Residential and commercial burglaries in New York City

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1 Introduction

This research paper examines the circumstances that are observed for reported burglaries in New York City. The purpose of this research paper is to identify patterns regarding burglaries over the span of twelve years. The main attributes that are looked at in determining the pattern are the date and time the crime occurred. Using date and time as the center of this study other elements are then compared with each other to better formulate a bigger picture based on the discoveries. Age of the victim and suspect are two example of secondary elements that are compared to the date and time of the incident. Location and what type premises were the target of burglary are another aspect that are looked at in relation to time of occurrence.

2 Literature Review

For a location to be a target of burglary four major categories are evaluated by the burglars to assess the location as a potential target or not, these four categories are, familiarity to the location, the occupancy or guardianship of the property, the prospective payout of the location, and the environment [Montoya et al., 2016]. These characteristics would create the perception of the burglars for their target selection, possible higher return from selecting wealthy house [White et al., 2014]. A study done by interviewing convicted burglars from Tehran, Iran-a large metropolitan city- showed that criminals chose properties in more wealthy parts of the city since they believed they would get a higher return [Tabrizi and Madanipour, 2006].

Guardianship is another factor that leads to target choosing by burglars. This concept refers to both elements that present a potential for the crime to be discovered while it's in progress either by the location's residence, staff or by law enforcement present in the area [Tabrizi and Madanipour, 2006]. When selecting targets, burglars choosing a target location try to avoid targets with potential confrontation with residence [Tabrizi and Madanipour, 2006]. Elements that would lead to an increase in surveillance of a location would decrease its chances of being chosen as a burglary location [Langton and Steenbeek, 2017] .

The environment surrounding the target and the structure of the target itself brings in new considerations for target selection. The locations surrounding environment with different levels of concealment, such as bushes, alleys or other vegetation or structures that conceal the burglar activity increases the chances

for selection [Montoya et al., 2016]. Other elements for location itself are target hardening which introduce new challenges for burglars such as locks, security devices [Montoya et al., 2016]. The mentioned elements could be further applied alongside with time of day, specifically daytime or nighttime. Each of the two mentioned times have their own benefits and problems from burglars' point of view. Benefits of targeting locations during nighttime, provides burglars with cover in the darkness [Tabrizi and Madanipour, 2006]. Nighttime also provides an opportunity for burglars to target locations that would be vacant and therefore lack any guardianship [Tabrizi and Madanipour, 2006], Business locations during nighttime could be a potential target since their premises would mostly be empty with employees, since they leave the work site after business hours [Yu and Maxfield, 2014].

3 Data

The data set is provided by City of New York and included NYPD historic data reported to the police including felonies, misdemeanors, and violations from 2006 to 2018. This data set includes information on what time the crime occurred started, what time the crime ended, and when the crime was reported to the police. For each crime there are multiple location variables describing different location attributes related to each crime. Each crime falls into one of the three groups, commercial, residential, or truck, furthermore each observation provides a description of the premise (e.g. Grocery store, residential apartment, or house) and a geo-spatial coordinate for the location of the crime. The coordinates have been shifted to the middle of the street to protect the victim's identity.

The data in this data set are categorical, date/time and numeric. The numeric data are the coordinates for the location. All the variables referring to time or date of the crime are in date/time format. All other variables are categorical, mostly referring to a type of premise.

3.1 Data Cleaning

Since the focus of this paper is on burglaries occurred in New York City, the data was filtered by the type of crime to only include burglaries, not including crimes related to burglary tools. After reviewing the variable for when the time crime started over sixty wrong entries were observed, these entries included dates before 2005 or after 2100. Since the date interval was defined in the data

dictionary, a review of the data showed that the year reported for when the crime stopped or the year the crime was reported, did not fall into the correct interval, it was apparent this was a data entry problem. To fix this issue the year of the observation that was entered wrong was changed to the year the crime was reported finished. However one observation had to be removed (complaint number 907472938), this observation had a year less than the date interval provided but both the crime start and finish time had the same year but the year the crime was reported was more than ten years. Since the original entry data are not provided to cross check to see if the crime was in fact discovered more than a decade later, and was reported to the police, this observation was considered an outlier and was removed. For categorical values that had missing data, the value of 'unknown' was assigned to impute the missing entries. After reviewing victims age group there where a few entries that did not match the provided age group, these included dates or other non-related entries, these entries where transformed to 'unknown'.

3.2 Near repeat

A new variable 'near-rep' was created which had a value of 0 or 1. This variable shows that the crime that was reported was considered a near repeat offense if another reported incident for burglary, for the same property type (residential apartment, construction site etc.) was reported and the crime happened within a two week interval from the current observation and the crime happened within 600 feet of original observation, calculated by the Manhattan distance between locations. For example, if there are two locations A and B and they are within 600 feet from each other. Location A is the origin, if location A is burglarized and within two weeks location B is also burglarized, a value of 1 would be assign to Location A. Later when evaluating Location B , since this location was burglarized within two weeks of a previous burglary it would also be assigned the value of 1. If the observation does not meet both criteria above it would be assigned a value of 0. For This method if the same location is burglarized within the time frame it is still counted as a near repeat burglary. Because of the computational process for calculating the near repeat and the large number of cases for residential locations, only the year 2017 was calculated for such premises.

3.3 Variables

The variables chosen are time and date for start of the crime and when it was finished, when it was reported to the police, description of the location, what borough it occurred, the time of day based on the report (day or night), suspects age and description, victims age, coordinates for the crime location, precinct the crime occurred and if the crime was a near repeat.

4 Hypothesis

The main hypothesis is related to time of incident, and the theory is that residential locations are targeted mostly during daytime during the week while commercial locations are targeted during night. The reasoning behind this hypothesis is the concept of guardianship of the property, which based on findings of [Tabrizi and Madanipour, 2006] burglaries avoid occupied locations. To test this hypothesis, the incidents are analyzed by the time it was recorded the crime took place. The age of the victim is also included in analysis to measure if there are any relations present between time the crime was reported and the age group of the victims.

Second hypothesis is related to near repeat incidents in which when a residential location is targeted there is a higher chance of burglary for nearby locations. This hypothesis is based on the findings of [Groff and Taniguchi, 2019] which states that the possibility of burglary increases when a nearby location is targeted. This hypothesis evaluates if the finding applies to New York City data.

5 Time of day and Burglary

The effects of occupancy for the target selection is a factor for the offender as studied by [Tabrizi and Madanipour, 2006], in which incarcerated offenders where interviewed, it was discovered 68 percent [Tabrizi and Madanipour, 2006] of the offenders did not choose to burglarize an occupied house. The trade-off associated with choosing a target residence during the day and night by the burglar, by comparing the higher chance of being discovered during the day along having a lower chance of confronting an occupied residence against lower chance of being discovered during the night but have a higher chance of entering occupied residence [Coupe and Blake, 2006].

Figure 1: Burglaries based on location type

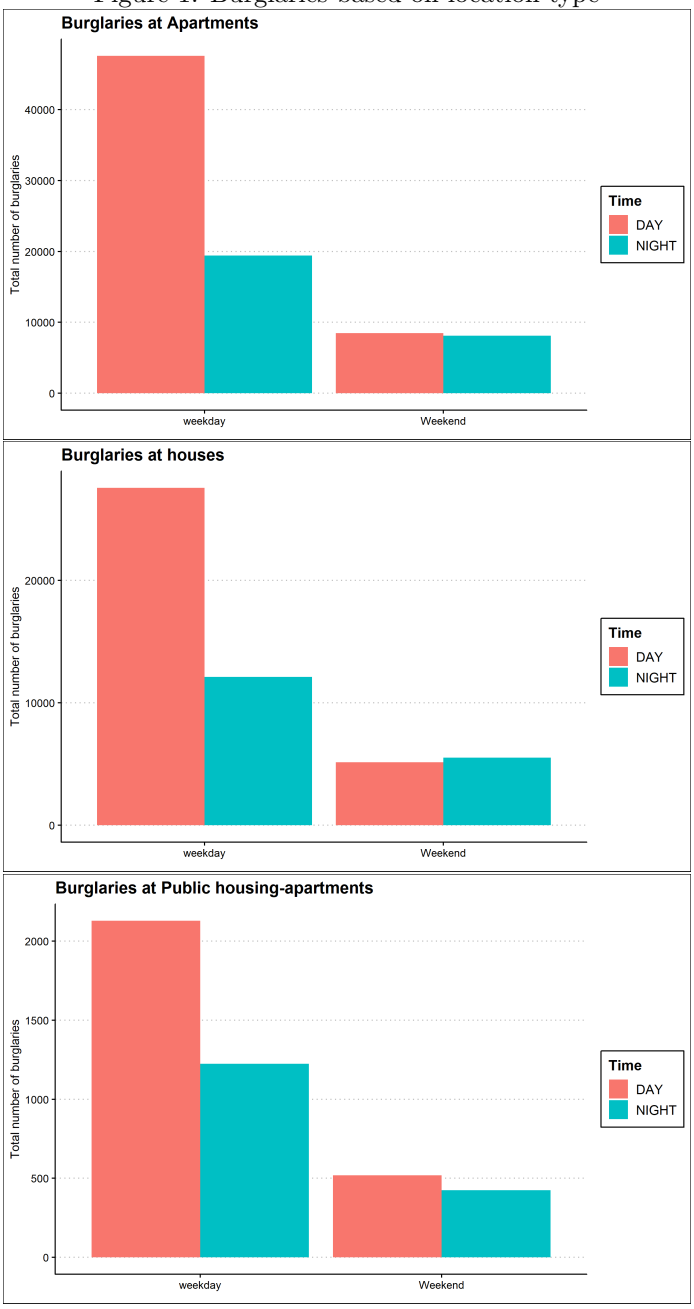


Figure 1 shows the number of burglaries occurred in residential properties, separated into three groups apartments, public housing apartments, and houses.

A common characteristic present in all three categories is the higher number of burglaries happen on weekdays and during daytime. On the weekends there was not a large difference between day and night incidents. Both apartment housing still showed a slight larger incident during the day, but residential houses showed a slight increase in nighttime burglaries.The characteristics of burglaries in New York City, follows closely to the findings of [Coupe and Blake, 2006] in which it points to higher number of daytime burglaries. The daylight vacancy of the premises leads to the property be chosen as a suitable target for burglary, therefore the next graph shows the age of the victim and the time the burglary occurred at their property [Coupe and Blake, 2006].

Figure 2: Victims age and crime time

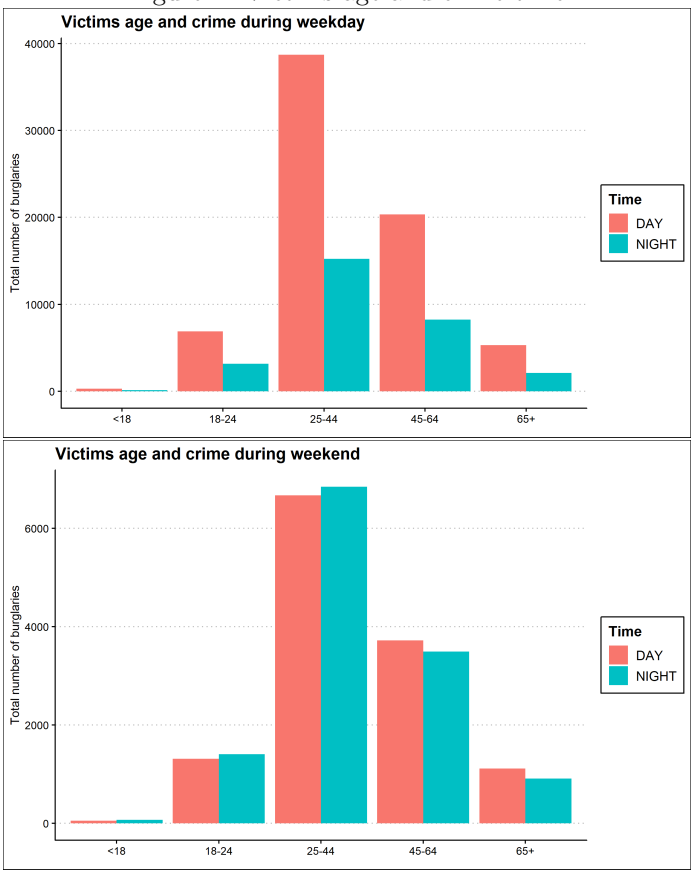


Figure 2 shows the relation between age of the victim and the burglary time between weekdays and weekend. Based on the finding's, individuals between the

age of 25 to 64 were the majority target of burglaries [Coupe and Blake, 2006]. The data does not provide the information in which the burglarized property was occupied during the incident or if it was vacant but based on the victims age information it could be assumed that individuals between 18 to 64 of age are working individuals which have not yet reached the retirement age therefore they were not present during the incident.

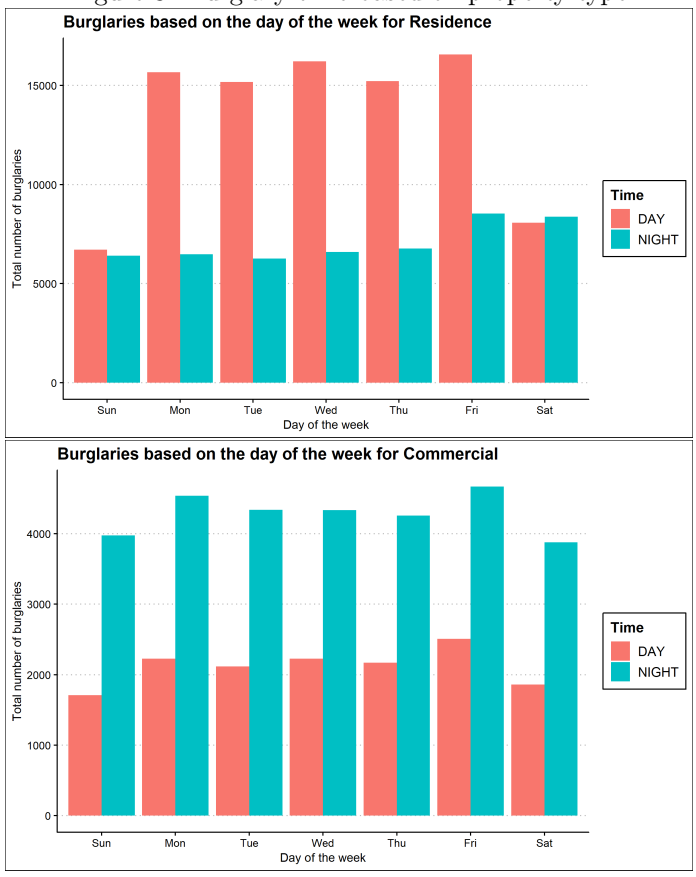
Guardianship is one criteria for target selection [Montoya et al., 2016], based on the number of burglary victims between 18 and 64 the high number of daytime burglaries because of victim's employment and lack of guardianship.

During the weekend the number of daytime and nighttime incidents for each age group were close, the 25 to 44-year age group had a slight increase in nighttime burglaries. The lifestyle choices for the age group of 25 to 64 based on their economic ability to enjoy activities outside of house such as going to restaurant during the weekend [Tabrizi and Madanipour, 2006] creates a vulnerability in guardianship.

The lowest total number of burglaries for individuals older than 18 years old belong to the 65 years and older victims. This group falls under the retired age group hence would mostly be present during the day and evenings. Burglars lower interest in choosing an occupied location [Coupe and Blake, 2006] alongside these individual's presence could act as a deterrent for burglaries therefore leading to a lower number of burglaries reported for this age group.

6 Comparing residential vs commercial guardianship

Figure 3: Burglary time based on property type



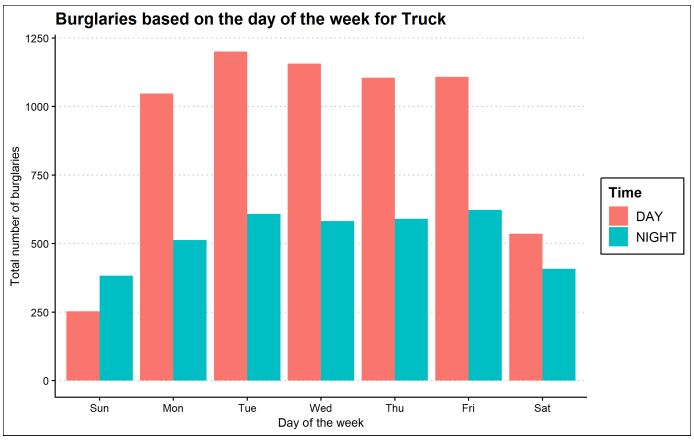


Figure 3 shows more in detail what day of the week and what time the burglaries happened comparing residential properties with commercial. A major difference between burglary at commercial properties and residential could be seen in the difference between the number of day incidents to night incidents for each property type. Both graph follow the concept of guardianship in target selection [Coupe and Blake, 2006] since commercial business would mostly close during the evenings therefore there is a larger amount of incidents during night and residential properties are mostly vacant during the day hence leading to larger amount of incidents reported during day time.

7 Age and time of burglary age of suspect miss title

Figure 4: suspects age

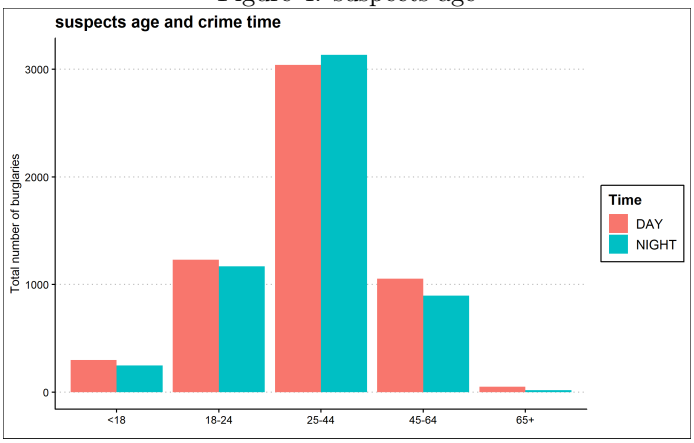


Figure 4 shows overall reported age of the suspect and the time of day the incident happened for all crime locations. There are no major indicators in each age groups citing a preferred time to target a property. With 24 year and younger age group there is a larger daytime report than nighttime. The younger suspects prepare to operate during the daytime to get maximum return compromising the lack of cover of darkness [Coupe and Blake, 2006]. Older offenders operating during nighttime exchanging lower possible returns for lower chance of being discovers [Coupe and Blake, 2006], but based on the analysis from New York City data, suspects in New York City do not follow the same rationalization, as seen the number of day and night time incidents follow each other closely and for suspects 45 and older day time leads nighttime incidents. For the age group 25 to 44 they are the most reported suspects but there have been more reports of them operating at nighttime compare to daytime. To understand the distribution of reported suspects operating time further better, the suspects age is looked at based on the location they were reported.

Figure 5: suspects age and time based on property type

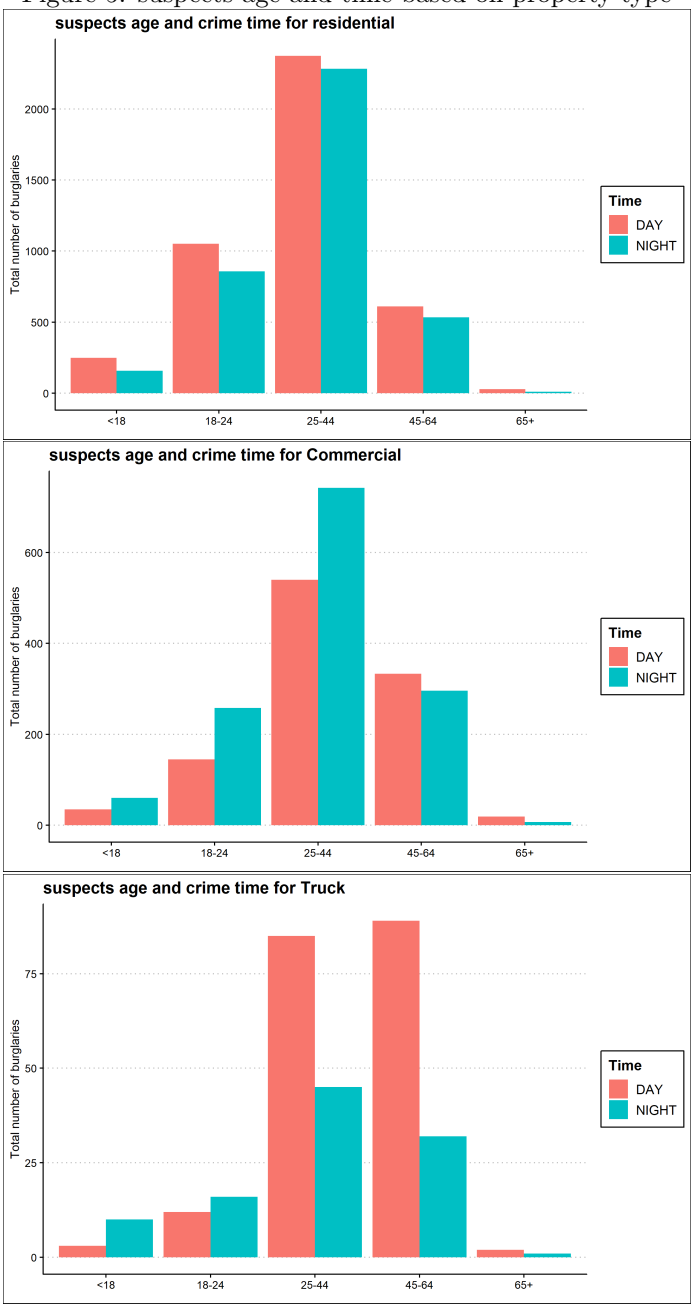


Figure 5 breaks down the age group of the suspects based on the three property types. Residential properties follow the same trend seen for overall

incidents in which daytime burglaries are higher compare to nighttime. All suspect age groups preferred day compare to night. For commercial buildings the suspects 44 years and younger were reported during nighttime, following the trend of commercial property being chosen at night as seen on figure 3, however suspects older than 45 years of age were reported slightly more during the daytime. For truck burglaries suspects 25 years an older were reported during the daytime but suspects 24 years and younger were reported for incidents during the night. Truck burglaries during the night for suspects younger than 18 were much higher than daytime, lack of guardianship during night and lower chance of being discovered during the night [Coupe and Blake, 2006] could be the main decision reason for younger offenders to target trucks at night.

8 Near repeat with residential properties

Figure 6: Total burglaries and number of near repeats in 2017

Figure 7: The precincts with most reported burglaries

Precinct	Not Near Repeat	Near Repat	total	percent
44	63	60	123	0.4878049
47	109	26	135	0.1925926
67	76	48	124	0.3870968
75	105	32	137	0.2335766
83	72	148	220	0.6727273

Figure 8: The precincts with a higher percent of near repeats

Precinct	Not Near Repeat	Near Repat	total	percent
18	15	43	58	0.7413793
5	10	23	33	0.6969697
6	19	44	63	0.6984127
7	11	19	30	0.6333333
83	72	148	220	0.6727273

Figure 6 shows the number of total burglaries for 3 different residential locations along with four different commercial locations during 2017. The near repeat data for apartments can also be looked at based on the percentage of near repeats to burglaries in different precincts. Figure 7 shows the top five precincts that reported the most burglaries in 2017, figure 8 shows the top five precincts with the highest percentage of near repeats. The only precincts common between these two figures is 83rd precinct, other four precincts show a higher near repeat percentage while not having a higher number of total reported incidents. One aspects of near repeat that needs to be considered is that higher number of near repeat offenses in an area could be the result of that areas higher risk factor based on previous incidents and not because of a pattern for near repeat burglaries in response to an original burglary [Moreto et al., 2014]. Risk and reward associated with choosing a location is a factor in near repeat offenses, since a location that was burglarised previously provides the burglar with potential knowledge of the area surrounding the original burglarised location since previous knowledge gives the burglar an advantage compared to targeting a location that is unknown [Rey et al., 2012]. The use of near repeat offenses would help police departments in the planning of routine activities instead of implementing different prediction methods such as computer models and local knowledge since these methods do not provide accurate predictions for new crime hot spots based on very recent data [McLaughlin et al., 2007].

9 Conclusion

Based on the finding from analysis of the time of the burglaries for the incidents reported in New York City, the first hypothesis was accepted since the finding shows that New York City also follows the same patterns of burglaries targeting locations when the guardianship is low.The findings from this study

supports the effects of guardianship and the impact of time of day when the burglary took place. Previous studies such as [Montoya et al., 2016], defined guardianship as one of the four characteristics that is considered by offenders when selecting a location for burglary. Figure 1 and figure 3 showed that residential properties are targeted mostly during the day and commercial properties are targeted mostly during night. It is also observed that victims in the age group of 25 to 44 and 44 to 64 are the target for daytime burglaries. . Since most Victims are in the working age range and therefore leave their residential premises during the day, therefore providing opportunities for offenders to target these locations, as [Montoya et al., 2016] and other studies such as [Tabrizi and Madanipour, 2006] point to offenders prefer locations that would be empty with lower risk of encountering the residence. Individuals older than 65 were targeted less for daytime burglaries, it could be concluded that because this age group falls under the retiring age, these individuals would be present at their premises more often, therefore not providing an opportunity for burglars targeting locations lacking guardianship.

The second hypothesis can be rejected based on the results form figure 7 and figure 8, a larger number of reported burglaries does not lead to a larger number of near repeat incidents as the findings of [Groff and Taniguchi, 2019] suggested. Since the property detail data was not available for this study, it could be assuming that the location data had a higher influence on the increase in the number of near repeat incidents.As mentioned by [Moreto et al., 2014], near repeat could increase the chances of target selection in an area because of offenders familiarity with location, this concept can be applied to familiarity category, for target selection as identified by [Montoya et al., 2016]. In this study it was found that larger number of crimes in an area wont necessary translate to more near repeat offences but the clustering of burglaries for residential property types could be the result of suspects familiarity to the surrounding area.

Based on the findings for hypothesis one, the at risk group which are the working age individuals between the age of 25 to 64 should be identified and with the use of community policing and other educational material, help them minimize the chances of being targeted as a suitable location by improving security of their house hold and provide harder challenge for burglar to enter their residence during the weekday daytime.

10 Limitations

The limitations that faced this study was the lack of information regarding the property that was burglarized, some of these information included a detailed description of the premises, what protective measures were in place (security alarms, locked doors etc.), and what where the stolen items. In a study by [Borg et al., 2014], the authors designed a survey like questionnaire that officers could fill which went into detail about each burglary incident, it helped to standardize the analysis process, and a similar approach to New York City data could be beneficial for future studies if a similar questioner is developed to standardize the report.

11 Future studies

As mentioned in the limitations section, the items that were stolen were not part of this data set. A future study should be conducted by examining the relation between the time of the day and the relation between items stolen during weekday or weekend. Another aspect that could be the subject of future study is introduction of environmental variables and property description for studying the burglaries, this study could examine property aspects such as mode of entry, location of entry and the build environment around the target location and cross reference these variables with the time of day and week. This study would provide the findings that could be compared to other finding for other cities to discover any potential pattern in target selection based on modes of entry or the target locations build environment. The near repeat could be studied as another path for studying the burglaries with utilization of additional variables such as items stolen and how offenders entered the premises. The additional variables would provide potential trend analysis for incidents that fall under near repeat categorization.

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