RIEEM Research Institute for Environmental Economics and Management

Discussion Paper Series No.2301

# The Spatial Distribution of Stigmatized Properties in Tokyo, Japan

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August 2023

WASEDA

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Abstract

While intangible yet psychologically repellent factors such as noise or pollutants require disclosure to potential buyers or renters in real estate transactions, the disclosure of a person's death within a building or unit remains uncertain. This uncertainty stems from the limited empirical research on incidents that are considered noteworthy, mainly due to the absence or limited availability of public databases pertaining to incidents that take place in living environments. In this article, we utilize a comprehensive database of incidents in the living environment, contributed by the public in Japan, to explore which types of incidents can be perceived as psychological defects. We find that suicides, homicides, fire deaths, alone deaths, discovery of a corpse, and accidental deaths are main interest of the public. Additionally, we examine the correlation between incident occurrences and socio-economic characteristics within a block. We find that the ratio of single-person household, ratio of elder persons, and ratio of person living in sharing housing are related to several incidents. On the contrary, the ratio of individuals residing in an area for a longer time is negatively or not related to the occurrence of such incidents.

JEL classification codes: R10; R12; R19

Keywords: Stigmatized property, Duty of disclosure, Posting information, Regression analysis

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## 1. Introduction

While structural flaws in a unit or building, or intangible yet psychologically repellent elements such as noise or pollutants, generally necessitate disclosure to potential buyers or renters in real estate transactions, the disclosure of a person's death within a building or unit remains uncertain. For instance, in the United States, it is not mandated except in certain states, whereas in Quebec, Canada, a murder must be disclosed[1]. Conversely, in Japan, it is required, but there are no established guidelines regarding the extent of disclosure[2]. If information regarding a person's death influences real estate transactions, it could have a detrimental impact on property prices and rents. However, there is insufficient discussion on the specific types of incidents that should be included and the magnitude of this impact. One reason for this situation is the lack of knowledge regarding the nature and temporal proximity of incidents that people find aversive.

The aim of this study is to ascertain the types of incidents that capture people's interest and explore the regional characteristics associated with the occurrence of such incidents in Tokyo's residential environment, thus facilitating scientifically informed discussions on psychologically objectionable incidents. We use the data from the website "Oshimaland.com", which was launched in 2005 to provide information on such incidents in Japan. The website administrators collected data until 2010, after which it continued to receive contributions from third parties and update the information. The website presents three primary types of information: the nature of the incident, its location, and the date of occurrence. As of June 2023, the website has amassed over 79,000 postings. Utilizing this comprehensive database of incidents in Japan, this study investigates the incidents that garner attention in the housing environment, with a focus on Tokyo.

Given the limited data available, several studies have attempted to estimate the negative externalities resulting from human deaths on property prices and rents. For example, Chang et al. (2018), examining the case of Hong Kong, reported a decrease of approximately 50% in property values for properties where a murder took place, and a decrease of around 20% for properties where a suicide occurred. On the other hand, Sadayuki (2020), the sole study of its kind in Japan, reported a rental decline of about 10% immediately after a murder occurred in a Tokyo apartment building. These studies analyzed limited data from real estate information websites and third-party information

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[1] For more detailed information, see the following website:

Kious, Rodgers, Barger, Holder & King, PLLC. (2020), https://krbhk.com/are-sellers-required-to-disclose-that-their-house-is-haunted/,

CRES, https://www.cresinsurance.com/what-is-psychologically-impacted-property/,

Gordon Brown Law, https://www.gordonbrownlaw.co.uk/blog/what-do-i-have-to-disclose-when-selling-a-property/ ,

Mondaq, (2018). https://www.mondaq.com/canada/real-estate/687544/real-property-stigma-and-the-duty-to-disclose,

[2] Since there is no guideline to disclose, Japanese courts' views on the duty to disclose are mixed. For example, see Nakato (2011).

submission platforms. The number of incidents analyzed ranged from 700 to 1000, encompassing suicides, homicides, fire-related deaths, accidental deaths, and other incidents.

In contrast to these studies, the present study boasts the following characteristics. First, it utilizes meticulously organized data from the website that encompasses a wealth of information contributed by the public. Second, it enables an analysis of the distribution of incidents according to different case types. Official statistics in this regard are challenging to establish due to privacy concerns, and obtaining information on the actual distribution of them is difficult. However, it is unlikely that their occurrence is random, necessitating an analysis of the regional characteristics associated with their prevalence.

Using information derived from large-scale public postings offers several advantages. Firstly, such data can reveal incidents that may be psychologically objectionable from the perspective of potential buyers. Secondly, ascertaining the actual distribution of accidental properties is highly challenging, and the collection of information in a real estate transaction relies on the efforts of the buyer. The ease of information collection is presumed to vary according to the case type. Thus, the distribution of accidental properties based on various media and information sources closely aligns with the information employed for actual decision-making.

This paper is organized as follows. Section 2 describes the website "Oshimaland.com" used in this study and the basic statistics obtained by organizing the data, and Section 3 reports the regression analysis model and the results of the analysis. Section 4 discusses the results of the analysis and Section 5 concludes.

## 2. Data sources and Descriptive statistics

### 2.1 Stigmatized Properties in Tokyo, Japan[3]

There are no official databases concerning the whereabouts of stigmatized properties in Japan. However, Oshimaland.com (http://www.oshimaland.co.jp) serves as a source for such information. Established in 2005, this website initially collected the data internally. However, since June 2011, they have allowed public postings. As of June 2023, there have been approximately 79,000 postings in Japan. This website provides three primary types of information: (1) details of the incident, (2) the address where the incident occurred, and (3) the time of the incident[4].

In this study, we utilized 9,242 postings registered as of April 2017 in Tokyo to investigate public preferences regarding stigmatized properties and their geographical characteristics. Let us first provide a brief overview of our data cleansing process. Initially, in 2017, we obtained the posting data from the Oshima-land administrator. Since the posting information was in free-text format, we used Stata, GIS, and a geocoding service provided by the university of Tokyo to cleanse the contents, dates,

[3] This section is mainly based on Yajima and Sadayuki (2022).

[4] For a detailed description of the posting process, see the Appendix A.

and addresses of the incidents. Regarding the content of the incidents, we categorized the postings based on relevant keywords, which we will describe later. For the timing of the incidents, we utilized two geocoding services: GIS (provided by Esri Japan) and the university of Tokyo. We also manually verified the data. Following this, we identified several postings that referred to the same incident and aggregated them while eliminating duplicates. For a detailed description of our data cleansing process, please refer to Appendix A.

Ultimately, we use 8,798 posting in this study. These postings were classified into six categories of stigmatized properties based on various keywords: *suicide*, *fire death*, *homicide*, *alone death*, *discovery*, *accidental death*, *psychological defects*, and *other incidents*. Here is a brief description of each stigmatized property category. Firstly, for *suicide*, we included all suicides regardless of the method, as well as postings indicating suicides by jumping. Secondly, *fire death* encompassed cases where deaths occurred due to fire or arson. *Homicide* category included all homicides regardless of the method used, such as stabbing, striking, or strangling. *Alone death* referred to cases where a posting explicitly mentioned "alone death" or the in-house death of an individual who was alone. Since some postings only reported the discovery of a corpse, sometimes in addition to other incidents such as suicides or homicides, we define *discovery* to indicates such cases. Next, *accidental death* encompassed cases where individuals died accidentally, such as by drowning or falling. Lastly, *psychological defects* indicated postings that mentioned the presence of psychological defects in an estate, while *other incidents* comprised cases with a small number of postings, such as natural deaths or deaths of unknown causes. It is important to note the distinction between *psychological defects* and *unknown deaths*, as the latter implies a death has occurred, whereas the former does not.

Table 1 provides the number of incidents and the detailedness of information by the incident. Column (1) and (2) shows the number of incidents and its ratio to the total number of incidents. Since some postings contain information on multiple incidents, the total number of incidents exceeds the total number of postings. We can see that *suicide* accounted for the highest percentage, about 30% of the total number of incidents. *Alone death* constituted a smaller proportion, around 5% of the total. However, it is possible that it can be included as part of *discovery*, where someone may post about an alone death as the discovery of a corpse.

Columns (3) through (5) indicate the extent to which information on the incident dates is recorded for each stigmatized property category. Column (3) shows the percentage of incidents for which the date is recorded, column (4) displays the percentage for incidents where at least the year is identified, and column (5) represents the percentage of incidents where no information on the timing is available. *Fire death* had the highest percentage of cases where even the date was identified, at around 87%. The second-highest categories were *homicide*, *discovery*, and *accidental death*, with ratios of approximately 74%. The third-highest category was *suicide*, with a ratio of around 49%. The other categories had less than a 50% ratio of incidents with identified dates. With regard to incidents

where the year of the incident was identified, this exceeded 60% for all categories except *psychological defects* and *other incidents*. These findings suggest that, in many cases, the postings contain some information about the date of the incidents.

These statistics indicate that the level of detail regarding incident dates can vary across stigmatized property categories. The level of detail may reflect the ease of identification by the public, the attention given by the public, and the memorability of the incidents. Fire deaths, homicides, discoveries of corpses, and accidental deaths are relatively easy for the public to detect at the scene or through media coverage. Conversely, suicides and alone deaths are often initially discovered by acquaintances of the deceased, such as neighbors, friends, government officials in health or welfare departments, or homeowners. It is unlikely that they would actively post about such incidents. Therefore, it can be relatively challenging for the public to determine the exact dates of these incidents unless they are covered in the media. However, in the case of *suicides*, the date of the incidents is identified in nearly half of the postings. This reflects the high level of public attention and may indicate a high degree of psychological significance in these cases. For *alone deaths*, the percentage of postings with identified dates is lower compared to the previously mentioned stigmatized property categories. This may be due to the difficulty for the public to become aware of such incidents, the lower degree of psychological significance compared to *homicides* or *suicides*, and the fact that even if the date of discovering an alone death is known, the public may be reluctant to provide a specific incident date if it cannot be precisely determined.

Finally, columns (6) and (7) present details regarding the address of the posted properties. Column (6) displays the percentage of cases where the building name is identified, while column (7) shows the percentage of cases where the address is identified. In the former cases, visitors to Oshimaland.com can find the building names associated with stigmatized properties on the website. In the latter cases, although the building name is not available, visitors can still search for the building using the provided address. For all stigmatized properties, nearly 100% of the postings include at least the address information.

In summary, the trends in the posing of each incident appears to align with its characteristics. However, a crucial question arises concerning whether the information from these postings truly represents the actual distribution of incidents. A comparison with the corresponding governmental statistics reveals a high level of reliability for homicides and fire-related incidents, in a while, for suicides and alone deaths, there is a possibility of bias[5]. The postings may be more concentrated in areas where these incidents are more likely to be discovered or reported.

**Table 1 Number of incidents and detailedness by Stigmatized property category**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|

[5] For detailed information, see the Appendix D.

| Stigmatized Properties | Number of Incidents | Ratio to the total number of incidents | Date of Incidents | | | Point of Incidents | |
|---|---|---|---|---|---|---|---|
| | | | Identified to Day | Identified to Year | Unknown | Identified to Building name | Identified to Address |
| *Suicide* | 2,566 | 28.3% | 48.6% | 66.4% | 9.8% | 82.3% | 95.6% |
| *Fire death*[a] | 1,027 | 11.3% | 87.2% | 90.2% | 2.7% | 89.6% | 97.7% |
| *Homicide* | 1,037 | 11.5% | 68.1% | 81.6% | 4.1% | 76.3% | 95.6% |
| *Alone death* | 462 | 5.1% | 39.8% | 63.6% | 5.6% | 82.9% | 96.8% |
| *Discovery*[b] | 1,412 | 15.6% | 67.9% | 80.0% | 4.8% | 84.5% | 97.5% |
| *Accidental death* | 640 | 7.1% | 68.1% | 81.6% | 4.1% | 76.3% | 95.6% |
| *Psychological defects*[c] | 1213 | 13.4% | 8.7% | 17.9% | 67.6% | 87.6% | 98.0% |
| *Other incidents* | 696 | 7.7% | 30.2% | 50.6% | 29.5% | 75.7% | 92.7% |
| Total | 9053 | 100.0% | | | | | |

a: Fire death implies the death of person by any fires including arson. b: Discovery contains any postings mention that someone detects a corps. Of the 1,412 cases, we find that 226 postings report some incidences in addition to the discovery of a corps. c: Psychological defects counts the number of postings mention that there are some psychological defects without any details.

In Table 2, we present a comparison of the incident categories covered in the existing literature. Additionally, we provide the number of incidents used in each of study (For this study, see Table 1). Notably, all of the literature, including this study, covers homicide or murder and suicide incidents. Furthermore, both Sadayuki (2020) and this study include fire deaths in their analysis. Among these incidents, suicide tends to have a higher sample size.

One distinctive feature of this study is the inclusion of alone deaths and the discovery of a corpse as incident categories. It may reflect the growing social concern surrounding alone deaths and the increasing trend in the suicide rate. The addition of these incident categories in our analysis can help shed light on their potential impact in housing market.

**Table 2 Incidents covered by literature.**

| | Stigmatized properties |
|---|---|
| Bhattacharya et al (2021) | Murder (N = 21), Suicide (N = 910), Accident (N = 73), Other (N = 28) |
| Sadayuki (2020) | Homicide (N = 260), Fire death (N = 308), Suicide (N = 193), Other (N = 274) |
| Chang and Li (2018) | Murder (N = 17), Suicide (N = 835), Accident (N = 70), Unclassified (N = 12) |
| This study (2023) | Suicide, Fire death, Homicide, Alone death, Discovery, Accidental death, psychological defects, and Other incidents. |

The number of each incident which is used in their analysis in parentheses.

Figure 1 shows the percentage of incidents by period of occurrence. Incidents in the 2010s or later account for the largest share (67%), followed by incidents in the 2000s (21%). The newer the incident, the more often it is posted. Moreover, we can see that incidents in the past are of interest to people to some extent.

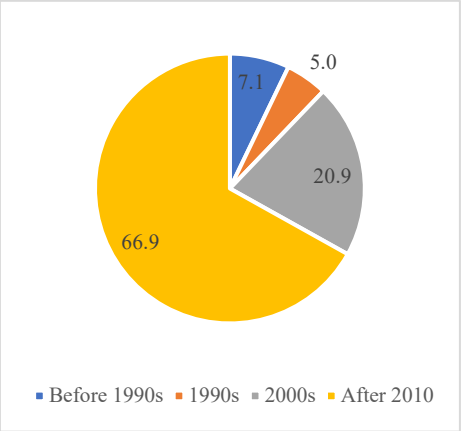


**Figure 1 The ratio of incidents by periods of occurrence (Excluding the cases in which the date of incident is unknown)**

Next, we compare the number of postings for each of these stigmatized properties with the figures reported in the corresponding governmental statistics. It is evident that the coverage varies significantly across different stigmatized properties. In 2015, the estimated number of deaths resulting from building fires in Tokyo was approximately 100, whereas the number of *fire deaths* posted for that year was around 80, indicating a high coverage rate of approximately 80%. Similarly, while there were about 100 confirmed cases of all homicides in Tokyo in 2015, including those occurring outside of buildings, there were approximately 50 postings related to homicides that year. Although not as high as *fire deaths*, this still represents a substantial coverage rate. On the other hand, in terms of *suicides*, there were approximately 600 suicides in Tokyo in 2015 that occurred in in-house or high-rise buildings. However, the number of corresponding postings during that time was only around 170, indicating a coverage rate of approximately 30% for suicides. Finally, concerning *alone deaths*, while the number of such deaths in Tokyo in 2015 was approximately 5,500, the number of postings regarding alone deaths in that year was only about 50, which accounts for less than 1% of the total. As for the discovery of a corpse, there are no appropriate governmental statistics available. For a detailed year-by-year coverage breakdown, please refer to the Appendix D.

Next, we investigate the time lag between the occurrence of an incident and its posting, focusing on *suicide*, *fire death*, *homicide*, *accidental death*, and *alone death*. We define the "posting rate" as the ratio of the number of posted incidents to the total postings, based on the number of days elapsed since the incident, for each of these five stigmatized properties. Figure 2 illustrates the cumulative posting rate within one month, while Figure 3 depicts the percentage change of the posting rate relative to the previous day for each property. In both figures, the x-axis represents the number of days elapsed since the incident, with "0" denoting the day of the incident.

Figure 2 is generated by following procedures. Firstly, we calculated the difference between

the date of posting and the date of the incident, whenever the incident date was available. Then, we calculated the cumulative number of postings in relation to the number of days elapsed since the incident, along with its ratio to the total number of postings. For Figure 3, we derived the first difference of the cumulative posting rate.

According to the Figure 2, fire death exhibits the highest posting rate on the same day as the incident, with approximately 40% of postings occurring immediately, and about 90% within three days of the incident. Furthermore, Figure 3 reveals that the percentage change in the posting rate relative to the previous day remains relatively low, at less than 0.5%, after three days, at least within the first month.

Both *homicide* and *accidental death* demonstrate a similar trend, with relatively lower posting rates within one month. Roughly 66% of *homicide* and 54% of *accidental death* are posted within three days after the incident. However, after three days, the posting rates for both types of incidents continue to increase, albeit at a slower pace compared to *fire death*. Notably, in the case of *homicide*, the percentage change in the posting rate ranges between 0.5% and 2% after three days from the incident, up to ten days elapsed.

Regarding *suicide*, the posting rate within three days is only around 37%, which is lower than the rates for the previous three incident types. The rate gradually increases with the percentage change ranging between 1% and 2% up to eight days elapsed. After that, the percentage change in the rate drops to less than 0.5%. However, it is worth noting that information about past incidents tends to continue being posted.

*Alone deaths* exhibit the lowest posting rate, approximately 36%, within three days after the incident. Similar to *suicides*, the posting rate for alone deaths gradually increases. However, the percentage change in the rate also shows a gradual increase. In particular, the percentage change is relatively higher during the first week following the incident compared to the other stigmatized properties.

These disparities in the posting rate among the five stigmatized properties can be attributed to several factors. Firstly, it is related to the ease of discovering incidents. *Fire deaths* are visually more evident than the other incident types, making them more likely to be immediately posted. *Homicides* also have a relatively high posting rate due to the relatively easier access to information through the media. In contrast, *suicides, alone deaths,* and *accidental deaths* are considered more challenging to obtain information about, resulting in lower posting rates. This tendency is particularly prominent for *alone deaths*. A survey conducted in Tokyo revealed that approximately 20-40% of alone deaths in single households took more than a week to be discovered. The higher rate of increase in the posting rate after about a week aligns with the findings of that survey. The increase in the number of *alone deaths* posted after some time may be attributed to the time required for incident discovery, cause of death determination, as well as the fact that such events are less likely to be noticed by third

parties.

Secondly, the continued posting of incidents even after some time has passed indicates a sustained level of public interest in these events. Only *fire deaths*, for which very few incidents were posted three days after their occurrence, may exhibit relatively lower interest levels.

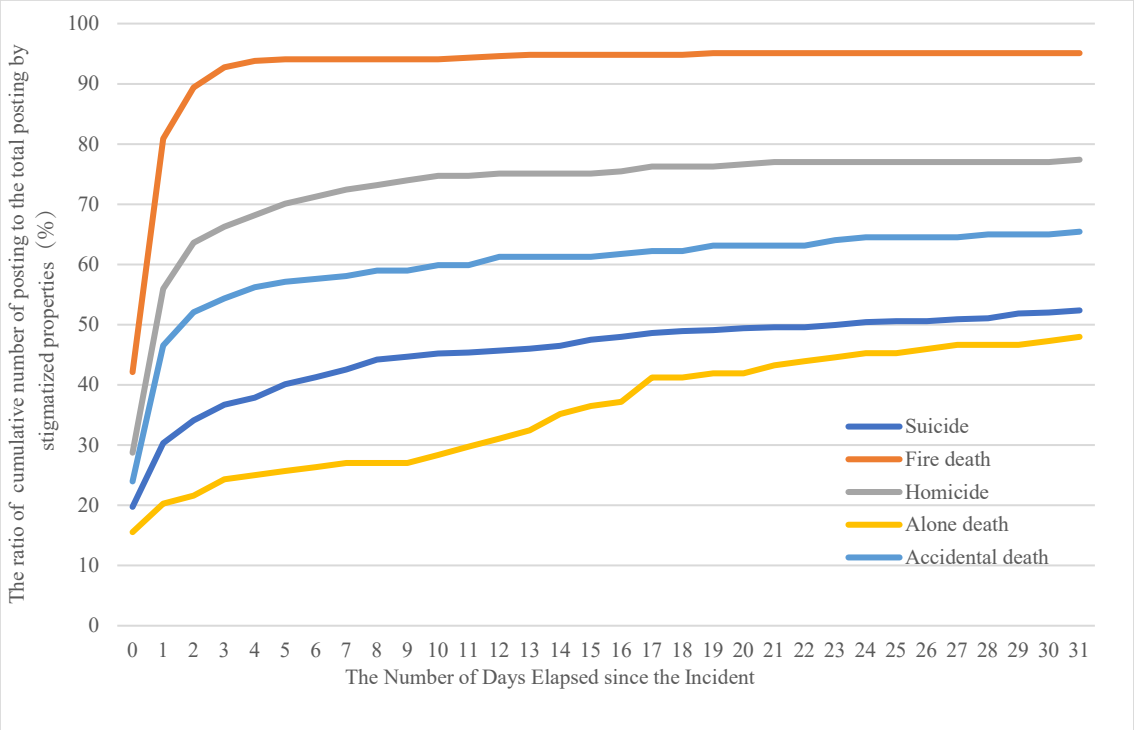


**Figure 2 The relationship between the number of days elapsed and cumulative number of posting by insidents.**

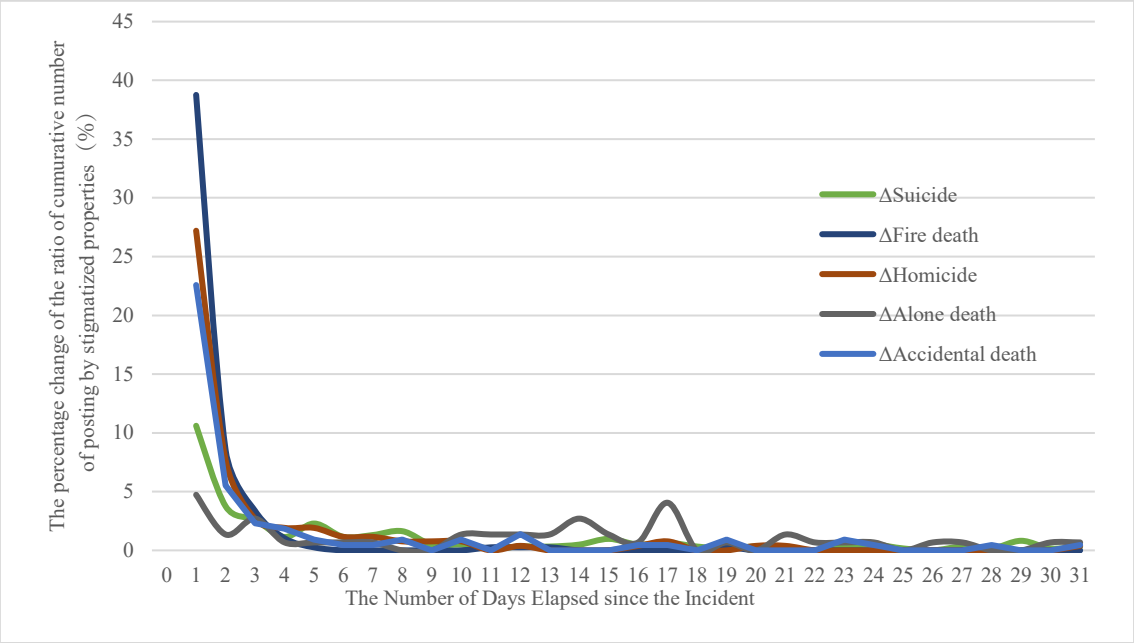


**Figure 3 The percentage change of the ratio of cumulative number of posting relative to those of the previous day by incidents (%)**

2.2 Spatial Distribution of Stigmatized Properties.

This subsection describes that the spatial distribution of the occurrence of *suicide*, *homicide*, *fire death*, *alone death*, *discovery*, and *accidental death*. To simplify, we do not discuss *psychological defects* and *other incidents*. Figure 3 shows each distribution of these six stigmatized properties in Tokyo. The colors correspond to blue - red - yellow, respectively, according to the number of postings. As can be seen from these figures, there are no postings in the western part of Tokyo, and they are concentrated in the eastern part, especially in the area of the 23 wards, which is the central area of Tokyo.

We can see that *discovery*, *suicide*, and *homicide* have a similar distribution. That is, they are widely distributed in the eastern part of Tokyo, with some areas, especially in the 23 wards, having a high number of cases scattered throughout the city. Reflecting the highest number of postings, the distribution of *suicide* is the widest. Especially, *homicide* and *suicide* are concentrated around Shinjuku and Toshima wards. In addition to both wards, there is also an area of high density in Taito Ward for *discovery*.

Next, we examine the distribution of *fire death*. The number of postings of *fire death* is about the same as that of *discovery* and *homicide*, however, there are relatively large number of areas with higher density such as Itabashi, Toshima, and Nakano wards. There are also areas of high density in parts of Koto and Ota wards.

Regarding *accidental death*, we can see that its density is relatively higher in both 23 ward and outside of them, moreover, the occurrence of accidental death is scattered. In contrast to the case

of *discovery*, *suicide*, and *homicide,* there are relatively many areas with higher density.

Finally, the distribution of *alone death* tends to differ from that of the four caterogries above. There are few areas of low density, and areas of high density are scattered across many wards. In addition, areas of high density are found outside of the 23 wards, although they are similarly concentrated in the vicinity of the 23 wards.

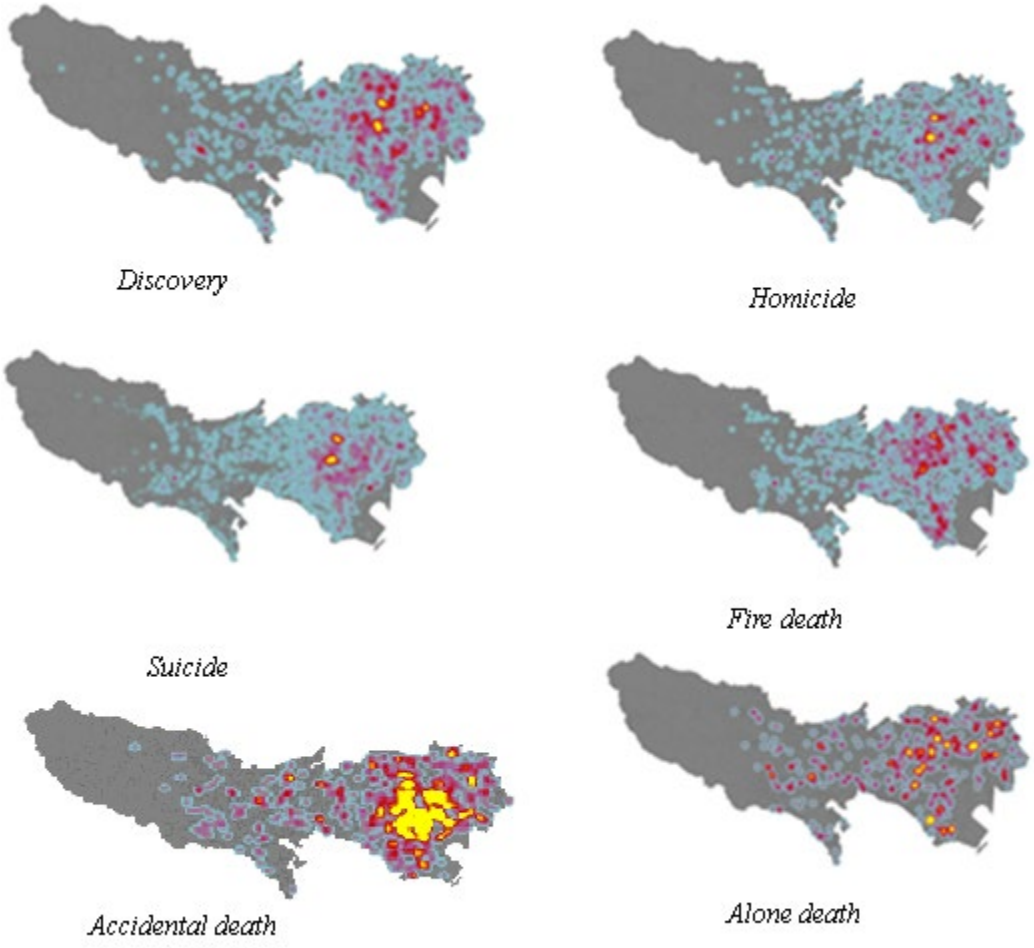


**Figure 4 The spatial distributions of stigmatized properties**

To examine the underlying factors influencing the aforementioned incident distributions, we also present the distributions of selected socio-economic characteristics as follows: the proportion of individuals residing in the same area since birth, the proportion of individuals who have lived in the area for less than 5 years, the proportion of single-person households, population density, the proportion of elderly households (aged over 65), and the proportion of owner-occupied households. These characteristics are represented by colors ranging from yellow to orange to red, in descending order of decreasing values. Gray areas indicate regions for which data could not be obtained.

This visualization reveals several patterns. Firstly, the proportion of individuals residing in the same area since birth tends to be higher outside the 23 wards, particularly in the western part. Conversely, the distribution of households that have lived in the area for less than 5 years is relatively elevated in the vicinity of the 23 wards. In some areas, both proportions are also notably high.

Examining the proportion of single-person households, it becomes apparent that this ratio is generally higher around the 23 wards. Similar observations can be made regarding population density, although the differences between regions are relatively minor.

Furthermore, the proportion of elderly households exhibits a tendency to be higher in areas located further away from the city center, such as Adachi and Itabashi wards within the 23 wards. Additionally, a relatively substantial percentage can be observed outside the 23 wards.

The distribution of owner-occupied households follows a similar pattern to that of the proportion of elderly households and tends to be higher in areas located away from the city center and outside the 23 wards.

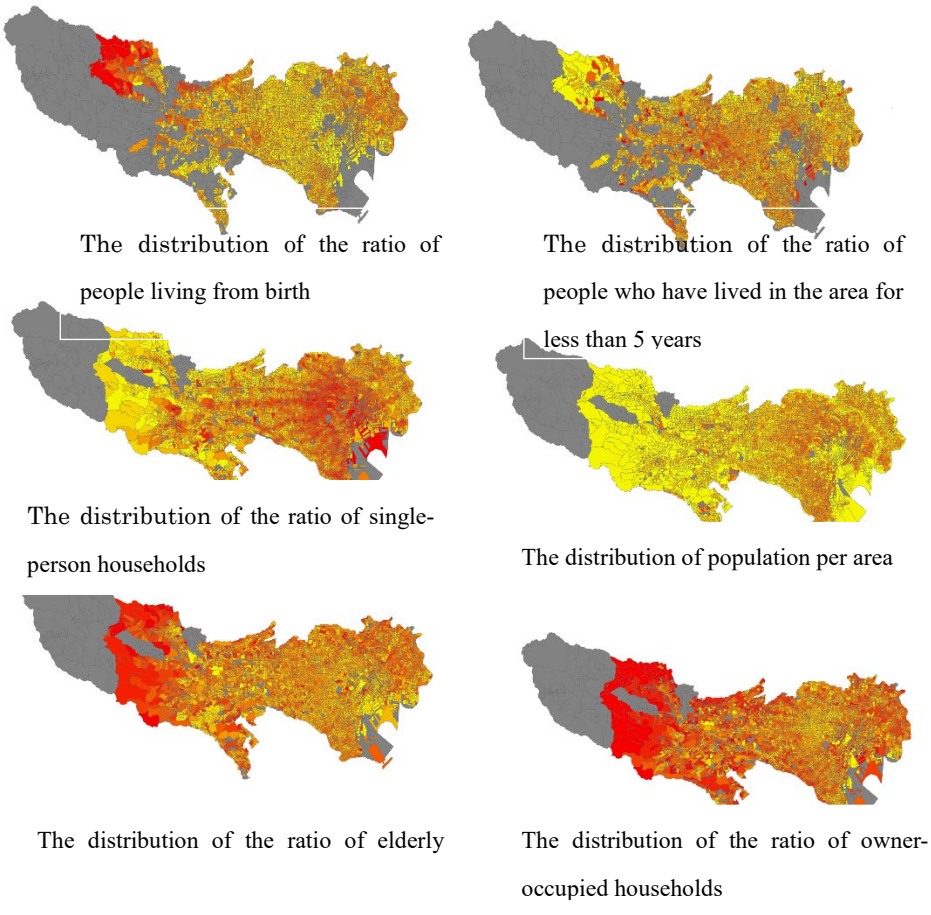


**Figure 5 The spatial distributions of selected socio-economic characteristics.**

Through a comparison of the distribution of postings related to psychological defects with the distribution of each regional attribute, we can identify certain trends. In general, we observe a higher prevalence of such postings in areas characterized by larger populations and a higher proportion of single-person households. Additionally, alone deaths appear to be relatively more frequent in areas located outside the 23 wards, aligning with regions that have a higher percentage of elderly households and owner-occupied residences. These observations suggest a potential association between regional attributes and the occurrence of psychological defects.

## 3. Regression Analysis

### 3. 1 Regression Model

The purpose of this study is to identify the relationship between the socio-economic characteristics and occurrence of stigmatized properties. As can be seen earlier, the occurrence of stigmatized properties may not be random, and it is related to the various regional characteristics such as population. Therefore, we assume that the occurrence of stigmatized properties is explained by the various socioeconomic attributes and living environments of each region. Since the number of occurrences of incidents takes discrete values with zero as the minimum value, we apply a Poisson regression model. The model assumed is as follows.

$$P(y_i = h|\boldsymbol{X_i}) = \exp[-\exp(\boldsymbol{\beta X_i})][\exp(\boldsymbol{\beta X_i})]^h/h!$$
$$h = 0,1,\dots$$

where $i$ denotes a block, $h$ implies the number of incidents in a block $i$, $\boldsymbol{\beta}$ is the parameters to be estimated.

For dependent variables, we aggregate each of *suicide*, *homicide*, *alone death*, *fire death* and *discovery* by blocks. In addition, we use the sum of number of these incidents. Therefore, we have seven dependent variables in this analysis.

For the explanatory variables, we consider various socio-economic factors. Firstly, we include the population per area to capture the effects of block size, expecting a positive coefficient. Secondly, we incorporate the ratio of elderly persons (aged 65 and above) to the total population and the ratio of single-person households to the total number of households in each block. These ratios can be related to several incidents. In Japan, around 60% of fire-related fatalities occur among elderly individuals, while single persons are more prone to fire mismanagement compared to families. Additionally, elderly and single-person households may be more likely targets for homicides. Thus, we expect positive coefficients for these variables in relation to fire deaths and homicides. Moreover, suicides may have a higher probability of occurrence in such households.

Thirdly, we include the ratio of people who have lived in the same area since birth or for

over 20 years, the ratio of owner-occupied households, and the ratio of people living in shared housing. These variables aim to capture the impact of community and the connections among residents. Higher ratios of owner-occupied households and long-term residents suggest stronger social interactions and lower incident probabilities.

Fourthly, we consider the effects of public safety in each block by including the ratio of detected crimes for violent offenses, brutal offenses, and burglaries, as well as the logarithmic value of the total number of these crimes. The number of detected crimes represents the crimes identified by the police, regardless of whether the corresponding criminals are apprehended. These variables are expected to capture the exposure to violent crimes in a region, which may be related to the occurrence of homicides and fire deaths. Additionally, we address the issue of missing data by replacing missing values with zero and introducing a missing dummy variable. If the coefficient of the missing dummy variable is statistically significant, it indicates that the missing data may be non-random.

Fifthly, we aim to control for the estate values of each region. We estimate a log-linear type hedonic price function using public transaction data from the Ministry of Land, Infrastructure, Transport, and Tourism. We then store the coefficients of regional dummies and include them in the equation[6]. The inclusion of these coefficients helps account for the relationship between estate values and incident probabilities. Missing values in the transaction data are replaced with zero, and a missing dummy variable is introduced. A statistically significant coefficient for the missing dummy suggests that the missing values may not be random, potentially indicating that the corresponding region is not valuable to consumers.

Finally, we consider the influence of the residential environment across districts by including the ratio of land use area sizes. The land use areas are defined by the Japanese City Planning Law, which outlines the permissible types of buildings, as well as their height and area, for each area category. There are 13 categories of land use areas, excluding the rural residential district. For instance, low-rise residential districts allow establishments such as restaurants, residences, and schools with two or fewer floors and a total floor area of 150m$^2$ or less. Commercial and industrial zones have specific permissions and restrictions. We note that our data does not include the rural residential district[7].

Using the above variables, we apply a backward-stepwise method to identify the optimal combination of variables. The procedure is as follows: First, we estimate a model with all variables and store the Akaike Information Criterion (hereinafter AIC). Next, we estimate the model without one of the variables and record the corresponding AICs for each variable. By comparing these AICs, including the initial AIC from the full model, we select the model with the smallest AIC[8]. We then

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[6] For a detailed process of the estimate, see the Appendix C.

[7] For details, see Ministry of Land, Infrastructure and Transport (2003).

[8] As of the missing dummies for estimated estate values, we excluded if the estimated estate value is excluded, since the missing dummy makes no sense itself. We also excluded the missing dummy for the total number of detected violent crimes if all crime-related variables are excluded.

replace the initial AIC with the smallest one and repeat the procedure. This process concludes if the initial AIC is the smallest among estimated AICs. We note that we do not compare all possible combinations of the variables.

**Table 3 Summary Statistics**

| Variables | N | Mean | S.D. | Min | Max |
|---|---|---|---|---|---|
| Socio-economic variables | | | | | |
| Population per area | 5209 | 0.01 | 0.02 | 0 | 0.65 |
| Ratio of elderly persons (65 or older) | 5115 | 22.73 | 7.73 | 0 | 100 |
| Ratio of owner-occupied households | 5108 | 51.65 | 18.55 | 0 | 100 |
| Ratio of single person households | 5110 | 44.38 | 15.15 | 2.32 | 100 |
| Ratio of people living in sharing housing. | 4763 | 62 | 24.79 | 0 | 100 |
| Ratio of people living from birth or more than 20 years | 4765 | 28.6 | 10.71 | 0 | 93.41 |
| Ratio of violent offences | 5522 | 0.04 | 0.06 | 0.00 | 0.50 |
| Ratio of brutal offences | 5522 | 0.04 | 0.06 | 0.00 | 0.50 |
| Ratio of burglary | 5522 | 0.04 | 0.07 | 0.00 | 1.00 |
| Missing dummy (Criminal) | 5522 | 0.34 | 0.47 | 0.00 | 1.00 |
| ln (Total number of criminals) | 5522 | 1.93 | 1.60 | 0.00 | 7.14 |
| ln (Estimated estate values) | 5522 | -0.58 | 0.47 | -2.44 | 1.06 |
| Missing dummy (Estimated estate values) | 5522 | 0.25 | 0.43 | 0.00 | 1.00 |
| Land Use Districts | | | | | |
| Type 1 exclusive district for low-rise residential buildings | 5522 | 27.82 | 35.07 | 0 | 100 |
| Type 2 exclusive district for low-rise residential buildings | 5522 | 0.61 | 5.24 | 0 | 95.63 |
| Type 1 exclusive district for medium and high-rise residential buildings | 5522 | 15.78 | 25.32 | 0 | 100 |
| Type 2 exclusive district for medium and high-rise residential buildings | 5522 | 2.93 | 9.58 | 0 | 99.28 |
| Type 1 exclusive district for residential buildings | 5522 | 10.85 | 20.71 | 0 | 100 |
| Type 2 exclusive district for residential buildings | 5522 | 1.74 | 7.98 | 0 | 96.4 |
| Semi-residential district | 5522 | 1.13 | 4.67 | 0 | 96.63 |
| Semi-commercial district | 5522 | 6.28 | 11.44 | 0 | 100 |
| Neighborhood commercial district | 5522 | 11.13 | 25.53 | 0 | 100 |
| Commercial district | 5522 | 10.92 | 23.89 | 0 | 100 |
| Industrial district | 5522 | 1.45 | 9.47 | 0 | 100 |
| Exclusive district for industrial buildings | 5522 | 0.54 | 6.64 | 0 | 99.6 |
| Occurrence of incidents (aggregated by block-level) | | | | | |
| Discoveries | 5522 | 0.25 | 0.59 | 0 | 8 |
| Suicides | 5522 | 0.46 | 0.98 | 0 | 19 |
| Homicides | 5522 | 0.19 | 0.53 | 0 | 13 |
| Alon deaths | 5522 | 0.08 | 0.32 | 0 | 6 |
| Fire deaths | 5522 | 0.18 | 0.46 | 0 | 4 |
| Accidental deaths | 5522 | 0.11 | 0.41 | 0 | 5 |
| Any incidents | 5522 | 1.28 | 1.83 | 0 | 23 |

3.2 Regression Results

Table 3 to Table 6 provide a comprehensive summary of our key regression results. Additionally, the odd-numbered columns display the outcomes when we exclude outliers beyond the 95th percentile of each dependent variable's distribution for the sake of comparison. Empty cells indicate that the corresponding variable was not selected by the stepwise method. We prioritize the results obtained using the entire sample.

We briefly explain the estimation results. We find that the population per capita has positive and significant relationships on Discoveries, Alone deaths, Homicides, and any incidents at least 10% level, while it has the negative and significant relationships on Suicides and Accidental deaths. Next, we can see that the ratio of elderly person has positive and significant relationships on Discoveries, Alone deaths, Homicides, Fire deaths, and any incidents.

The ratio of owner-occupied households has significant impact only on *accidental deaths*. The ratio of single person households has positive and significant impact on *discoveries*, *suicides*, *alone deaths*, *homicides*, *fire deaths*, *accidental deaths*, and any incidents. The ratio of people living in sharing housing has positive and significant relationships on Discovery, Suicides, Accidental deaths, and any incidents. Moreover, it has negative relationships on Fire deaths at 10% level for 95 percentile sample. The ratio of people living from birth or more than 20 years has negative and significant relationships on Homicides and any incidents.

Estimated estate values have positive and significant relationships on Accidental deaths, while it has also positive sign on Homicides. For other types of incidents, signs are positive and negative for fire deaths, but not significant. On the other hands, the missing dummy for the variable is statistically significant for several types of incidents such as Alone deaths, Homicides, Fire deaths, Accidental deaths, and any incidents, with negative signs. This result implies that the district has no transaction data may be non-random, that is these areas tend to have lower estate values.

As of the variables in terms of crimes, we find that the log of the number of crimes has positive and significant relationships on the occurrence of all incidents. We also find that the missing dummy of the number of crimes is positive and significant relationships on all stigmatized properties. In a region that the information on the number of crimes is missing, the incidents tend to occur. Looking for each type of crime, the ratio of brutal offences relates the occurrence of suicides and homicides, the ratio of violent offences relates homicides, and the ratio of burglary offences relates alone deaths. Their coefficients are positive.

## Table 4 Estimation Results (Poisson) 1

| | [1] | [2] | [3] | [4] |
|---|---|---|---|---|
| | Discoveries | | Suicides | |
| | | 95% | | 95% |
| Population per capita | 5.427** | 5.783** | -11.068*** | -9.706*** |
| | (2.62) | (2.63) | (3.81) | (3.56) |
| Ratio of elderly persons (65 or older) | 0.014*** | 0.014*** | | |
| | (0.00) | (0.00) | | |
| Ratio of owner-occupied households | | | | |
| Ratio of single person households | 0.013*** | 0.011*** | 0.006** | 0.005** |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Ratio of people living in sharing housing | 0.006*** | 0.003 | 0.007** | 0.008*** |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Ratio of people living from birth or more than 20 years | | | -0.008 | -0.004 |
| | | | (0.01) | (0.00) |
| Estimated estate values | -0.295 | 0.046 | -0.107 | -0.043 |
| | (0.25) | (0.19) | (0.15) | (0.12) |
| Missing dummies (Estimated estate values) | 0.120 | -0.260 | -0.098 | -0.100 |
| | (0.27) | (0.23) | (0.15) | (0.15) |
| Ratio of violent offences | | | | |
| Ratio of brutal offences | | | 1.053* | 0.664 |
| | | | (0.61) | (0.52) |
| Ratio of burglary offences | | | | |
| ln (Total number of crimes) | 1.347*** | 0.758*** | 0.993*** | 0.632*** |
| | (0.20) | (0.23) | (0.19) | (0.14) |
| Missing dummies (the number of crimes) | 0.407*** | 0.278*** | 0.280*** | 0.225*** |
| | (0.05) | (0.06) | (0.03) | (0.03) |
| Sample size | 4647 | 4424 | 4647 | 4492 |

Robust standard errors in parenthesis. Municipal fixed effects and land-use district dummies are included in all models. *** $p>0.01$, ** $p>0.05$, * $p>0.1$.

## Table 5 Estimation Results (Poisson) 2

| | [5] | [6] | [7] | [8] |
|---|---|---|---|---|
| | Alone deaths | | Homicides | |
| | | 95% | | 95% |
| Population per capita | 10.076*** | 10.003*** | 4.177* | 3.571 |
| | (2.78) | (2.62) | (2.19) | (2.34) |
| Ratio of elderly persons (65 or older) | 0.022** | 0.021** | 0.020** | 0.018** |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Ratio of owner-occupied households | -0.010 | -0.008 | | |
| | (0.01) | (0.01) | | |
| Ratio of single person households | 0.012* | 0.017*** | 0.015*** | 0.007* |
| | (0.01) | (0.01) | (0.01) | (0.00) |
| Ratio of people living in sharing housing | -0.004 | -0.002 | | |
| | (0.01) | (0.00) | | |
| Ratio of people living from birth or more than 20 years | | | -0.020*** | -0.014*** |
| | | | (0.01) | (0.01) |
| Estimated estate values | 0.544 | 0.278 | 0.169 | 0.299* |
| | (0.33) | (0.32) | (0.12) | (0.16) |
| Missing dummies (Estimated estate values) | -1.522*** | -1.267*** | -0.539** | -0.794*** |
| | (0.40) | (0.40) | (0.23) | (0.26) |
| Ratio of violent offences | | | 3.500*** | 2.889** |
| | | | (1.22) | (1.32) |
| Ratio of brutal offences | 1.525 | 2.745*** | 1.531** | 0.481 |
| | (1.17) | (0.98) | (0.62) | (0.64) |
| Ratio of burglary offences | 1.395* | 0.894 | | |
| | (0.77) | (0.78) | | |
| ln (Total number of crimes) | 1.350*** | 1.291*** | 1.527*** | 0.971*** |
| | (0.31) | (0.33) | (0.26) | (0.26) |
| Missing dummies (the number of crimes) | 0.383*** | 0.324*** | 0.383*** | 0.306*** |
| | (0.09) | (0.09) | (0.06) | (0.05) |
| Sample size | 4647 | 4604 | 4648 | 4517 |

Robust standard errors in parenthesis. Municipal fixed effects and land-use district dummies are included in all models. *** $p > 0.01$, ** $p > 0.05$, * $p > 0.1$.

**Table 6 Estimation Results (Poisson) 3**

| | [9] | [10] | [11] | [12] |
|---|---|---|---|---|
| | Fire deaths | | Accidental deaths | |
| | | 95% | | 95% |
| Population per capita | | | -17.423*** | -15.784** |
| | | | (6.27) | (6.65) |
| Ratio of elderly persons (65 or older) | 0.012* | 0.005 | -0.012 | -0.007 |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Ratio of owner-occupied households | | | 0.007** | 0.006* |
| | | | (0.00) | (0.00) |
| Ratio of single person households | 0.009* | 0.006 | 0.011** | 0.009 |
| | (0.00) | (0.00) | (0.00) | (0.01) |
| Ratio of people living in sharing housing | -0.004 | -0.005* | 0.017*** | 0.011*** |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Ratio of people living from birth or more than 20 years | | | | |
| Estimated estate values | -0.104 | -0.246 | 0.624*** | 0.502* |
| | (0.16) | (0.18) | (0.24) | (0.27) |
| Missing dummies (Estimated estate values) | -0.337** | -0.249 | -0.483* | -0.523* |
| | (0.15) | (0.19) | (0.29) | (0.29) |
| Ratio of violent offences | 2.456* | -2.122 | | |
| | (1.40) | (3.15) | | |
| Ratio of brutal offences | | | | |
| Ratio of burglary offences | | | | |
| ln (Total number of crimes) | 0.980*** | 0.775*** | 0.912*** | 0.663** |
| | (0.24) | (0.19) | (0.29) | (0.32) |
| Missing dummies (the number of crimes) | 0.310*** | 0.258*** | 0.357*** | 0.285*** |
| | (0.04) | (0.05) | (0.06) | (0.07) |
| Sample size | 4647 | 4545 | 4647 | 4578 |

Robust standard errors in parenthesis. Municipal fixed effects and land-use district dummies are included in all models. *** $p>0.01$, ** $p>0.05$, * $p>0.1$.

## Table 7 Estimation Results (Poisson) 4

| | [13] | [14] |
|---|---|---|
| | Any incidents | |
| | | 95% |
| Population per capita | | |
| Ratio of elderly persons (65 or older) | 0.010*** | 0.006** |
| | (0.00) | (0.00) |
| Ratio of owner-occupied households | | |
| Ratio of single person households | 0.010*** | 0.010*** |
| | (0.00) | (0.00) |
| Ratio of people living in sharing housing | 0.003* | 0.004*** |
| | (0.00) | (0.00) |
| Ratio of people living from birth or more than 20 years | -0.008* | -0.001 |
| | (0.00) | (0.00) |
| Estimated estate values | -0.044 | -0.076 |
| | (0.12) | (0.10) |
| Missing dummies (Estimated estate values) | -0.212* | -0.185* |
| | (0.12) | (0.11) |
| Ratio of violent offences | 1.349 | 0.698 |
| | (0.86) | (0.80) |
| Ratio of brutal offences | 0.497 | 0.604* |
| | (0.39) | (0.34) |
| Ratio of burglary offences | | |
| ln (Total number of crimes) | 1.132*** | 0.885*** |
| | (0.17) | (0.12) |
| Missing dummies (the number of crimes) | 0.334*** | 0.287*** |
| | (0.03) | (0.03) |
| Sample size | 4647 | 4497 |

Robust standard errors in parenthesis. Municipal fixed effects and land-use district dummies are included in all models. *** p >0.01, ** p >0.05, * p>0.1

## 4. Discussion

Our analysis indicates that the occurrence of discoveries, suicides, homicides, accidental deaths, and fire-related fatalities is related to various regional factors. Initially, discoveries and deaths occurring in solitude exhibit a positive correlation with population density per capita, whereas suicides, homicides, and accidental deaths exhibit a negative correlation. These findings can be interpreted as follows: In areas with higher population densities, the likelihood of discovering a corpse or an unattended death within a property is greater. Conversely, the occurrence of homicides, crimes, and suicides is less probable in densely populated areas due to increased community surveillance. Furthermore, our study reveals a positive correlation between the proportion of elderly individuals and deaths occurring in solitude as well as fire-related fatalities. This observation aligns with the fact that both deaths occurring in solitude and the frequency of fires are relatively higher among the elderly population in Japan.

Additionally, we observe a relationship between the proportion of single-person households and the occurrence of all incidents. This association can be interpreted as follows: The discovery of a corpse implies that a deceased individual is found within a property for various reasons. Single individuals are more likely to find themselves in such circumstances compared to those living with family or other household members. Furthermore, the positive correlation with homicides suggests that single-person households may have a relatively higher likelihood of being involved in such incidents. Moreover, in terms of the positive correlation with fire-related fatalities and accidental deaths, it is plausible that single-person households have a higher probability of being unaware of fire safety measures and other accident prevention practices, potentially leading to fatal outcomes. Additionally, single-person households may be more inclined to reside in rental accommodations and may exhibit a greater susceptibility to psychological defects.

Regarding the proportion of individuals residing in shared housing, we observe significant positive relationships with discoveries, suicides, and accidental deaths. In shared housing arrangements such as apartments, there is a relatively higher likelihood of neighbors discovering a corpse when incidents occur. The association between the proportion of individuals residing in shared housing and suicides suggests that prospective buyers or renters of shared housing, such as apartments, may exhibit a heightened interest in incidents of suicide and accidental deaths.

In terms of the proportion of individuals who have lived in the area since birth or for more than 20 years, this variable reflects the extent to which the population consists of long-term residents. Therefore, the negative relationship between the occurrence of homicides and this variable can be interpreted as indicating that committing a homicide becomes more challenging in areas where people have established strong social bonds and mutual care. Another plausible interpretation is that areas with a low influx of new residents may exhibit less interest in stigmatized properties.

Finally, we observe that the crime rate is positively correlated with all incidents. There are

a couple of possible interpretations for this finding. One possible explanation is that regions with higher crime rates tend to have an overall higher level of risk and social challenges, making them more prone to incidents related to public safety and well-being. Another plausible interpretation is that regions with higher crime rates may attract more attention from the public and media, leading to a greater likelihood of incidents being noticed and reported.

## 5. Conclusion

This study represents the pioneering effort to analyze the characteristics of areas where psychologically impaired properties are situated (i.e., areas likely to be registered) based on data sourced from Oshimaland.com, an external platform dedicated to the posting of various incidents. This website has been established in 2005 to collect and show the information on stigmatized properties in Japan and have allowed public posting by public from 2011. As of June 2023, there have been approximately 79,000 postings in Japan.

Utilizing 8,798 posting registered as of April 2017 in Tokyo, we described the preferences for stigmatized properties in Japan. We find that the postings can be classified into following categories: suicide, fire death, homicide, alone death, discovery of a corps, accidental death, psychological defects, and other incidents. One difference between this study and existing literature is that we include alone deaths and discovery of a corps, which may reflect the growing social concern surrounding alone deaths and the increasing trend in the suicide rate.

Our analysis reveals distinct patterns in the timing of incident postings. Specifically, we observe that over 60% of suicide, fire death, and accidental death incidents are posted within 30 days of their occurrence, while the percentages for suicide and alone death incidents are slightly lower, at less than 50%. Of particular significance is the timing of fire death incident postings, with a staggering 90% of them being posted within just three days of the occurrence. On the other hand, postings related to alone deaths tend to be delayed, with the majority of them being made at least seven days after the incident. The discrepancy in posting timing can be attributed to the challenges in detecting certain types of incidents. Homicides and fire deaths can be covered in the media, on the other hand, alone deaths may go unnoticed by the broader community and are possibly known only to the deceased person's family or welfare personnel. In fact, a comparison with corresponding governmental statistics reveals that the ratio of the number of postings to the reported number of incidents tends to be higher for homicides and fire deaths, while the opposite is true for alone deaths. (See the Appendix D).

In summary, we find that public has certain extent of interest for in-house deaths since they post as “psychological defects” even they do not know the detail. Among various incidents, they have relatively higher interest on the occurrence of suicides, homicides, fire deaths, accidental deaths, alone deaths, discovery of a corps, and other incidents. The ease of being posting varies among incidents, however, even incidents that are difficult to detect, such as an alone death, are gradually posted. These

results indicate that it is essential to reveal and incorporate the potential impact of stigmatized properties on property prices and transactions. Moreover, a discovery of a corps can be treated as a stigmatized property in future study.

We also investigated the correlation between the occurrence of each incident and various socio-economic characteristics. Firstly, we find that population density per capita is positively correlated with the occurrence of alone death and discovery of a corps, while negatively correlated with that of suicides, homicides, and accidental deaths. Secondly, we observe a relationship between the proportion of single-person households and the occurrence of all incidents. Thirdly, the proportion of individuals residing in shared housing has positive relationships with discoveries, suicides, and accidental deaths. Fourthly, the ratio of elderly person has positive and significant relationships on discoveries, alone deaths, homicides, and fire deaths. Fifthly, we find that the crime rate is positively correlated with all incidents we targeted.

These results indicate that which region has higher likelihood of the occurrence of incidents. Notably, the ratio of single-person household, the ratio of elderly persons, and the ratio of people living in sharing housing are related to several incidents. On the other hand, it is not likely to occur in a region with higher ratio of people living longer time. The ratio of owner-occupied household may be also not related to the occurrence since this variable is dropped for almost models in the stepwise procedure. If we interpret these results reflect their preferences, it may imply that single-household or person living in sharing housing have higher interest, while the people live in their own houses or longer time in a region have lower interest. However, it would be counterintuitive not to consider the occurrence of incidents, security, and safety when choosing a place to live for an extended period or when making a significant investment such as buying a house.

Finally, this study encounters the following considerations. Firstly, the analysis solely encompasses data up to 2017 within the Tokyo metropolitan area. It is plausible that disparate trends may manifest in regions beyond central Tokyo. Therefore, future investigations should encompass these regions for comparative purposes. Secondly, it is imperative to explore actual transactional sites to gauge the extent to which the "Oshimaland.com" data employed in this study influences real estate transactions in practice.

Acknowledgement

In carrying out this research, valuable data was provided by the administrator of Oshimaland.com. The research is also supported by the Japan Housing Research Institute, Seijo University, and JSPS Grants-in-Aid for Scientific Research JP19K13697 and JSPS Grants-in-Aid for Scientific Research JP22K13401.

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Appendix A

A1. Oshimaland (https://www.oshimaland.co.jp/)

This appendix succinctly elucidates Oshimaland.com, a publicly accessible website dedicated to aggregating and divulging information pertaining to stigmatized properties in Japan. The inception of this website dates back to 2005, with the inclusion of public-provided information commencing in 2011. As of June 2023, the website boasts an excess of 79,000 postings Figure A1 presented below encapsulates a snapshot of the homepage of Oshimaland.com. Each fire mark symbolizes an incident-related posting. Evident from the figure, a majority of the registered stigmatized properties are situated in Tokyo (33,511) and Osaka (16,747). Notably, approximately half of the registered stigmatized properties are concentrated in Tokyo.

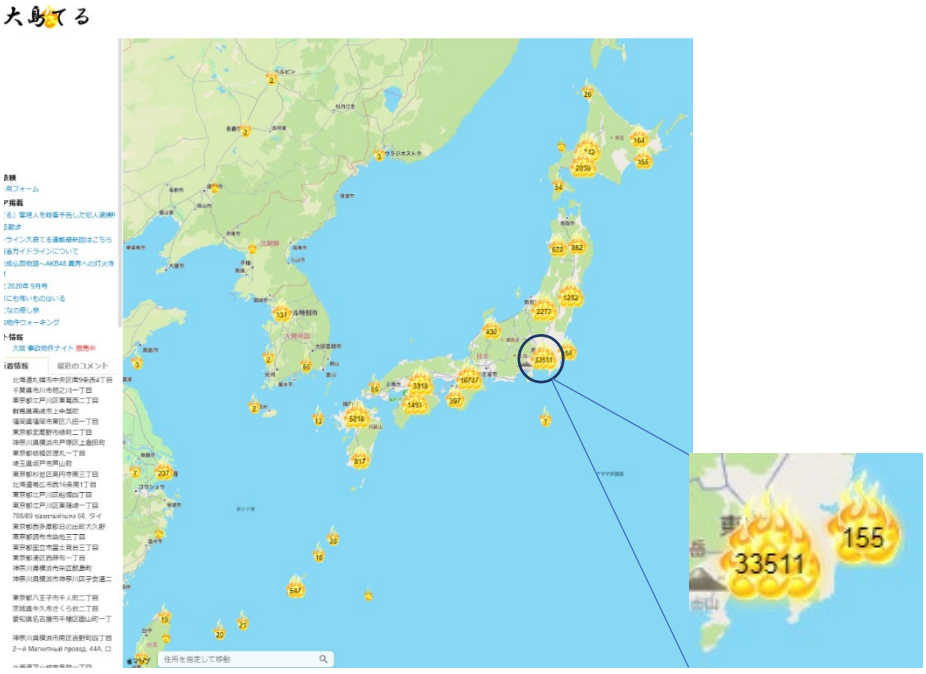


**Figure A 1 The top-page of Oshimaland.com**

Subsequently, we delineate the procedure for submitting information. Enlarge the aforementioned map and designate a specific point (representing the location of the property to be registered), prompting the emergence of a screen akin to Figure A2 depicted below. At this juncture, the address corresponding to the designated point is automatically ascertained and exhibited on the left-hand side of the screen (concealed region as per the author's discretion). We possess the capability to input comprehensive details pertaining to the incident, including the date of occurrence, as well as intricate address particulars, such as the appellation of the apartment, to the best of our knowledge. Should the identified address prove inaccurate (and upon discernment of such an error), it can be

overwritten..

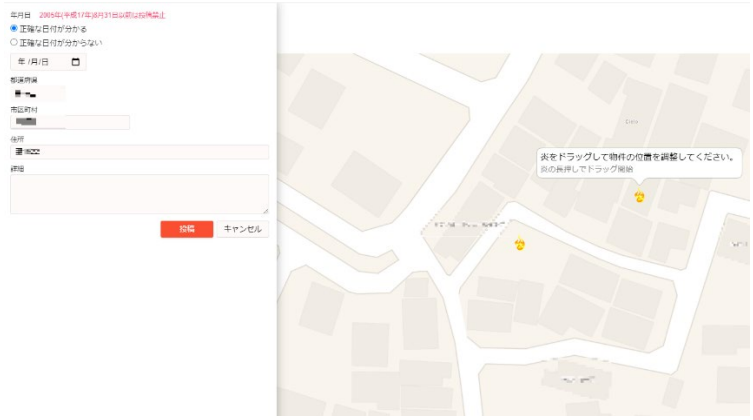


**Figure A 2 A window to post the information.**

Figure A3 illustrates an exemplar of the posted information (blurred region by the author). By selecting a fire symbol, visitors to the site are afforded unrestricted access to the information associated with the respective property. Furthermore, should any inaccuracies be identified within the registered information (as deemed appropriate), or if supplementary details are deemed necessary, they can be appended in the form of a "comment" (Figure A3, lower left). As exemplified in this instance, comments expressing reservations regarding the veracity or substantiation of the registered information may be included, enabling site visitors to make a comprehensive assessment based on this input. The operators and personnel of Oshimaland.com diligently verify the authenticity of the posted information on a case-by-case basis. In instances where the information is determined to be unfounded or false, it will be expunged accordingly.


**Figure A 3 An example of posted information.**

Appendix B The data cleansing processes.

In the appendix, we provide a detailed explanation of the data cleansing process employed in this study. The raw data obtained from Oshimaland.com in 2017 consisted of user-submitted information on stigmatized properties in free-text format. To utilize this data for analysis, it was necessary to cleanse and structure the information. We divided the data cleansing process into three parts: the date of the incident, the address of the incident, and the type of incidents.

(1) The date of incidents.

The date of incidents was recorded in various formats by users. Commonly, individuals indicated the day, month, and year of the incident using either Japanese Era or Western notation. Some entries contained more ambiguous information such as "M/YYYY ~ M/YYYY," "around YYYY," or "Spring/YYYY." Initially, we created a variable to capture cases where the day, month, and year of the incident were discernible. Subsequently, we created several additional variables to account for these ambiguous cases. For the purpose of this study, we primarily utilized the specific day, month, and year information and omitted further description.

(2) The address of incidents.

Regarding the address of incidents, the following cleansing steps were undertaken. Since the raw data from Oshimaland.com did not include longitude and latitude coordinates for each incident, we utilized the geocoding service provided by the Center for Special Information Science at the University of Tokyo as the first step. Subsequently, we employed ArcGIS to plot the location of each incident and merge it with other socio-economic information.

While we successfully obtained the longitude and latitude of each stigmatized property, we encountered instances where building names, stairs, and room numbers were not separated. Using Stata, we divided them into three variables: building name, stair, and room number. However, despite this division, a few cases remained unresolved. Consequently, we manually identified and rectified such instances by collaborating with research assistants.

(3) The type of incident.

Regarding the categorization of incidents, we utilized keywords in Japanese to classify the posts into different types of stigmatized properties using Stata. We have provided a summarized translation of the corresponding keywords for each stigmatized property used in this study. Due to the potential for multiple postings implying the same incident, it was necessary to eliminate duplications for data analysis purposes. Furthermore, manual checks were conducted by research assistants to identify and

correct any duplications or misclassifications of incidents resulting from orthographical variants or other factors.

| Stigmatized properties | Corresponding key words |
|---|---|
| *Suicide* | Suicide, Jumping, Hanging, Double suicide |
| *Fire death* | Death by fire, Death by arson |
| *Homicide* | Murder, Stabbing to death, Shooting to death, Strangulation to death, Knocking to death, Violent death, Abuse death, Death by injury, Death by drowning, Hit-and-run accident causing personal injury, Vehicular manslaughter, Stabbing |
| *Alone death* | Alone death |
| *Discovery* | Discovery, Discovered, Mummy, Corpse (of a person), Skeleton corpse, Dumping a corpse |
| *Accidental death* | Accidental death, Crushing death, Fall, Drowning, Traffic accident, Underlying, Death by overworks, Trapped, Explosion, Electrocution, Caught in between, Death by poisoning, Starvation, Suffocation, Freezing, Lightning, Heatstroke, Snowfall, Food poisoning, Snowbound, Hit by a car |
| *Psychological defects* | Unnatural death, Stigmatized properties |
| *Other incidents* | Ghost, Natural death, Death due to illness, Noise, etc. |

Appendix C Estimation of estate values.

In Japan, it was not possible to merge the public transaction data with our data due to limitations in the public database, which only provided information on the sub-region where the transaction took place. To address potential bias related to the located environment of stigmatized properties, we made efforts to estimate and control for the real estate value of sub-regions through the following procedure. Utilizing transaction data from June 2020 in Tokyo obtained from the Real Estate Transaction-price Search, provided by the Ministry of Land, Infrastructure, Transport and Tourism, we conducted an estimation of the hedonic price function outlined below.

$$\ln(Price_{it}) = \boldsymbol{X_{it}\beta} + \boldsymbol{\gamma RegionalDummies_i} + \varepsilon_{it} \quad \cdots \text{(C1)}$$

where i denotes an estate, t denotes the transacted year-month from 2006 to 2019.

We briefly explain the variables. The dependent variable is the log of $Price_i$ which is a transaction price per floor. $\boldsymbol{X_i}$ is a vector of control variable to indicate the characteristic of transacted unit. We include the floor space, the floor level of the transacted unit, the number of floor levels of its building, the distance to the closest station from its building, the year when the building was completed, and total number of units in the building. Moreover, we included the quadratic term of these variables. We also included indicators whether a building was reformed and new buildings, the direction of the road in front of its building, building structure, and land use district. These variables are expected to control the effects of attributes of transacted unit and its building on transaction price.

$\boldsymbol{RegionalDummies_j}$ is a vector of indictor for each of subregions. We stored the coefficients of them from the estimation.

In addition to them, we include both yearly and monthly dummies. They capture the time-specific unobserved shock in each transacted year-month. $\varepsilon_{it}$ is the error term.

| | (1) | (2) |
|---|---|---|
| | ln (Price) | |
| | coef | se |
| Floor level | 0.00754 | (0.000452) |
| Total number of floor space | -0.00107 | (0.000703) |
| Distance to the closest station | -6.40e-05 | (6.18e-06) |
| Building year | -0.0395 | (0.000322) |
| Floor space | 1.65e-06 | (6.38e-07) |
| Total number of units | -1.35e-05 | (2.05e-05) |
| Floor level^2 | -6.87e-05 | (1.22e-05) |
| Total number of floor space^2 | -1.28e-06 | (1.35e-05) |
| Distance to the closest station^2 | 3.89e-09 | (7.06e-10) |
| Building year^2 | 0.000391 | (6.93e-06) |
| Floor space^2 | -0 | (0) |

| | | |
|---|---|---|
| Total number of units^2 | 2.75e-08 | (8.76e-09) |
| New building | 0.0824 | (0.00367) |
| Reformed building | 0.123 | (0.00243) |
| N | 117,319 | |
| R^2 | 0.685 | |

The variables are not shown in the Table include the land use dummies, building structure dummies, yearly dummies, and monthly dummies. The constant is also not shown. Standard errors in parentheses.

Appendix D Comparison between the official statistics and Oshimaland.com[9]

In this appendix, we compare the number of posted stigmatized properties to the corresponding official statistics for *suicide*, *fire deaths*, *homicide*, and *alone death*. The availability of official statistics allows us to assess the accuracy and coverage of the postings on Oshimaland.com.

For *suicide*, we utilize the Vital Statistics data from the Ministry of Health, Labour, and Welfare. We calculate the total number of suicides that occurred in houses or high buildings in Tokyo. We note that this statistic is available from 2009. Figure B 1 presents the trend of reported suicides in houses or high buildings according to the vital statistics, along with the posted number of suicides on Oshimaland.com from 2000 to 2015. Notably, Oshimaland.com started accepting posts from the public in June 2011, so we distinguish the periods before and after that date. The reported number of suicides ranges from 500 to 600 during this period, while the number of posted suicides on the website increases over time. In 2015, 170 suicides were posted on Oshimaland.com, accounting for approximately 30% of the total reported suicides. This suggests that newer incidents are more likely to be posted on the website, indicating its growing popularity and increased visibility of recent events.

Regarding *fire deaths*, we rely on the fire statistics provided by the Fire and Disaster Management Agency in Japan. Although the statistics include the total number of building fires, it only reports the overall number of fire deaths. To estimate the number of fire deaths, we multiply the total number of fire deaths by the ratio of the number of building fires to the total number of fires. Figure B 2 displays the number of estimated fire deaths and posted fire deaths from 2000 to 2015. The estimated fire deaths have remained around 100 per year since 2010. In contrast, the number of posted fire deaths ranges between 60 and 80 each year, indicating that it covers a significant percentage of the actual fire deaths that occurred. Furthermore, most of the fire deaths reported on the website were registered by the administrators by June 2011, with very few cases posted prior to the website's launch in 2005. This suggests that fire deaths are more easily detected and that people's memories and attention to such incidents tend to fade over time.

For *homicides*, we use the Crime Statistics by the National Policy Agency in Japan. Figure B 3 illustrates the trend of reported and posted homicides in Tokyo from 2000 to 2015. The number of reported homicides has been decreasing over time, reaching almost 100 cases. In contrast, the number of posted homicides has been increasing and ranging between 40 and 60 after 2005. As the official statistic may include homicides that occurred outside of houses, the ratio of posted homicides to reported homicides is very high. This indicates that homicides are more easily detected or remembered by the public compared to other incidents.

For *alone death*, we refer to the Statistics on deaths of single-person households at home residences handled by the Tokyo Metropolitan Medical Examiner's Office. This statistic covers the number of in-deaths in single-households, specifically alone deaths in Tokyo. Figure B 2 displays

[9] This appendix is mainly based on Yajima and Sadayuki (2022).

the trend of reported and posted alone deaths from 2003 to 2015. We observe a gradual increase in reported alone deaths over time, ranging between 3,000 and 5,000 since 2013. The number of posted alone deaths has also been increasing; however, the ratio to the official statistic is approximately 1% in 2015. This suggests that detecting cases of alone deaths by the public is more challenging compared to other incidents.

These comparisons between posted stigmatized properties and official statistics provide insights into the coverage and characteristics of the data collected on Oshimaland.com. As of homicides and fire deaths, we can treat the posted information as an actual distribution of the incidents. On the other hands, regarding suicides and alone deaths, the posting data may be skewed toward areas where those incidents are more likely to be uncovered.

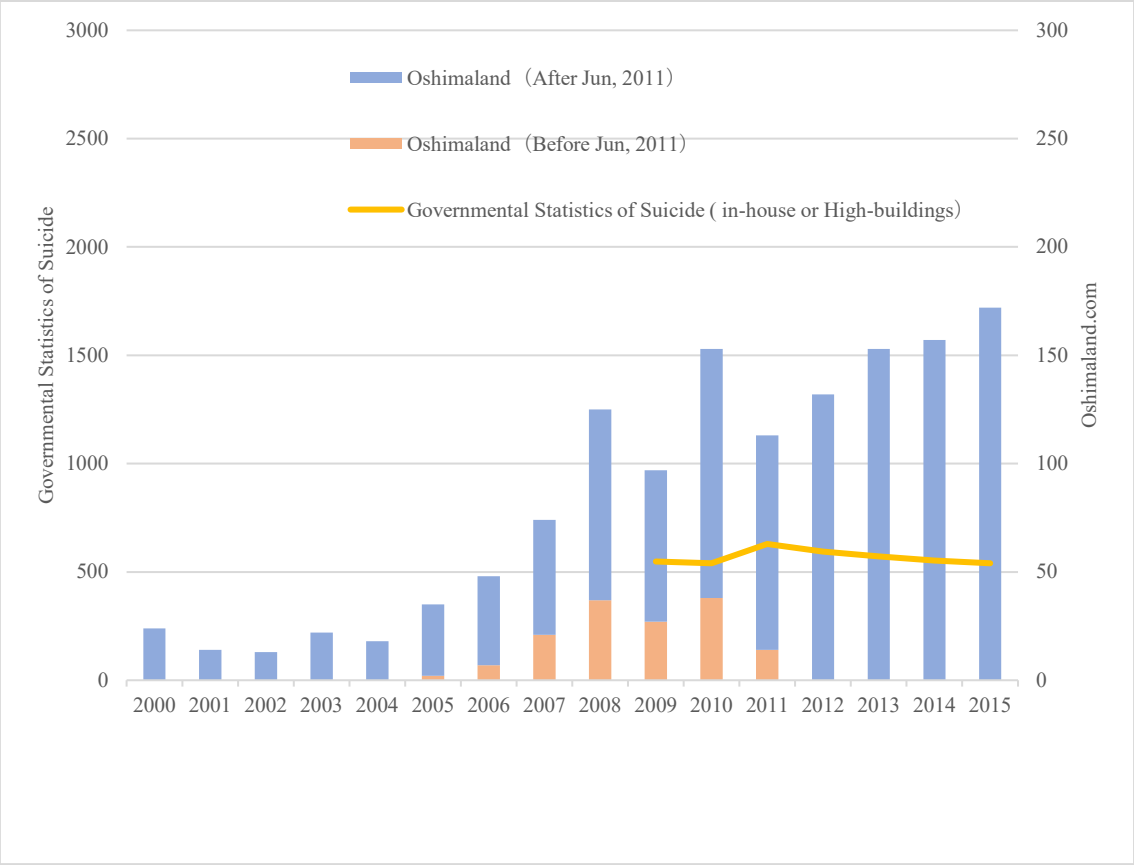


**Figure D 1 A comparison of the posted number of suicides on Oshimaland.com to the corresponding official statistics.**

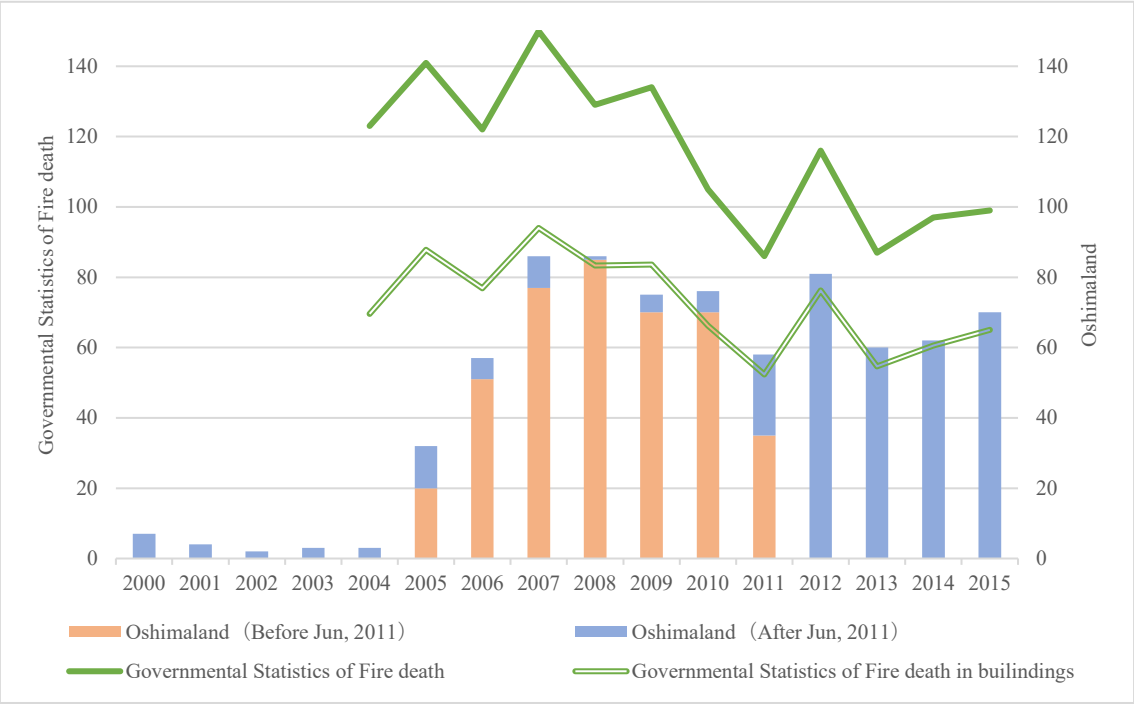


**Figure D 2 A comparison of the posted number of fire deaths on Oshimaland.com to the corresponding official statistics.**

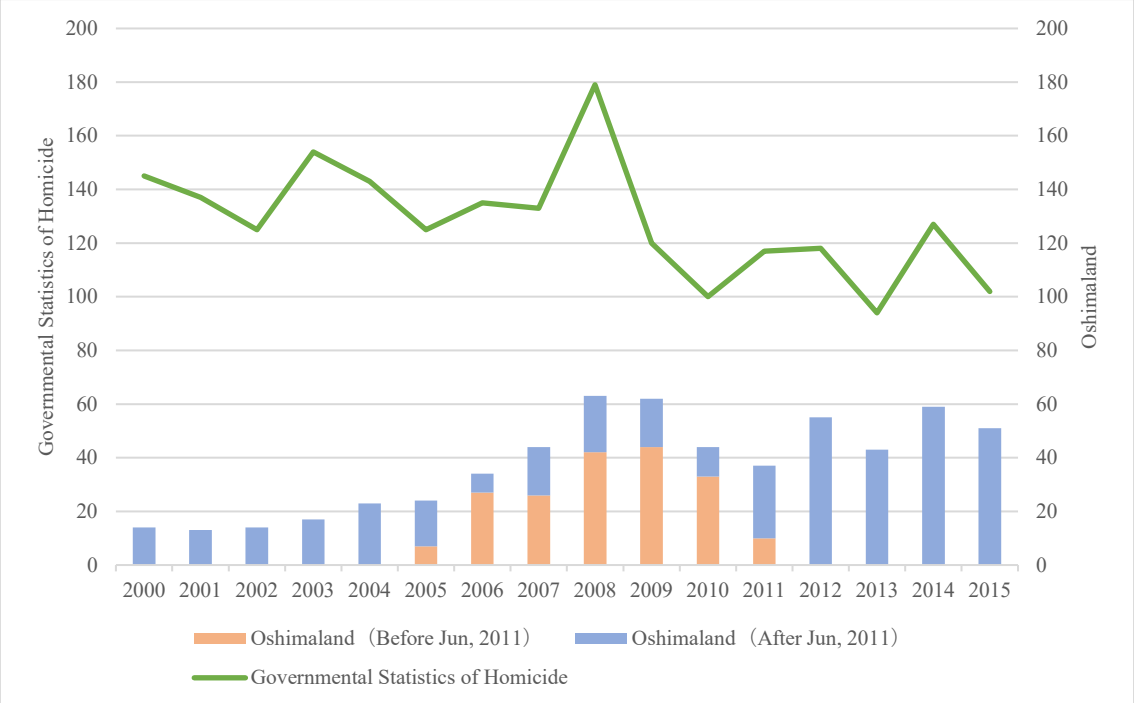


**Figure D 3 A comparison of the posted number of homicides on Oshimaland.com to the corresponding official statistics.**

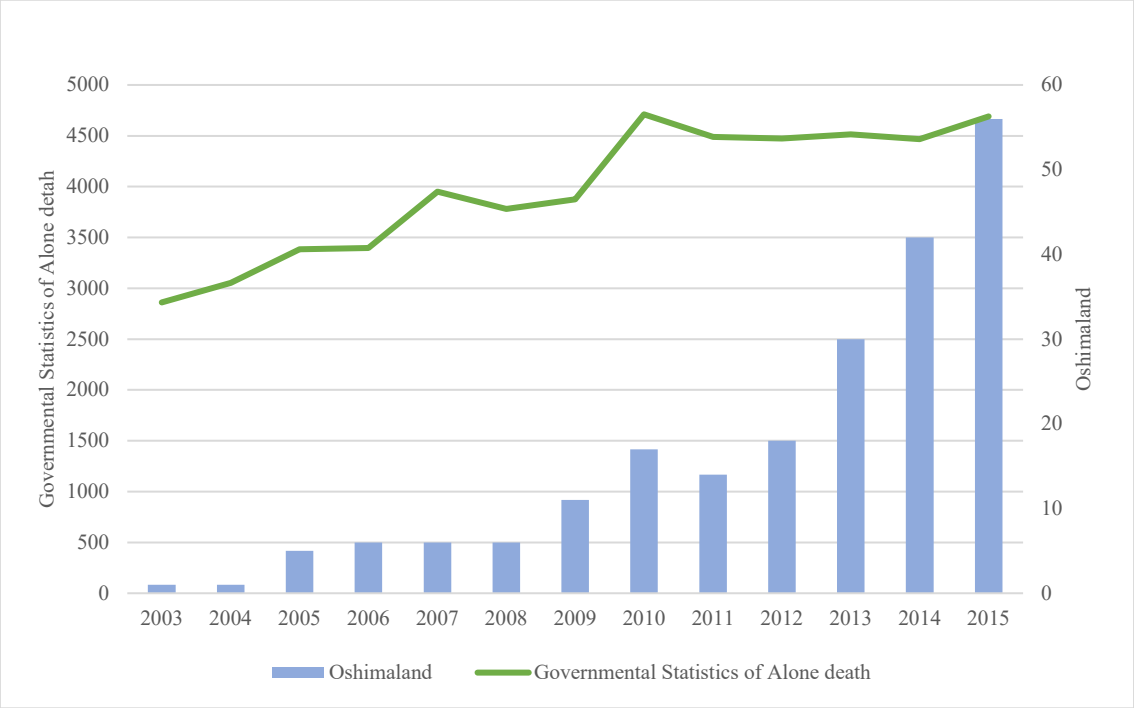


**Figure D 4 A comparison of the posted number of alone deaths on Oshimaland.com to the corresponding official statistics.**