Urban Homicide in Global South: A Study on Homicide Changes of Capital Dhaka of Bangladesh

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by

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Abstract

Homicides are part of life in Dhaka, the Capital of Bangladesh like megacities of the world. Different studies have shown that Dhaka has a higher trend of homicides. But the present study has found, Dhaka city has downward trends from 2017. The forecast analysis of the present study shows that a downward trend is expected until 2020. The study also found a correlation between poverty rate and homicide trends. Different studies showed that the gap between rich and poor is widening day by day in Bangladesh. The present study has found a correlation between these variables. The study also found males are the major victims of high-profile homicides. The present study analyzes the homicides data from eight police divisions of Dhaka city, Bangladesh Census 2011, and Bangladesh Poverty Map 2016. And, secondary data were collected from newspapers, magazines, research articles, and related websites. Research questions of the study were: homicide trends, future trends, population size and homicide rates, and correlation among variables in high-profile homicides.

Keywords: Homicides; Dhaka; future trends; population and homicides; poverty rate; and homicides

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Dedication

This work is dedicated to my beloved wife for being with me throughout the entire graduate journey. Without her support, I may never have completed this dissertation.

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Chapter I

Introduction

Homicide is the most damaging crime in society. Homicides are a common phenomenon in society. As a result, homicides are varied and complex from person to person and society to society. The circumstances giving rise to a domestic homicide are likely to be vastly different from a gang homicide or a corporate manslaughter case. Riddick et al. (1989) defined homicide as “the death of an individual following the infliction of trauma with intent to harm, injure or kill.” Cole & Gramajo (2009) "defined homicide as fatal injuries inflicted by another person with the intent to injure or kill, by any means."

The socio-economic condition of a society affects the trends of the homicide of that society. Different studies show that societies with smaller income differences between rich and poor tend to have better health and less violence. Research has found that homicides and assaults tend to be most common where income inequality is highest (Braun, 1995; Marmot et al., 2008; Wilkinson & Pickett, 2010). Furthermore, comparative research on homicide has become an established tradition in the arena of criminology and sociology of crime. Some scholars have accounted for variation in the homicide rate among nations in the contemporary world. Others have conducted their studies across cities, metropolitan areas, or states in the United States (Williams & Flewelling, 1988). In developed countries, the rate of gun homicide, and the total homicide rate were significantly correlated with levels of gun ownership; there was no significant correlation between non-gun homicide and gun ownership (Hemenway & Miller, 2000). However, homicides vary from country to country by a wide margin. Gartner (1990) suggested that homicides in western countries seem to be going down over the years, but homicides are now having an upward trend.

In connection with that in 2002, just over half of all homicides in the world (52.6 percent) were accounted for by the 25 countries (comprising a total population of 970.8 million) with rates above 20 per 100,000 (i.e., over twice the world average). The (weighted) average homicide rate for these 25 countries was 30.3 per 100,000, over three times the world average (Cole & Gramajo, 2009). Different socio-economic variables played a role in shaping the homicide trends of a country. Young males aged between 15 and 29 are more prone to be engaged in crime than any other age group (Hirschi & Gottfredson, 1983; Wilson & Herrnstein, 1985). Urbanization is also associated with crime and deviant behavior (Fajnzylber et al., & Loayza, 2002). Though the trends of homicides vary from country to country. However, it is evident that in developing countries there is immense competition for wealth due to the high margin of urbanization in over populous cities, categorized by elevated joblessness and urban poverty. Sometimes, homicides can be elevated by the urban settings and advantage of inconspicuousness (Cole & Gramajo, 2009). For the last couple of years, academicians and researchers tend to connect income disparity with homicides; focusing on the Gini coefficient, and violent crime rates (Krahn et al., 1986; Krohn, 1976). The association between disparity and deviant behavior has often been coined from the context of the relative deprivation theory of homicide, according to which “aggression is held to be spurred by a sense of frustration and relative poverty” (MacKellar, 2003, p.498). Inequality may make differences between rich and poor more seeming and so elevate conflict. It might also elevation interaction between persons and therefore surge the probability of relational violence (Krahn, Hartnagel, & Gartrell, 1986). Additionally, education plays a control variable role in homicides. Different studies have found that education affects homicides in many ways. Low levels of education might take to high joblessness and poverty-related crimes and homicides. However, studies have found that

educational attainment has a negative and weak effect on homicides (Barro & Lee, 2001; Fajnzylber et al., 2002).

Current scholarly works have shown that both developing and developed countries have had downward trends in homicide from 1990 to 2005. Homicide rates dropped in European, Asian, and North American countries. However, this decline was generally confined to wealthier countries of Europe, the United States, and a few highly industrialized western-style democracies (LaFree et al., 2015; Weiss et al., 2016). Studies also indicated that homicide trends in Asia are different from those observed in Europe, the United States, and other developed countries (LaFree et al., 2015). Though, as the biggest continent, Asia has different homicide trends in different subsections. For example, Asia has six subsections of North Asia, South Asia, East Asia, Central Asia, Southeast Asia, and Southwest Asia. Southern Asia covers Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, and Sri Lanka. These countries and the western Asian sub-region have lower homicide trends than the other four sub-regions (Furqan & Mahmood, 2020).

Being separated from Pakistan in 1971, Bangladesh is now one of the densely populous countries in the world. According to the World Bank, Bangladesh had 163 million people in 2019. In recent decades, Capital Dhaka is one of the fastest expanding metropolises in the world. For the last four decades, the average annual growth has been over 7 percent (Wassener, 2012). And Dhaka is expected to grow to about 20 million in 2020 (Baker, 2007). With the rapid urban expansion, crime and violence have become a key issue for Dhaka (Chowdhury, 2012). Nearly 61 percent of the crimes of the country occur in the Capital(S. Hossain, 2006). Several 164,953 crimes were registered in six metropolitan areas from 2008 to 2012 in Bangladesh. Among them, 70.48 percent of crimes were registered under the Dhaka Metropolitan Police (Rahman, n.d.) So,

Dhaka has a growing trend of urban crime and violence. With the rising number of homicides, there are hardly any scholarly works based on the murder trends in connection with the rapid expansion of the urban population. The present studies found that despite being a megacity, Dhaka has a five years' average of 2.34 homicides per 100,000 population. And, in 2019, the Capital has 2.39 homicides and as a country, Bangladesh has 2.84 per 100,000 population. The rate is the fifth lowest in South Asia after the Maldives and Sri Lanka which have 1.88 and 2.34 according to the 2019 data of the World Health Organization (World Health Organization, n.d.). With the rising number of homicides in Bangladesh, the literature review of this research paper is divided into three parts. First, the author discussed the homicide trends in the developed nations. In the second part, the author discussed the homicide trends of other countries of the world, and in the last part, the author focused on the homicide trends of the global south.

General Homicide Trends in Global North

For the last three decades, homicide has been a key reason for death among adolescents and young adults in the United States. Homicide rates among persons from 10 to 24 years varied substantially over time but showed a decline from 1994 through 2010. These results suggest that progress has been done in lessening homicide. However, progress is slowing, and the primary prevention of homicides needs continued emphasis (David-Ferdon et al., 2013). The number of murders was at an all-time high in the United States of 24,703 homicides in 1991, then it went down to 15,522 homicides by 1999. Among the homicide victims, blacks have six times higher than the rate for white people. The criminalization rate for blacks was 34.4 per 100,000, which was almost 8 times higher than the rate for whites of 4.5 per 100,000 (c & Smith, 2013). In 2011 the homicide rate of the United States fell to 4.2 homicides per 100,000 inhabitants. This was the lowest in four decades. From 1992 and 2011, firearms were mostly used in 73 percent of all

murders of males and 49 percent of all murders of females, with minor fluctuations during the period. And handguns were mostly used for homicides (Smith & Cooper, 2011). Similarly, Chu and Sorenson (1996) stated that firearms play a key part in homicide. The authors stated that three of every four homicides in California in 1993 were conducted with a gun. Firearm homicide risk is even higher for adolescents: in the same year, 90 percent of the murdered 15- to 19-year-olds in California were killed with a gun. The authors also suggested that there is a correlation between firearm sales and homicides. In 2015, there were approximately 36,000 firearm-related deaths in the United States; 13,463 were homicides among them. In the same year, 72.9 percent of homicides were firearm homicides and, of these, approximately 90 percent were committed with a handgun (Siegel et al., 2017).

Spatial Distribution of Homicides

Bullock (1955) conducted a study on the homicides in the city of Houston, Texas, during the period 1945-49. The study found homicide in a city is more concentrated when cases are distributed according to the streets on which they occurred. More than 87 percent of the homicide cases occurred in West Dallas, Dowling, Lyons, and Preston, or within eight blocks of these streets. It should be noted that many cases occur at points where these streets intersect with others. The resulting pattern is the delineation of four areas of concentration, with each area dominated by one of the above streets.

Crime is not randomly concentrated in areas. The crime incidents vary from place to place. Different factors play roles in variations. Wang and Zhang (2019) suggested that criminal activities are usually concentrated in preferred areas that are decided by offenders. These locations are not in the center of hot areas, however at other locations from the center. Sherman,

Buerger, & Gartin (1989) showed that 50 percent of police calls in Minneapolis come from 3 percent of the place.

Urbanization and Homicides

In addition to location, there is a strong relationship between homicide and urbanization and socioeconomic conditions (Cubbin et al., 2000). The authors found the southern part of the USA has higher homicide rates than the northern part along with the metropolitan areas of the country. Urbanization was the powerful factor of homicide rates after age for both White and Black men, and the highest rates were seen in major metropolitan areas. So, urbanization plays a vital role in shaping the trajectory of homicides. It was found that, when a city has a higher number of outmigration rates, it has higher numbers of homicides (Hollis, 2017). Race, 6economics, and population shape the social climate of a city. And the social climate directs the violence level of the city.

Social Inequality and Homicides

(Hollis, 2017) found that population change, vacant homes, citizen perceptions, and homicide rates in Detroit, the largest city in the midwestern state of Michigan. Population decline has led to important changes in Detroit. However, it is also evident that the gap between city and suburban crime rates in the United States has narrowed in the last couple of years. More specifically, growing and urbanizing suburbs and communities where crime cutting stalled or lost ground since the 1990s stand to benefit from lessons learned and successful policies adopted in communities that achieved significant declines in both violent and property crime over the past two decades (Kneebone & Raphael, 2011). In the United States, classical causes of homicides, such as changes in resource deprivation (including less affluent family condition, percent families living in poverty, Gini index, median family income, percent black residents,

and percent children not living with both parents), and the percent of the population made up of youth were associated with changes in homicide offending.

The sturdy association between the index of relative deprivation/affluence and changes in homicide rates suggests continued support for classic structural theories in the country (McCall et al., 2008). So, there is still poverty and inequality that directs the homicide trends of society. Lattimore et al. (1997) suggested that there was a potential relationship between poverty and homicide. The authors conducted a study on three cities' increasing homicide rate trends. Apart from economic inequality and poverty, Messner and Tardiff (1986) conducted a study in the 26 neighborhoods in Manhattan, New York. They found that the relative size of the population under poverty and the percent divorced, or separation is the predictor of homicide trends. Homicide rates are found to be highest in those neighborhoods featured by higher poverty and pervasive marital problems. Morenoff and Sampson (1997) conducted a study in the Chicago neighborhood on the spatial dynamics of violent crimes. They found that homicide is an important predictor of population change even after considering numerous aspects of socioeconomic disadvantage and other environmental factors related to neighborhood transition. High levels of neighborhood homicide were consistently connected with total population loss in the subsequent decade. They mentioned, “However, the effect of violent crime on population change was also transmitted through the spatial diffusion of homicide. All else being equal, the more that crime in the area surrounding a given neighborhood increased, the greater its total population loss over a decade. This result corresponds with the geographic analysis of city maps, which reveal a clear pattern of association between the diffusion of homicide and population change (Morenoff, & Sampson, 1997, p.56).”

Political Economy and Homicides

Similarly, the urban political economy shapes homicides along with socio-economic conditions. Velez and Richardson (2012) found that Chicago neighborhoods that have lower levels of bank lending have relatively higher numbers of homicides. Higher mortgage areas have lower levels of homicide rates. However, it is to be mentioned that all homicides are not equally connected with income inequality. Some types of homicide could be more strongly associated with income inequality than others (Roberts & Willits, 2014). It was found that both Canada and the United States have higher homicide rates when racial discrimination, deprivation, and family disturbance cause desperateness and anger, homicide rates increase (Lenton, 1989). Like the United States, Canada has the social structural distribution of inequality and social disorganization factors. These factors play an important role in shaping the homicide trends in Canada (Kennedy, Silverman, & Forde,1991).

However, other developed countries have different levels of homicide trends and patterns. For instance, knives or sharp instruments have been the most common weapons for homicides for the last 40 years in England and Wales. Though, there was a rise in homicides in England during the 2000s with rising gun violence. However, the rise of homicide in the country from 2014 has been knife-driven (Morgan et al., 2020). The study categorized homicides into alcohol-related, drug-related, domestic, and gang-related are not mutually exclusive, and overlap with other types of categorizations like infanticide, intimate partner homicides, robbery homicides, and sexually motivated homicides. Consequently, homicide trends have become hard to explain.

France has a strong macro-sociological connection between homicide and problems of social integration, concerning particularly some urban areas ghettoized. However, despite social,

ethnic, and political elements that sometimes raise the homicide rate, and despite criminality linked to the criminal underworld, homicide is mainly a convenience crime in France (Mucchielli, 2012). On the other hand, Germany has a moderate homicide rate in comparison to other countries. The demography of the country has two dimensions, immigration, and the aging population. Alcohol consumption and the use of drugs play a key role in homicide trends in Germany (Birkel & Dern, 2012).

It is evident from the trends of homicides from developed countries that every country has a different trend of homicides. However, homicides in developed countries have different variables like spatial distribution, inequality of wealth, political economy, urbanization, weapons use, and use of guns in violence. These features have made western countries different from Asian countries.

Homicide Trends in Global South

The term “Global South” denotes largely to the countries of Latin America, Asia, Africa, and Oceania. It is one of a family of terms, including “Third World” and “Periphery,” that denote regions outside Europe and North America, mostly low-income and often politically or culturally marginalized (Dados & Connell,2012). The use of the phrase Global South marks a shift from a central focus on development or cultural difference toward an emphasis on geopolitical relations of power. Clarke (2018) defined the "term Global South generally refers as countries classified by the World Bank as low or middle income that are in Africa, Asia, Oceania, Latin America, and the Caribbean. This definition descriptively uses the term and is simply the most recent in a long list of catch-all concepts used to identify, define, and cluster the poorer section of the world. Therefore, like its predecessors (periphery; less developed, developing, underdeveloped; the third world), it lumps together very diverse economic, social, and political experiences and

positions into one overarching category." In comparison to Global South, Global North or developing countries have different trajectories and patterns of homicides (Dados & Connell,2012).

Murder Data in Global South

Murder data in the Global South have some loopholes. Marwah (2014) mentioned that In India, three factors influence murder data provided by police. They are low emphasis and no priority on data collection among law enforcement agencies, data vary from urban to rural areas, and murder data from marginalized and more vulnerable groups remain unreported. Many countries in the Global South were colonies of different Western countries. To many extents, murder statistics from the colonial age cannot be found (Jaishankar & Halder, 2017).

Income Inequality

Income inequality is playing an important role in homicides in developing countries. Szwarcwald et al. (1999) conducted a study on income inequality and homicide rates in Rio de Janeiro, Brazil. The authors found high degrees of income inequality in the city where a high rate of homicides is present. The study also suggested that homicides are concentrated mainly in urban areas rather than suburbs. Another study found that a one percent increase in the drug traffic rate relates to a 0.34 percent increase in the homicide rate in Brazil (Miranda et al., 2018).

Rivera (2016) carried out a study on violence in Latin America. The study found Colombia and Mexico have high rates of homicide due to drug-related crimes and social violence. The study also found that economic factors are fewer supporting factors in social violence in developing countries of Latin America. The authors suggested that increasing educational attainment and the development of the judicial system can play a key role in reducing homicide.

Similarly, Sindwani and Chowdhry (1996) carried out a study on serious crimes in New Delhi, the capital of India, and Houston of the United States. The authors found Houston has a higher homicide rate than Mumbai. For both cities, poverty and unemployment are the main reasons for violent crimes. Drugs, guns, fragile family structure, and lack of moral values are the main concerns for Houston. On the other hand, Delhi residents consider population problems, illiteracy, corruption, inefficiency in government offices, and the ineffective judiciary as the major factors of crime in their area. These social problems are prevalent in the Global South (Clarke, 2018).

Like India, in South Africa; only half of all murder cases are sent for the judicial process. In 2000 only 49 percent of murder cases were knocked in the judiciary, however, only 4,007 cases resulted in a guilty verdict (McCafferty & Action, 2003).

Weapons of Homicide

In terms of murder weapons, guns are mostly used in many third-world countries. Pal et al. (2017) conducted a study on the weaponry pattern of homicidal deaths in Faisalabad city of Pakistan during 2014-2015. Their study found 391 homicidal deaths were found during this time. The age group of 22-29 years old were the major victims. And firearms were used mostly for homicides. On the other hand, in India, according to the available data, most murders are still committed with indigenous weapons such as choppers, hatchets, axes, spears, chains, knives, and bamboo sticks. The association between homicides and alcohol is fifty percent in the country (Nagpaul, 1985). Developing countries do not have flexible gun availability for their people like the United States. It was found, in India, unlicensed firearms account for 86 to 92 percent of reported firearm-related murders. Three states: Bihar, Jharkhand, and Uttar Pradesh have two-thirds of all firearm-related homicides (Kohli et al., 2011).

Demography and Homicide Trends:

Different studies have found that there is no significant association between age structure and homicide. However, Weiss et al., (2016) suggest that the transformation of countries' young population is a key indicator of forecaster of homicide in a country. Those countries that have a growing young population can face higher homicide rates in the future. There are around 1.8 billion young people in the world now. Among the developing countries cover 90 percent of the young people (UNFPA, 2013). There is a chance that developing countries can face higher homicides in the future. Bangladesh has one of the biggest youth population in comparison to other countries. According to International Labour Organization (ILO), Bangladesh has 47.6 million youth people which is around 20 percent of the total population (International Labour Organization, 2018). The young population works as a demographic dividend for any country. However, it can be a threat if a country is failed to accommodate its youth with jobs and prospects. This is also applicable to Bangladesh.

Homicides and Spatial Distribution:

The spatial distribution of crime has a long history. Beginning from the scholarly works of Quetelet and Guerry in the 19th century and carrying on with the influential works of the Chicago school, proved that place plays an vital role to understand the inner dimensions of the crime of a society (Messner et al., 1999). Messner and other authors carried out a study on exploratory spatial data analysis (ESDA) to observe the spreading of homicides in 78 counties in the St. Louis metropolitan area. The study found lethal violence spreads out from one county to another. The study also suggested that homicides are not only concentrated in urban areas, but rural areas have homicides too. In another study, Barata et al. (1998) carried out a study to analyze the relationship between socioeconomic statistics and homicide mortality rates in the city

of Sao Paulo of Brazil between 1988 and 1994. The study found an inversely proportional relation between homicide death rates and living conditions characterized by several socioeconomic indicators in residential zones in the city of Sao Paulo. The study stated that the Southern zone, which had the worst conditions, exhibited a risk of death from homicide three times greater than in the Central zone. But none of the studies has been found in South Asia about the spatial distribution of homicides. However, the present study will contribute to the spatial distribution of homicides in Dhaka, the capital of Bangladesh.

Homicides Trends in Dhaka City

Like other South Asian countries, Bangladesh has an urban growth rate of 2.13 in 2019 which is higher than other South Asian countries like India, Pakistan, and Sri Lanka (World Bank, n.d.). This rapid urbanization makes the Capital Dhaka a haphazard city. The unplanned growth affects the socio-economic condition of the city (Roy, Sowgat, & Mondal, 2019). One hundred fifteen thousand inhabitants live in Dhaka per square mile which has ranked the city as the most densely inhabited city in the world (Demographia, 2021). And Bangladesh is now experiencing all-time high-income inequality. Household Income and Expenditure Survey (HIES) of Bangladesh Bureau of Statistics (BBS), the country's Gini coefficient, which is the economic measure of equality, stood at 0.482 in 2016, up from 0.458 in 2010. The Gini coefficient is measured on a scale of 0 to 1; the closer it is to 1 the higher is inequality in society. A coefficient of 0.50 is regarded as a degree of inequality that is liable to generate social unrest (Byron & Sohel, 2019). This has an impact on the violent crime trends of Dhaka city. The city experienced 1153 homicides in 2011, and it rose to 1396 in 2014 (Khan, 2015). The city dwellers face murder, robbery, and women repression regular basis along with other crimes (Khan, 2015). As a city, Dhaka covers around 70 percent of the crime recorded in a total of six metropolitan

cities (Rahman, 2012). Few researchers tried to analyze the homicide trends of Dhaka from a data mining approach. Few doctors analyzed homicide trends from the perspective of medical and postmortem. Al-Azad et al., (2015) conducted a study on the record-based cross-sectional data which includes 506 cases of homicide out of the total of 3005 medico-legal autopsies conducted at the Forensic Medicine Department of Dhaka Medical College during the year of March 2006 to February 2007. The study found 37.5 percent of homicides are conducted by firearms.

However, there is no considerable amount of scholarly work on homicides in Dhaka city. Another reason is, in Bangladesh criminology and criminal justice as a discipline has started their journey only years back. Consequently, there is a gap in research on crime trends in Dhaka city. The thesis will shed light on the homicide trends of Dhaka city with the help of census data. Hence, the work will be a combination of both trends and spatial distribution of homicides of Dhaka city. It is evident from the above that the shortage of literature on homicides trends in Dhaka city. In connection with that criminology and criminal justice is growing slowly in Asia in comparison with the swift development of the field in North America and Europe (Liu, 2009). Consequently, scholarly works on homicides are absent in Bangladesh. Furthermore, the present study focused on the trends of homicides in Dhaka city according to the spatial distribution from 2005 to 2020 of eight police divisions. The present study tries to find out the association between census data and homicides. The study also focuses on the forecast, and correlations between age, gender, motive, and modus operandi of three police divisions.

CHAPTER II

Methods

Research Questions

The present paper will shed light on the trends of homicides in the capital Dhaka. It is apparent from the relevant works of literature that Bangladesh has a higher urban growth rate in comparison to other countries. It is also one of the populated capitals in the world. The city suffers from unplanned growth both in population and infrastructure. Additionally, Bangladesh is having all-time high-income inequality. In connection with that the research questions of the studies are:

- What are the homicide trends of Dhaka city?
- What could be the future trends of homicides in the capital?
- What is the connection between population size and the homicide rate in Dhaka?
- Is there any correlation among variables in high-profile homicides?

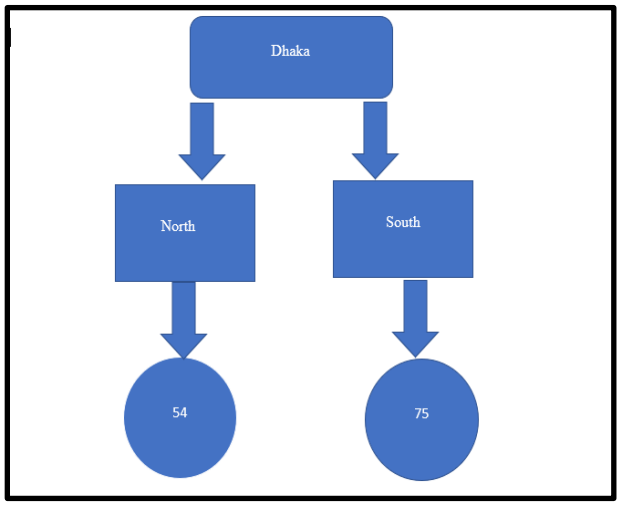
It is mentioned earlier that homicide trends in Dhaka city lack related research work. Because of lack of data the study did not conduct any multiple regression or statistical causal analysis. But in all of the bivariate analysis and interpretation based on previous literature, it has been implied that homicide is related to and is caused by differences in various socioeconomic, demographic, and geographic factors. Thus, it can be said that the study is based on the following dependent and independent variables. Dependent Variables: homicides, and homicide trends. Independent variables are police divisions, gender, modus operandi, time of homicides, population number, literacy rate, school attendance rate, and poverty rates.

Study Site Background

Dhaka City

It is mentioned earlier that Dhaka city has around one hundred fifteen thousand inhabitants. Out of 164.7 million Bangladeshi, one in four live below the poverty line. Over 3 million people are estimated to live in the slums of Dhaka alone (Lansat, 2018). With the rise of the population, dwellers of Dhaka are facing the rise of violent crimes every day. The present study is conducted on the homicide trends of the capital Dhaka city. Dhaka has a long history of its own. But it grew as an urban epicenter in the Sultanate ruling time and rose into importance in the time of Mughal empire when it relished the position of the regional capital. The city played an important role against the British colonial rules. After the termination of colonial rules, Dhaka was the provincial capital of East Pakistan. After independence from Pakistan, Dhaka became the capital of Bangladesh (Chowdhury, 2021). Now Dhaka has approximately 163 million people in 118 square miles. For the increasing population, Dhaka is divided into two city corporations, North and South. Dhaka is divided into 129 wards at the grassroots level (Chiran, 2020). The below figure shows the administrative structures of the capital Dhaka.

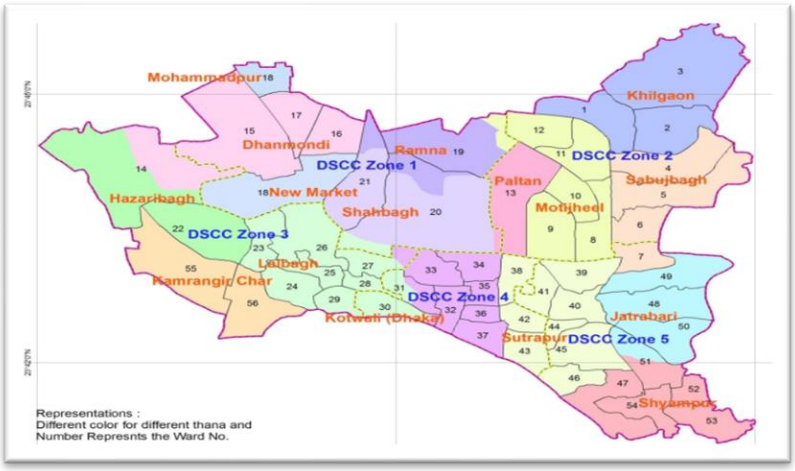
Figure 1
Dhaka City Administrative Structure



Dhaka South City Corporation

In 2011 Dhaka City Corporation was divided into two city corporations for better services and decentralization. Local Govt. (City Corporation) Amendment Act (2011) created two city corporations in Dhaka is Dhaka South City Corporation and Dhaka North City Corporation (Rahman & Hasan, 2019). Mayor is the chief executive of the city corporation. Now, Dhaka South City Corporation consists of 75 wards around 42.47 square miles (Dhaka South City Corporation, n.d.). The area of the city corporation is placed on the below:

Figure 2
Dhaka South City Corporation Map



Source:http://www.mediabangladesh.net/dhaka-city-map-South-and-north-City-corporation/

Dhaka North City Corporation

Dhaka North City Corporation was established in 2011. The city corporation covers an area of 75.76 square miles which is divided into 54 wards. Dhaka North City Corporation is the biggest city corporation in the country in terms of population which has 10.06 million people

only in 75.76 square miles (Dhaka North City Corporation, 2020). The area of DNCC is placed in the below:

Figure 3

Dhaka North City Corporation Map

Source:http://www.mediabangladesh.net/dhaka-city-map-South-and-north-City-corporation/

Dhaka Metropolitan Police:

Dhaka Metropolitan Police (DMP) was established on 1st February 1976. DMP started its journey with 12 police stations along with 6000 forces in 1976. But now, DMP has 49 police stations along with 26,661 personnel. The 49 police stations are working under 8 police divisions (Dhaka Metropolitan Police, n.d.).

Figure 4

Areas Covered by Dhaka Metropolitan Police

Source:https://www.researchgate.net/publication/320292356_Transforming_Urban_Dichotomies_and_Challenges_of_South_Asian_Megacities_Rethinking_Sustainable_Growth_of_Dhaka_Bangladesh

The data for this study has been collected from the Dhaka Metropolitan Police Headquarters. Every police station of Dhaka city prepare its data. Later the data is organized and tabulated by the Dhaka Metropolitan Police Headquarters. Usually, there is no separate tabulation for homicide data of Dhaka. However, homicides are tabulated along with all other crime data. The data of the present study is collected from police data, later they were tabulated and categorized for the study. Apart from police data, the author used the Bangladesh Population and Housing Census, 2011. The present study went through a simple analysis of the characteristics of the data. Like other third-world countries, police data of homicides are not well

decorated. Police divisions only enlisted several homicides. For this reason, the data lack diversity, like age, gender, motive, modus operandi, arms, arrest, etc. Rather, the study relies on variables like the year, homicides, police divisions, and population size. To answer the research questions, the present study is divided into five parts for the analysis:

- General discussions of homicides in eight divisions of Dhaka city,
- Changepoint detection of homicides in eight police divisions followed by Here Pruned Exact Linear Time (PELT) change-point detection algorithm,
- Correlation analysis of homicides and census of 2011 using Spearman's rank-order correlation,
- Forecasting of homicides from June 2020 to December 2021 by applying both non-seasonal (mean, naïve, drift, ETS, ARIMA) and seasonal methods (Naive, Random walk drift, ARIMA, and ETS using seasonal decomposition of time series by loess (STL)) and
- The Chi-Square Test for Association is used to determine if there is an association between the gender of the victim and other homicide-related variables such as Division, victim's age, modus operandi of homicide, and time of the homicides.

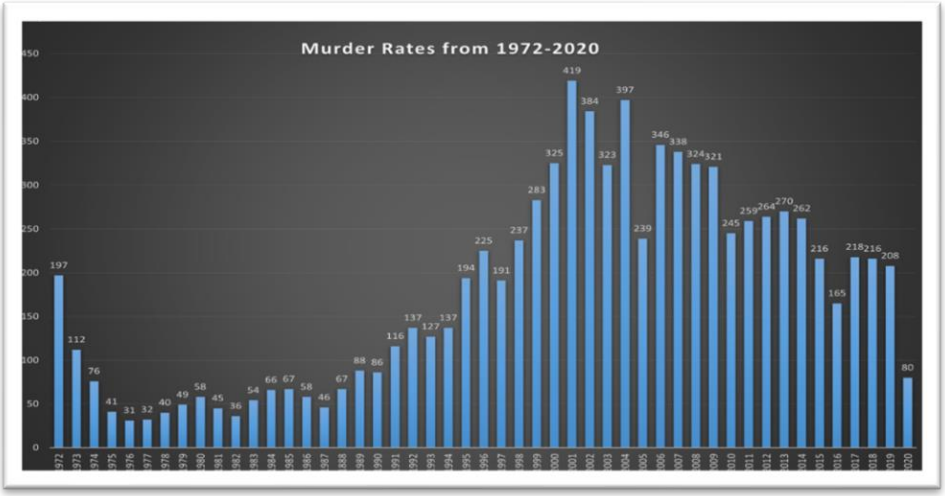
CHAPTER III

Findings

The homicides trends of Dhaka city have a different trend than any other city. The homicides data shows that it was 197 during 1972, just after the liberation war. The police data says, in 2019 there were 208 homicides were committed. So, the difference is not very higher in other countries. The figure shows that from 1977 to 1987, the capital has a lower homicides trend. From 1976 to 1990, Bangladesh was under military rules. In these years, the highest homicides rate in a year was 116 in 1991, and the lowest was 31in 1976. It can be assumed that for the strict military rule, there was fewer homicides rate in these 14 years, the homicides rate was low. However, after 1991, Bangladesh started its journey to democracy. The homicides rate has an upward trend. Among all the years, 2001 has the highest homicides rates, because of the election year. However, after 2017 the homicides rate has a downward trend. The below figure is based on the homicide trends from 1972 to June 2020 collected from Bangladesh Police:

Figure 5

Homicides Rates from 1972-2020



Ramna Division

Ramna division includes six police stations. They are Ramna, Shahbagh, Dhanmondi, New Market, Hazaribagh, and Kalabagan. According to Population and Housing Census, 2011 of Bangladesh, the area and population of these police stations is stated in the below figure:

Table 1

The population of Police Stations Under the Ramna Division

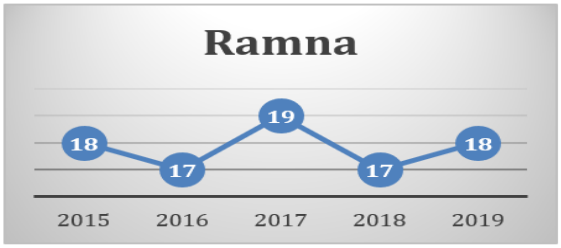
Police Station	Population
Ramna	200,973
Dhanmondi	147,643
New Market	49,523
Hazaribagh	185,639
Kalabagan	118,660
Shahbagh	68,140
Total	770,578

Note***Due to the unavailability of corrected areas, the area of the police stations cannot be estimated in the population census.

The Ramna police division mixed trends of homicides rates. In 2016, the rate was reduced to 17 from 18 in 2015. However, the rate went to 19 from 2016. It was reduced to 17 and increased again in 2019 to 18. The Ramna Police Division has an average 2.38 homicide rate every year. So, the police division has a mixed trend.

Figure 6

Yearly Homicides in Ramna Division



Lalbagh Division: Lalbagh division has six police stations. They are Kotwali, Lalbagh, Bangshal, Chak Bazar, Kamrangirchar, and Sutrapur. The demography and areas of the Lalbagh division are described below:

Table 2

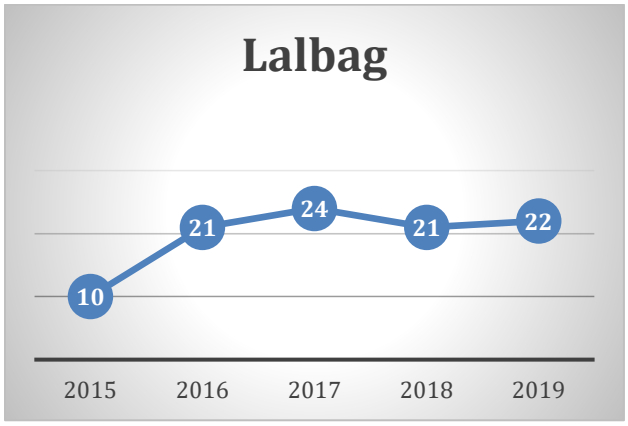
The population of Police Stations Under Lalbagh Division

Police Station	Population
Kotwali	62,087
Lalbagh	369,933
Bangshal	186,952
Chak Bazar	156,147
Kamrangirchar	96,301
Sutrapur	211,210
Total	1,082,630

The Lalbagh division has had a steady rate of homicides from 2016 to 2019. It was 22 in 2016 and 2019, the rate was 22 homicides in a year. The division has an average of 1.81 homicide rates every year. The division has a static trend from 2016.

Figure 7

Yearly Homicides in Lalbag Division



Wari Division: Wari division covers Shyampur, Jatrabari, Demra, Kadamtali, Gendaria, and Wari police stations. The demography and areas of the Lalbagh division are described below:

Table 3

The population of Police Stations Under the Wari Division

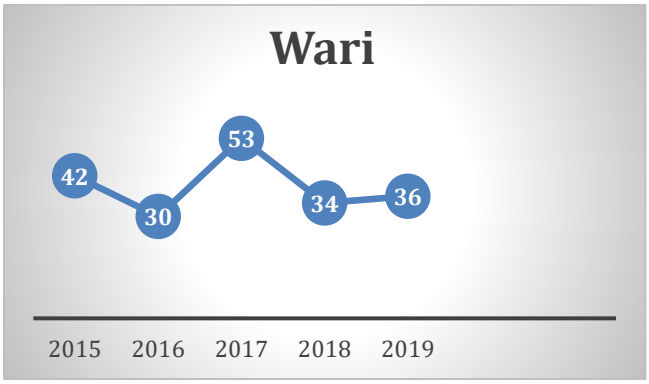
Police Station	Population
Shyampur	184,062
Jatrabari	443,061
Demra	226,679
Kadamtali	370,895
Gendaria	137,721
Wari	0***
Total	1,362,418

Note*** Wari was added with Sutrapur police station when the census was done in 2011. Due to high crime rates, the Wari police station was separated from the Sutrapur.

The division has one of the highest homicide trends among all the police divisions. The division has an average of 39 homicides every year. It was highest in 2017 which was 57, and the lowest in 2016 which is 30. So, the division has 2.64 homicides per 100, 000 people; it is the highest in Dhaka. The information is placed below in the figure:

Figure 8

Yearly Homicides in Wari Division



Motijheel Division: Motijheel is the most important commercial hub of Bangladesh. As a police station, it was established on February 1st, 1976. The demography and areas of the Motijheel division are placed on the below table:

Table 4

The population of Police Stations Under Motijheel Division

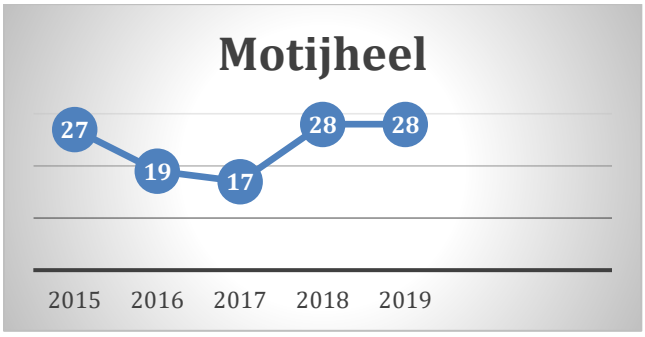
Police Station	Population
Paltan	59,639
Motijheel	210,006
Sabujbagh	376,421
Khilgaon	327,717
Rampura	224,079
Mugda	0***
Shahjahanpur	0***
Total	119,7862

Note***Both police station was started in 2012 after the census has been done in 2011.

As a commercial hub of the country, Motijheel has a comparatively low homicide rate than other police divisions. The division has an average of 23.8 homicides every year. And, Motijheel has an average of 1.98 homicides per 100,000 people in the division. The yearly homicide rates have been placed on the below figure:

Figure 9

Yearly Homicides in Motijheel Division



Tejgaon Division: Tejgaon as a police station was established in 1953. It covers Prime Ministers' Office and is adjacent to Dhaka Cantonment. But as a high-profile zone, the division has a trend of the upward homicide rate. The population of Tejgaon is placed on the below table:

Table 5

The population of Police Stations Under the Tejgaon Division

Police Station	Population
Tejgaon	148,255
Tejgaon Industrial Area	146,732
Mohammadpur	355,843
Adabor	203,989
Sher-E-Bangla Nagar	137,573
Hatirjheel	0***
Total	992,392

Note***Both police station was started in 2012 after the census has been done in 2011.

It can be observed from Figure-10 that the Tejgaon division has an upward trend of homicides. In 2019, the division experienced 30 homicide cases. The below two figures provide the yearly homicide trends and homicides per 100,00 in the Tejgaon division.

Figure 10
Yearly Homicides in Tejgaon Division

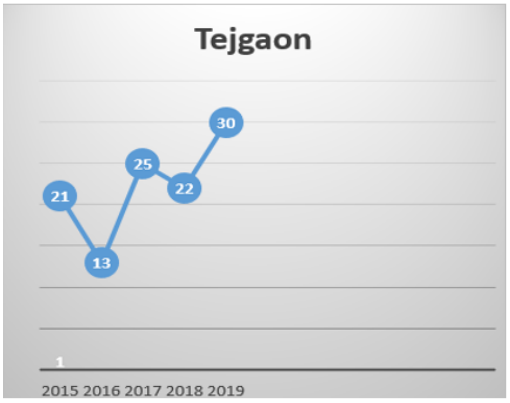
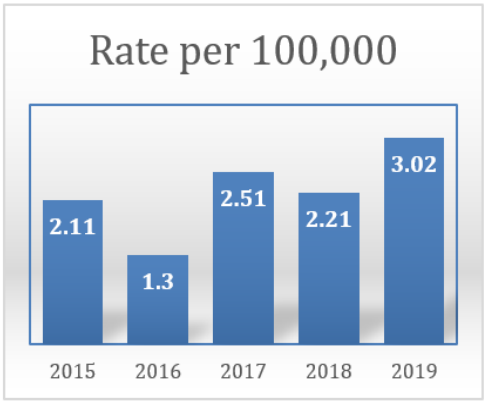


Figure 11
Homicide Rates per 100,00 in Tejgaon Division



Mirpur Division: Mirpur police station was established in 1962. The area covers a larger part of Dhaka which has Dhaka Zoo, Dhaka Botanical Garden, International Cricket Stadium, and many more. The demographic features of the Mirpur division are placed in the below table:

Table 6

The population of Police Stations Under the Mirpur Division

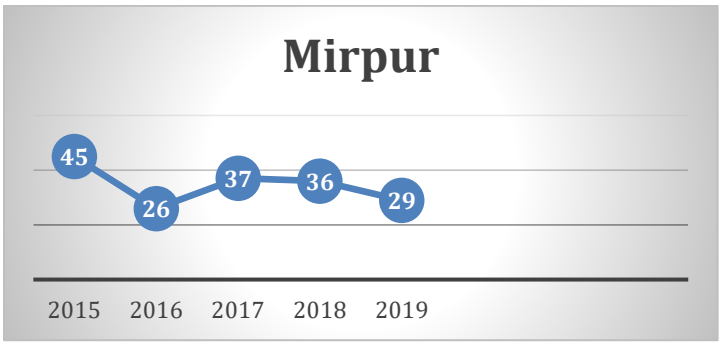
Police Station	Population
Mirpur Model	500,373
Shah Ali	115,489
Pallabi	596,835
Kafrul	396,182
Roopnagar	0***
Vashantek	0***
Darus Salam	159,139
Total	176,8018

Note***Both police station was established after the census was conducted.

Though Mirpur is a densely populated area, the homicide rates of this division have downward trends from 2017 to 2019. The division has an average of 1.95 homicides in five years.

Figure 12

Yearly Homicides in Mirpur Division



Gulshan Division: Gulshan as a police station started its journey in 1972. It is one of the richest parts of Dhaka. As an affluent part, the division has almost similar homicide trends to other parts of Dhaka. The demographic features of Gulshan are placed on the below table:

Table 7

The population of Police Stations Under Gulshan Division

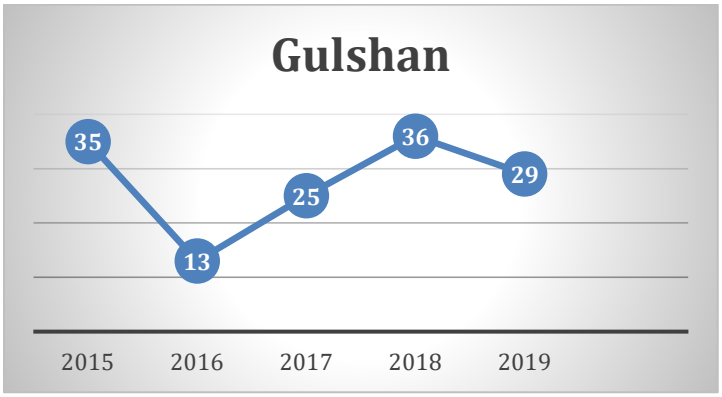
Police Station	Population
Gulshan	253,050
Badda	536,621
Khilkhet	130,053
Cantonment	131,864
Vatara	0***
Banani	0***
Total	1051,588

Note***Both police station was established after the census was conducted.

The division has a downward trend in 2019. But before that, it has a mixed trend. It has a five years' average homicide rate of 2.61 per 100,00 population. All the data are placed in the below figure:

Figure 13

Yearly Homicides in Gulshan Division



Uttara Division: Uttara as a police station, was established in 1988. It was separated from Gulshan for better surveillance and administrative procedures. Now it has seven police stations. The demographic features of the Uttara division are placed on the below:

Table 8

The population of Police Stations Under Uttara Division

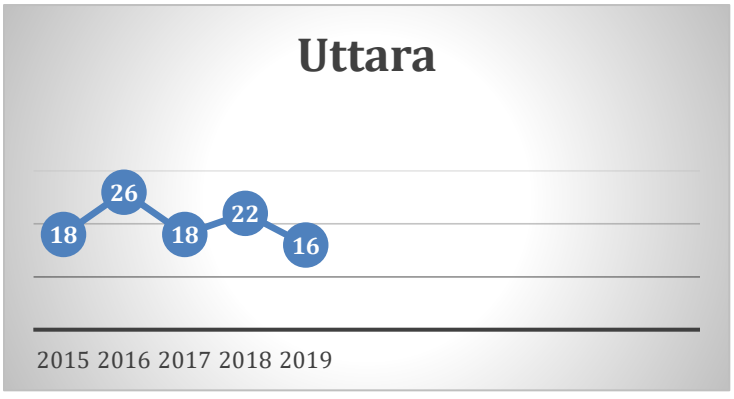
Police Station	Population
Uttara	179,907
Uttara East	0***
Uttara West	0***
Turag	157,316
Airport	10,626
Dakshinkhan	255,931
Uttarkhan	78,933
Total	682,713

Note***Both police station was established after the census was conducted.

Uttara is a suburb of Dhaka. It is close to other districts like Gazipur. As a suburb, the area has been experiencing an influx of people for rapid urbanization. However, the division has had a downward trend of homicide rates since 2017. And the division has an average of yearly 2.92 homicides. All data are placed on the below figure:

Figure 14

Yearly Homicides in Uttara Division



Summary from the divisions: It is visible from the above data that Dhaka has a mixed trend in homicide rates. Among all the police divisions, four divisions Ramna, Lalbag, Wari, and Motijheel have an upward trend. And, three other divisions Mirpur, Gulshan, and Uttara have a downward trend. And, the commercial hub of the country Motijheel division has a static trend of homicide. It can be assumed from the divisional analysis that Dhaka city has a diversified socio-economic condition. It affects the fluctuations. For example, a large part of the Uttara division is a suburb and planned residential area. So, the homicide rate is lower there in comparison to other areas. Gulshan division has a unique disparity by covering both affluent and less affluent areas. So, for the diversity, we can assume a higher homicide rate in that division which the present study found so. However, the homicides of Dhaka city lack relevant works of literature and study. Future research is needed to seek the reasons for different homicide trends in different divisions of the capital.

Change Point Analysis of Homicides:

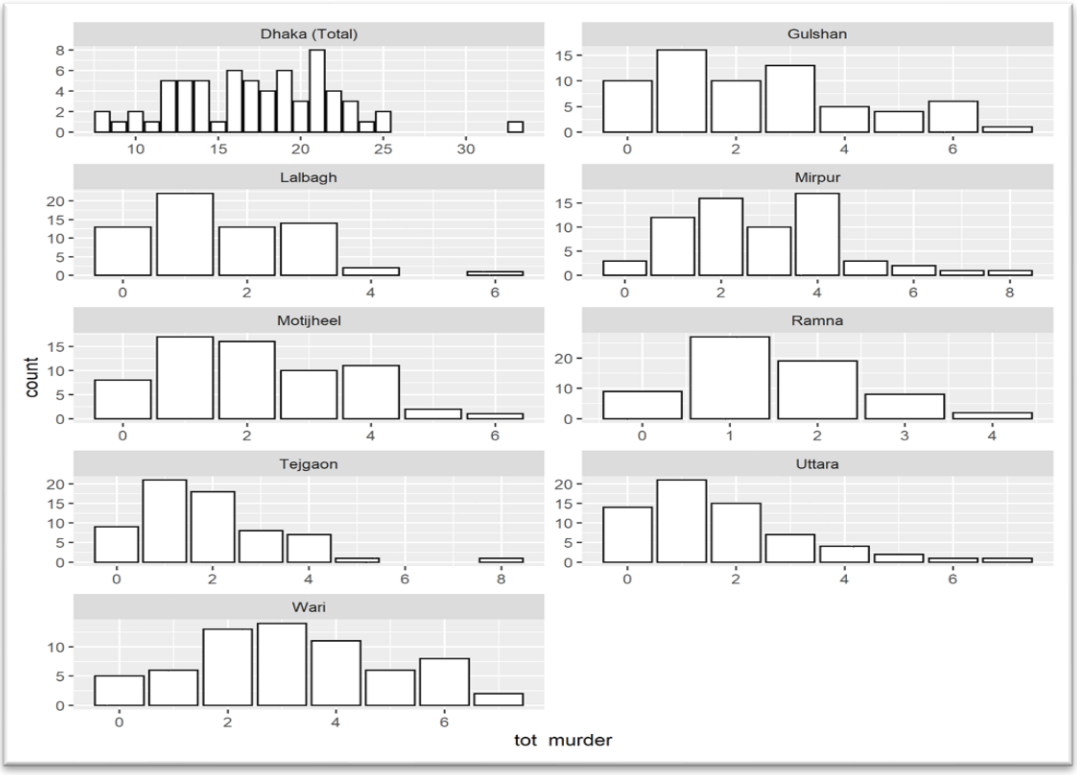
Here Pruned Exact Linear Time (PELT) change-point detection algorithm has been applied to identify significant changes in the number of homicides of 8 divisions of Dhaka city. Change-point detection algorithms perform a set of mathematical operations over a time series to identify points at which the statistical properties of a sequence of observations change significantly (Killick & Eckley, 2014).

The PELT algorithm attempts to find a set of change points for a given time series, such that their number and location in time minimizes a given segmentation cost. PELT algorithm has been chosen because it yields more accurate detection of statistical changes consider all possible data points while maintaining high levels of performance (Dorcas Wambui, 2015).

All the statistical analysis was carried out in R. Changepoint analyses were carried out using the changepoint (Killick et al., 2016) for normally distributed data and changepoint. np (Haynes et al., 2021) which applies a non-parametric approach for non-normal data R-packages. Normality test was performed using the northeast (Anderson-Darling normality test, Lilliefors test) and stats (Shapiro-Wilk test) R-package.

Figure 15

Normality test



Before conducting change point analysis here three types of normality tests have been conducted namely, Anderson-Darling normality test, Lilliefors (Kolmogorov-Smirnov) test, and Shapiro-Wilk test. The null hypothesis for all these tests is that the data follows a normal distribution.

Except for the combined homicides number of Dhaka city, it has been found that the p-values for the tests on all the 8 divisions are less than 0.05 indicating that the null hypothesis is accepted. That is, the time series of the homicides number for all the 8 divisions are normally distributed. And for Dhaka city, the time series of the homicide numbers are not normally distributed.

Table 9

P-Value

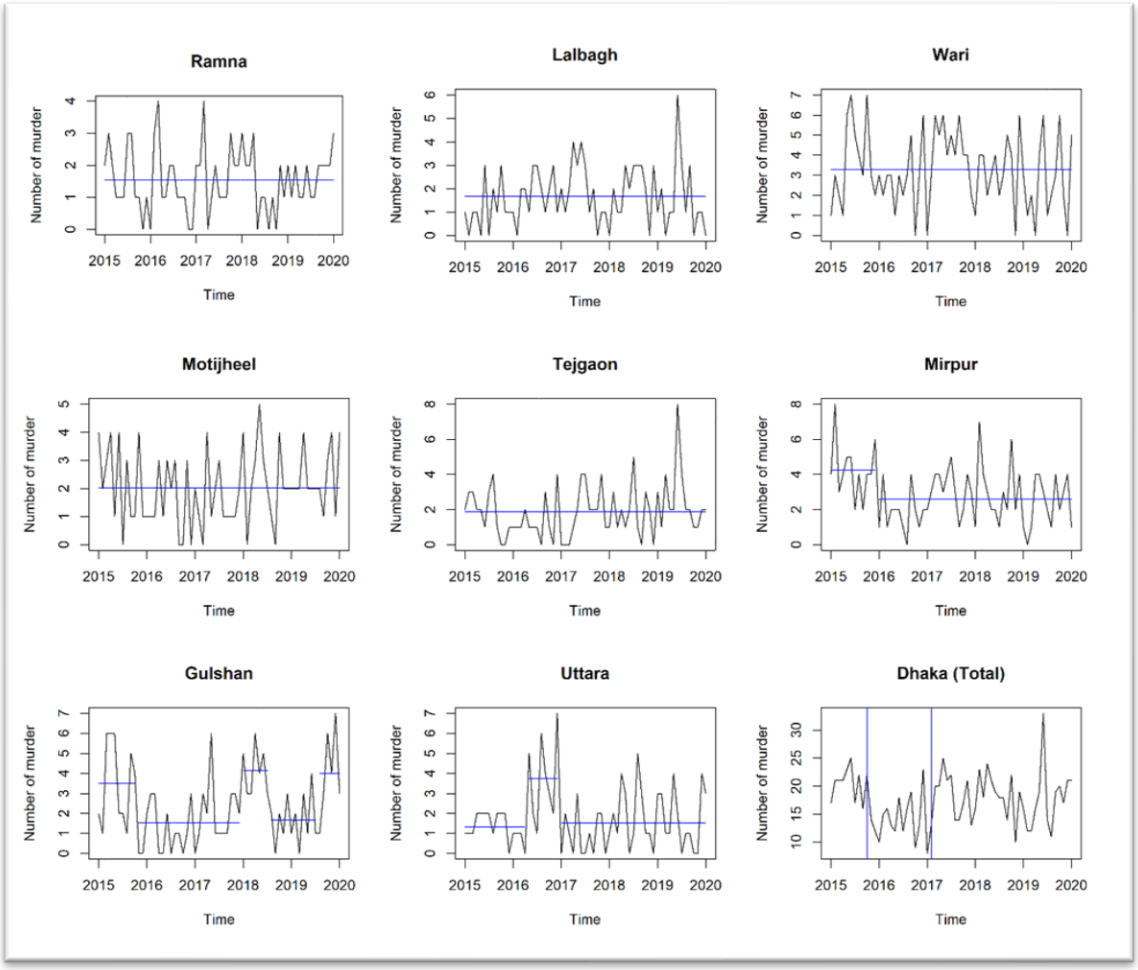
Division	**Anderson-Darling normality test**		**Lilliefors (Kolmogorov-Smirnov) test**		**Shapiro-Wilk test**	
	Test statistics	**p-value**	**Test statistics**	**p-value**	**Test statistics**	**p-value**
Gulshan	1.899	0.000	0.173	0.000	0.912	0.000
Lalbagh	2.471	0.000	0.221	0.000	0.889	0.000
Mirpur	1.591	0.000	0.168	0.000	0.933	0.002
Motijheel	1.787	0.000	0.169	0.000	0.929	0.001
Ramna	3.119	0.000	0.245	0.000	0.891	0.000
Tejgaon	2.401	0.000	0.205	0.000	0.869	0.000
Uttara	2.769	0.000	0.215	0.000	0.866	0.000
Wari	1.030	0.010	0.134	0.005	0.954	0.017
Dhaka City (Total)	0.430	0.300	0.080	0.372	0.973	0.158

Changepoint analysis

For the Mirpur division, PELT identified a significant change in the average number of homicides in January 2016. From January 2015 to December 2015 the average number of homicides in the Mirpur division was 4.2 which has been significantly decreased to 2.6 and remain stable from January 2016 to June 2020. In the case of the Gulshan division, PELT identified 4 significant change points as of October 2015, January 2018, August 2018, August 2019. From January 2015 to September 2015 the average number of homicides in the Gulshan division was 3.5 which has been significantly decreased to 1.5 from October 2015 to December 2017. Again, the average frequency of homicides significantly jumped to 4.1 from January 2018 to July 2018 which dropped to 1.7 for August 2018 – July 2019. In the end, from August 2019 to June 2020, the average number of homicides significantly rises to 4.0 again. For the Uttara division, PELT estimated two significant change points in the average number of homicides such as May 2016 and January 2017. From January 2015 to April 2016 the average number of homicides in the Gulshan division was 1.3 which has been significantly increased to 3.7 from May 2016 to December 2016. Again, the average frequency of homicides significantly dropped to 1.5 and remain stable from January 2017 to June 2020. For Lalbagh, Motijheel, Ramna, Tejgaon, and Wari division PELT-identified no significant change in the average number of homicides. For Dhaka city comprising a total of all divisions, PELT estimated two significant change points in the average number of homicides such as October 2015 and March 2017. From January 2015 to September 2015 the average number of homicides in Dhaka city was 20.3 which has been significantly decreased to 14.4 from October 2015 to February 2017. On the other hand, the average frequency of homicides significantly again rose to 18.3 and remained stable from March 2017 to June 2020.

Figure 16

Change Point Direction



Note: For all divisions using "changepoint" package has been used and for combined data of Dhaka city "changepoint. np" package has been used. The minimum segment length was set to 6 months. The type of penalty was MBIC.

Table 10
Changepoint Data

Division	Number of changepoint	Changepoint locations	Period	Average Homicides
Gulshan	4	October 2015 (10)	January 2015 – September 2015	3.5
		January 2018 (36)	October 2015 – December 2017	1.5
		August 2018 (43)	January 2018 – July 2018	4.1
		August 2019 (55)	August 2018 – July 2019	1.7
			August 2019 – June 2020	4.0
Lalbagh	-	-	-	1.7
Mirpur	1	January 2016 (12)	January 2015 – December 2015	4.2
			January 2016 – June 2020	2.6
Motijheel	-	-	-	2.0
Ramna	-	-	-	1.5
Tejgaon	-	-	-	1.9
Uttara	2	May 2016 (16)	January 2015 – April 2016	1.3
		January 2017 (24)	May 2016 – December 2016	3.7
			January 2017 – June 2020	1.5
Wari	-	-	-	3.3
Dhaka City (Total)	2	October 2015 (10)	January 2015 – September 2015	20.3
		March 2017 (26)	October 2015 – February 2017	14.4
			March 2017 – June 2020	18.3

The analysis shows that from January 2015 to September 2015, Dhaka city has an average of 20.3 homicides. There is no study on the causes of homicide change points in Dhaka city. However, different newspapers show that 2015 was one of the violent years for Bangladesh. From January 2015; BNP, the main opposition party of Bangladesh called for an all-out strike throughout the country for the free and fair general election on the first anniversary of the 10th general elections of Bangladesh ((Agence France-Presse in Dhaka, 2015). BNP and its allies boycotted the election for lack of a level playing field. On the first anniversary of the election, BNP called for an indefinite shut down of the country which was continued for three long

months and killed at least 76 people (The Daily Prothom Alo, 2016); Human Rights Watch, n.d.). In 2015 in total 197 people were killed in political violence across the country which was more than 2014 (Parvez, 2018). 2015 was also followed by several terrorist attacks in Bangladesh. Bangladesh outfits of Al-Qaeda and ISIS assassinated around 7 bloggers, writers, and online activists, and more than a hundred people were injured by their attacks ; Bhatt, 2020; Bashar, 2015). On the other hand, from March 2017 to June 2020; Dhaka city has an average of 18.3 homicides. From January 2017 to November 2018 there were 321 political violence incidents were registered in Bangladesh which had 49 political homicides (A. Hossain, 2017). Another report said, there were 77 political homicides in 2017 (Odhikar, n.d.). Bangladesh had the 11th parliamentary election in 2018. This election was also followed by political violence and chaos which is based in the capital Dhaka. On election day, 22 people were killed (Reuters, 2018). Politically, Bangladesh is polarized, and every election year affects the law-and-order situation of the country.

Correlation analysis of Homicides and Bangladesh Census, 2011

A Pearson product-moment correlation and Spearman's rank-order correlation were run to determine the relationship between the number of homicides and population in the 8 divisions of Dhaka city for the time of 2015-2020.

Table 11

Pearson and Spearman's Rank-order Correlation

Division	**Pearson**	**Spearman**
Gulshan	-0.10	-0.09
Lalbagh	-0.36	-0.09
Mirpur	-0.75	-0.66
Motijheel	0.03	0.29
Ramna	-0.66	-0.44
Tejgaon	-0.03	0.03

Uttara	-0.65	-0.67
Wari	-0.59	-0.49

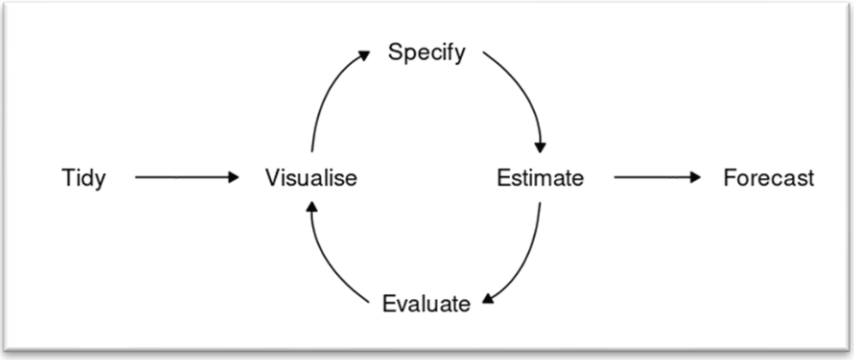
It has been found that except Motijheel division, the rest of the 7 divisions shows a negative relationship between the number of homicides and population for both Pearson product-moment correlation and Spearman's rank-order correlation analysis. The strongest negative relationship between these two variables is found in Mirpur division (Pearson r = -0.75, Spearman r = -0.66) followed by Ramna (Pearson r = -0.66, Spearman r = -0.44) and Uttara division (Pearson r = -0.65, Spearman r = -0.67).

Forecasting of Homicides in Dhaka City:

To predict the number of homicides in Dhaka city forecasting framework proposed by Rob J Hyndman depicted below has been applied. All forecasting-related data management and analysis [using “Forecast” package (Hyndman et al., 2021).] have been conducted in R. Hyndman & Athanasopoulos (2021) suggested a framework for forecasting analysis which is followed in the present study.

Figure 17

Forecasting Framework



Source: Hyndman, R.J., & Athanasopoulos, G. (2021) Forecasting: principles and practice, 3rd edition, OTexts: Melbourne, Australia.

(i) Data preparation (tidy):

The first step in forecasting is to prepare data in the correct format. Monthly homicide data for Dhaka city for the time of January 2015-June 2020 has been loaded and prepared for time series analysis.

(ii) Plot the data (visualize):

In this stage, data has been visualized to observe the trend and as well as the existence of any seasonal pattern.

Figure 18

Visualization of Forecasting Data

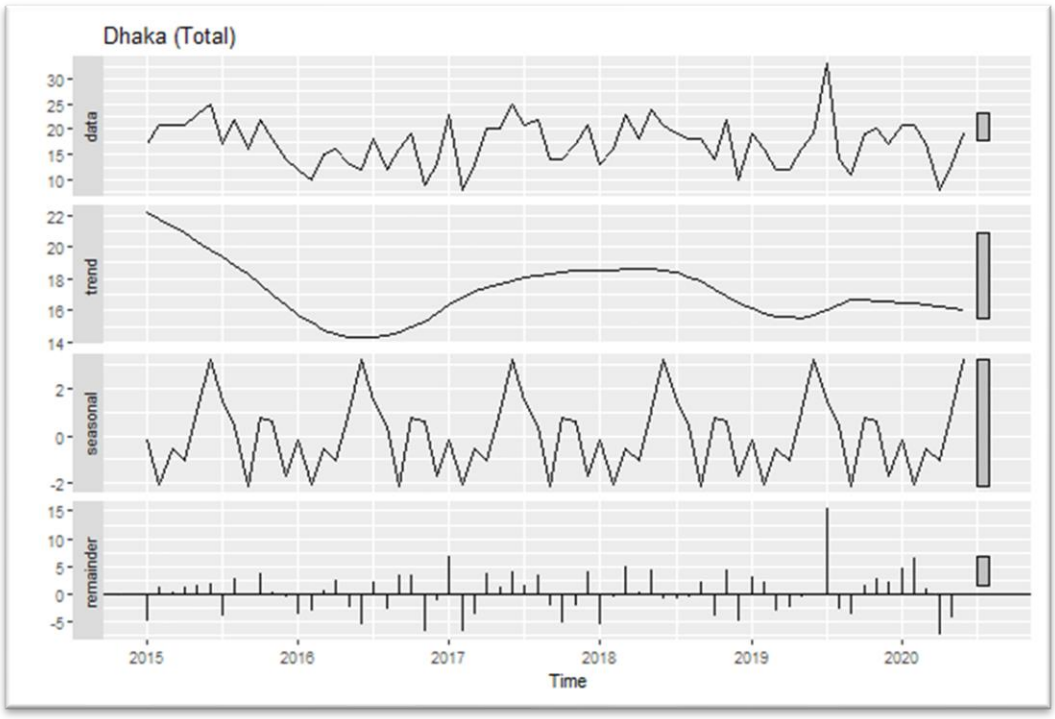


Figure: The number of homicides in Dhaka City (top) and its three additive components obtained from a robust STL decomposition with flexible trend-cycle and fixed seasonality.

It has been observed the number of homicides showed a downward trend from 2015 to 2016 and after that, it rose again and flattened for the rest of the period and there is a seasonal component that does not change over time.

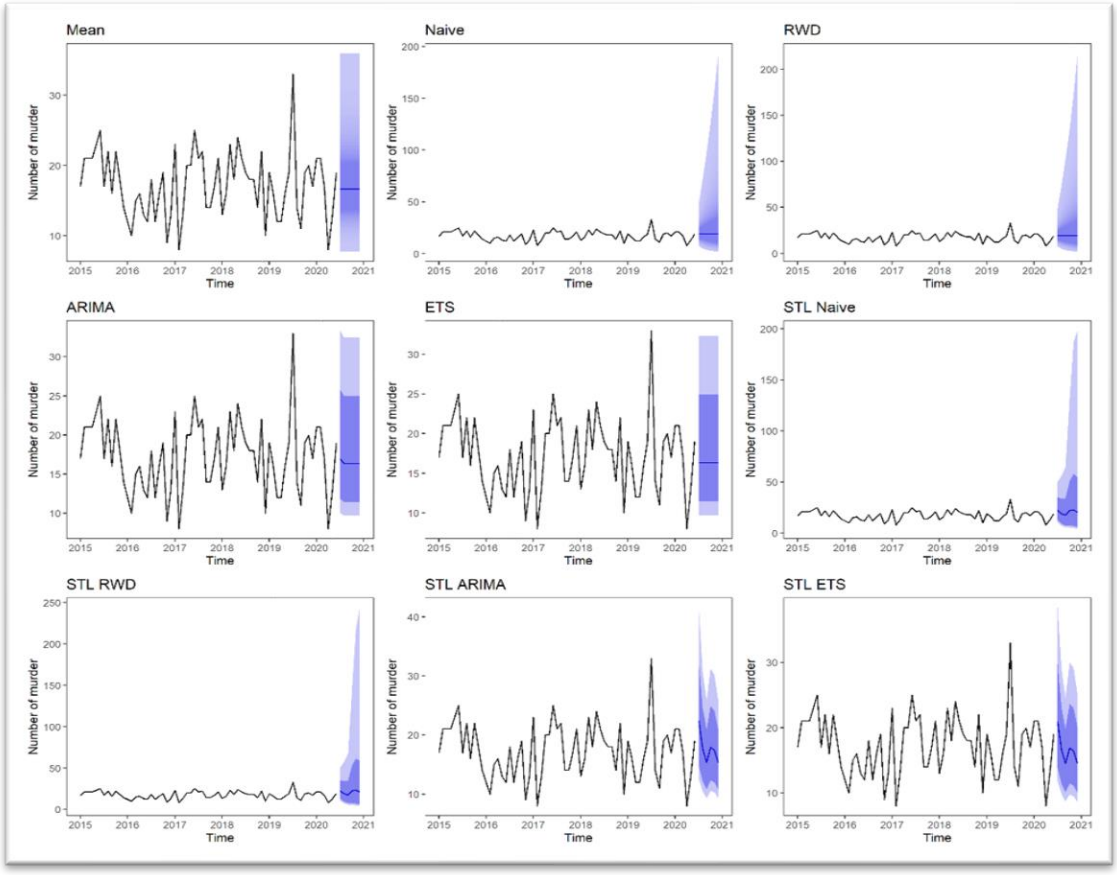
(iii) Define forecasting models & estimate:

To predict the number of homicides in Dhaka city nine different forecasting techniques have been applied including both seasonal and non-seasonal methods. Among non-seasonal methods mean, naïve, drift, and Exponential smoothing state space (ETS), and Auto-Regressive Integrated Moving Average (ARIMA) have been applied. On the other hand, in the case of seasonal models m techniques have been applied seasonal decomposition of time series by loess (STL) method. The STL method applies a deterministic model that allows the components to be calculated separately using different methods. It estimates the behavior of the trend using a LOESS regression, and in turn, calculates the seasonal component by selecting different models such naive, RWD, ARIMA, ETS. The main difference that the STL model has with the others is that, when considering the trend as a LOESS estimation, it is extremely flexible to the changes in the trend of the series, unlike the linear regression, which assumes that the series maintains the same constant.

The fitted values and residuals are obtained from the estimated models and analyzed to check whether the models have adequately captured the information in the data.

Figure 19

Forecasting of 6 Months



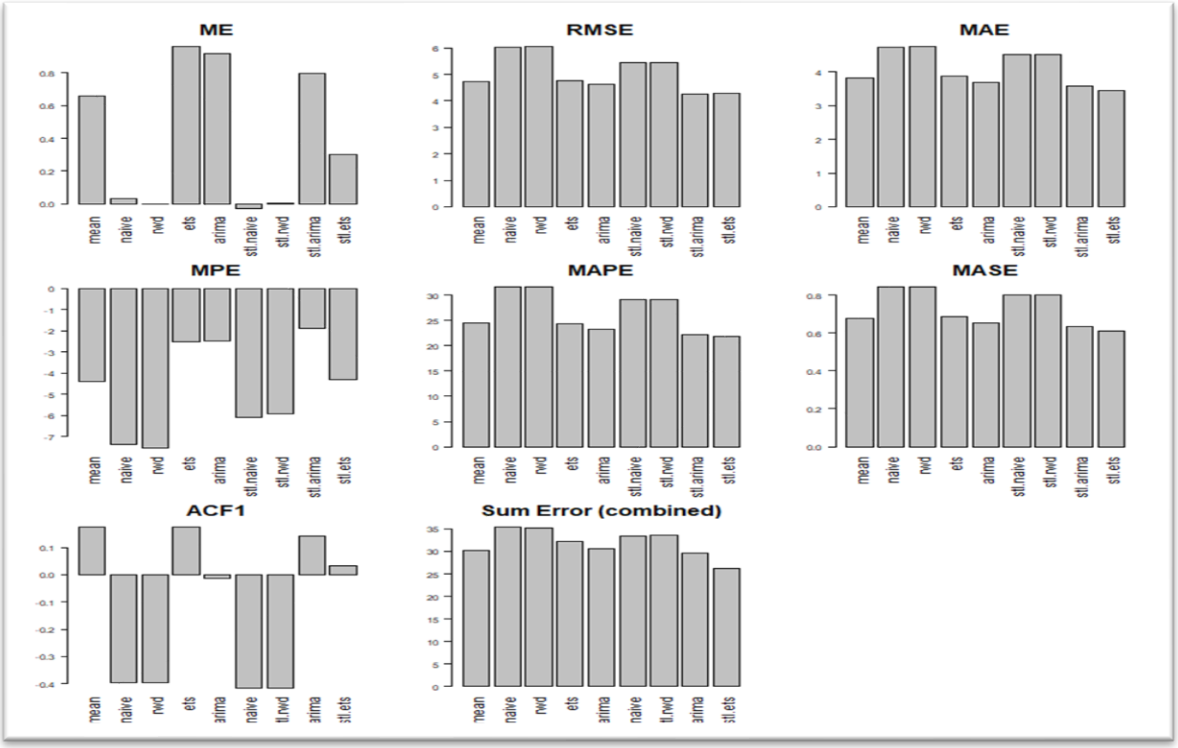
The above Figure shows 6 months forecast (July 2020 to December 2020) using nine different forecast methods applied to the monthly homicides of Dhaka City from January 2015 to May 2020.

(iv) Evaluate the accuracy of the models

To measure the accuracy of the model following metrics has been computed for all the nine forecasting methods mentioned above i.e., Mean Error (ME), Root-Mean-Square Error (RMSE), Mean Absolute Error (MAE), Mean Percentage Error (MPE), Mean Absolute Percentage Error (MAPE), Mean absolute scaled error (MASE), Auto Correlation Function 1 (ACF1). All these metrics have been summed up to get the composite sum of errors.

Figure 20

Visualization of Forecasting Metrics



Forecasting methods	Sum errors
Mean	30.148
Naive	35.429
Random walk drift (RWD)	35.289
Exponential smoothing state space (ETS)	32.261
Auto Regressive Integrated Moving Average (ARIMA)	30.668
STL Naive	33.413
STL RWD	33.561
STL ARIMA	29.695
STL ETS	26.238

From the computed forecast accuracy measures it can be concluded that STL-ETS model is the best-fitted model for forecasting future trends with a minimum of sum errors (26.238).

(iv) Produce forecasts

It has been forecasted that during June 2020 the total homicides of Dhaka will be around 21 (95% PI 12-38). After June, the number of homicides will be decreased and will end at 14 in December 2020.

Table 12

Forecasted Homicides Data

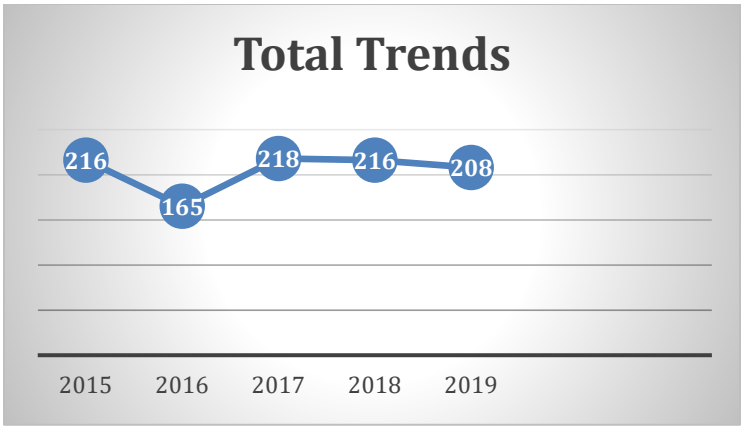
Month	Year	Forecasted homicides (STL-ETS)	80% Prediction interval		95% Prediction interval	
			Low	High	Low	High
Jul	2020	21	14	30	12	38
Aug	2020	17	11	23	10	29
Sep	2020	14	10	20	9	25
Oct	2020	17	11	24	10	30
Nov	2020	16	11	23	9	29
Dec	2020	15	10	20	9	25

After 1991, Bangladesh started its journey to democracy. The homicides rate has an upward trend. Among all the years, 2001 has the highest homicides rates, because of the election year. However, after 2017 the homicides rate has a downward trend. Dhaka city experienced an upward trend of homicide from 1992 to 2008. However, the trend is showing downward from 2017. 2017 has 218 homicides which were decreased to 208 in 2019. And for COVID-19

situation, homicides are decreased too. Police data suggested that from January 2020 to June 2020; there were only 82 homicides were conducted. The trend is like other countries of the world (Langton et al., 2021).

Figure 21

Total Homicide Trends



Association of gender and other relevant information:

The Chi-Square Test for Association is used to determine if there is an association between the gender of the victim and other homicide-related variables such as division, victim's age, modus operandi of homicide, and time of the homicides. For the time constraints, the author conducted Chi-Square Test in three police divisions. It has been found that the victim's age and modus operandi of homicide are significantly associated with the gender of the victims. For all the different age groups and modus operandi of homicides, proportionately more males are being murdered compared to females. More than 70% of the homicides in the 25+ age category are male. Whereas, 100% of the homicides that occurred because of being beaten to death are male and 90% of the homicides due to stabbing are male.

Table 13

Chi-Square Test

	Gender of the victim			Chisq stat	p-value
	Female (%)	Male (%)	Unknown (%)		
Division				6.650	0.156
Lalbagh	28.57	71.43	0.00		
Ramna	13.33	66.67	20.00		
Wari	50.00	50.00	0.00		
Victim's age				13.838	0.031
<18	44.44	55.56	0.00		
19-24	33.33	66.67	0.00		
25+	28.57	71.43	0.00		
Unknown	0.00	57.14	42.86		
Modus operandi of homicide				13.638	0.009
Beaten to death	0.00	100.00	0.00		
Stabbing	10.00	90.00	0.00		
Others	50.00	31.25	18.75		
Time of homicides				4.433	0.351
Day	25.00	75.00	0.00		
Night	25.00	68.75	6.25		
Not mentioned	37.50	37.50	25.00		
Total (N=32)	28.13	62.50	9.38		

Correlation analysis of Homicides and Other Variables

A Pearson product-moment correlation and Spearman's rank-order correlation were run to determine the relationship between the number of homicides and population for Dhaka city using data of total homicide, literacy rate, school attendance rate, and the poverty rate for the 7 police divisions namely, Gulshan, Mirpur, Motijheel, Ramna, Tejgaon, Uttara, and Wari. Data of literacy rate and school attendance rate were collected from Bangladesh Census, 2011. And, the poverty rate of police divisions is collected from Poverty Maps of Bangladesh, 2016. Both censuses were conducted by the Bangladesh Bureau of Statistics which is the only government organization of Bangladesh responsible for statistical data.

Table 14

Correlation among Homicides and other Variables

Variables	Pearson	Spearman
Literacy rate & Homicide	-0.71	-0.71
Male literacy rate & Homicide	-0.74	-0.68
Female literacy rate & Homicide	-0.59	-0.54
School attendance rate & Homicide	-0.42	-0.32
Male school attendance rate & Homicide	-0.65	-0.61
Female school attendance rate & Homicide	-0.24	-0.11
Poverty rate & Homicide	0.00	0.21

It shows a negative relationship between the number of homicides and the literacy rate of Dhaka city for both Pearson product-moment correlation and Spearman's rank-order correlation analysis (Pearson r = -0.71, Spearman r = -0.71). School attendance rate also shows a negative relationship with the number of homicides for Dhaka city (Pearson r = -0.42, Spearman r = -0.32). A similar relationship holds for both male and female literacy rates and school attendance rates. But in poverty rate has shown a positive relationship with the number of homicides (Pearson r = 0.00, Spearman r = 0.21).

Discussions:

Studying the trends of homicides has always been a prime factor of criminological research. This field of study always attracts researchers, academicians, social workers, and law enforcement agencies. Different socio-economic factors affect homicide trends in a country. However, it is more apparent and complicated for a third-world country like Bangladesh. As a megacity, Dhaka has diversified homicide rates. The study found that the Wari division is the second-highest populous division, but it has homicides among the rest of the seven divisions. On the other hand, the Mirpur division has the highest number of homicides, and the division is the

most populous. The study found population density is playing a role in shaping the trends of homicides. On the contrary, the Ramna division has the second-lowest population, at the same time Ramna division experienced the lowest homicides among all the divisions. Tejgaon division is ranked third in population and fourth in total homicides. Uttara division ranked sixth in homicides and eighth in the total population. So, findings suggest that the population is playing a big role in the number of homicides in Dhaka city. Uttara division is ranked first from the lowest population, similarly, the division is ranked third from the lowest homicide rates.

Dhaka has experienced the highest urbanization growth rate in South Asia. From 2000 to 2010, the urbanization rate was 1.1 in South Asia whereas Dhaka has an urbanization rate of 1.69 at the same time (Ellis & Roberts, 2015). The rapid urbanization rate has made Dhaka vulnerable to higher homicide rates. Future trends of homicides will be interesting in Dhaka. For the COVID-19 scenario, the capital has experienced a lower homicide rate in 2020. However, it can increase in the post-pandemic situation.

It has been observed that except for, Mirpur, Gulshan, and Uttara division the average number of homicides shows no significant deviation and hover around 2 homicides in each division with sudden fluctuation in both directions during the period from January 2015 to June 2020. Overall, for Dhaka city, it has been forecasted that during June 2020 the total homicides of Dhaka will be rise to 21 (95% PI 12-38) and then will drop and stabilize to 14 in December 2020. It has been also found that except Motijheel division, the rest of the 7 divisions shows a negative relationship between homicides and population. Whereas the high-profile case analysis depicts significant gender disparity of victims' age and modus operandi of homicide. It has been found that comparatively more males become the victim of homicides than females in all the age groups as well as all of the categories of the modus operandi of homicides.

Limitations of the Study:

The present study was conducted during the COVID-19 period. The data was collected from the Bangladesh Police. Bangladesh Police was badly affected by COVID-19. Until April 2021; 20,000 police personnel were affected by COVID-19, and 88 died (Uddin, 2021). So, collecting data from the police for the study was difficult. However, the nature of the data was straightforward, like numbers, years, and place of homicides. So, extracting variables from the data was difficult and cumbersome. The present study lacks related literature on Dhaka city homicides. In Bangladesh, the criminology discipline is incepted only a decade back. And, Bangladesh Police does not have in-depth research activities due to political pressures and fear of dissemination of real-time data to the public which can affect the image of the police.

Future Research Areas:

Enthusiastic researchers can contribute to the following study areas based on Bangladesh. From the micro and macro level, several research works can be done. The researcher can conduct a study on trends of homicides based on the police station which can provide the grassroots level picture of homicides. Police stations can be categorized based on the economic situation into three categories: affluent, less affluent, and poverty-stricken. It is found from the present study that there is a correlation between homicides and poverty. So, the micro level study can be conducted on police stations. It will provide a more apparent picture of homicides. By comparing affluent, less affluent, and poverty-stricken police stations, researchers can expect a better picture of the grassroots levels. Researchers can collect the gender, age, weapon, the motive of homicides data from police stations. Regression analysis can be conducted based on these data. The present study is based on the data from Bangladesh Census 2011. However, a new census is supposed to be conducted in 2021. Another similar study can be conducted based on the 2021

census. Dhaka Metropolitan Police does not have a crime mapping system for the spatial analysis of crime. DMP crime map has not been updated since 2014. Future studies can be carried out on the spatial analysis of homicides in the capital.

Policy Proposals:

The present study suggests some following policy proposals. The data collection and preservation of Bangladesh Police is outdated which is based on year, number, and police division/station. A detailed and statistically sound approach is needed for the right direction of the police approach. Bangladesh Police should open its database to public use like the neighboring country India. In India, one can easily access the homicide database. Bangladesh Police can follow that path. Bangladesh Police should welcome more and more academicians to conduct a study on homicides and other crime trends. Bangladesh can face a rise in homicides if the country is failed to meet the needs of the growing young population. Policymakers of Bangladesh should focus on employment and education to reduce the risk.

CHAPTER IV

Conclusion

Homicide trends vary from country to country and society to society. Developed nations have downward trends of homicides. However, developing countries have mixed trends in homicides. The lack of data and the slow rise of criminology and criminal justice have made homicide trends and patterns ambiguous. Bangladesh is not different from that scenario. Before, 2014 all the homicides data were scattered and were registered centrally. After 2014 all crime data is preserved in a computerized system. The present study is a very basic analysis of homicide data of Dhaka city. The study found homicide trends of Dhaka city have a downward trend which was enhanced by the changing scenarios of COVID-19. However, crime and homicide trends after the COVID-19 situation would be a great concern for Dhaka city. It is mentioned earlier that the affluent 20 percent of people in Bangladesh have 42.8 percent of their wealth. The poorest 40 percent of people have only 20.7 percent of the wealth(*Bangladesh Poverty and Wealth, Information about Poverty and Wealth in Bangladesh*, n.d.). Similarly, the present study found that there is a correlation between the poverty rate and homicides. The changepoint analysis found, from January 2015 to September 2015 and March 2017 to June 2020; Dhaka city has a higher trend of homicides than other timeframes. From January 2015, there was three months' long political unrest in Bangladesh where Dhaka was the center point. In 2018, there was another general election held in the country. It can be assumed general election periods have an impact on homicide trends. The population is supposed to correlate with homicides. However, the present study shows that except Motijheel division, the rest of the 7 divisions have a negative relationship between the number of homicides and population. Forecast analysis suggested that homicides will decrease in 2020. However, different secondary data show that total crime rates have been decreased during 2020. Additionally, analysis from high-profile

homicide cases found that victims' age and modus operandi of homicide are significantly associated with the gender of the victims. The present study is one of the pioneering research works on homicides in Dhaka city. However, in the future, more and more micro-level efforts are needed to analyze the homicide trends of Dhaka city.

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A8%E0%A6%BE%E0%A7%9F-%E0%A6%86%E0%A6%95%E0%A7%8D%E0%A6%B0%E0%A6%BE%E0%A6%A8%E0%A7%8D%E0%A6%A4

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Appendix

Forecasting R Code:

```
# Clear all object & free up memory
rm(list = ls(all.names = TRUE))
gc()
library(readxl)
library(tidyverse)
library(tidyr)
library(lubridate)
library(nortest)
library(stats)
library(cowplot)
library(gridExtra)
library(patchwork)
library(imputeTS)
library(forecast)
library("xlsx")
#Setting working directory
setwd("E:murder/")
monthly_murder_data_raw <- read_excel("monthly_murder_data.xlsx")
monthly_murder_data_thana <- monthly_murder_data_raw %>%
  mutate(date = make_date(year, month)) %>%
  complete(thana, date = seq.Date(min(date), max(date), by = "month"))  %>%
```

```
  select(., -c(year, month)) %>%
  select(., c(date, thana, tot_murder)) %>%
  na_seadec()
monthly_murder_data_dhaka <- monthly_murder_data_thana %>%
  group_by(date) %>%
  summarise(tot_murder = sum(tot_murder)) %>%
  mutate(thana = "Dhaka (Total)")

monthly_murder_data <- bind_rows(monthly_murder_data_thana,
                                 monthly_murder_data_dhaka)
#STAGE-1: Data preparation

#############################################################################
#######
# Creating Time series
#############################################################################
#######

monthly_murder_data_Ramna_ts <- monthly_murder_data %>%
  filter(thana == "Ramna") %>%
  select(., c(tot_murder)) %>%
  ts(
    .,
```

```
  start = c(2015, 1),
  end = c(2020, 6),
  frequency = 12
 )

monthly_murder_data_Lalbagh_ts <- monthly_murder_data %>%
 filter(thana == "Lalbagh") %>%
 select(., c(tot_murder)) %>%
 ts(
  .,
  start = c(2015, 1),
  end = c(2020, 6),
  frequency = 12
 )

monthly_murder_data_Wari_ts <- monthly_murder_data %>%
 filter(thana == "Wari") %>%
 select(., c(tot_murder)) %>%
 ts(
  .,
  start = c(2015, 1),
  end = c(2020, 6),
  frequency = 12
```

```
  )


monthly_murder_data_Motijheel_ts <- monthly_murder_data %>%
  filter(thana == "Motijheel") %>%
  select(., c(tot_murder)) %>%
  ts(
    .,
    start = c(2015, 1),
    end = c(2020, 6),
    frequency = 12
  )


monthly_murder_data_Tejgaon_ts <- monthly_murder_data %>%
  filter(thana == "Tejgaon") %>%
  select(., c(tot_murder)) %>%
  ts(
    .,
    start = c(2015, 1),
    end = c(2020, 6),
    frequency = 12
  )


monthly_murder_data_Mirpur_ts <- monthly_murder_data %>%
```

```
  filter(thana == "Mirpur") %>%
  select(., c(tot_murder)) %>%
  ts(
    .,
    start = c(2015, 1),
    end = c(2020, 6),
    frequency = 12
  )

monthly_murder_data_Gulshan_ts <- monthly_murder_data %>%
  filter(thana == "Gulshan") %>%
  select(., c(tot_murder)) %>%
  ts(
    .,
    start = c(2015, 1),
    end = c(2020, 6),
    frequency = 12
  )

monthly_murder_data_Uttara_ts <- monthly_murder_data %>%
  filter(thana == "Uttara") %>%
  select(., c(tot_murder)) %>%
  ts(
```

```
    .,
    start = c(2015, 1),
    end = c(2020, 6),
    frequency = 12
  )

monthly_murder_data_Dhaka_TOT_ts <- monthly_murder_data %>%
  filter(thana == "Dhaka (Total)") %>%
  select(., c(tot_murder)) %>%
  ts(
    .,
    start = c(2015, 1),
    end = c(2020, 6),
    frequency = 12
  )

# sTAGE-2: Visualize

##############################################################################
#######
# STL Time series decomposition
##############################################################################
#######
```

```
p1_hist <- ggplot(monthly_murder_data, aes(x = tot_murder)) +
  geom_bar(fill = "white", colour = "black") +
  facet_wrap(thana ~ ., scales = "free", ncol = 2)

ggsave(
  "plot_hist.tiff",
  units = "in",
  width = 8,
  height = 7,
  dpi = 300,
  compression = 'lzw'
)

stl_Dhaka_tot <- monthly_murder_data_Dhaka_TOT_ts[,1] %>%
  stl(s.window = "periodic", robust = TRUE)

png("seas_dhaka_tot.tiff", width = 600, height = 400)

autoplot(stl_Dhaka_tot) + ggtitle("Dhaka (Total)")

dev.off()
```

```
seasadj_monthly_murder_data_Dhaka_TOT_t <-
  round(forecast::seasadj(stl_Dhaka_tot))

# Stage - 3: Define model & estimate stage:

################################################################################
#######
# Forecast
################################################################################
#######

#Mean method
fit.m_Dhaka_TOT <- meanf(
  monthly_murder_data_Dhaka_TOT_ts,
  h = 6,
  level = 0.95,
  fan = T,
  lambda = "0"
)
checkresiduals(fit.m_Dhaka_TOT)
fp1_dhaka <- autoplot(fit.m_Dhaka_TOT) +
  ggtitle("Mean") +
  xlab("Time") + ylab("Number of murder")+
```

```
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())


#Naive method
fit.naive_Dhaka_TOT <-
  naive(
    monthly_murder_data_Dhaka_TOT_ts,
    h = 6,
    level = 0.95,
    fan = T,
    lambda = "0"
  )
checkresiduals(fit.naive_Dhaka_TOT)
fp2_dhaka <- autoplot(fit.naive_Dhaka_TOT) +
  ggtitle("Naive") +
  xlab("Time") + ylab("Number of murder")+
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())
```

```
#Drift method
fit.drift_Dhaka_TOT <-
  rwf(
    monthly_murder_data_Dhaka_TOT_ts,
    h = 6,
    drift = T,
    level = 0.95,
    fan = T,
    lambda = "0"
  )
checkresiduals(fit.drift_Dhaka_TOT)
fp3_dhaka <- autoplot(fit.drift_Dhaka_TOT) +
  ggtitle("RWD") +
  xlab("Time") + ylab("Number of murder")+
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())

#ARIMA
fit.arima_Dhaka_TOT <-
  auto.arima(monthly_murder_data_Dhaka_TOT_ts, lambda = "auto")
checkresiduals(fit.arima_Dhaka_TOT)
```

```
fp4_dhaka <-  autoplot(forecast(fit.arima_Dhaka_TOT, h = 6))+
  ggtitle("ARIMA") +
  xlab("Time") + ylab("Number of murder")+
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())


#Exponential smoothing state space
fit.ets_Dhaka_TOT <-
  ets(monthly_murder_data_Dhaka_TOT_ts, lambda = "auto")
plot(fit.ets_Dhaka_TOT)
checkresiduals(fit.ets_Dhaka_TOT)


fp5_dhaka <- autoplot(forecast(fit.ets_Dhaka_TOT, h = 6)) +
  ggtitle("ETS") +
  xlab("Time") + ylab("Number of murder")+
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())


# Seasonally adjusted: Naive
```

```
fit.stl.naive_Dhaka_TOT <-
  stlf(
    monthly_murder_data_Dhaka_TOT_ts,
    method = 'naive',
    lambda = "auto",
    h = 6,
    biasadj = TRUE
  )
checkresiduals(fit.stl.naive_Dhaka_TOT)

fp6_dhaka <- autoplot(fit.stl.naive_Dhaka_TOT) +
  xlab("Time") + ylab("Number of murder") +
  ggtitle("STL Naive") +
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())

# Seasonally adjusted: Random walk drift
fit.stl.rwdrift_Dhaka_TOT <-
  stlf(
    monthly_murder_data_Dhaka_TOT_ts,
    method = 'rwdrift',
```

```
    lambda = "auto",
    h = 6,
    biasadj = TRUE
  )
checkresiduals(fit.stl.rwdrift_Dhaka_TOT)
fp7_dhaka <- autoplot(fit.stl.rwdrift_Dhaka_TOT) +
  xlab("Time") + ylab("Number of murder")+
  ggtitle("STL RWD")+
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())

# Seasonally adjusted: ARIMA
fit.stl.arima_Dhaka_TOT <-
  stlf(
    monthly_murder_data_Dhaka_TOT_ts,
    method = 'arima',
    lambda = "auto",
    h = 6,
    biasadj = TRUE
  )
checkresiduals(fit.stl.arima_Dhaka_TOT)
```

```
fp8_dhaka <- autoplot(fit.stl.arima_Dhaka_TOT) +
  xlab("Time") + ylab("Number of murder")+
  ggtitle("STL ARIMA") +
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())

# Seasonally adjusted: ETS
fit.stl.ets_Dhaka_TOT <-
  stlf(
    monthly_murder_data_Dhaka_TOT_ts,
    method = 'ets',
    lambda = "auto",
    h = 6,
    biasadj = TRUE
  )
checkresiduals(fit.stl.ets_Dhaka_TOT)

fp9_dhaka <- autoplot(fit.stl.ets_Dhaka_TOT) +
  xlab("Time") + ylab("Number of murder")+
  ggtitle("STL ETS")+
```

```
  theme_bw()+
  theme(panel.background = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank())



fp_dhaka <- fp1_dhaka+fp2_dhaka+fp3_dhaka+fp4_dhaka+fp5_dhaka+
  fp6_dhaka+fp7_dhaka+fp8_dhaka+fp9_dhaka


ggsave(
  "plot_forecast_dhaka.tiff",
  units = "in",
  width = 13,
  height = 11,
  dpi = 300,
  compression = 'lzw'
)



# Stage-4: Evaluate the accuracy of the models
acc.mean_Dhaka_TOT <- accuracy(fit.m_Dhaka_TOT)
acc.naive_Dhaka_TOT <- accuracy(fit.naive_Dhaka_TOT)
acc.drift_Dhaka_TOT <- accuracy(fit.drift_Dhaka_TOT)
```

```
acc.ets_Dhaka_TOT <- accuracy(fit.ets_Dhaka_TOT)
acc.arima_Dhaka_TOT <- accuracy(fit.arima_Dhaka_TOT)
acc.stlf.naive_Dhaka_TOT <- accuracy(fit.stl.naive_Dhaka_TOT)
acc.stlf.rwdrift_Dhaka_TOT <- accuracy(fit.stl.rwdrift_Dhaka_TOT)
acc.stlf.arima_Dhaka_TOT <- accuracy(fit.stl.arima_Dhaka_TOT)
acc.stlf.ets_Dhaka_TOT <- accuracy(fit.stl.ets_Dhaka_TOT)

acc.tab <-
  rbind.data.frame(
    acc.mean_Dhaka_TOT,
    acc.naive_Dhaka_TOT,
    acc.drift_Dhaka_TOT,
    acc.ets_Dhaka_TOT,
    acc.arima_Dhaka_TOT,
    acc.stlf.naive_Dhaka_TOT,
    acc.stlf.rwdrift_Dhaka_TOT,
    acc.stlf.arima_Dhaka_TOT,
    acc.stlf.ets_Dhaka_TOT
  )

acc.tab$method <- c(
  "mean",
  "naive",
```

```
  "rwd",
  "ets",
  "arima",
  "stl.naive",
  "stl.rwd",
  "stl.arima",
  "stl.ets"
)

desired_order <- c("mean",
                   "naive",
                   "rwd",
                   "ets",
                   "arima",
                   "stl.naive",
                   "stl.rwd",
                   "stl.arima",
                   "stl.ets")

SumErr <- acc.tab %>% group_by(method) %>%
  summarise(SumErr = sum(ME, RMSE, MAE, MPE, MAPE, MASE, ACF1)) %>%
  arrange(SumErr)
```

```
# Re-order the levels
SumErr$method <- factor( as.character(SumErr$method), levels=desired_order )
# Re-order the data.frame
SumErr <- SumErr[order(SumErr$method),]


write.xlsx(
  SumErr,
  file = "SumErr.xlsx",
  sheetName = "SumErrt",
  row.names = T,
  col.names = T
)
png("plot_forecast_acc_dhaka.tiff", width = 800, height = 800)


layout(matrix(c(1:9),
              nrow = 3, ncol = 3, byrow = TRUE))


par(las=2)


barplot(acc.tab$ME,names.arg = acc.tab$method,main = "ME",
        cex.main=2, cex.names=1.5)
barplot(acc.tab$RMSE,names.arg = acc.tab$method,main = "RMSE",
        cex.main=2, cex.names=1.5)
```

```
barplot(acc.tab$MAE,names.arg = acc.tab$method,main = "MAE",
        cex.main=2, cex.names=1.5)
barplot(acc.tab$MPE,names.arg = acc.tab$method,main = "MPE",
        cex.main=2, cex.names=1.5)
barplot(acc.tab$MAPE,names.arg = acc.tab$method,main = "MAPE",
        cex.main=2, cex.names=1.5)
barplot(acc.tab$MASE,names.arg = acc.tab$method,main = "MASE",
        cex.main=2, cex.names=1.5)
barplot(acc.tab$ACF1,names.arg = acc.tab$method,main = "ACF1",
        cex.main=2, cex.names=1.5)
barplot(SumErr$SumErr,names.arg = SumErr$method,main = "Sum Error (combined)",
        cex.main=2, cex.names=1.5)
dev.off()

#Stage-5: Produce forecasts

# Predicted value Seasonally adjusted: ETS
fit.stl.ets_Dhaka_TOT
```