What's Sauce for the Goose is Sauce for the Gander? Evidence for Near Repeat Victimization Theory in Astana and Almaty

Abstract

This study focuses on the phenomenon of near repeat victimization in the cities of Astana and Almaty. In order to understand the mechanisms underlying this phenomenon and identify its characteristics in the context of two different metropolitan areas in Kazakhstan, we analyze contemporary crime data and academic research. We hypothesize that factors such as the geographical distribution of crime and the effectiveness of policing interventions may have a significant impact on the frequency and nature of repeat crime in these cities. The results of our study will allow us to better understand the nature of this phenomenon and offer recommendations for improving measures to prevent the near repetition of victimization in Astana and Almaty.

1. Introduction

According to a common expression, "the criminal always returns to the scene of crime." In parts of the criminological literature, this phrase has been interpreted more broadly. What if the perpetrator returns to the place to commit a new crime? Or, what if another offender returns to the same place?

According to research, certain types of criminal incidents (e.g., theft or robbery) give rise to others in the neighborhood and can spread like an infection to nearby areas (Halterlein, 2021). One of the best-known crime prediction algorithms, PredPol (Egbert & Krasmann, 2019), works on the basis of this observation. The developers of this system were inspired by the statistical methods used in studies of earthquake cascades, where a shock in one place within a certain period of time generates new shocks nearby.

In criminology, this approach to crime analysis is called *near repeat victimization theory*. This is the idea that in certain situations, after a robbery, for example, we can expect a similar incident to occur close to that location within a certain period of time (usually up to three to seven days). According to the plan of the Concept of Public Security of the Republic of Kazakhstan for 2024–2028, the development of criminological analytics and the introduction of crime forecasting approaches are important elements in ensuring the safety of the citizens of Kazakhstan. President Kasym-Jomart Tokayev also emphasized security and crime prevention in his statements (On approval of the Concept for Public Safety in Partnership with the Community for 2024-2028).

However, the simple transfer of theory to the realities of Kazakhstan may not justify the expectations. For example, the PredPol mentioned above, which showed high quality of work in the first years of its existence, is increasingly recognized as an ineffective method even by police departments in the United States. Thus, it becomes important not just to use international experience at any cost but, first of all, to understand the necessity of this step in the realities of large cities in the Republic (Puente, 2019).

In this study, I attempt to assess in what contexts and on what scale the theory of near-repeat victimization is applicable to the two largest metropolitan areas of the Republic of Kazakhstan: Astana and Almaty. In this research framework, I will focus on the study of various groups of crimes, but in the context of their spatial and temporal characteristics. The task is to show the scope and applicability of the theory of repeat victimization in the megacities of Kazakhstan. To the best of our knowledge, this approach is being applied for the first time not only in Kazakhstan but also in the neighboring countries of the post-Soviet space.

2. Literature review

2.1. Importance of space and time

Numerous previous studies have found that crime events tend to cluster in space and time (Chainey et al., 2018; Johnson et al., 2007). Understanding and qualitatively applying the influence of time and space in criminological research is complex, as the context of the crime point is different everywhere. For example, it is impossible to say that the crime patterns in Astana and Almaty will be the same even if they are in the same country, so it is important to clearly understand all facets of spatial criminology. To a large extent, the clustering effect is influenced by the spatial characteristics of the crime, while time only comes as an add-on parameter (Tita & Radil, 2010). Theories in spatial criminology can be categorized into three directions: theories of community social control, which emphasize how the community's emerging characteristics have an impact on local crime rates; theories of criminal opportunity, which concentrate on features that affect where crimes occur in space; and theories that try to explain how geographic factors influence what drives people to commit crimes (Hipp & Williams, 2020). The community control theory contends that cohesion for a variety of reasons (racial, economic, etc.) deters crime in the neighborhood, so it is crucial to take both the crime's spot and the offender's home location into consideration when conducting a criminal investigation (Hipp & Williams, 2020). Although the idea of a neighborhood in spatial criminology is hazy and hard to define, its significance in research is crucial when examining the causes of crime. The integration of the concept of neighborhood leads to a term like "neighborhood effect", in which there is a division of a city into several neighborhoods according to their characteristics, mainly the standard of living (Tita & Radil, 2010). Therefore, during the clustering of the space, it leads to the addition of other subfeatures, such as divisions based on race, unemployment rate, and standard of living. Researchers confirm that high crime rates are more influenced by two socially similar neighborhoods that are far apart than those that are socially different but adjacent (Tita &

Radil, 2010). That is, the second case in Figure 1 has a greater impact on the scale of crime than the first case. In addition, Tita and Radil (2010) state that the scale of crime will be more intensified if two socially similar, especially poor or minority in the case of race characteristics, neighborhoods are located adjacent to each other (Case 3). The neighborhood as a unit of space, however, is unsuitable for research since it may be partitioned into too small or too big portions (Hipp & Williams, 2020); in addition, it is crucial to include the community's social heterogeneity and homogeneity characteristics.

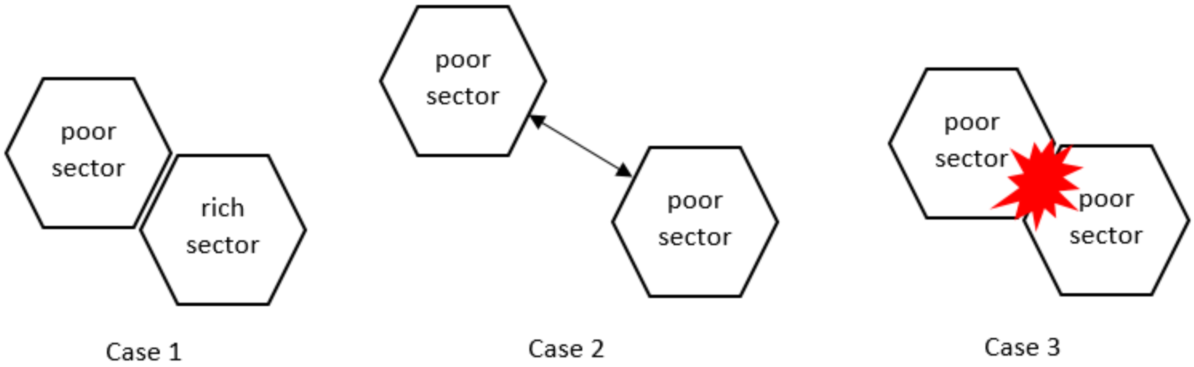

Figure 1. Spatial and social proximation of neighborhoods

The selection of space itself to analyze is one of the challenges in spatial criminology. The concept of place in criminology can be viewed in two forms: as a physical location and as a context (Tita & Radil, 2010). This division leads to the initial three directions of spatial criminology, specifically criminal opportunity theory, which examines the reasons for the choice of location as a crime. In the case of the form of the physical location, it is important to answer the question "How did the location help the crime to occur?" and in the case of the context "Why did it happen here?". That is, the physical location is studied more at the micro-level, while the context is studied at the meso/macro-levels (Hipp & Williams, 2020). However, there may be slight uncertainties in determining the form and level. For example, a market (bazaar) may be considered as both a physical location and context because it is easy to steal in a market due to the huge mass of people, but it may also be because there is a high turnover of money, i.e., criminals know that something is definitely there. Having the proper level of aggregation is crucial since such uncertainties are perplexing (Tita & Radil, 2010).

A significant proportion of all crimes are influenced not only by the very presence of the perpetrator as a physical being but also by the ideal time and space for the crime, as the target of the crime must be in convenient conditions for the perpetrator to be motivated; this is known as the rational choice perspective (Johnson et al., 2007). The motivation of the criminal is studied at the macro level; further, the micro level of crime is the space itself. Johnson et al. (2007) argue that when motivated to commit a crime, the offender increases the frequency of occurrence at the target location, thereby learning the setting and simulating the principle of routine activity, ostensibly a familiar environment for the offender. Subsequently, the setting explored makes it easy for the offender to navigate in this space and commit multiple crimes, leading to the confirmation of the Near Repeat Victimization Theory (Johnson et al., 2007).

2.2. Implementation of near repeat victimization theory in other contexts

Having understood the importance of the space and time of the crime, it is possible to begin to analyze the various methods that have been used previously to confirm or deny the Near Repeat Victimization Theory. To begin with, it is important to distinguish the difference between near repeat and repeat victimization. Repeat victimization is a repeated incident involving the same place or victim but without clustering over time and space, whereas near repeat victimization is a clustering of crime over time and space, i.e., a series of crimes occurring close to each other and over a short time (Farrell & Pease, 2017). Near repeats and repeats form hot spots and the concentration of hot spots causes high-intensive crime areas (Farrell & Pease, 2017).

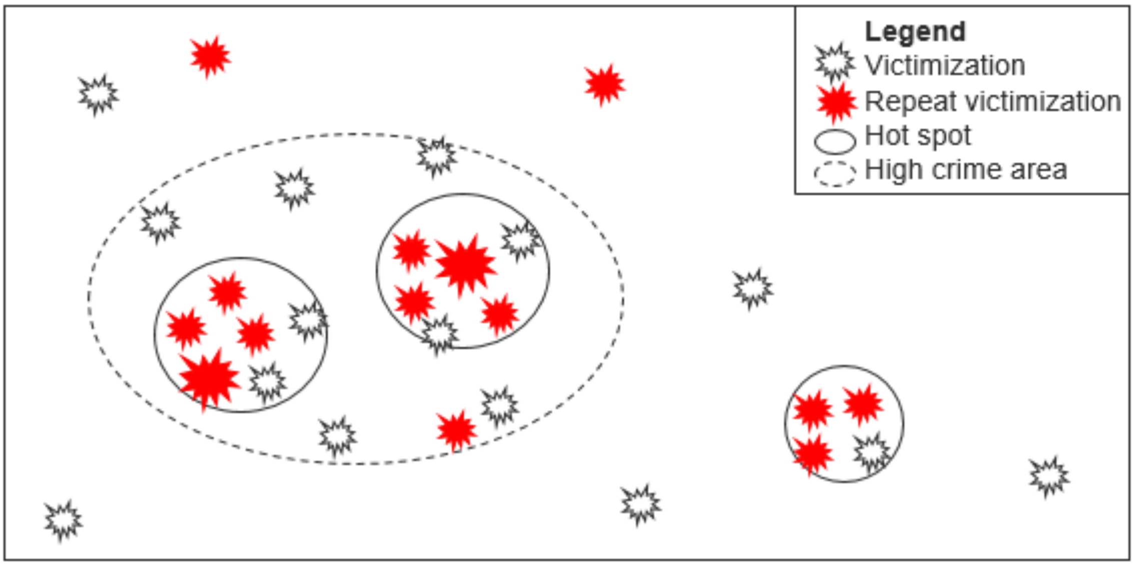

Figure 2. Hot spots and high crime areas (adapted from Farrell & Pease, 2017)

Concentrations of hot spots and consequently high crime neighborhoods appear due to two concepts: *flag* and *boost* (Farrell & Pease, 2017). The *flag* hypothesis suggests that the attractiveness of a target point attracts further crime by creating hotspots, while *boost* argues that the presence of crime in a space accelerates the occurrence of further crime (Haberman & Ratcliffe, 2012; Farrel & Pease, 2017). These two concepts are correlated with each other; however, *flagged* evidence must occur before *boosted*; that is, *boosted* is event dependent (Grove et al., 2012). In the logic of *boost*, the criminal is not seen as existing in a "vacuum" but as part of a certain community, within which information is also disseminated about which area of the city is the most favorable for doing business (Glasner et al., 2018). For example, a burglar will know what he or she left behind or what he can rob next time. In addition, this is because it is more important for criminals to save time and energy to commit a crime in an explored location, no matter the crime type and location, taking all the risks, than to look for a new location and target (Johnson et al., 2009).

One of the most popular methods of confirming or refuting the theory of near repeat victimization is the Knox test. Knox studied the spread of leukemia in children and showed that the disease spreads with certain spatial and temporal characteristics (Knox & Bartlett, 1964). Nowadays, based on this method, special "near repeat calculators" are even created, which give an analyst the spatial and temporal spread of a phenomenon. The Knox test's methodology is justified by the evidence that there are more observed occurrences than expected events (Johnson et al., 2007). The Knox method operates with two categories of events: observed and expected. Observables are the number of pairs between crime X1 and all subsequent crimes (let's call them X2 and X3) in a given space and time interval. For example, within one day after X1, crimes X2 and X3 occurred within a radius of 100 meters. Then we form two pairs: X1-X2 and X1-X3. Taking other intervals of time and space will result in a different number of pairs. Thereby, each n-th event creates 0,5 * n * (n-1) pairings for it (e.g. for 4 events, there are 6 pairings as in Figure 3). Hence, this leads to the Knox ratio, whose formula is R = (observed results)/(expected results), which results later are distributed through the contagion table (Knox table) (Johnson et al., 2009).

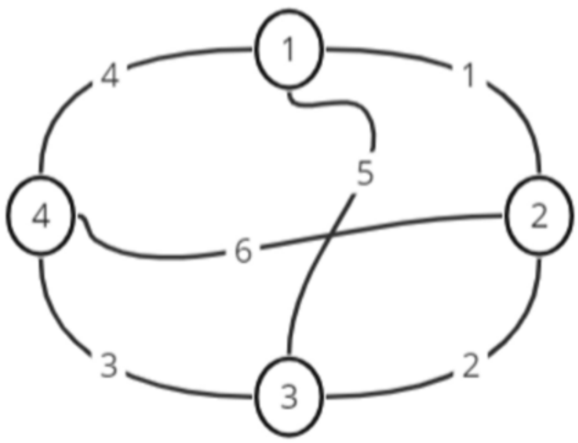

Figure 3. Illustration of the maximum number of pairs between events

		Time				
		3 d	6 d	9 d	12 d	15 d
	0-100 m	x	x	x	x	x
	100-200 m	x	x	x	x	x
Space	200-300 m	x	x	x	x	x
	300-400 m	x	x	x	x	x
	>400 m	x	x	x	x	x

Table 1. Knox table

Table 1 illustrates the Knox table, where the thresholds for space and time vary. Johnson et al. (2009) analyzed crime patterns using space-time clustering in Bournemouth through the Knox test and Monte Carlo simulation, thereby concluding that the Near Repeat Victimization Theory works better in the context of burglary than theft from motor vehicles (Tables 2 and 3). The Monte Carlo method allows for the simulation of a sample population computationally, thereby accurately determining the validity of the sample rather than leaving uncertainties in doubt. Results from tables 2 and 3 show that the Knox ratio of thefts in Bournemouth within the same spot and 14 days is approximately two times higher than the thefts from motor vehicles.

		Time				
	Thefts	14 d	28 d	42 d	56 d	70 d
	Same	4,00	1,50	2,00	1,67	0,83
	0-100 m	1,63	1,24	1,22	0,87	1,07
Space	101-200 m	1,26	1,17	1,23	1,01	1,04
	201-300 m	1,14	1,04	1,11	0,99	1,01
	301-400 m	1,11	1,08	1,16	1,01	1,02

Table 2. Results of thefts under Monte Carlo simulation (adapted from Johnson et al., 2009)

		Time				
	TFMV	14 d	28 d	42 d	56 d	70 d
	Same	2,22	1,05	1,38	1,00	1,00
	0-100 m	1,74	0,87	0,95	0,90	0,92
Space	101-200 m	1,46	0,91	1,07	0,91	0,98
	201-300 m	1,22	0,93	1,11	0,91	1,00
	301-400 m	1,21	0,90	1,05	0,93	1,07

Table 3. Results of TFMV under Monte Carlo simulation (adapted from Johnson et al., 2009)

Townsley et al. (2003) explained the patterns of data distribution in the Knox table as follows (Figure 4, dark cells where ratio is significantly greater than 1): The first case suggests confirmation of the Near Repeat Victimization Theory; the second case suggests that crime is concentrated in one place regardless of time, indicating a hot spot; the third case is explained as a series of incidents in which space has no meaning (e.g., a series of riots in a city during a large-scale revolt).

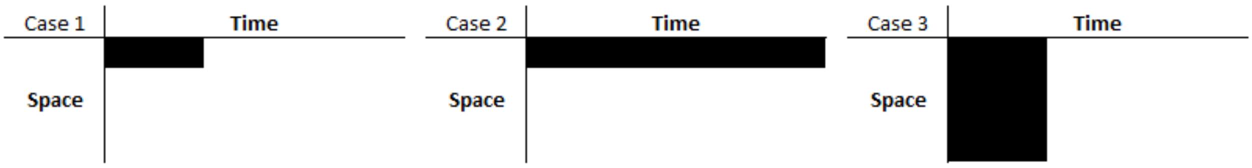

Figure 4. Evaluation of the results of the Knox test (adapted from Townsley et al., 2003)

The Knox test is tied to all Near Repeat Victimization Theory analysis methods because it is a fundamental kind of space and time clustering. It is necessary to ascertain the methodology and logic to confirm or deny the theory before applying the Knox test. Glasner et al. (2018) conducted a large-scale analysis of all thefts from 2013 to 2016 in Vienna, Austria, comparing two methodologies: *heuristic*, where each event finds a pair for itself at the scale of the buffer zone; and *near repeat chain*, where an event finds a pair for itself in the same buffer zone and a subsequent event finds another pair, thus creating a chain (Figure 5). By simulating five different time intervals (1, 3, 5, 7, 9 days) and five distances (100, 300, 500, 700, 900 meters), Glasner et al. (2018) proved that both methods are almost equally effective, but the near repeat chain performed better than the heuristic in all intervals in the scores of accuracy index, although the authors initially assumed that the heuristic method would be more effective due to the ease of application.

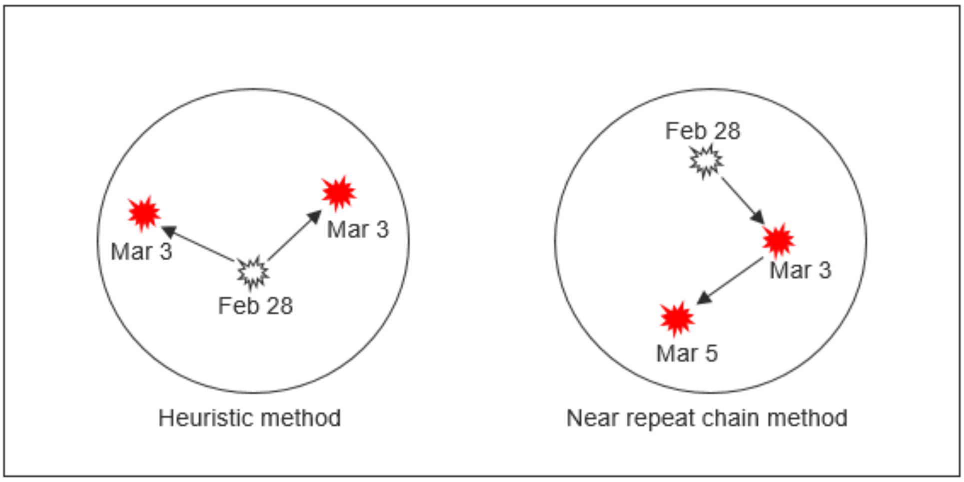

Figure 5. Heuristic method vs Near repeat chain method. Burglaries within 3 days and 300 m (adapted from Glasner et al., 2018)

However, the repeat chain method has a number of drawbacks and uncertainties. One of these uncertainties is chain termination (Haberman & Ratcliffe, 2012), where it is argued that the chain of evidence is usually broken after the second event or that it is complex to find the next one. For instance, it is not possible to find a proximate consequential event after March 3, as shown in Figure 5 (near repeat chain method). For the record, not only the methods are flawed, but also the clustering algorithm, as in the Knox test. Townsley et al. (2003) argue that the Knox method has limitations such as edge effects and arbitrary cut-offs. For example, when dividing space and time into different bandwidths, it is difficult to determine why such intervals are chosen, which can lead to biased results.

A predictive model that is correctly constructed helps to build qualitative preventive plans to reduce crime. One such example is the Kirkholt Burglary Prevention Project applied in Rochdale, United Kingdom, in which, following near repeat predictivity, improved security measures were implemented, thereby reducing repeat victimization by 80 percent and neighborhood crime by 53 percent (Glasner et al., 2018). Preventive models have long been used in US cities. For example, in the 1990s, a year-long experiment with double reinforcement in 110 hot spots in Minneapolis showed that within eight months, the number of crime-related calls decreased by a factor of 3 to 4 in both the target and control groups (Weisburd & Braga, 2019). In addition, Glasner et al. (2018) argue that the allocation of police resources to hot spots has no effect on shifting crime to neighborhoods.

2.3. Theoretical framework

This capstone project will focus on mainstream criminological theories, social disorganization theory, and routine active theory as fundamental concepts, which will help to understand the reasons and impacts behind crimes. Mainstream criminological theories are a mix of mainly three theories: anomie-strain theory, which states that the criminal being an 'outcast' of society will try to achieve fame through crime; differential association theory emphasizes that the behavior of the criminal is derived from the interactions with others, especially other criminals; control theory, on the other hand, argues that social ties (e.g., family) help prevent crime, thus controlling the behavior of the criminal (Lilly et al., 2018). The theories of social disorganization and routine activity are relevant to mainstream criminological theories but can still be considered separate theories for Near Repeat Victimization. Social disorganization theory examines the relationship between the characteristics of space and crime, whereas routine activity theory is explained by three factors: a motivated offender, a suitable target, and the lack of adequate security, i.e., the conditions under which it is convenient for the offender to commit crime (Andresen, 2010). That is, further research will not only analyze crime patterns and test the Near Repeat

Victimization hypothesis but will also try to explain the causes behind crime using these theories.

3. Methodology

3.1. Data description

Data for the research were taken from the Crime Map portal of the Committee on Legal Statistics and Special Records of the General Prosecutor's Office of the Republic of Kazakhstan (General Prosecutor's Office, 2024). The map displays the points of each crime in the Republic with basic information about the incident (Appendix 1): article, severity, time of commission, time of registration, type of place of commission (e.g., private house, shopping center, or entrance). The map reflects information from the Unified Register of Pre-Trial Investigations from the first half of the 2010s and is updated daily. This imposes some limitations on analysis, as the register contains only initiated criminal cases, which, for various reasons, may not exhaustively describe the criminogenic situation in the territory. More comprehensively, there could be geolocated points of incident reports by emergency numbers, but there are limitations to such data. Data on all crimes that occurred in 2023 was used. This period was chosen due to the absence of external and internal shocks occurring in 2020 and 2022, which may have had an effect on the specificity of the distribution of crime in the urban area.

The dataset used for 2023 contains 152,296 criminal incidents. For a correct description, based on the literature, we have identified three groups of crimes that are expected to have a spatial specification. The first of them is theft (Articles 187, 188 of the Criminal Code of the Republic of Kazakhstan). In the total dataset, we find 66,076 crimes and misdemeanors accounted for thefts of varying degrees of severity (i.e., 43%). In Astana, there are 9,057 thefts (14% of all such cases in the country), and in Almaty, there are 14,007 (21%, respectively). Theft by a large margin is the most common crime in the country.

The second and third groups of interest are violent crime on the one hand and robbery on the other. However, there was a problem that the crimes in each of these groups were not sufficient for statistical analysis. For this reason, it was decided to combine these categories for research purposes. Realizing that robbery and violent crime are conventionally considered crimes against property, we focus on the violent aspect of these crimes and treat them in a broad sense (i.e., not always expressed physically). Thus, hereinafter in the text, we refer to violent crimes as incidents classified under Articles 99, 101, 102, 102, 104, 104, 106, 107, 110, 111, 114, 191, and 192 of the Criminal Code of the Republic of Kazakhstan. In the dataset, we record 9671 crimes under these articles (6% of all incidents for 2023). In Astana, 880 cases fall under these offenses (9% of all violent incidents in the country), and in Almaty, 1,366 (14%, respectively).

The prepared data are divided by two cities: Astana (9,076 incidents) and Almaty (11,804 incidents). However, at this stage, we encountered one limitation. As we wrote above, certain types of spaces have the property of "attracting" or "generating" crime (Farrell & Pease, 2017). These include bars, train stations, shopping centers, and so on. In these places, the theory we are testing will be more likely to work due to the fact that there are relatively few such locations in the city. Therefore, in addition to testing all cases in the category (theft or violence), we also analyze three samples of crime location types that may not themselves be crime hotspots: street spaces, private sector, and apartment spaces. These categories were derived by combining the more private types of spaces represented in the crime map data of the General Prosecutor's Office of the Republic of Kazakhstan (Appendix 2).

In the case of thefts, we analyze all three samples; in the case of violent incidents, we analyze one sample. The categories of private living spaces and apartment buildings were combined for two reasons. First, these types contained insufficient data for statistical analysis. Second, in our opinion, it is important to study the recurrence of violent crime in the context of a residential space or, conversely, a street space. In this sense, the type of living quarters does not seem to be as significant for the analysis.

3.2. Analysis strategy

The main method of operation is the Knox test (Johnson et al., 2007). However, before the use of the test, spatial and time intervals for the summary table (in meters and days, respectively) should be established. Currently, there are no strict rules stipulating the number and format of ranges for the test. We used two benchmarks for the establishment. The first was Chainey's (2021) textbook, in which he suggests working with no more than five ranges and breaking them down by 100 m (i.e., 100, 200, 300 m, etc.). The second is Steenbeek's (2020) manual, which suggests adding intervals "longer than N meters" and "longer than T days." This will help to obtain more conservative results, in which a small number of closely spaced "hot spots" will not distort the overall result.

As a result, the following space ranges were selected: up to 5 meters, 100, 250, 500, 700, and greater than 700 meters. The time ranges are: up to 24 hours, 3, 5, 7, 14, 21 days, and more than 21 days. As a result, for example, assuming a time range of 3 days and a spatial range of 700 meters, a buffer zone with a radius of 700 meters is created for each crime within 3 days. The presence of other incidents within this zone and period is then analyzed. The R and Python programming languages were used to analyze the data. R and its frameworks, such as SF (simple features), process spatial data faster and help to visualize it with ease, while Python was used to write the Knox test function.

4. Results

Table 4 shows the results for the full sample of all theft incidents. In both cities, most of the cells that are distant in terms of space and time have a Knox ratio equal to 1. This indicates that, within most of the intervals, the observed frequency is close to the expected frequency. However, in the remaining cases, I observe different results. In Astana, the number of new crimes after already-committed crimes is 4.7 times higher than expected values in the case of the nearest future—one day and 0–5 m. However, even as the range increases, we see an increased number of events, although their number is much less pronounced, and the increase ranges from 1.2 to 1.9 times over the range of up to 100 m and two weeks from the crime. In Almaty, we see similar dynamics in all respects, although the increase in the number of closest new crimes is slightly higher at 5.7 times.

	0-5 м.	5-100 м.	100-250 м.	250-500 м.	500-700 м.	700-∞ м.
до 1 дня	4.7	1.9	1.2	1.1	1.1	1
1-3 дня	1.4	1.2	1	1.1	1	1
3-7 дней	1.6	1.2	1	1	1	1
7-14 дней	1.4	1.2	1	1	1	1
14-21 дней	1.3	1.1	1	1	1	1
21-∞ дней	0.9	1	1	1	1	1

p-value: <0.01 0.05 0.1

	0-5 м.	5-100 м.	100-250 м.	250-500 м.	500-700 м.	700-∞ м.
до 1 дня	5.7	1.9	1.4	1.2	1	1
1-3 дня	1.8	1.2	1.1	1	1	1
3-7 дней	1.4	1.2	1.1	1	1	1
7-14 дней	1.3	1.1	1	1	1	1
14-21 дней	1.2	1.1	1	1	1	1
21-∞ дней	0.9	1	1	1	1	1

p-value: <0.01 0.05 0.1

Table 4. All thefts in Astana (9,057 incidents, left) and Almaty (14,007 incidents, right)

	0-5 м.	5-100 м.	100-250 м.	250-500 м.	500-700 м.	700-∞ м.
до 1 дня	12.4	3.6	1.9	1.6	1.3	1
1-3 дня	2.2	1.3	1.2	1.4	1.2	1
3-7 дней	2	0.8	0.9	1.1	1	1
7-14 дней	1.9	1	1	1	1	1
14-21 дней	1	1.3	1	1.1	1.1	1
21-∞ дней	0.9	1	1	1	1	1

p-value: <0.01 0.05 0.1

	0-5 м.	5-100 м.	100-250 м.	250-500 м.	500-700 м.	700-∞ м.
до 1 дня	32	3.6	2.8	1.3	1	1
1-3 дня	2	1.2	1.4	1	1.1	1
3-7 дней	1.1	1.5	1.2	1.1	1	1
7-14 дней	1.4	1.4	1	1	1	1
14-21 дней	1.2	1.6	1.2	1	1.1	1
21-∞ дней	0.8	0.9	1	1	1	1

p-value: <0.01 0.05 0.1

Table 5. Thefts in apartments and private sectors in Astana (1,984 incidents, left) and Almaty (3,206 incidents, right)

	0-5 м.	5-100 м.	100-250 м.	250-500 м.	500-700 м.	700-∞ м.
до 1 дня	12.8	4.2	0	1.8	0.8	1
1-3 дня	1.9	0	0.8	1.2	1.1	1
3-7 дней	1.8	1.1	0.8	1.2	1	1
7-14 дней	1.9	0.6	0.9	1.1	0.9	1
14-21 дней	1.3	0.8	1	1.2	1.1	1
21-∞ дней	0.9	1	1	1	1	1

p-value: <0.01 0.05 0.1

	0-5 м.	5-100 м.	100-250 м.	250-500 м.	500-700 м.	700-∞ м.
до 1 дня	17	2.1	2.2	1.8	1.3	1
1-3 дня	1.9	1.6	1.1	1.2	1	1
3-7 дней	1.2	1.3	1.1	1	1	1
7-14 дней	1.5	1	1	1.1	1.1	1
14-21 дней	1.2	1.2	1.1	1	1.1	1
21-∞ дней	0.9	1	1	1	1	1

p-value: <0.01 0.05 0.1

Table 6. Thefts in streets in Astana (881 incidents, left) and Almaty (2,165 incidents, right)

Turning to more specific types of theft (Tables 5 and 6), it is worth saying that in the case of Astana, such incidents in residential spaces have a statistically significant chance of being close to the next on two axes: either within one day and up to 500 m from the event, or very close to the incident within 14 days. Street thefts are clustered only spatially but not temporally, meaning the concentration of crimes in one place, in other words a hotspot (Townsley et al., 2003). In Almaty, we observe more complex distributions. Thus, we find significance and a 2 or 3-fold increase in the Knox coefficient within one day after the crime and 250 m. We find weaker but also significant effects at the same spatial distance up to two weeks after the event. However, it is worth noting that the number of thefts in the sample that occurred in this way is already less significant and does not exceed 7%.

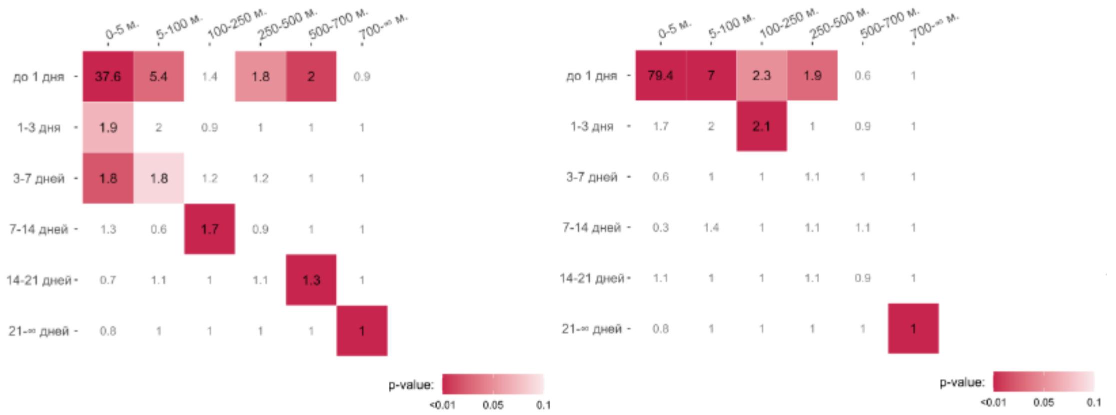

Table 7. All violent crimes in Astana (880 incidents, left) and Almaty (1,366 incidents, right)

According to criteria for defining "violent crimes," we find 880 incidents in Astana and 1,366 crimes in Almaty. Thus, in the absolute majority of cases, we see a sharp increase in the Knox coefficient at the maximum available proximity in terms of space and time. However, this effect is rarely extended to other cells. Perhaps the only exception with a more pronounced effect we can see is in the case of all violent crimes in Astana. For this sample, we observe an increase in the number of actual crimes by more than 1.8 times at cells up to 100 m and 7 days compared to the expected ones. However, in terms of the relative number of new crimes, this is also not an outstanding result, since except for the cell with the closest spatial and temporal distance, we are talking about at most 2% of all such cases.

A detailed analysis of the results may raise valid concerns due to the quality of the data used, as in all samples the vast majority of repeat incidents occur, in fact, on the same day and at the same point as the previous crime. This result can be explained by the specifics of committing such crimes. The work of Glasner et al. (2018) noted the same phenomenon, which is explained by so-called "cascades" of criminal acts—situations when a certain location becomes convenient for committing crimes in a short period of time, which are used by different offenders. Furthermore, a vast majority of incidents can be related to routine active theory, which is explained by three factors: a motivated offender, a suitable target, and the lack of adequate security, i.e., the conditions under which it is convenient for the offender to commit crime (Andresen, 2010). In addition, we still do not rule out the disadvantages of the Knox test because it has limitations such as edge effects and arbitrary cut-offs, as stated by Townsley et al. (2003). That is, it may be that the time and space intervals were chosen incorrectly, which can affect the final result.

5. Conclusion

According to the plan of the Concept on the Public Safety of the Republic of Kazakhstan for 2024–2028, the development of criminological analytics and the introduction of crime forecasting approaches are important elements in ensuring the safety of the country's citizens. One of the best-known ways to predict new crimes in space is the so-called near repeat victimization theory. Its intuition can be reduced to the well-known expression, "The criminal always returns to the scene of the crime." However, in contrast to this common expression, the theory states that after one crime has been committed, the risk that a new incident will occur nearby in the near future increases. At the same time, the simple transfer and application of such theories to crime prevention in Kazakhstani reality may not have the expected effect without prior analysis. The reverse strategy, with in-depth research at the beginning, can lead to the development of more effective measures to prevent illegal behavior, which will ultimately lead to a reduction in crime and increased confidence in law enforcement. In the quantitative research, using crime point data for 2023 from the Unified Register of Pre-Trial Investigations of the General Prosecutor's Office of the Republic of

Kazakhstan, the research aims to show the limits of applicability of the theory of near repeat victimization on the example of theft and violent crime in Astana and Almaty.

Main results:

- In the cities studied, there is confirmation of the near repeat victimization theory, but predominantly for theft. Violent crime has much less pronounced clustering in time and space. Also, the effect found is more pronounced in the case of Almaty than Astana;
- The greatest effect of near repeat victimization in the case of theft is for distances of up to 100 m and three days since the previous crime. In this interval, the actual number of incidents is higher than expected by a factor of one and a half to 32 times (depending on the type of space where the crime was committed);
- The most pronounced effect of near repeat is expected for shopping centers, stores, and a number of public buildings. In addition, we observe it at some locations in the private sector on the outskirts of Almaty;
- These results need to be clarified, as a significant part of the effect may be due to the specifics of filling out the Unified Register of Pre-Trial Investigations by grassroots police officers.

In line with these results, this study makes the following recommendations to improve the quality of the results: (i) Conducting a controlled field experiment in Almaty to evaluate crime prevention policies based on the theory of a near repeat victimization approach. Based on the results, a specific program can be developed for the most effective implementation of preventive measures in the city. (ii) Conducting an audit of the practice of completing the Unified Register of Pre-Trial Investigations in the police departments of Astana and Almaty.

Such work will allow for a more balanced assessment of the applicability not only of the near repeat victimization theory but also of other spatial criminology approaches.

6. References

Andresen, M.A. (2010). The place of environmental criminology within criminological thought. In M.A. Andresen, P.J. Brantingham, & J.B. Kinney (Eds.), Classics in Environmental Criminology. Co-published: Burnaby, BC, SFU Publications and Boca Raton, FL, Taylor & Francis, 5 - 28.

Chainey, S. P., Curtis-Ham, S. J., Evans, R. M., & Burns, G. J. (2018). Examining the extent to which repeat and near repeat patterns can prevent crime. Policing: An International Journal.

Chainey, S. (2021). Understanding crime: Analyzing the geography of crime.

Egbert, S., & Krasmann, S. (2019). Predictive policing: not yet, but soon preemptive?. Policing and society.

Farrell, G., & Pease, K. (2017). Preventing repeat and near repeat crime concentrations. In Handbook of crime prevention and community safety (pp. 143-156). Routledge.

Glasner, P., Johnson, S. D., & Leitner, M. (2018). A comparative analysis to forecast apartment burglaries in Vienna, Austria, based on repeat and near repeat victimization. Crime Science, 7, 1-13.

Grove, L. E., Farrell, G., Farrington, D. P., & Johnson, S. D. (2012). Preventing repeat victimization: A systematic review. Brottsförebyggande rådet/The Swedish National Council for Crime Prevention.

Haberman, C. P., & Ratcliffe, J. H. (2012). The predictive policing challenges of near repeat armed street robberies. Policing: a journal of policy and practice, 6(2), 151-166.

Halterlein, J. (2021). Epistemologies of predictive policing: Mathematical social science, social physics and machine learning. Big Data & Society, 8(1)

Hipp, J. R., & Williams, S. A. (2020). Advances in Spatial Criminology: The Spatial Scale of Crime. Annual Review of Criminology, 3, 75-95.

Johnson, S. D., Bernasco, W., Bowers, K. J., Elffers, H., Ratcliffe, J., Rengert, G., & Townsley, M. (2007). Space–time patterns of risk: A cross national assessment of residential burglary victimization. Journal of Quantitative Criminology, 23, 201-219.

Johnson, S. D., Summers, L., & Pease, K. (2009). Offender as forager? A direct test of the boost account of victimization. Journal of Quantitative Criminology, 25, 181-200.

Knox, E. G., & Bartlett, M. S. (1964). The detection of space-time interactions. Journal of the Royal Statistical Society. Series C (Applied Statistics), 13(1), 25-30.

Lilly, J. R., Cullen, F. T., & Ball, R. A. (2018). Criminological theory: Context and consequences (7th ed.). SAGE Publications.

Official website of the Committee on Legal Statistics and Special Records of the General Prosecutor's Office of the Republic of Kazakhstan. (2024). Map of criminal offenses. Retrieved from https://qamqor.gov.kz/gis

On approval of the Concept for Public Safety in Partnership with the Community for 2024-2028. Retrieved from https://legalacts.egov.kz/npa/view?id=14555141

Puente M. (2019). LAPD data programs need better oversight to protect public, inspector general concludes. Los Angeles Times

Steenbeek, W. (2020). NearRepeat and the Near Repeat Calculator software: a comparison

Tita, G. E., & Radil, S. M. (2010). Making Space for Theory: The Challenges of Theorizing Space and Place for Spatial Analysis in Criminology. Journal of Quantitative Criminology, 26(4), 467-479.

Townsley, M., Homel, R., & Chaseling, J. (2003). Infectious burglaries. A test of the near repeat hypothesis. British Journal of criminology, 43(3), 615-633.

Weisburd, D., & Braga, A. A. (Eds.). (2019). Police Innovation: Contrasting Perspectives (2nd ed.). Cambridge University Press. Online ISBN: 9781108278423.

7. Appendix

Column Name	**Meaning**	**Example**
UD	Criminal case number	192710030010215
crime_stat	Article in the law	ст.106 ч.2
crime_code	Transformed crime_stat	1060
organ	Law enforcement agency	РУВД Ауэзовского района
crime_date	Actual date of the crime	07.04.2021 22:15
case_initiation_date	Date of the crime record	08.04.2021
hard_code	Severity of crime in figures	3
hard_code_name	Severity of crime in caption	Тяжкое
crime_scene_street	The street of crime	Рыскулова
crime_scene_house_num	The number of the house	57/2
crime_place_name	The place of crime	Улица (площадь)
reg_code	The code of region	192710
city_code	The code of city	1927
org_code	The code of organ	19271003
geometry	The coordinate of crime	POINT (51.2858 51.2621)

Appendix 1. Variables of the dataset

Aggregating category **(author's data)**	**Subcategories** **(data from CPSIS of the General Prosecutor's Office of the Republic of Kazakhstan)**
Street public spaces	park(square), street, street (square), other street, beach
Private (non-commercial) property	from the car interior, garage, personal transport, shed, private yard, private house

	under construction, private yard, including fenced, summer house, house
Apartment buildings and adjacent property	apartment, basement, dormitory, attic, entrance of a residential building, unfenced courtyard of the building (excluding private ones), elevator compartment
Cultural, educational, recreational and GRB facilities	house of culture, museum, night club, theater/cinema, recreation center (sanatorium), hotel, gambling facility, theater, trading house, cafe, restaurant, checkroom
Public goods (indoors)	cafeteria, university, kindergarten (nursery school), educational institution, medical institution, places of religious worship
Commercial facilities	joint-stock company, joint-stock bank, state bank, interstate bank, bank with foreign participation, private bank, cash offices of enterprises and institutions, pawnshop, kiosk, commission store, private store, office, market, pharmacy, joint-stock company, exchange office, communication department
Transportation facilities	bus station, parking lot, highway (highway), gas station, air terminal, airport, car, railway station, marine (river) station, public transport, motor transport, air transport, railway transport, marine transport, river transport, platform, passenger train car vestibule, other mechanized transport, metro station
Production and storage facilities	base, production facilities, industrial premises, industrial premises, warehouse, storage, utility rooms of residential buildings, utility rooms of kitchens
Other objects	other premises, other location, military facilities, barracks, container, forest, woodland, woodlot, pasture, heat tracts, water body, sewage wells, wasteland, ravine, cemetery, river bank, offices, buildings under construction or abandoned, underground utilities
Not specified	-

Appendix 2. Categorization of spaces