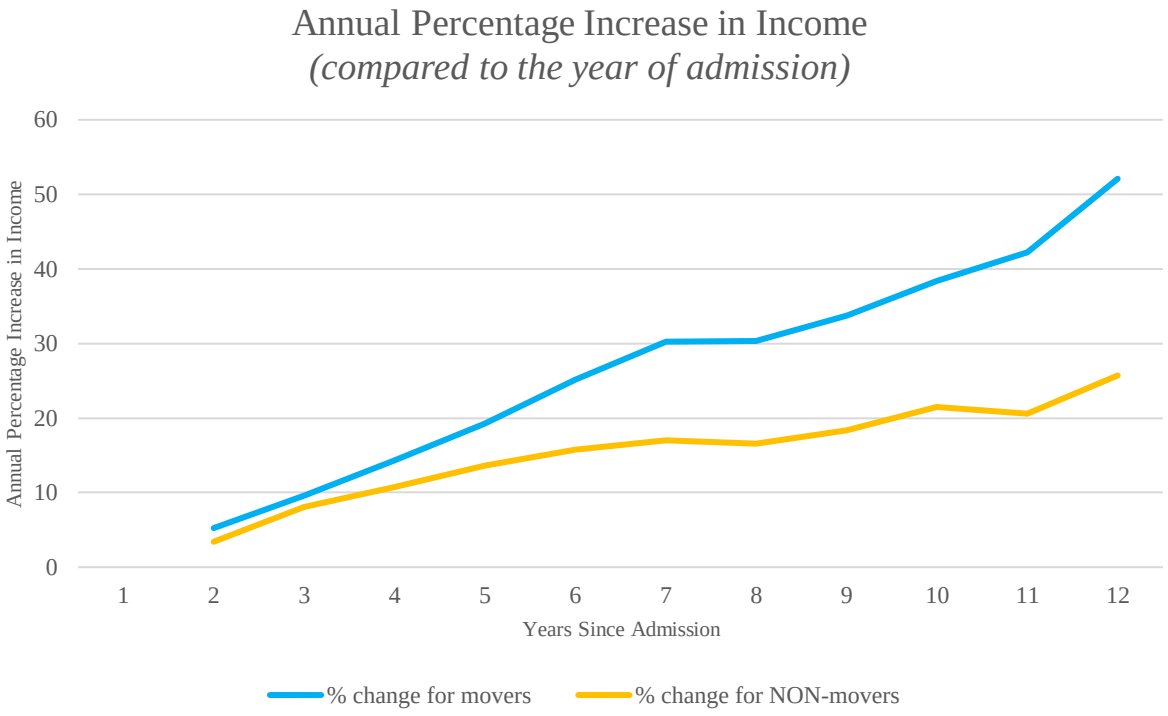


Figure 17.2: Annual Percentage Increase in the Adjusted Income by Calendar Years

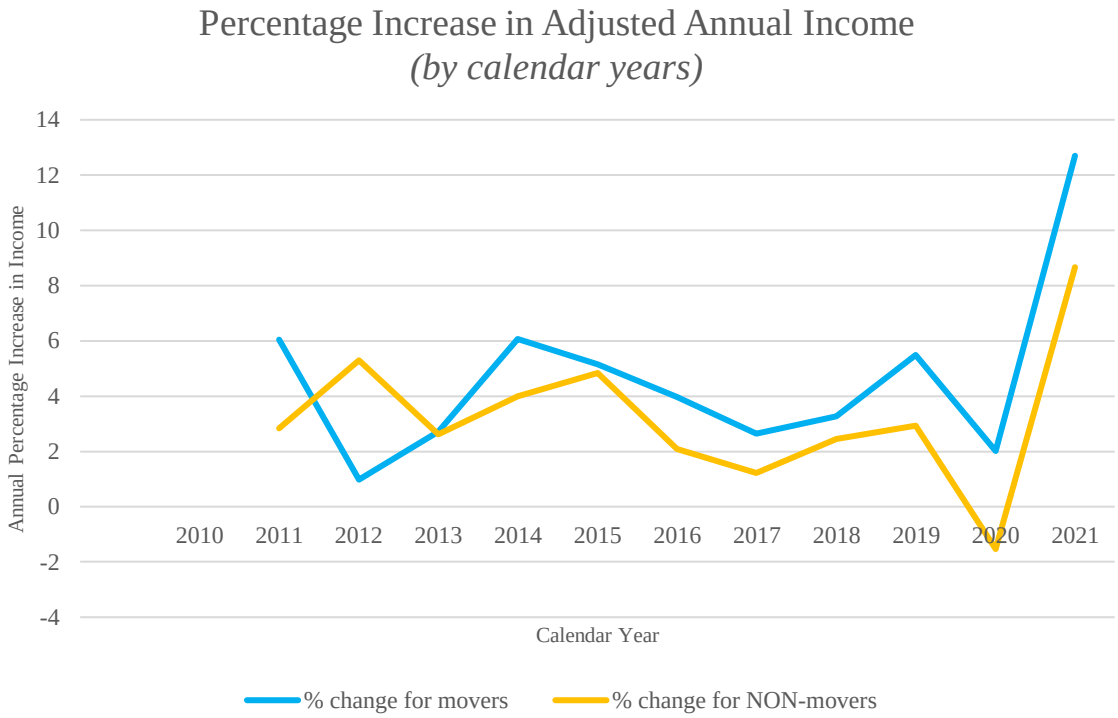


Figure 18: Map of the Neighborhood Quality Index

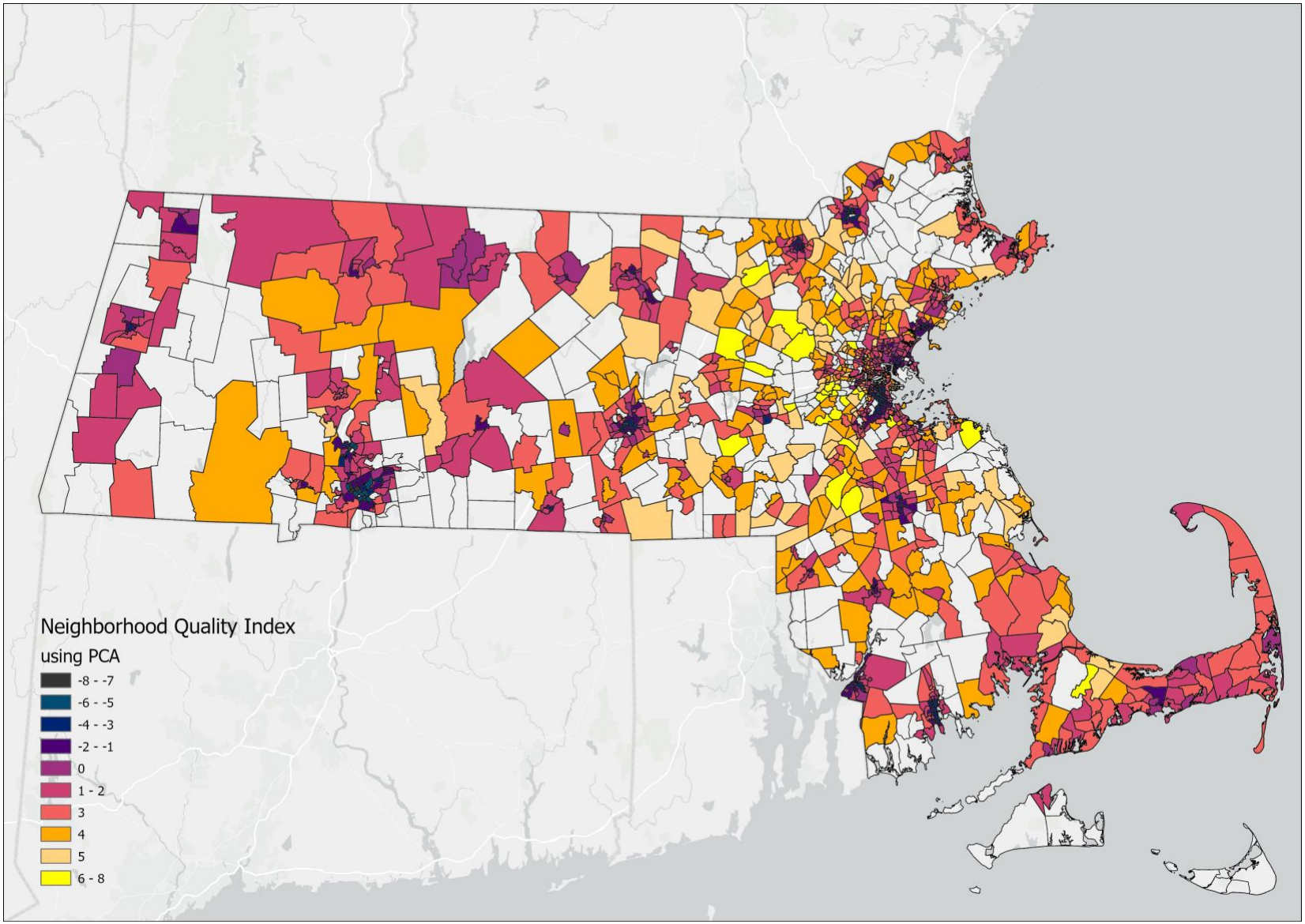
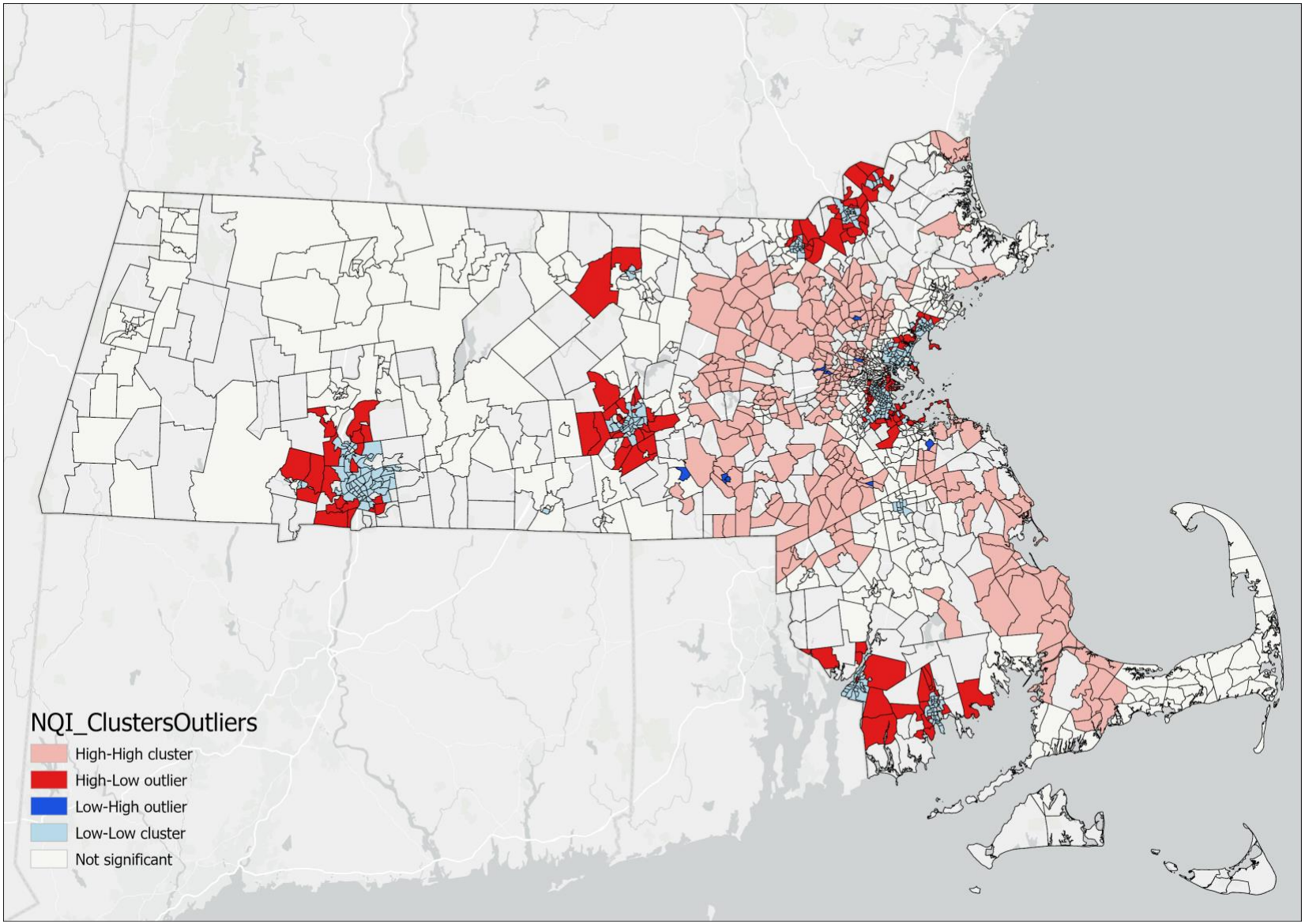


Figure 19: Cluster Map of the Neighborhood Quality Index



Tables

Table 1: Variable Definition: Individual and Household Characteristics

Variables	Definition
Ever Moved	= 1 if individual ever moved to a new unit-city; = 0 if individual never moved to a new unit-city
Moved	= 1 if individual moved to a new unit-city; = 0 if individual did not move to a new unit-city
Census Ever Moved	= 1 if individual ever moved to a different census tract; = 0 if individual never moved to a different census tract
Census Moved	= 1 if individual moved to a different census tract; = 0 if individual did not move to a different census tract
Standardized NQI	Neighborhood Quality Index (standardized)
Female	= 1 if female; = 0 if male
Age of Head of Household	Age of the head of household
Number of adults between 18-21 years	Number of household members from 18-21 years of age
Number of adults between 22-25 years	Number of household members from 22-25 years of age
Number of adults between 26-35 years	Number of household members from 26-35 years of age
Number of adults between 36-49 years	Number of household members from 36-49 years of age
Number of adults between 50-61 years	Number of household members from 50-61 years of age
Number of adults between 62-85 years	Number of household members from 62-85 years of age
Number of adults above 85 years	Number of household members above 85 years of age
Elderly	= 1 if individual is an elderly; = 0 if individual is not an elderly
Disabled	= 1 if individual is disabled; = 0 if individual is not disabled
White	= 1 if individual is White; = 0 if individual is non-White
Hispanic	= 1 if individual is Hispanic; = 0 if individual is non-Hispanic
Number of children between 0-3 years	Number of children in the household from 0-3 years of age
Number of children between 4-5 years	Number of children in the household from 4-5 years of age
Number of children between 6-12 years	Number of children in the household from 6-12 years of age
Number of children between 13-17 years	Number of children in the household from 13-17 years of age

Number of Disabled Children	Number of disabled children in the household
Total Household Members	Total number of household members
Number of Dependents	Total number of dependents
Adjusted Annual Income	Adjusted annual income amount in $1000
Disability Allowance	Allowance provided for disability aid in $
Childcare Allowance	Allowance provided for childcare aid in $
Elderly Allowance	Allowance provided for elderly aid in $
Year of Admission	Year of admission into the HCV program
Years since Admission	Number of years since admission into the HCV program

Table 2: Summary Statistics for Individual and Household Characteristics for Cross-Sectional Model

Variable	Number = 1	Mean	p50	SD	Min	Max
Ever Moved Census Tracts	15,645	0.33	0.00	0.47	0.00	1.00
Standardized NQI		0.02	0.04	1.02	-3.34	2.87
Female	34,589	0.73	1.00	0.44	0.00	1.00
Age of Head of Household		45.77	44.00	15.08	0.00	107.00
Number of adults aged 18-21 years		0.13	0.00	0.38	0.00	4.00
Number of adults aged 22-25 years		0.08	0.00	0.30	0.00	3.00
Number of adults aged 26-35 years		0.30	0.00	0.51	0.00	4.00
Number of adults aged 36-49 years		0.35	0.00	0.53	0.00	4.00
Number of adults aged 50-61 years		0.27	0.00	0.48	0.00	4.00
Number of adults aged 62-85 years		0.19	0.00	0.44	0.00	6.00
Number of adults above 85 years		0.01	0.00	0.10	0.00	2.00
Elderly	7,724	0.16	0.00	0.37	0.00	1.00
Disabled	16,218	0.34	0.00	0.47	0.00	1.00
White	34,353	0.72	1.00	0.45	0.00	1.00
Hispanic	14,356	0.30	0.00	0.46	0.00	1.00
Number of children aged 0-3 years		0.16	0.00	0.45	0.00	6.00
Number of children aged 4-5 years		0.11	0.00	0.34	0.00	4.00
Number of children aged 6-12		0.43	0.00	0.74	0.00	7.00
Number of children aged 13-17		0.26	0.00	0.57	0.00	6.00
Number of Disabled Children		0.06	0.00	0.28	0.00	8.00
Total Household Members		2.25	2.00	1.39	1.00	12.00
Number of Dependents		1.03	1.00	1.26	0.00	10.00
Adjusted Annual Income(1000s)		17.48	13.87	13.34	0.00	165.19
Disability Allowance		0.15	0.00	21.04	0.00	4486.00
Childcare Allowance		184.13	0.00	1174.03	0.00	58123.00
Elderly Allowance		207.86	400.00	199.85	0.00	400.00
Year of Admission		2015.2	2015.0	3.50	2010.0	2021.0

Sample Size: 47,499 number of unique groups

Table 3: Summary Statistics for Individual and Household Characteristics for Panel Model

Variable	Number = 1	Mean	p50	SD	Min	Max
Moved Census Tracts	22,214	0.10	0.00	0.30	0.00	1.00
Standardized NQI		0.00	0.03	1.00	-3.34	2.87
Female	167,335	0.74	1.00	0.44	0.00	1.00
Age of Head of Household		46.31	45.00	14.80	0.00	107.00
Number of adults aged 18-21 years		0.13	0.00	0.38	0.00	4.00
Number of adults aged 22-25 years		0.08	0.00	0.30	0.00	4.00
Number of adults aged 26-35 years		0.30	0.00	0.51	0.00	6.00
Number of adults aged 36-49 years		0.35	0.00	0.53	0.00	6.00
Number of adults aged 50-61 years		0.27	0.00	0.48	0.00	4.00
Number of adults aged 62-85 years		0.19	0.00	0.44	0.00	6.00
Number of adults above 85 years		0.01	0.00	0.10	0.00	3.00
Elderly	37,535	0.17	0.00	0.37	0.00	1.00
Disabled	78,000	0.35	0.00	0.48	0.00	1.00
White	162,738	0.72	1.00	0.45	0.00	1.00
Hispanic	67,583	0.30	0.00	0.46	0.00	1.00
Number of children aged 0-3 years		0.16	0.00	0.44	0.00	7.00
Number of children aged 4-5 years		0.11	0.00	0.34	0.00	4.00
Number of children aged 6-12		0.43	0.00	0.75	0.00	8.00
Number of children aged 13-17		0.26	0.00	0.57	0.00	9.00
Number of Disabled Children		0.06	0.00	0.28	0.00	8.00
Total Household Members		2.27	2.00	1.40	1.00	13.00
Number of Dependents		1.04	1.00	1.27	0.00	11.00
Adjusted Annual Income		17.26	13.76	12.94	0.00	198.76
Disability Allowance		0.28	0.00	46.92	0.00	13560.00
Childcare Allowance		208.70	0.00	1210.83	0.00	58123.00
Elderly Allowance		205.86	400.00	199.91	0.00	400.00
Years since Admission		3.16	3.00	2.74	0.00	11.00

Sample Size: 225,325 total observations

Table 4: Variable Definition: Neighborhood Characteristics

Variable	Definition
Percent in Poverty	Percentage of poverty
Percent Minority	Percentage of minority
Percent White	Percentage of white population
Percent Black	Percentage of black population
Percent Hispanic	Percentage of Hispanic population
Percent Single-Family Home Ownership	Percentage of single-family homeownership
Employed Civilian	Number of employed civilians
Unemployed Civilian	Number of unemployed civilians
Percent in Labor Force	Percentage of civilians in the labor force
Percent not in Labor Force	Percentage of civilians not in the labor force
Percent Employed in Labor Force	Percentage of employed civilians in the labor force
Percent Unemployed in Labor Force	Percentage of unemployed civilians in the labor force
Median Household Income	Median household income in 2012 in $1000
Median House Value	Median house value for the owner in $1000
Median Gross Rent	Median gross rent
Average Commute Time	Average commute time to work in minutes
Percent Health Insurance Coverage	Percentage of population covered by health insurance
Percent Health Insurance Coverage	Percentage of population not covered by health insurance

Table 5: Summary Statistics for Neighborhood Characteristics

Variable	Mean	p50	SD	Min	Max
Percent in Poverty	19.58	17.54	12.28	0.04	67.3
Percent Minority	41.83	36.18	28.7	0.53	99.87
Percent White	64.95	70.2	25.72	0.13	99.47
Percent Black	13.78	6.13	18.83	0	91.01
Percent Hispanic	18	11.05	18.48	0	93.57
Percent Single-Family Home Ownership	30.02	23.31	23.8	0	99.06
Employed Civilian	2181.03	2119	920.25	0	5147
Unemployed Civilian	275.81	254	145.94	0	1299
Percent in Labor Force	65.74	67.16	8.45	12.55	88.71
Percent not in Labor Force	34.26	32.84	8.45	11.29	87.45
Percent Employed in Labor Force	88.02	89.01	5.7	59.96	99.95
Percent Unemployed in Labor Force	11.98	10.99	5.7	0.05	40.04
Median Household Income	49.07	47.08	22.21	0	199.64
Median House Value	280.36	273.2	105.95	0	1000
Median Gross Rent	990.73	980	288.95	0	2001
Average Commute Time	26.58	27	6.01	0	44
Percent Health Insurance Coverage	94.14	94.55	3.39	70.49	100
Percent Health Insurance Coverage	5.86	5.45	3.39	0	29.51

Table 6: Neighborhood Quality Index (NQI) using Principal Component Analysis (PCA)

Variable	PCA
Poverty Percentage	-0.3138
Minority Percentage	-0.2796
White Percentage	0.2537
Black Percentage	-0.1668
Hispanic Percentage	-0.259
Single Family Homeownership Percentage	0.2543
Number of Employed Civilians	0.227
Number of Unemployed Civilians	-0.1101
Percentage of Civilians in the Labor Force	0.2107
Percentage of Employed in the Labor Force	0.2952
Median Household Income in 20212	0.3155
Median House Value for all Owners	0.2006
Median Gross Rent	0.1932
Average Commute Time to Work	0.0663
Percentage covered by Health Insurance	0.2135

Table 7.1: Number of Households, Adjusted Annual Income, Amount allowed for Child Care, Family Allowance for Medical Expenses and Allowance for Elderly/Disabled compared to initial Year of Admission

Years since admission	Number of Households	Average Adjusted Annual Income (in $1000)	Amount Allowed for Child Care ($)	Family's Allowance for Medical Expenses ($)	Allowance for Elderly/Disabled ($)
0	14507	15.668	170.57	190.62	207.01
1	10005	16.179	212.27	208.40	206.25
2	6659	16.803	218.70	229.85	206.87
3	4519	17.259	231.18	241.96	206.38
4	3440	17.790	235.18	240.16	206.44
5	2583	18.346	228.94	248.34	202.42
6	2078	18.812	227.28	249.34	203.36
7	1357	18.761	206.67	252.55	202.71
8	1004	19.159	202.42	277.61	206.43
9	712	19.746	168.33	284.01	204.41
10	423	20.033	137.17	310.14	209.43
11	212	21.233	128.68	275.19	208.27

Table 7.2: Number of Households, Adjusted Annual Income, Amount allowed for Child Care, Family Allowance for Medical Expenses and Allowance for Elderly/Disabled by Calendar Years

Years	Number of Households	Average Adjusted Annual Income (in $1000)	Amount Allowed for Child Care ($)	Family's Allowance for Medical Expenses ($)	Allowance for Elderly/Disabled ($)
2010	908	13.387	155.22	145.23	203.08
2011	1968	13.960	172.76	226.18	207.43
2012	2111	14.398	189.25	253.74	208.01
2013	2146	14.779	199.32	222.92	207.34
2014	2688	15.548	201.84	212.81	209.72
2015	3064	16.321	204.77	237.20	208.04
2016	3512	16.822	224.67	224.44	207.42
2017	3974	17.146	237.05	234.77	205.13
2018	4374	17.639	249.11	242.47	203.84
2019	5193	18.370	250.55	249.27	206.30
2020	7223	18.374	175.88	230.16	204.67
2021	10338	20.250	171.88	216.97	202.88

Table 8.1: NQI by the year of admission cohort

		Neighborhood Quality Index (Years of Admission) for All Households											
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Years Since Admission	0	0.076	0.024	0.022	-0.026	-0.149	-0.065	0.029	0.036	-0.049	0.029	0.035	0.183
	1	0.096	-0.075	-0.051	-0.043	-0.064	-0.062	0.044	0.035	-0.035	0.030	0.053	
	2	-0.001	-0.071	-0.056	-0.031	-0.083	-0.065	0.057	0.042	-0.010	0.065		
	3	0.014	-0.061	-0.050	-0.016	-0.081	-0.040	0.100	0.023	0.009			
	4	0.012	-0.048	-0.049	-0.022	-0.043	-0.027	0.117	0.058				
	5	0.005	-0.032	-0.053	0.019	-0.043	-0.003	0.141					
	6	-0.013	-0.039	-0.017	0.058	-0.013	0.036						
	7	-0.003	-0.007	-0.021	0.083	0.035							
	8	0.016	0.000	0.014	0.104								
	9	0.008	0.013	0.062									
	10	0.040	0.070										
	11	0.059											

	Movement to Census Tract with Higher NQI than Previous Census Tract of Residence
	Movement to Census Tract with Lower NQI than Previous Census Tract of Residence

Table 8.2: NQI by the year of admission cohort for Movers only

		Neighborhood Quality Index (Years of Admission) for All Households											
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Years Since Admission	0	0.007	-0.061	-0.146	-0.069	-0.186	-0.134	-0.084	-0.055	-0.147	0.008	-0.004	0.257
	1	0.044	-0.101	-0.153	-0.076	-0.127	-0.129	-0.034	-0.063	-0.101	0.098	0.093	
	2	-0.016	-0.101	-0.144	-0.079	-0.104	-0.119	-0.001	-0.043	-0.025	0.191		
	3	-0.001	-0.080	-0.151	-0.053	-0.083	-0.072	0.048	-0.012	-0.001			
	4	0.008	-0.057	-0.131	-0.056	-0.038	-0.038	0.077	0.103				
	5	-0.005	-0.025	-0.112	0.001	-0.032	0.006	0.157					
	6	-0.020	-0.017	-0.067	0.053	0.015	0.076						
	7	0.006	0.004	-0.076	0.088	0.075							
	8	0.024	0.018	-0.019	0.106								
	9	0.018	0.052	0.071									
	10	0.070	0.108										
	11	0.093											

	Movement to Census Tract with Higher NQI than Previous Census Tract of Residence
	Movement to Census Tract with Lower NQI than Previous Census Tract of Residence

Table 9: Cross-Sectional Regression Results of Model 1

VARIABLES	(1) Model 1
Standardized NQI	0.0104***
	(0.0022)
Gender	0.0613***
	(0.0048)
Age of Head of Household	-0.0025***
	(0.0002)
Number of adults between 18-21 years	0.0084
	(0.0059)
Number of adults between 22-25 years	-0.0012
	(0.0075)
Number of adults between 26-35 years	-0.0063
	(0.0060)
Number of adults between 36-49 years	0.0009
	(0.0056)
Number of adults between 50-61 years	-0.0059
	(0.0059)
Number of adults between 62-85 years	-0.0092
	(0.0063)
Number of adults above 85 years	-0.0074
	(0.0195)
Elderly	0.0004
	(0.0090)
Disabled	0.0271***
	(0.0054)
Race	-0.0493***
	(0.0049)
Ethnicity	0.0294***
	(0.0050)
Number of children between 0-3 years	-0.0013
	(0.0052)
Number of children between 4-5 years	0.0007
	(0.0066)
Number of children between 6-12 years	0.0009
	(0.0034)
Number of children between 13-17 years	0.0013
	(0.0041)
Number of Disabled Children	-0.0046
	(0.0078)
Total Household Members	0.0009
	(0.0046)
Number of Dependents	0.0211***

	(0.0052)
Adjusted Annual Income	-0.0011***
	(0.0002)
Disability Allowance	-0.0001***
	(0.0000)
Childcare Allowance	0.0000***
	(0.0000)
Elderly Allowance	-0.0000
	(0.0000)
Year of Admission	-0.0329***
	(0.0006)
Constant	66.6436***
	(1.1180)
Observations	47,499
R-squared	0.0849

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Panel Regression Results of Model 2 and Model 3

VARIABLES	(1) Model 2	(2) Model 3
Age of Head of Household	-0.0014***	0.0040***
	(0.0001)	(0.0014)
Number of adults between 18-21 years	0.0010	-0.0014
	(0.0018)	(0.0020)
Number of adults between 22-25 years	0.0009	-0.0003
	(0.0023)	(0.0026)
Number of adults between 26-35 years	0.0031*	0.0033
	(0.0018)	(0.0021)
Number of adults between 36-49 years	0.0038**	0.0040**
	(0.0017)	(0.0020)
Number of adults between 50-61 years	0.0015	0.0022
	(0.0018)	(0.0020)
Number of adults between 62-85 years	0.0015	0.0031
	(0.0019)	(0.0022)
Number of adults above 85 years	0.0007	-0.0002
	(0.0056)	(0.0066)
Elderly	0.0043	-0.0187***
	(0.0027)	(0.0055)
Disabled	0.0097***	0.0077
	(0.0018)	(0.0048)
Number of children between 0-3 years	0.0008	-0.0019
	(0.0016)	(0.0018)
Number of children between 4-5 years	0.0012	0.0011
	(0.0020)	(0.0023)
Number of children between 6-12 years	-0.0020**	-0.0029**
	(0.0010)	(0.0011)
Number of children between 13-17 years	-0.0018	-0.0031**
	(0.0012)	(0.0014)
Number of Disabled Children	0.0021	0.0008
	(0.0024)	(0.0028)
Number of Dependents	0.0104***	0.0185***
	(0.0007)	(0.0019)
Adjusted Annual Income	-0.0005***	0.0001
	(0.0001)	(0.0001)
Disability Allowance	-0.0000***	-0.0000***
	(0.0000)	(0.0000)
Childcare Allowance	0.0000	-0.0000
	(0.0000)	(0.0000)
Elderly Allowance	-0.0000	0.0000
	(0.0000)	(0.0000)
Years since Admission	0.0044***	-0.0418***

	(0.0003)	(0.0017)
Year = 2011	0.0644***	0.1143***
	(0.0028)	(0.0043)
Year = 2012	0.1756***	0.2826***
	(0.0036)	(0.0063)
Year = 2013	0.1045***	0.2490***
	(0.0028)	(0.0075)
Year = 2014	0.0928***	0.2771***
	(0.0024)	(0.0094)
Year = 2015	0.0840***	0.3013***
	(0.0022)	(0.0114)
Year = 2016	0.0779***	0.3331***
	(0.0020)	(0.0135)
Year = 2017	0.0794***	0.3734***
	(0.0021)	(0.0156)
Year = 2018	0.0787***	0.4109***
	(0.0020)	(0.0178)
Year = 2019	0.0845***	0.4550***
	(0.0021)	(0.0199)
Year = 2020	0.0771***	0.4881***
	(0.0020)	(0.0221)
Year = 2021	0.1365***	0.5928***
	(0.0024)	(0.0253)
Constant	0.0489***	-0.3629***
	(0.0037)	(0.0560)
Observations	225,325	225,325
R-squared		0.0222
Number of head_id	47,499	47,499
Time Fixed Effects	YES	YES
Household Fixed Effects	NO	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix A
List of Unit City Names

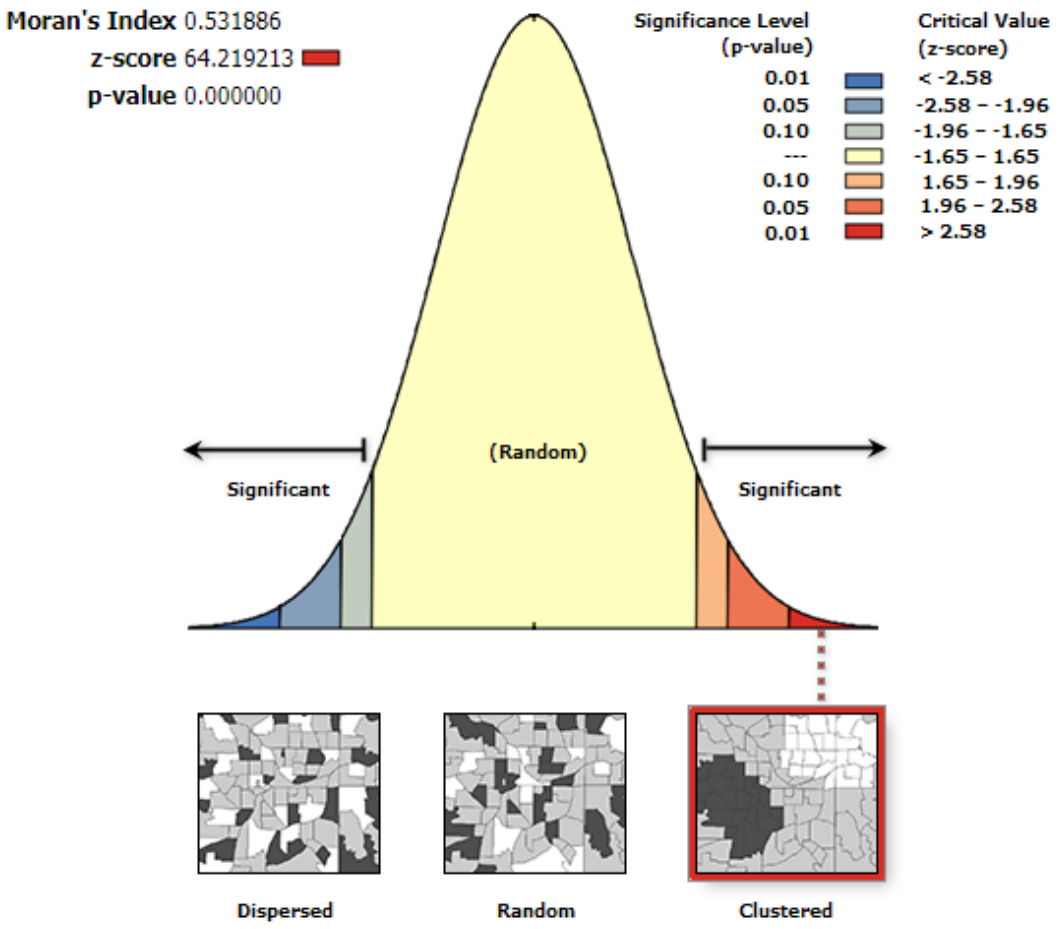
Abington	Boxborough	Concord	Easton	Holbrook	Lowell
Acton	Bradford	Conway	Erving	Holden	Ludlow
Adams	Braintree	Cotuit	Everett	Holliston	Lunenburg
Agawam	Brant Rock	Dalton	Fairhaven	Holyoke	Lynn
Allston	Brewster	Danvers	Fall River	Hopedale	Lynnfield
Amesbury	Bridgewater	Dartmouth	Falmouth	Hopkinton	Magnolia
Amherst	Brighton	Dedham	Feeding Hills	Housatonic	Malden
Andover	Brockton	Deerfield	Fiskdale	Hudson	Manchester
Arlington	Brookfield	Dennis	Fitchburg	Hull	Mansfield
Ashfield	Brookline	Dennis Port	Florence	Huntington	Marblehead
Ashland	Burlington	Devens	Florida	Hyannis	Marion
Athol	Buzzards Bay	Dighton	Forestdale	Hyde Park	Marlborough
Attleboro	Cambridge	Dorchester	Foxborough	Indian Orchard	Marshfield
Auburn	Canton	Dorchester Center	Framingham	Ipswich	Marstons Mills
Auburndale	Carver	Douglas	Franklin	Jamaica Plain	Mashpee
Avon	Centerville	Dracut	Gardner	Jefferson	Mattapan
Ayer	Charlemont	Dudley	Gill	Kingston	Mattapoisett
Barnstable	Charlestown	Duxbury	Glendale	Lakeville	Maynard
Barre	Charlton	East Boston	Gloucester	Lancaster	Medfield
Bedford	Charlton City	East Bridgewater	Great Barrington	Lawrence	Medford
Belchertown	Chatham	East Cambridge	Greenfield	Lee	Medway
Bellingham	Chelmsford	East Douglas	Hadley	Leeds	Melrose
Belmont	Chelsea	East Falmouth	Hanover	Leicester	Merrimac
Bernardston	Cherry Valley	East Orleans	Hanson	Lenox	Methuen
Beverly	Cheshire	East Sandwich	Harwich	Lenox Dale	Middleborough
Beverly Farms	Chestnut Hill	East Taunton	Harwich Port	Leominster	Milford
Billerica	Chicopee	East Walpole	Haverhill	Leverett	Millbury
Blackstone	Clarksburg	East Wareham	Hawley	Lexington	Millers Falls
Bondsville	Clinton	East Weymouth	Haydenville	Lincoln	Millis
Boston	Cohasset	Eastham	Heath	Linwood	Milton
Bourne	Colrain	Easthampton	Hingham	Littleton	Monroe

Montague	Orange	Saugus	Stoughton	Wellesley	Williamsburg
Nahant	Orleans	Sharon	Stow	Wellesley Hills	Williamstown
Natick	Osterville	Shelburne	Sturbridge	Wellfleet	Wilmington
Needham	Oxford	Shelburne Falls	Sudbury	Wendell	Winchendon
Needham Heights	Palmer	Shirley	Sunderland	West Barnstable	Winchester
New Bedford	Peabody	Shrewsbury	Swampscott	West Boylston	Winthrop
Newburyport	Pembroke	Shutesbury	Swansea	West Bridgewater	Woburn
Newton	Pepperell	Somerset	Taunton	West Chatham	Wollaston
Newton Highlands	Pittsfield	Somerville	Teaticket	West Dennis	Worcester
Newton Upper Falls	Plainville	South Attleboro	Templeton	West Falmouth	Woronoco
Newtonville	Plymouth	South Barre	Tewksbury	West Harwich	Wrentham
North Adams	Pocasset	South Boston	Thorndike	West Hyannisport	Yarmouth Port
North Andover	Provincetown	South Chatham	Three Rivers	West Newton	
North Attleboro	Quincy	South Dartmouth	Townsend	West Roxbury	
North Billerica	Randolph	South Deerfield	Truro	West Springfield	
North Chelmsford	Raynham	South Dennis	Turners Falls	West Stockbridge	
North Dartmouth	Reading	South Easton	Tyngsborough	West Townsend	
North Easton	Readville	South Grafton	Upton	West Wareham	
North Falmouth	Revere	South Hadley	Uxbridge	West Warren	
North Oxford	Rochdale	South Harwich	Vineyard Haven	West Yarmouth	
North Quincy	Rockland	South Lawrence	Wakefield	Westborough	
North Reading	Rockport	South Orleans	Walpole	Westfield	
North Truro	Roslindale	South Walpole	Waltham	Westford	
North Weymouth	Roxbury	South Weymouth	Waquoit	Westminster	
Northampton	Roxbury Crossing	South Yarmouth	Ware	Westport	
Northborough	Russell	Southbridge	Wareham	Westwood	
Northbridge	Sagamore	Spencer	Warren	Wewoka	
Northfield	Sagamore Beach	Springfield	Warwick	Weymouth	
Norton	Salem	Sterling	Watertown	Whately	
Norwood	Salisbury	Stockbridge	Wayland	Whitinsville	
Onset	Sandwich	Stoneham	Webster	Whitman	

Appendix B
Global Moran's I Reports

Report 1: Number of HCV Holders from 2010 to 2021

Spatial Autocorrelation Report



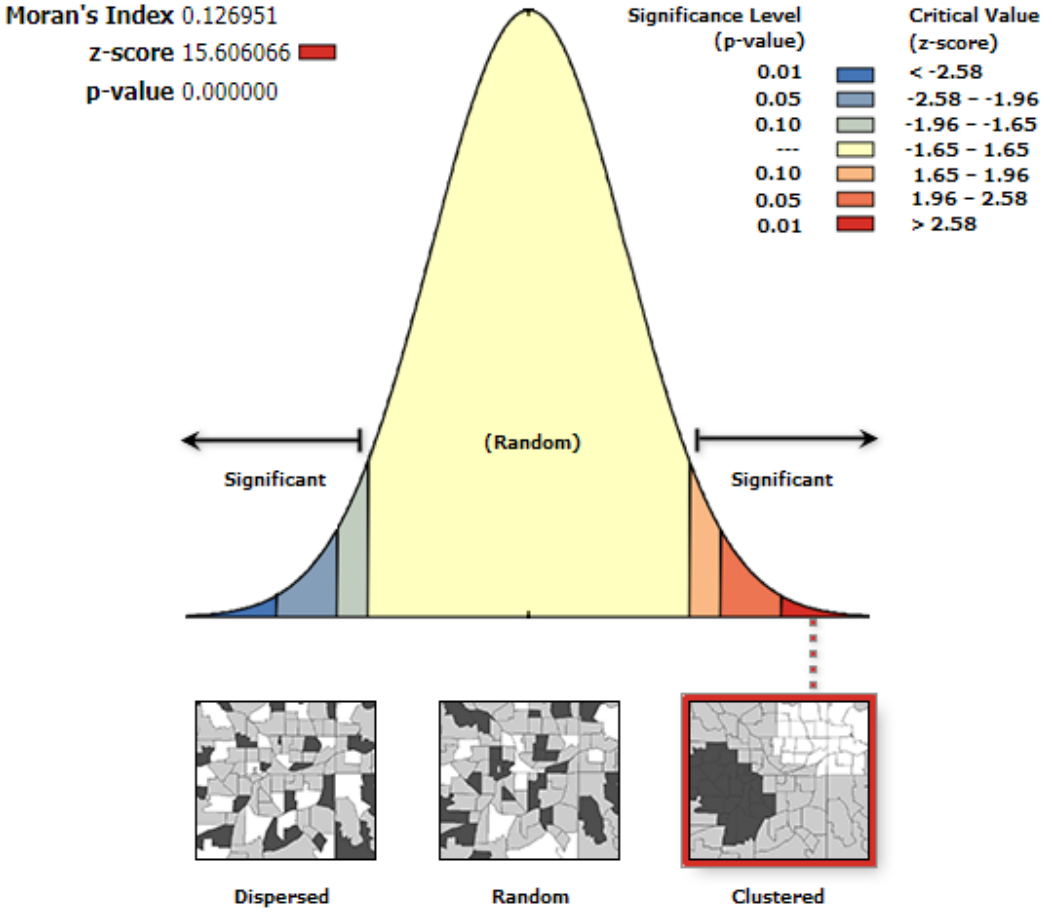
Given the z-score of 64.219213, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Global Moran's I Summary

Moran's Index	0.531886
Expected Index	-0.000852
Variance	0.000069
z-score	64.219213
p-value	0.000000

Report 2: Number of Section-8 Housing Units from 2010 to 2021

Spatial Autocorrelation Report



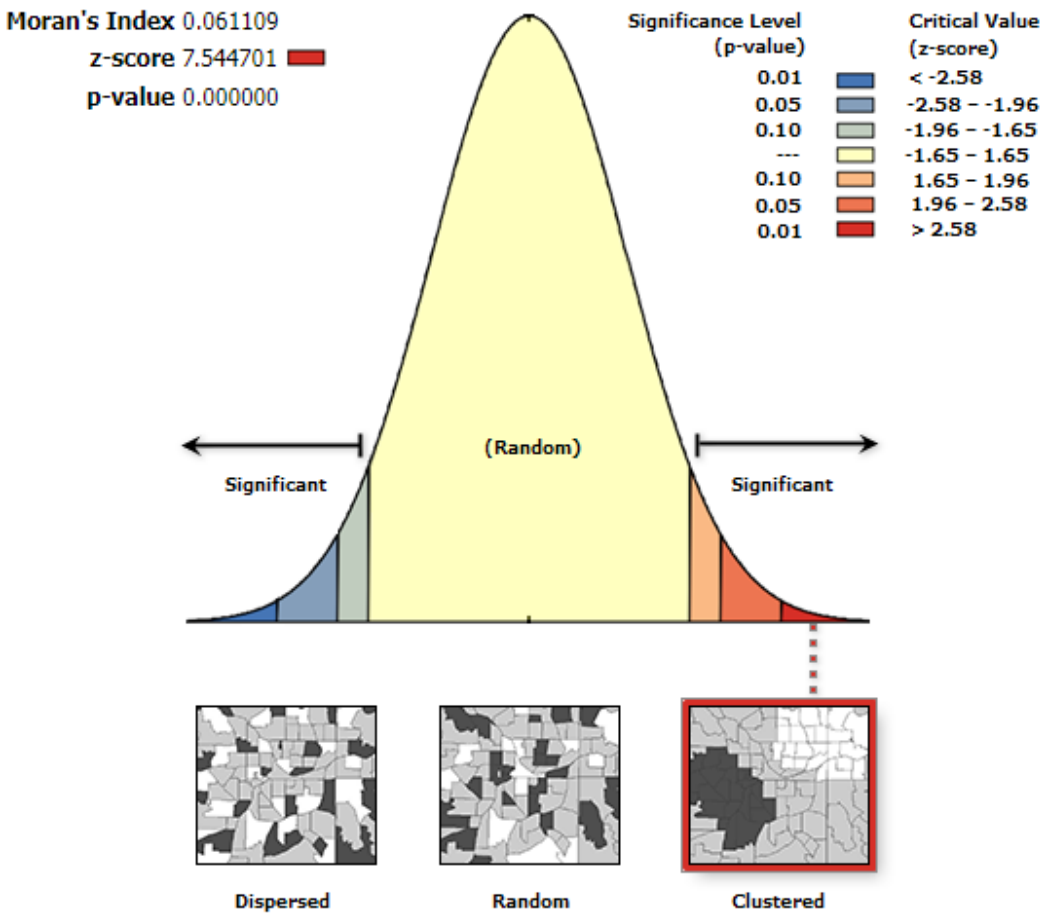
Given the z-score of 15.606066, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Global Moran's I Summary

Moran's Index	0.126951
Expected Index	-0.000852
Variance	0.000067
z-score	15.606066
p-value	0.000000

Report 3: Initial Locations of HCV Recipients based on their Year of Admission

Spatial Autocorrelation Report



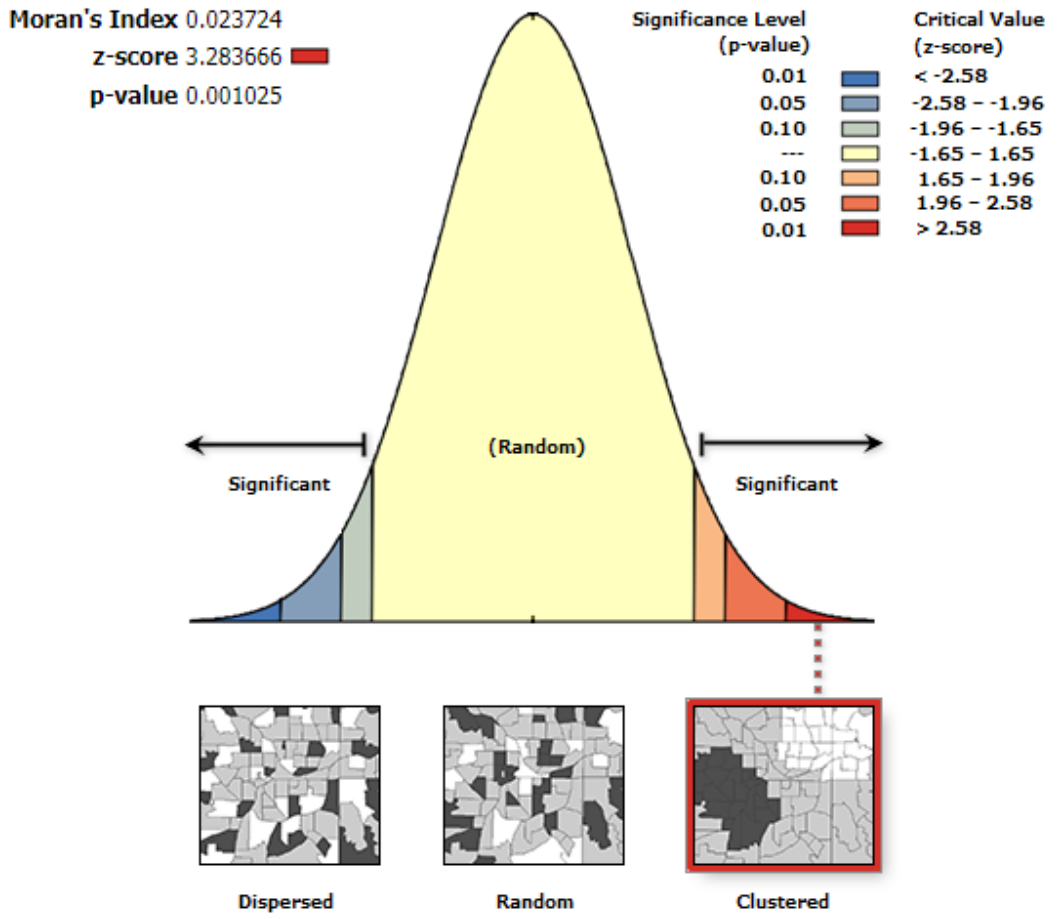
Given the z-score of 7.544701, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Global Moran's I Summary

Moran's Index	0.061109
Expected Index	-0.000852
Variance	0.000067
z-score	7.544701
p-value	0.000000

Report 4: Number of Move-Ins by HCV Holder from 2010 to 2021

Spatial Autocorrelation Report



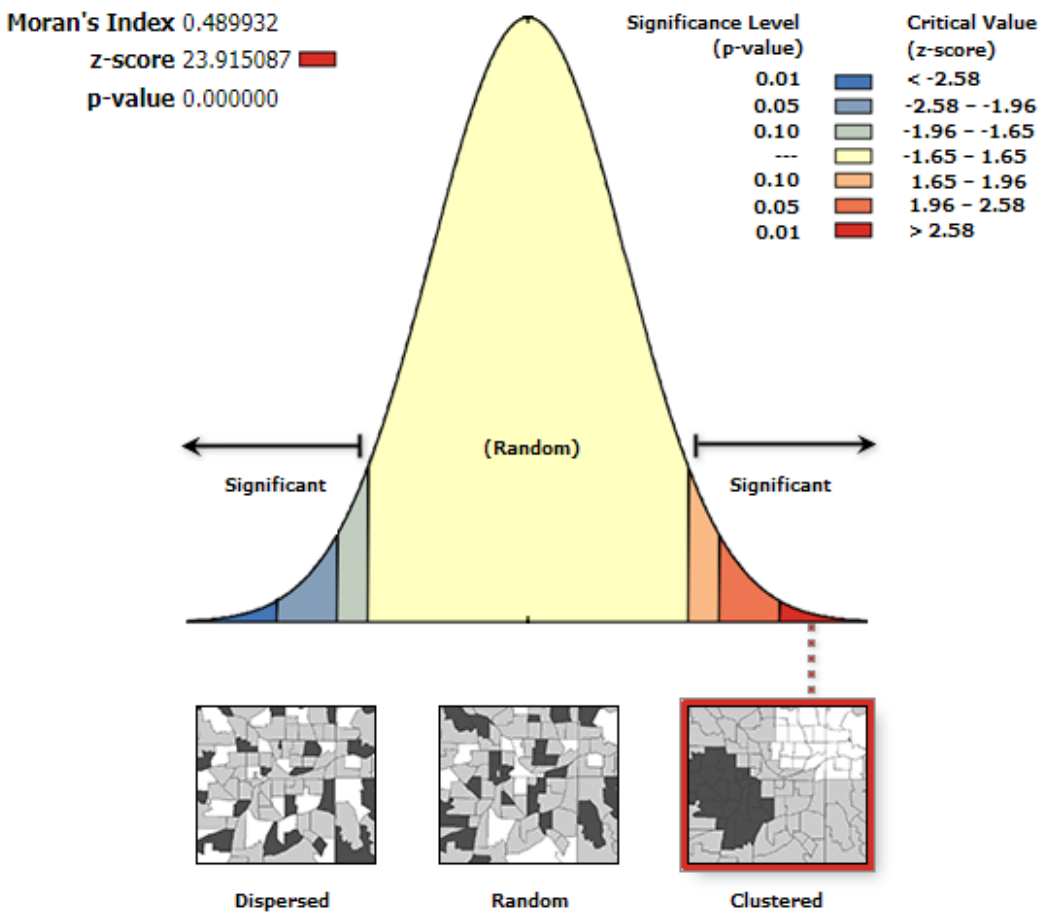
Given the z-score of 3.283666, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Global Moran's I Summary

Moran's Index	0.023724
Expected Index	-0.000852
Variance	0.000056
z-score	3.283666
p-value	0.001025

Report 5: Mean Distance Travelled by HCV Holders from 2010 to 2021

Spatial Autocorrelation Report



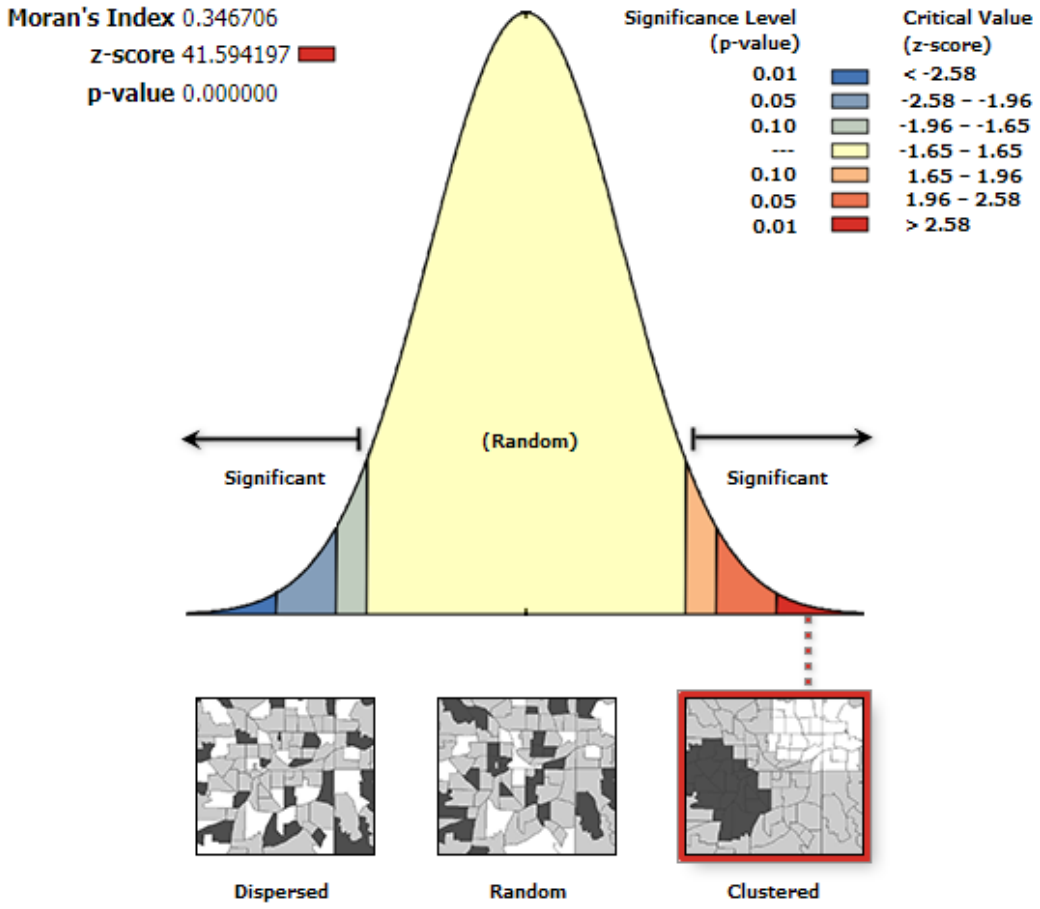
Given the z-score of 23.915087, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Global Moran's I Summary

Moran's Index	0.489932
Expected Index	-0.002155
Variance	0.000423
z-score	23.915087
p-value	0.000000

Report 6: Neighborhood Quality Index

Spatial Autocorrelation Report



Given the z-score of 41.594197, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Global Moran's I Summary

Moran's Index	0.346706
Expected Index	-0.000858
Variance	0.000070
z-score	41.594197
p-value	0.000000

Appendix C
Economic Significance

Semi-Standardized Coefficient Calculation

$$\frac{IQR_{NQIst}}{sd_{(census\ ever\ moved)}} * 100\% = \frac{0.0429305}{0.5} * 100\% = 8.5\%$$

It is economically insignificant.

Semi-Elasticity Calculation

$$\frac{\hat{\beta}_{disabled}}{\overline{census_ever_moved}} * 100\% = \frac{0.0097}{0.46} * 100\% = 2.10\%$$

It is economically insignificant.

$$\frac{\hat{\beta}_{gender}}{\overline{census_ever_moved}} * 100\% = \frac{0.0613}{0.46} * 100\% = 0.133\%$$

It is economically insignificant.

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