Sri Lanka Journal of Social Sciences 2025 ***48****(1): 03-19*
DOI: https://doi.org/10.4038/sljss.v48i01.8869

RESEARCH ARTICLE

Age Disparities in Delinquency and Victimhood Across Crime Types: Exploring Age-dependent Dynamics

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Abstract: Crime is an inevitable but manageable aspect of any society. We analysed the age profiles of the suspects and victims of various crimes using a sample of crime records obtained from a regional police station in Sri Lanka. Graphical analysis methods and chi-square tests were used to identify the differences among age groups and different types of crime. For widely reported crimes including housebreaking, theft, robbery, and personal assault, delinquency peaks in 20s and smoothly declines with age. People in their 40s are the most vulnerable to property crimes such as housebreaking and theft. These differences may be explained by the age-related differences in income and unemployment. The suspects of well thought out crimes, such as cheating and breach of trust were the most matured with a peak in 30s-40s. The number of suspects below 20 were significantly low for all types of crimes other than those related to rape and sexual abuse. A strictly adolescent peak of delinquency was observed in 16-19 for crimes associated with abduction, rape and/or sexual abuse and the majority of the victims were children. A child victim or suspect was reported in 10% of all incidents. Involvement in criminal grouping was most prevalent between late teens and 40 years of age. The composite age profile of the suspects complies with the traditional age-crime profile with a minor shift. However, it shows a significant deviation from the age profiles of both convicted and unconvicted prisoners in Sri Lanka, which could be a reflection of delays in arresting and court hearings.

Keywords: crime, suspects, victims, offenders, age profile, delinquency

INTRODUCTION

Crime is an inevitable aspect of any society, though the prevalence of certain crimes may vary across communities. Crime is thus a major societal issue in Sri Lanka too. According to Sri Lanka Police, in 2020, 31,098 crime incidents have been reported (Sri Lanka Police, 2021). This was a slight decrease compared to 34,578 incidents reported in 2019 (Department of Census and Statistics, 2021). The number of cases reported annually has ranged between 30,000 and 40,000 over the last five years. Among the incidents reported in 2020, there were 6811 incidents related to illegal drugs (22%), 6499 incidents of housebreaking (21%), 4073 incidents of theft (13%), 2891 incidents related to cheating, misappropriation, and breach of trust (9%), 2148 robberies (7%), 1962 incidents of voluntarily causing hurt by weapon (6%), and 1954 cases of rape (6%). The number of incidents reported from different police divisions also vary significantly, for example, the highest number of cases related to illegal drugs have been reported from Kurunegala (599 cases) while the highest number of rape incidents have been reported from Anuradhapura (177 cases) (Sri Lanka Police, 2021).

According to Sri Lankan prison statistics, 19,856 convicted prisoners, including 395 females were directly admitted to the prisons in 2020; this is a significant decrease compared to 29,164 prisoners directly admitted

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in 2019 (Department of Prisons, 2021). The COVID-19 pandemic and the subsequent lockdowns may be a reason for the decrease in 2020. However, the prison population rate (number of both convicted and unconvicted prisoners per 100,000 population) in Sri Lanka is 94 which is relatively higher compared to neighbouring South Asian countries such as India, Pakistan, and Nepal where the rates are respectively 33, 43, and 65 (Walmsley, 2018).

While the aggregate numbers of incidents and prisoners provide a broad overview of the distribution of crime in a country, in-depth analysis of crime data is required to generate insights into frequent patterns, trends, and associations among crime incidents. Such insights improve our understanding on when, where, by whom, and against whom certain crimes are likely to be committed and provide directions for efficient prevention of criminal activities. Thus, crime analysis is performed focusing on various aspects of crime incidents, offenders, and victims. Identifying spatial and temporal patterns of crime incidents and their associations at the regional scale constitutes a major branch of crime analysis (Kortas et al., 2022; Lin et al., 2022; Xia et al., 2021). Various spatiotemporal patterns of crime incidents have been identified in different geographical areas and communities. For example, Xiang et al. (2023) who analysed crime incidents in Downtown Eastside of Vancouver found that spatial configuration of crime is associated with land use. In Detroit, United States, crime incidents in spatial blocks were associated not only with the crime incidents reported in the past but also with the crime incidents in adjacent blocks (Lin et al., 2022). In Florianópolis, Brazil, the concentration of street crime was found to be stable over time, but exact locations varied depending on temporal factors such as the season, weekday, and time (Valente, 2019). Montolio and Planells-Struse (2016) and Ristea et al. (2020) studied how sports events cause temporal fluctuations in crime rates and patterns. They have indicated that depending on the type of crimes, the rates can temporarily rise or drop before or after sports events.

Another major branch of empirical research into crime is dedicated to identifying the factors associated with crime. Research studies have found that socioeconomic factors such as unemployment (Adeyemi et al., 2021; Yigzaw et al., 2023), education level (Bennett, 2018; Yigzaw et al., 2023), income (Adeyemi et al., 2021; Goh & Law, 2023), housing prices/subsidies (Kortas et al., 2022; Manea, 2023), and physical factors such as commercial centres (Yigzaw et al., 2023) and street networks and lights (Xiang et al., 2023; Xu et al., 2018; Yigzaw et al., 2023) also have associations with crime.

Though extensive research has been carried out on understanding crime patterns and associated factors in various countries and regions, only a few studies in Sri Lanka have focused on or related to analysis of crime incidents. Some of those studies are also narrowly focused on a specific type of crime. For instance, one study focused on alcohol abuse among adolescents and illegal substance use (Senanayake et al., 2018) and another focused on wife-battering (Vidanapathirana, 2014). Jayathunga (2010) has studied the sociological factors affecting homicide focusing on Rathnapura Divisional Secretariat area. Rathnayake (2010) has studied crime incidents in relation to micro and macro level urban attributes such as street patterns, open spaces, commercial uses, public movements, visibility, and boundary walls. Recently, Wickremasinghe and Kaluthanthri (2021) studied the impact of the built environment on crime distribution and hotspots in urban areas, focusing on the Colombo Municipal Council area. However, in most other areas in Sri Lanka, the patterns, trends, and associations in crime incidents, criminal behaviours of the offenders, and trends in victimization are still poorly understood owing to a lack of empirical evidence.

This research focused on the analysis of crime data recorded at a regional police station in Sri Lanka between 2015 and 2020 with special reference to the age profiles of the suspects and victims of various crimes. The primary objective of the study was to identify the age differences in delinquency towards different types of crimes and in the probability of being victims of various crimes. Primarily, a quantitative approach was adopted to generate insights from crime data records. Graphical analysis and classical chi-square tests were used to identify age differences. Findings of this study would contribute to the empirical knowledge on age dynamics of crime and provide insights for both preventing the delinquent groups and for protecting the vulnerable groups.

Crime theory and evidence from Sri Lanka

Criminal behaviours among individuals and their determinants have been studied widely from both theoretical and empirical perspectives leading to development of theories which explain how crimes occur and how people become criminals. These theories generally suggest sociological, psychological, and biological factors associated with crime (DeCamp, 2015). Sociological theories relate the social environment (family, economic conditions, education, etc.) to criminal behaviour. Psychological theories explain delinquent behaviour based on individual mental conditions and personality characteristics. Biological theories, which are less popular nowadays, link certain biological conditions and criminal behaviour. While there are several theories of crime, some of the most popular are routine activity theory, crime opportunity theory, and crime pattern theory (Wang & Zhang, 2020).

The well-known routine activity theory suggests that crime incidents take place when three factors come together: a motivated offender, an accessible/suitable target, and the absence of capable guardians (Kitteringham & Fennelly, 2020; Zhang et al., 2022). For example, a person who has the ability to commit a crime may be motivated by factors such as hunger and frustration. A motivated offender may come across an accessible target such as a house with an unlocked door or window. Then if some person who is capable of protecting the property is not present, i.e., in the absence of a capable guardian, the offender would commit the crime. Thus, the routine activity theory provides a framework for crime prevention by eliminating any of the three factors. It provides a theoretical base for investigating how demographic factors such as age and gender play a role in being a motivated offender or a suitable target for a crime (Mohammad & Nooraini, 2021).

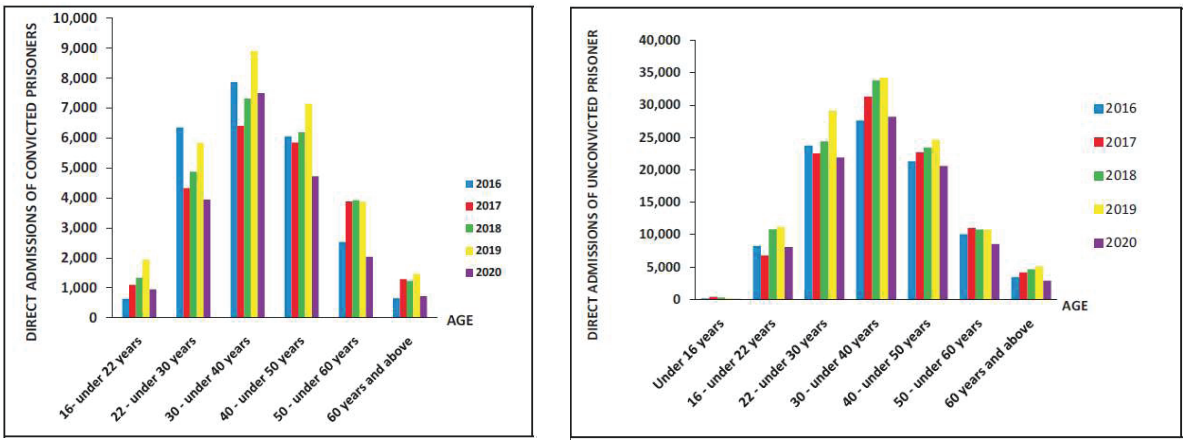
Crime opportunity theory suggests that crime occurs when a motivated offender come across an opportunity to commit the crime (Clarke, 2012; Tilley & Sidebottom, 2015). This theory recognizes crime opportunities or vulnerabilities as the main cause of crime. It also provides a foundation for studying the interaction between criminals and their targets. Opportunities may stem from sociological and situational factors within the communities. For example, young people being victims of cybercrime more often than elderly people (Oksanen & Keip, 2013) and elderly people being more vulnerable to property theft and robbery may be explained by the crime opportunity theory (Clarke, 2012). Crime opportunity theory supports the study of age differences in delinquency and vulnerability to better understand and prevent the opportunities for crime.

According to crime pattern theory, crime is more likely to occur when a physical environment which facilitates or fosters crime overlaps with the offender's comfort zone (He et al., 2020; Zhang et al., 2022). It emphasizes the importance of understanding the spatial contexts that provide opportunities to commit crimes. Deterrence theory states that people tend to commit crimes when the perceived benefits of committing a crime outweigh the associated costs (Levan & Mackey, 2015). This theory supports the idea that severity of punishment determines the extent to which people are deterred from crime. While there are several other theories related to crime occurrence, e.g., rational choice theory (Zhang et al., 2022) and boost theory (Wang & Zhang, 2020), all these theories generally agree that crime can be prevented or at least reduced by eliminating the circumstances and factors that facilitate crime.

Studies on the demographics of criminals throughout the world have generally agreed that delinquency increases over the teenage years, peaks at the age of 19-20 years, and then gradually decreases with age (Bindler & Hjalmarsson, 2017). Since the beginning of criminology, this traditional age-crime profile with adolescent peak, also known as the age-crime invariance thesis, has been considered as a biological phenomenon of increasing violent behaviour in adolescence and declining criminal behaviour in adulthood (Kanazawa & Still, 2000; Shulman et al., 2013; Steffensmeier et al., 2020; Ulmer & Steffensmeier, 2014). However, the prison statistics in Sri Lanka contradict this widely found age-crime profile (Department of Prisons, 2021). According to Sri Lankan prison statistics, the highest percentage of convicted prisoners is in the age group of 30-40 years closely followed by the percentages in the 40-50 age group and the 22-30 age group. As shown in Figure 1, delinquency among Sri Lankans tends to increase until maturity (30-40 years) and remains relatively higher until 50 years. Delays in court hearings may be a possible explanation, but the age profile of the unconvicted prisoners is also

Figure 1

Age Profiles of Convicted and Unconvicted Prisoners in Sri Lanka Between 2016 and 2020



Note. Adapted from Department of Prisons (2021)

quite similar to that of convicted prisoners (Figure 1). Delayed onset of criminal behaviour (Beckley et al., 2016) and sympathy towards juvenile offenders may also be possible explanations, but none of these scenarios have been tested with data from the Sri Lankan context.

The traditional age crime profile has been challenged based on the argument that age crime profiles can vary by the type of crime and the sociocultural context and that they may change over time (Ulmer & Steffensmeier, 2014). For instance, in Sri Lanka, the age profile of the drug offenders is similar to that of all convicted and unconvicted offenders with the peak occurring in 30-40 age group but since 2019, the peak has shifted to 22-30 age group (Department of Prisons, 2021). There are both empirical evidence and theoretical justification for geographically variant age crime associations (Steffensmeier et al., 2020; Ulmer & Steffensmeier, 2014). Hence, crime analysis performed focusing on a specific community within a defined geographical area provides more reliable information about criminal behaviour in a locality.

In the Sri Lankan context, no research study has investigated the age profile of offenders or suspects and virtually nothing is published on the age profiles of the victims. The associations between the demographics of offenders and victims, which reveal the groups of offenders who frequently target certain groups of victims, are yet to be identified at the local context.

METHODOLOGY AND DATA

A relatively large dataset of historical records of crime that occurred at distinct locations over a long period of time is required to identify the age differences in delinquency and victimhood across different types of crimes. Hence, a larger geographical area occupied by culturally, socially, and ethnically diverse communities would be preferable as the study area, but due to the practical limitations in collecting data, crime incidents reported at a single but main police station were used in this study to elicit information on offenders and victims of crime. Though the suspects are not convicted offenders and they can be released without charge or acquitted by the court, owing to the difficulties in accessing data pertaining to convicted offenders, suspect information was used as a proxy for potential offenders.

Study area

The study was based on Katugasthota police area in Kandy District of Sri Lanka. Katugasthota is located approximately 100 km away from the capital Colombo towards the central hills. Katugasthota Police Station is one of the major police stations in Kandy Police Division. There are 52 police divisions in Sri Lanka including eight special divisions and Kandy is one of the 44 regional divisions. Katugasthota police area consists of 52.86 km^2 of area, three divisional secretariats with 90 grama niladhari divisions (Grama niladhari division is the smallest administrative unit in Sri Lanka). Out of the 31,098 crime incidents reported from the whole island in 2020, 1,111 cases were from Kandy Division (Sri Lanka Police, 2021). This is the fifth highest number of cases reported by any police division. Katugasthota police area within the Kandy Division may be considered as a representative police area at least for the Kandy Division, if not for the whole country.

Data collection

The Data on crime incidents reported at the Katugasthota Police Station were manually copied from the summary books of crime records for each year from 2015 to 2020 available at the police station. The date, time (if known), location, a brief description of the incident, and the demographics (age and gender) of the victim and suspect (if known) were copied from the books. Some records were later removed owing to errors in copying and missing or invalid data. A series of incidents of torching and damaging properties had been recorded between 5th and 9th March 2018. During this period, there was an unrest of an ethnic nature in Katugasthota area. Hence all those records were also removed because they represented a series of unusual incidents.

After removing all the unusable incidents, records of 987 incidents were retained. Those records were not uniform in their composition. For instance, the number of suspects and/or victims can vary among the incidents. For drug-related offenses, there were no victims while for some cases related to theft and personal hurt, there were several suspects. In cases of housebreaking, theft, and robbery, the complainant was considered as the victim. There was no suspect identified for some housebreaking, property damage, and theft incidents. In some instances, only the name of the suspect and/or the victim had been recorded and thus their age, gender, or both were not available in the corresponding summary records. In the analysis, only the records which consisted of the required fields were considered.

For the purpose of analysis, the crime records were grouped into seven broad categories as listed in Table 1. The categorization was done based on the keywords used to describe each incident.

Table 1

Summary of Crime Incidents Reported Between 2015 and 2020

Type of crime	No. of cases	No. of victims	No. of suspects
(1) Abduction, rape, and/or sexual abuse	65	66	73
(2) Housebreaking, property damage and/or theft (steal)	585	587	483
(3) Attack, injure, attempt murder, and/or murder	151	155	260
(4) Depredation/robbery	72	72	107
(5) Breach of trust and/or cheating	73	86	79
(6) Possession and/or trafficking of illegal drugs or narcotics	28	-	31
(7) Other	13	9	24
Total	987	975	1057

Data analysis

Graphical and tabular analysis methods were used as the primary method of identifying more delinquent groups of suspects and more vulnerable groups of victims. Analysis was performed for each type of crime separately by tabulating and graphing the number of suspects and victims in each age group. To evaluate the statistical significance of the age differences observed visually, some chi-square tests were performed where appropriate. Cross tabulation of the ages of the suspects and victims was also used to examine whether the suspects in certain age groups target potential victims in specific age groups.

Chi-square tests were used where appropriate to examine whether there is any statistically significant association between the age of the suspects and the age of the victims. In discrete data analysis, chi-square tests are applicable only under certain assumptions/ conditions. To analyse the age dynamics of sex related crimes, mainly, rape and sexual abuse, a network visualization and analysis of the associations between the ages of the suspects and victims was performed using the igraph package in R software. The network was constructed with each node representing a specific age and gender (for example, a node with label 15F represents 15 years old females) and each directed arc represents an instance of suspect-victim interaction (i.e., a directed arc from 21M to 15F indicates a crime incidence where a 21-years-old male is suspected of targeting 15-years-old-female victim). Such a network enables instant observation of frequently occurring links and thus generates insights into any associations between the ages of the suspects and victims of various crimes.

RESULTS AND DISCUSSION

Crime records grouped under each category were first analysed separately using graphical and tabular methods. Such analysis helps in understanding the differences in the age profiles of suspects and victims of different types of crime.

Abduction, rape, and sexual abuse

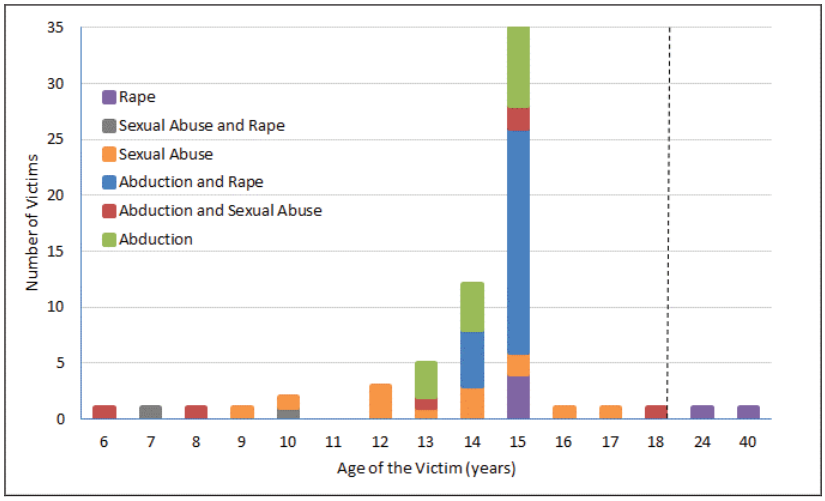
All crime incidents which were described using the terms “rape” or “sexual abuse” were considered under this category. Since most of the abductions were also accompanied by rape or sexual abuse, cases related to abduction (sometimes described as kidnap from lawful guardianship) were also included in this category. Among the 65 cases reported at the police station, there were 45 cases involving abduction, 32 cases involving rape, and 20 cases involving sexual abuse. Six cases of abduction and rape/sexual abuse were associated with love affairs and the victims were aged 15 years as recorded.

The age profile of the victims is shown in Figure 2. Among the 66 victims, only 2 were above 18 years old and all others were children including 7 boys aged 7-15 years. There were 35 victims (53% of all victims) in the age of 15 and 12 victims (18% of all victims) in the age of 14. The graph shows that children are at the highest risk of being targeted by sexual offenders and that vulnerability of the children to sexual crime tends to increase sharply between 12 and 15 years.

In Sri Lanka, the minimum age for sexual consent is 16 years (Goonesekere & Amarasuriya, 2013; Madhubani, 2017) and hence, the bulk of rape cases include incidents

Figure 2

Age Profile of The Victims of Abduction, Rape, and Sexual Abuse



Note. The dotted line demarcates the portion of the x-axis (age-axis) with continued integer values from 6 to 18.

of underage girls running away with their boyfriends and having marital relationships, considered as statutory rape. On the other hand, rape incidents involving those above 15 years may not have been reported as crime, owing to factors such as perceived shame and fear. Another relevant fact is that, according to the laws in Sri Lanka, the minimum age for marriage is 18 years for non-Muslims. (According to Goonesekere and Amarasuriya (2013), for Muslims, "the relevant age for statutory rape is 12 years" and the relevant act has not specified a minimum age for marriage). Such differences in the age for marriage and age for sexual consent have also raised complexities and difficulties in handling rape cases. Irrespective of those concerns, current data provide an alarming revelation about the vulnerability of children in their early adolescence to abduction, rape, and sexual abuse.

The age profile of the suspects of abduction, rape, and sexual abuse shown in Figure 3 indicates that juveniles are more delinquent towards such offenses. Among the 73 suspects including 4 females, there were 26 suspects below 20 (36%), 23 suspects in their 20s (32%), 11 in 30s (15%), 6 in 40s (8%), 3 in 50s (4%) and 2 above age 50 (3%). Surprisingly, 36 suspects (~50%) were aged 16-21 years. The graph shows that delinquency for sex related offences tends to increase from 16 years, peaks at 19 years and then gradually decreases with age. Thus, the age profile of the suspects of crimes associated with abduction, rape, and sexual abuse complies with the traditional age crime profile with a peak in the age of 19-20 years (Bindler & Hjalmarsson, 2017).

The cross tabulations of suspects and victims of crimes involving abduction, rape, and sexual abuse are given in Table 2 below. A network analysis was also performed to visualize and further understand the mapping between suspects and victims (Figure 4). Both illustrations provide an overview of the groups of victims who are frequently targeted by certain groups of suspects. The table shows that female children in the 13-15 years age group are highly vulnerable to such crimes committed by their immediate male elders in the age group of 16-21 years. The network also highlights several arrows directed at node 15F from almost all surrounding nodes, but more frequently from nearby nodes. Hence the network visually confirms that the girls in lower teen ages are frequently targeted by their immediate male elders. However, these numbers may include complaints by parents of girls who run away and/or willingly engage in a marital relationship with their boyfriends who are just a few years older. But there is clear evidence that most crimes associated with abduction, rape, and sexual abuse against children are perpetrated by their immediate elders.

Adolescent sexual offending is a widely discussed problem in other countries also. Studies based on Australia have estimated that 30-50 percent of sexual offences against children are committed by adolescent boys (Grant et al., 2006) and that 40-90 percent of such offenses are committed by children and young people (O'Brien, 2010). In the UK, survey data have shown that 66% of contact sexual abuse against children under 18 years was committed by peers (Radford et al., 2011). As such, O'Brian (2010) raised concerns over the lack of attention paid to young people committing sex related crimes against children.

Table 2

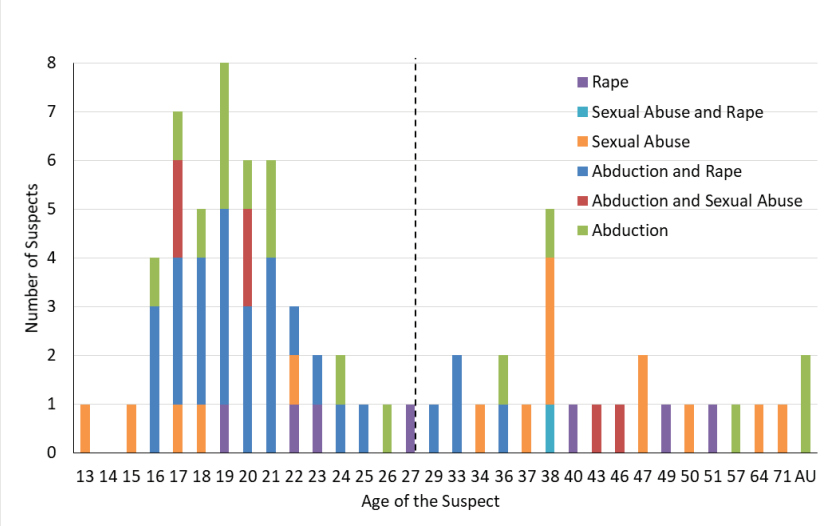
Cross Tabulation of Suspects and Victims of Abduction, Rape, and Sexual Abuse

Suspect's age	Victim's age				
	6-9	10-12	13-15	16-18	19-40
13-15	0	1	0	0	0
16-21	1	0	33	1	0
22-27	0	0	8	1	0
28-33	0	0	2	0	0
34-38	0	3	5	1	0
40-71	2	1	3	0	2

Note. The cell values indicate instances of victimization (rather than the crime incidences).

Figure 3

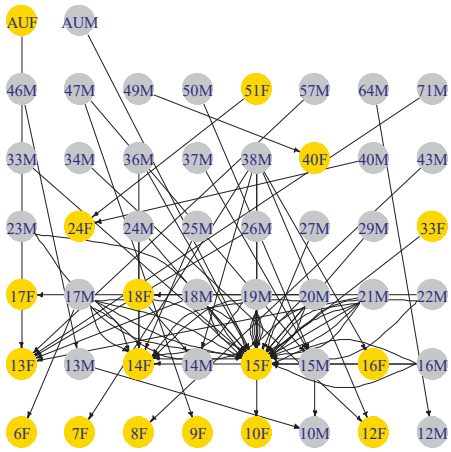
Age Profile of the Suspects of Abduction, Rape, and Sexual Abuse



Note. Two suspects whose age was not recorded are labelled as AU. The dotted line demarcates the portion of the x-axis (age-axis) with continued integer values from 13 to 27.

Figure 4

Network Illustration of Suspects and Victims of Abduction, Rape, and Sexual Abuse



Note. Each node (circle) represents a specific age and gender. The number (inside the circle) indicates the age of the suspect or victim and the character indicates the gender. An arrow from one node to another indicates a crime incidence where a suspect of the age and gender represented by the first node commits a crime against a victim of the age and gender represented by the second node. AUF=Age unknown female and AUM=age unknown male.

Housebreaking, property damage, and theft

All property related crimes described as (i) housebreaking; (ii) breaking/damaging/intruding a house and steal; (iii) breaking/damaging/intruding other properties such as shops, temples, etc. and steal; (iv) breaking/damaging other properties or assets including vehicles; and (v) stealing/theft (money, jewellery, or other moveable assets) were included in this category. These crimes can be broadly categorized as property crimes and they are the most widely spread crime reported in the area, accounting for 60% of the reported incidents.

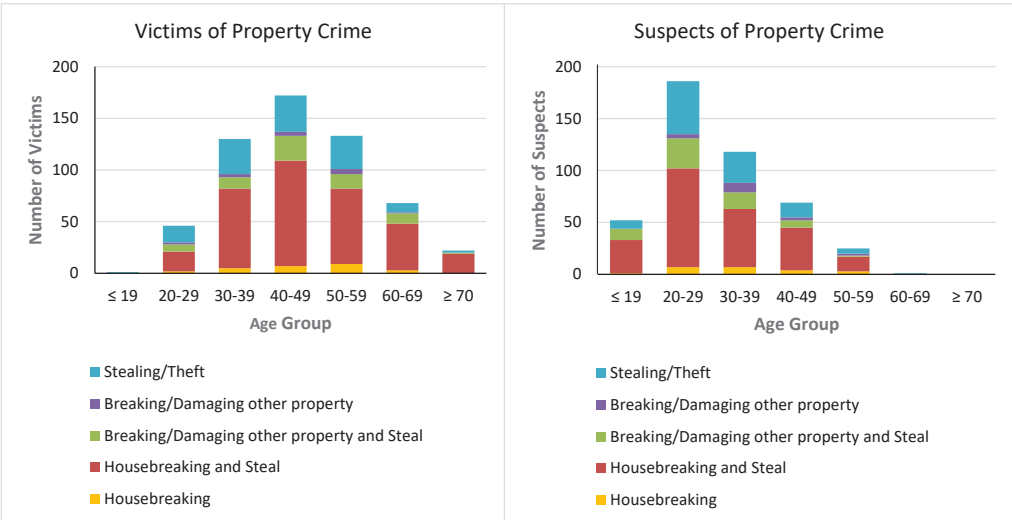
Among the victims, there were 380 males, 185 females, and another 22 whose gender was not recorded (the complainant was considered as the victim in most of these property theft and damage incidents). A higher number of male victims is not a surprise since it is usually an adult male who goes to the police station to report property theft and damage incidents such as housebreaking. For this category of crimes, 483 suspects including 16 females were on record. Age profiles of the suspects and victims (whose age was known) are shown in Figure 5.

As shown in Figure 5, the highest percentage of the property crime victims is in the 40-49 age group (30%), followed by the 50-59 age group (25%) and 30-39 (21%) age groups. The age profile of these property crime victims coincides with widely found age-income profiles around the world (Lee & Ogawa, 2008) and therefore, the data suggests that higher income groups are frequently targeted. In most countries, individual earnings peak in their 40s. For example, in the US, Japan and India, income peaks at age 47. The share of earnings for younger ages below 25 is just 7% on average, while the largest share of earnings is secured by the 25-65 age group (Lee & Ogawa, 2008). Hence, it is understandable why the highest income age range of 40 to 49 is widely targeted in property theft and damage incidents.

In contrast, the age profile of property crime suspects shows that propensity towards such crime tends to peak in the 20s and then gradually decreases until the late 50s. This pattern may be explained by the unemployment trends over different age cohorts, together with their low-income status. In Sri Lanka, the unemployment rate is significantly higher in the age range 20 to 29 (15.3%) compared to 3.1% in the 30-39 group and 1.2% in the 40 and above group (Central Bank of Sri Lanka, 2020). Thus, the low-income groups are apparently more delinquent towards crimes associated with theft owing to poverty. Though the unemployment rate in the 15-19 age group is 26% which is the highest (Central Bank of Sri Lanka, 2020), the vast majority of those teenagers are dependent children whose basic needs are met by their parents. Hence, their delinquency towards property crimes such as housebreaking and theft tends to be lower. But the age of 20-29 may be critical because this is the time that young people start exploring the world on their own after completing school around the age of 19-20. New friends, economic hardships, distracted attention from parents, freshly enjoyed freedom, difficulty in finding jobs, social media, and other socioeconomic factors may compel young people to experiment with various means of making a living including illegal activities. After this critical stage, they appear to learn lessons from their own mistakes and depart from criminal activities.

Figure 5

Age Profiles of the Victims and Suspects of Property Crimes



The age-crime profile of those property crime suspects resembles the traditional age-crime profile though there may be a slight shift to the right with the peak occurring a little later at the age of 25-26. It is also worth noting here that there were spikes in 19-20, 25-26, and 31-32, but a more reliable suspect age profile could be generated with the grouping of ages into 10-year blocks, given the limited number of crime records (~1000). The smooth decline in the number of suspects after 20s is in agreement with the theory of ageing-out criminals which underpins the traditional age-crime profile with an adolescent peak and a tail skewed towards adulthood.

However, some research has claimed that the adolescent peak is an outcome of their economic status rather than a biological factor (Males, 2015; Males & Brown, 2013). They have shown that the well-known age-crime profile prevails in populations suffering from high poverty and that adolescents commit crimes more often than adults because they are poorer than adults – "young people do not age out of crime, they wealth out" (Males, 2015). Our results, particularly with respect to property crimes, provide compelling evidence which supports this wealth-out thesis.

The cross tabulation of suspects and victims (Table 3) shows that offenders in all ages below 50, frequently target adults in their 30s, 40s, 50s, and 60s. We performed a chi-square test of independence considering only the suspect groups below 50 and the victim groups between 30 and 69 to examine whether there is an association between the age of the suspect and the age of the victim. The results indicated that there is no statistically significant association between the suspect's age and the victim's age. X^2 (9, N = 374) = 6.24, p = .72. Hence the offenders' age does not have a significant impact on their choice of a target (with respect to the targets' age). The choice of all offenders, irrespective of their age, is biased towards high income age groups.

Personal assault, injury, and murder

All indicants explained as, attack and/or injure (123), stab and injure (5), and kidnap and attack (8) were considered under this category. Since there were a relatively lower number of murder attempts (6) and murder cases (9) reported, they were also included in this category which covers crimes involving personal physical harm. Altogether there were 151 cases of personal physical harm and the vast majority of cases (81%) were associated with attack and injure.

Among the victims, there were 118 males, 36 females, and one newborn infant. The age profile of the victims of personal harm is shown in Figure 6 (left). It shows a shift to the left compared to the age profile of property crime victims, indicating that adults in their 20s and 30s are highly vulnerable to physical assault. The data suggest that young people in their 20s and 30s are more likely to be victims of physical attack and injury than to be victims of property crimes.

There were 260 suspects of crime associated with personal assault including 27 females. The suspect age profile is similar to the suspect age profile of property crimes except that some suspects of personal assault are in their 60s and 70s while almost all property crime suspects were below 60. Though previous studies have shown that teenagers are more delinquent towards aggressive crimes such as personal assault (Reyes et al., 2012; Schlomer et al., 2015), a relatively lower number of teenagers were present among the suspects of physical assault and injury. However, a more refined age-wise breakdown showed that the peak actually occurs in 19-20 and thus the age profile of the suspects of personal assault generally complies with the traditional age crime profile.

The cross-tabulation of suspects and victims (Table 4) shows that crimes related to personal assault are widely

Table 3

Cross Tabulation of Suspects and Victims of Property Crimes

Suspect's age	Victim's age						
	≤19	20-29	30-39	40-49	50-59	60-69	≥70
≤19	0	2	13	20	12	5	0
20-29	0	16	36	52	50	22	4
30-39	1	9	18	36	34	14	4
40-49	0	3	16	22	13	11	3
50-59	0	2	6	6	4	5	1
60-69	0	0	0	0	1	0	0

Note. The cell-values indicate instances of victimization (rather than the crime incidences).

Figure 6

Age Profile of the Suspects and Victims of Crimes Related to Personal Assault

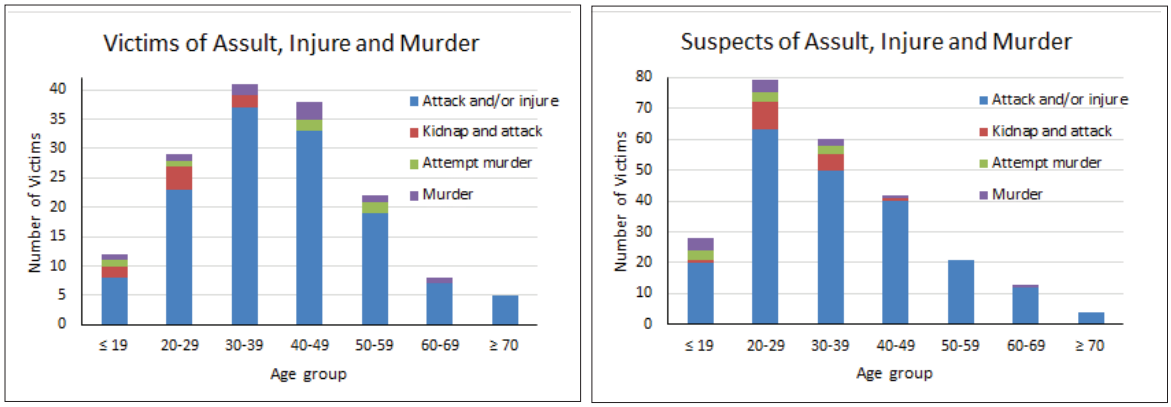


Table 4

Cross Tabulation of Suspects and Victims of Personal Assault, Injury and Murder

Suspect's age	Victim's age						
	≤19	20-29	30-39	40-49	50-59	60-69	≥70
≤19	7	2	7	4	2	3	4
20-29	7	17	29	10	13	0	3
30-39	3	9	21	13	11	3	2
40-49	0	3	16	12	9	0	2
50-59	1	5	4	5	5	1	0
60-69	0	1	4	2	4	2	0
≥70	0	0	1	0	2	1	0

Note. The cell values indicate instances of victimization (rather than the crime incidences).

spread among all age groups while the concentration is higher in the 20-59 age group. A chi-square test performed considering only the suspect groups between ages 20 and 49 and victim groups between ages 20 and 59 indicated that there is no statistically significant association between the suspect's age and the victim's age. X^2 (6, N = 163) = 6.24, p = .27. Hence the offenders' age does not have a significant impact on their choice of a target (with respect to the targets' age).

Depredation/robbery

Among the 72 depredation incidents reported, 18 were accompanied by some kind of physical attack or injury. The age and gender profile of the victims shown in Figure 7 provides evidence that vulnerability is indifferent among demographics. There were 34 male victims and 38 female victims spread among all ages between 20 and 70. Hence, the pattern of victimization in depredation is different from that of crimes related to property theft and personal assault.

However, the data on suspects show that depredation is predominantly a male crime with 105 male suspects and only 2 female suspects. The age profile of suspects (Figure 7) is quite similar to that of property crimes involving housebreaking, property damage, and theft. The peak is around the age 25-26 and there is a consistent decline towards maturity. The factors such as income and unemployment, as discussed above under the property crimes category, may explain the sharp rise in delinquency between the teen years and 20s followed by a consistent decline after 20s. Those who are involved in such crimes during their early 20s appear to wealth-out of crime as they mature and earn more (Males, 2015).

In robberies, offenders usually target valuable artifacts such as money and jewellery. As shown together with the suspect age profile in Figure 7, there were 55 (70%) suspects for depredating money, 43 (60%) suspects for depredating jewellery (particularly a gold chain or a necklace), 7 (1%) suspects for mobile phones, and 3 suspects for three wheelers (There were incidents of depredating more than one item, e.g., gold chain and money). The graph shows that the offenders in all ages frequently target money and jewellery. However, the data were insufficient to statistically verify whether suspect's

Figure 7

Age and Gender Profile of the Victims and Age Profile of the Suspects of Depredation

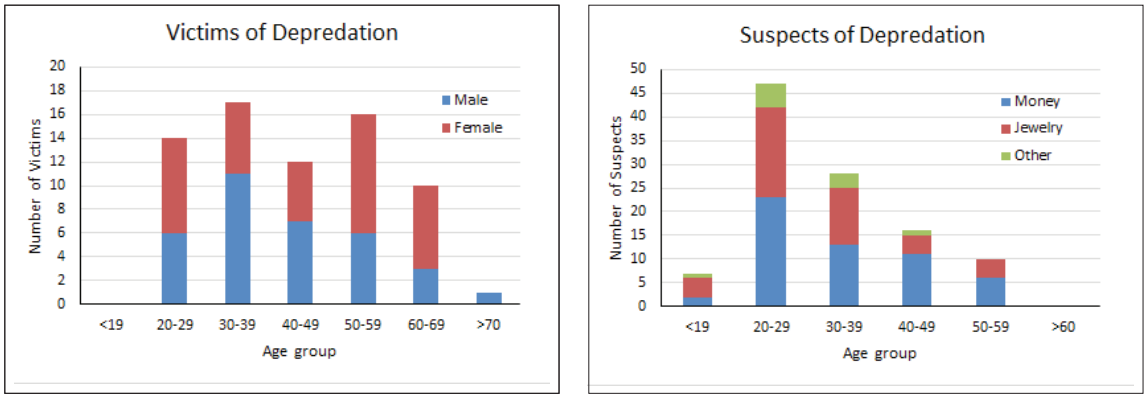
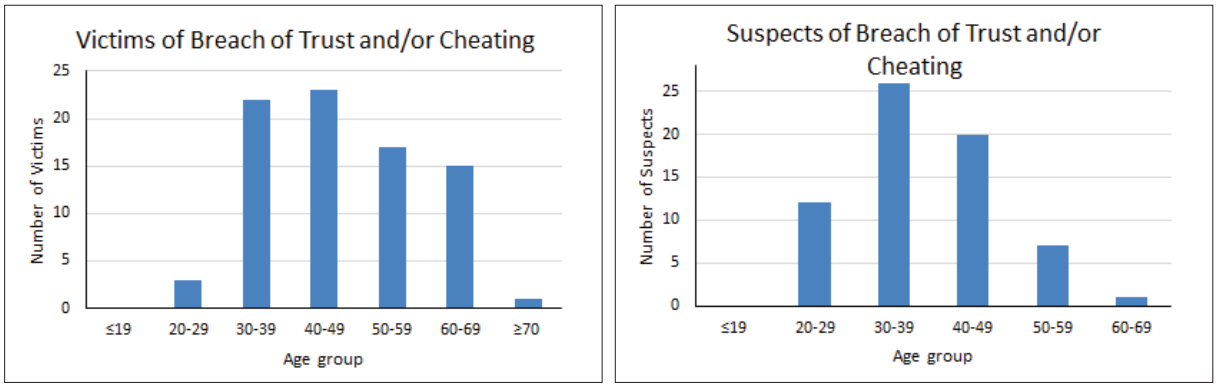


Figure 8

Age Profile of the Suspects and Victims of Breach of Trust and Cheating



age has any association with the age of the victims or with the items they target.

Breach of trust and cheating

All the incidents recorded as breach of trust (6), cheating (68), and breach of trust and cheating (2) were considered under this category. The majority of both victims and suspects were males (83% and 77% respectively). Age profile of the victims (Figure 8) shows that people in their 30s and 40s are highly vulnerable to breach of trust and cheating while those in their 50s and 60s can also be cheated quite often. A chi-square test showed that there is no statistically significant difference in the proportions of victims in age groups from the 30s to the 60s. $X^2(3, N = 77) = 2.32, p = .51$. This result infers that all people in their 30s to 60s are equally vulnerable to breach of trust and cheating.

Interestingly though, the suspects of breach of trust and/or cheating appear to be more mature compared to the suspects of all other types of crimes analysed in this work. 70% of the suspects were in their 30s and 40s while only 18% of the suspects were in their 20s and none was below 20. This is also the only crime type with a significant peak in the 30s. The suspect age profile suggests that non-violent crimes such as breach of trust and cheating are more often committed by older criminals even though they may have aged out of violent crimes.

Possession and transport of illegal drugs

There were 28 cases of possession and/or transport of illegal drugs involving 30 suspects. 27 incidents were related to heroin while the other was related to cannabis. In total, 172 g of illegal drugs (including 5.5 g of cannabis) have been found in the possession of the suspects. The suspect age profile together with the amount of drugs is shown in Table 5. The peak occurs at 30s but the amount of drugs found with the suspects in their 20s is the highest. Therefore, present data is insufficient to draw justifiable evidence of age differences in delinquency towards drug offences. However, possession and trafficking of illegal drugs accounts for the highest number of crimes reported island-wide (22% of all incidents). But in the police area considered in this study, the number of crimes related to illegal drugs is low (3%) and this could be a geographical variation.

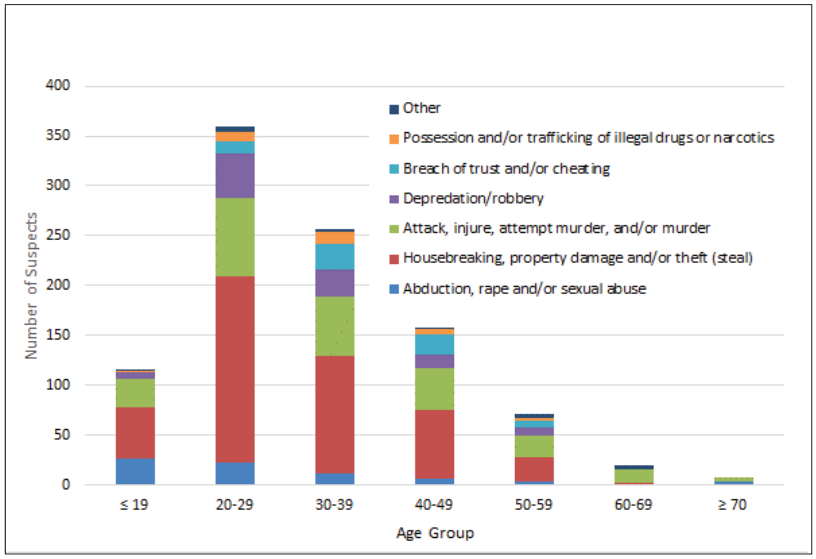
Table 5

Suspects of Crimes Associated with Illegal Drugs

Suspect's age	No. of incidents	Amount of drugs (g)
≤19	2	6.13
20-29	9	62.87
30-39	12	45.54
40-49	5	27.12
50-59	2	30.07
≥60	0	0.00

Figure 9

Age Profile of All Suspects



There were 13 other crime incidents which were not included in any of the above categories. They were blackmail and extort money (2), extort money (2), possession of fake money (2), possession and transport of illegal weapon (2), procuration of a child (2), using a forged curfew pass (1), inappropriate homosexual activity (1), and killing buffaloes using illegal wiring (1).

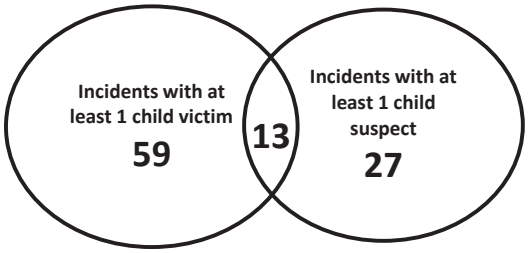
The composite age profile of the suspects of all crimes is shown in Figure 9. The sharp rise from teenagers to 20s followed by a smoothly skewed decline towards adulthood is a clear replication of the traditional age-crime profile. The only deviation, if any, may be a minor shift of the peak towards mid 20s.

Child victims and suspects

In order to identify the crimes in which children are frequently targeted or involved, we extracted a subset of crime records which involved at least one child victim or suspect. As in many other countries, the age of majority in Sri Lanka is 18 years (Goonesekere & Amarasuriya, 2013) and hence 18 was considered as the age threshold to extract the subset of records. As shown in Figure 10, there were 99 crime incidents (10% of all incidents) involving children as victims or suspects, composing of 72 incidents with at least 1 child victim, 40 incidents with at least 1 child suspect, and 13 incidents with both a child victim and a child suspect. In these 99 incidents, there were 73 child victims including 57 (78%) females and 50 child suspects including 40 (80%) males. The numbers clearly show that boys are more delinquent while girls are more vulnerable. From another perspective, there were 14 instances where a child was suspected of a crime against a child, 36 instances where a child was suspected of a crime against an adult while there were 73 instances

Figure 10

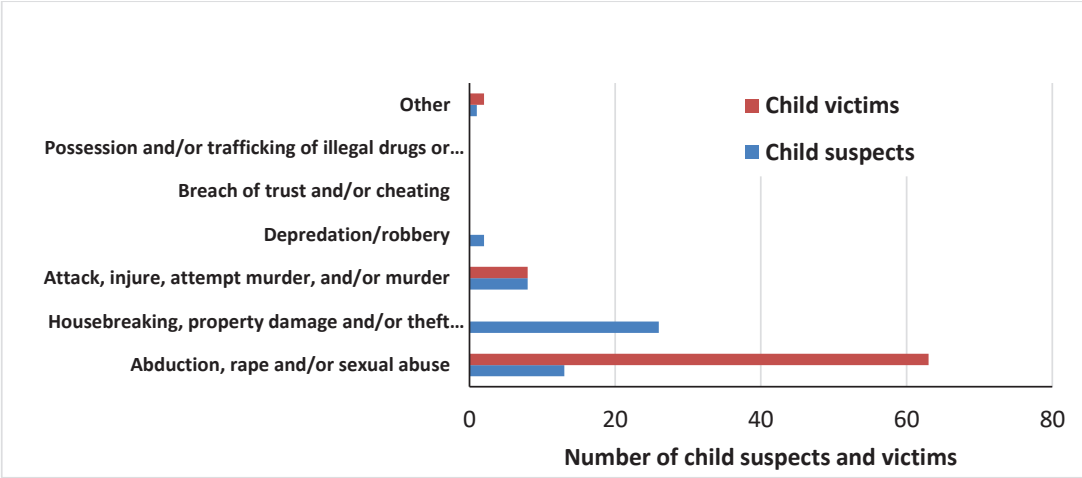
Crime Incidents Involving Child Suspects and Victims (Left) and the Cross Tabulation of Child Victims and Suspects (Right)



	Victims	
Suspects	Child	Adult
Child	14	36
Adult	73	Not Relevent

Figure 11

Child Victims and Suspects by Type of Crime



where an adult was suspected of a crime against a child (Figure 10).

The data suggests that children are victimized by adults more often than they are victimized by peers. Child offenders are more likely to target adults rather than children. It should be reminded here that, though the majority of sexual offenders were between 16 and 21, only those below 18 are considered children.

Figure 11 shows that the vast majority of child victims are victims of adduction, rape, and sexual abuse while child offenders seem to be more delinquent towards housebreaking, property damage, and theft.

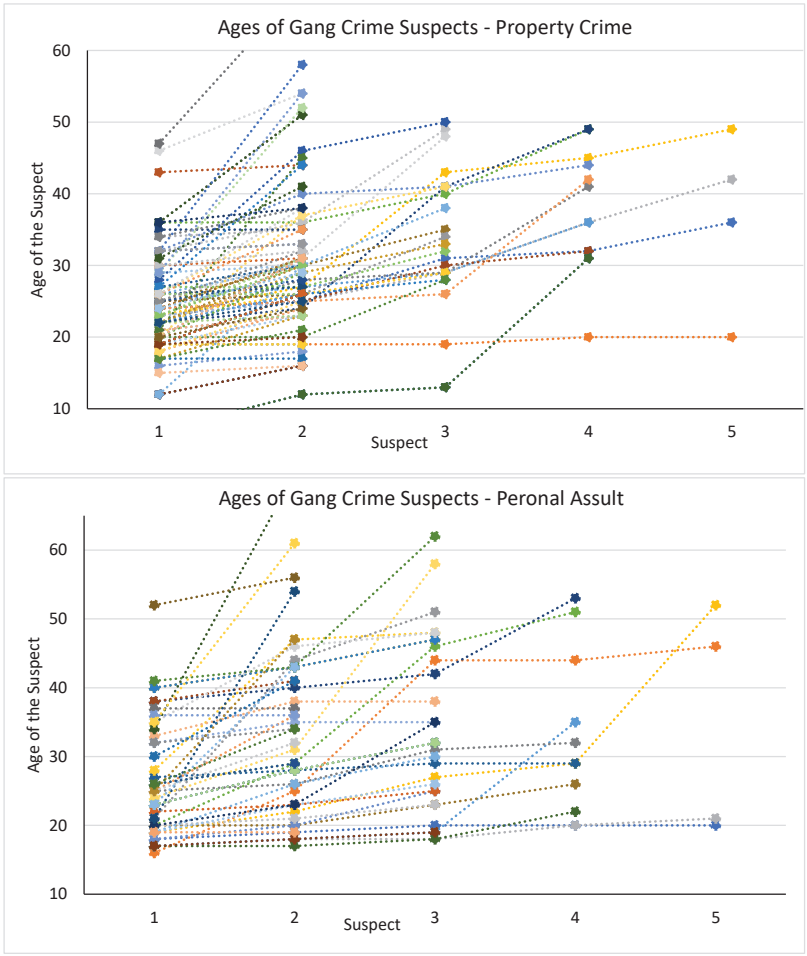
Evidence of criminal groups

Among all the types of crimes studied in this research, (i) housebreaking, property damage, and/or theft; (ii) personal assault, injury, and murder; and (iii) depredation/robbery had the highest proportion of incidents with more than one suspect. Such incidents signal possible presence of criminal grouping. Understanding the age structure of criminal groups helps in reducing the factors which foster the formation and growth of criminal gangs (Ibrahim et al., 2022). Hence, we extracted a subset of crime incidents under above three categories, having two or more suspects whose ages were known. There were 157 incidents including 91 incidents of property crimes, 44 incidents of personal assault, and 22 incidents of depredation, with two or more age-known suspects.

In Figure 12 below, each line links the ages of the suspects of a single incident in ascending order. There were only a few incidents with 5 or more suspects. So only the ages of the 5 youngest suspects are shown in the graph. Though strong conclusions cannot be drawn from visual inspection of the graphical illustration, the graphs show that criminal grouping is prevalent between late teenage years and 40 years. For property crimes, the lines are slightly sloped, indicating that the ages of suspects within groups could often vary by ±10 years. For personal assault incidents, there are more horizontal

Figure 12

Ages of the Groups of Suspects



lines indicating that individuals in the same or close ages group together to commit such crimes.

CONCLUSION

We studied the age profiles of the suspects and victims of different types of crime using a sample of incidents obtained from a regional police station in Sri Lanka. Graphical analysis methods and chi-square tests were used to identify age differences in delinquency and vulnerability towards various crimes.

For widely reported property crimes such as housebreaking and theft, delinquency peaks in the 20s and smoothly declines with age while the adults in their 40s are the most vulnerable to such property crimes. These differences can be explained by the age differences in economic factors, mainly income and unemployment. High-income groups are frequently targeted while low-income groups tend to be more delinquent. For personal assault causing injury or murder and depredation/robbery incidents, the number of suspects peaks in the 20s and decreases thereafter. Depredation was the only crime for which both males and females were equally vulnerable. For the above three types of crimes, the suspect's age does not have a significant impact on their choice of the target (in terms of the target's age). The suspects of well-thought-out crimes such as cheating and breach of trust are the most mature with a peak in their 30s. It is understandable that adult criminals tend to rely on their brains rather than on masculinity. The number of suspects below 20 were significantly low for all types of crimes other than those related to sexual abuse and rape. The propensity to sex offences seems to be higher from age 16 to 21 and a strictly adolescent peak was observed for such crimes. Unfortunately, the majority of the victims of rape and sexual abuse were children. Vulnerability to sexual crime increases sharply from 13 to 15 years and peaks in 15. A child victim or suspect was reported in 10% of all incidents. The results indicate that most of the crimes against children, particularly sexual abuse and rape, are committed by their immediate elders in late teens and early 20s. Involvement in group crimes was most prevalent between late teenage years to 40 years.

The composite age crime profile shows a slight shift to the right compared to the typical age-crime profile found in many countries indicating that the offenders are somewhat mature, but the persistent decline towards adulthood complies with theory. Right-shifted peak may be an indication of delayed onset of criminal offending owing to favourable sociocultural factors such as parents looking after and closely watching their children until they reach their 20s. However, the peak of the suspect age profile occurs approximately 10 years before (in the 20s) compared to the age profiles of both convicted and unconvicted prisoners in Sri Lanka which peak in the 30s. This may be an indication of long delays in arresting the suspects and court hearings. The age of the prisoners may be higher than the age of the suspects because legal proceedings take a long time.

The results provide evidence that economic hardships caused by unemployment and low income may be a driver for crimes such as housebreaking, theft, and robbery. With respect to those crimes, findings of this study support the argument proposed by Males (2015) against the conventional age-out theory – "young people do not age-out of crime, they wealth-out". However, the wealth-out theory does not apply to all types of crimes, particularly to sex offending. This study reveals that males in their 16-21 can be responsible for the majority of sex-related offences against children below 16. This finding is consistent with the evidence from other countries, and thus there may be biological explanations. Education and awareness programs for the children and close attention from the parents and school teachers are required to address the problem. Further analysis of country-wide data from all possible sources beyond police records is required to understand the real dimensions of the problem.

The major limitation of this study was that it used police records of suspects and victims. Analysis of data on convicted offenders or prisoners and the crimes committed by them may provide more reliable information about the age differences in delinquency and vulnerability. Since data were collected from only one police station, the geographical area covered was quite small compared to the whole country. There were regional biases in the dataset (note that, for the whole country, the highest percentage of reported cases were related to illegal drugs, but in the study area, the highest percentage of cases were related to housebreaking, property damage, and theft while only a few cases were related to illegal drugs). Hence, further research covering the whole country is highly recommended. This study has only focused on the age and gender of the suspects and victims, but there may be several other socioeconomic, psychological, and biological factors associated with delinquency and vulnerability. These factors should also be considered in future research to generate a more holistic understanding of criminal behaviours and activities.

ACKNOWLEDGEMENTS

Authors appreciate Mr M. W. S. Uwindasiri, the officer in-charge of Katugasthota police station and Mr N. I. Baddewaththage, officer in-charge of crime at Katugasthota police station for providing access to the data used in this study.

REFERENCES

Adeyemi, R. A., Mayaki, J., Zewotir, T. T., & Ramroop, S. (2021). Demography and crime: A spatial analysis of geographical patterns and risk factors of crimes in Nigeria. *Spatial Statistics, 41*, Article 100485. https://doi.org/10.1016/j.spasta.2020.100485

Beckley, A. L., Caspi, A., Harrington, H., Houts, R. M., Mcgee, T. R., Morgan, N., Schroeder, F., Ramrakha, S., Poulton, R., & Moffitta, T. E. (2016). Adult-onset offenders: Is a tailored theory warranted? *Journal of Criminal Justice, 46*, 64–81. http://doi.org/10.1016/j.jcrimjus.2016.03.001

Bennett, P. (2018). The heterogeneous effects of education on crime: Evidence from Danish administrative twin data. *Labour Economics, 52*, 160-177. https://doi.org/10.1016/j.labeco.2018.02.002

Bindler, A., & Hjalmarsson, R. (2017). Prisons, recidivism and the age-crime profile, *Economics Letters, 152*, 46-49. https://doi.org/10.1016/j.econlet.2017.01.002

Central Bank of Sri Lanka. (2020). *Sri Lanka socio economic data 2020*. https://www.cbsl.gov.lk/sites/default/files/cbslweb_documents/publications/otherpub/publication_sri_lanka_socio_economic_data_folder_2020_e.pdf

Clarke, R. V. (2012). Opportunity makes the thief. Really? And so what? *Crime Science, 1*, Article 3. https://doi.org/10.1186/2193-7680-1-3

DeCamp, W. (2015). 3 - Theories of crime and criminal behavior and their implications for security. In S. J. Davies, C. A. Hertig, & B. P. Gilbride (Eds.), *Security supervision and management* (4th ed., pp. 37-49). Butterworth-Heinemann. https://doi.org/10.1016/B978-0-12-800113-4.00003-1

Department of Census and Statistics. (2021). *Statistical abstract 2021*. http://www.statistics.gov.lk/abstract2021/CHAP13

Department of Prisons. (2021). *Prison statistics of Sri Lanka*. http://prisons.gov.lk/web/wp-content/uploads/2021/05/prison-statistics-2021.pdf

Goh, L. T., & Law, S. H. (2023). The crime rate of five Latin American countries: Does income inequality matter? *International Review of Economics & Finance, 86,* 745-763. https://doi.org/10.1016/j.iref.2023.03.036

Goonesekere, S., & Amarasuriya, H. (2013). *Emerging concerns and case studies on child marriage in Sri Lanka*. UNICEF Sri Lanka. http://www.iccwtnispcanarc.org/upload/pdf/2501970655EMERGING%20CONCERNS%20AND%20

CASE%20STUDIES%20ON%20CHILD%20MARRIAGE%20IN%20SRI%20ANKA%20%20.pdf

Grant, J., Thornton, J., & Chamarette, C. (2006). Residential placement of intra-familial adolescent sex offenders. *Trends & issues in crime and criminal justice, 315*. https://www.aic.gov.au/publications/tandi/tandi315

He, Z., Deng, M., Xie, Z., Wu, L., Chen, Z., & Pei, T. (2020). Discovering the joint influence of urban facilities on crime occurrence using spatial co-location pattern mining. *Cities, 99*, Article 102612. https://doi.org/10.1016/j.cities.2020.102612

Ibrahim, O. M., Okuonghae, D., & Ikhile, M. N. O. (2022). Mathematical modeling of the population dynamics of age-structured criminal gangs with correctional intervention measures. *Applied Mathematical Modelling, 107*, 39-71. https://doi.org/10.1016/j.apm.2022.02.005

Jayathunga, N. S. (2010). A sociological study of the homicide in Sri Lanka: A case study in Rathnapura Secretariat Division. *Sabaragamuwa University Journal, 9*(1), 45-55. http://dx.doi.org/10.4038/suslj.v9i1.3733

Kanazawa, S., & Still, M. C. (2000). Why men commit crimes (and why they desist). *Sociological Theory, 18*(3), 434–447. https://doi.org/10.1111/0735-2751.00110

Kitteringham, G., & Fennelly, L. J. (2020). Chapter 19 - Environmental crime control. In L. J. Fennelly (Ed.), *Handbook of loss prevention and crime preventio*n (6th ed., pp. 207-222). Butterworth-Heinemann. https://doi.org/10.1016/B978-0-12-817273-5.00019-3

Kortas, F., Grigoriev, A., & Piccillo, G. (2022). Exploring multi-scale variability in hotspot mapping: A case study on housing prices and crime occurrences in Heerlen. *Cities, 128*, Article 103814. https://doi.org/10.1016/j.cities.2022.103814

Lee, S-H, & Ogawa, N. (2008). *Labor income over the lifecycle Evidence from twenty-three countries*. National Transfer Accounts (NTA) Project. Retrieved April 8, 2023, from https://ntaccounts.org/doc/repository/Labor%20Income%20over%20the%20Life-Cycle.%20Evidence%20from%2023%20Countries.pdf

Levan, K., & Mackey, D. A. (2015). Prevention of crime and delinquency. In J. D. Wright (Ed.), *International encyclopedia of the social & behavioral sciences* (2nd ed., pp. 877-882). Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.45012-9

Lin, X., Zhang, J., & Jiang, S. (2022). Spatial and temporal correlations of crime in Detroit: Evidence from spatial dynamic panel data models. *International Review of Law and Economics, 72*, Article 106100. https://doi.org/10.1016/j.irle.2022.106100

Madhubhani, I. (2017, September 10). Statutory rape laws in Sri Lanka: the underpinning issues. *Sunday Observer*. https://www.sundayobserver.lk/2017/09/10/issues/statutory-rape-laws-sri-lanka-underpinning-issues

Males, M. (2015). Age, poverty, homicide, and gun Homicide: Is young age or poverty level the key issue? *SAGE Open, 5*(1). https://doi.org/10.1177/2158244015573359

Males, M., & Brown, E. (2013). Teenagers' high arrest rates: Features of young age or youth poverty? *Journal of Adolescent Research, 29*(1), 3-24. https://doi.org/10.1177/0743558413493004

Manea, R. E., Piraino, P., & Viarengo, M. (2023). Crime, inequality and subsidized housing: Evidence from South Africa. *World Development, 168*, Article 106243. https://doi.org/10.1016/j.worlddev.2023.106243

Mohammad, T. & Nooraini, I. (2021). Routine activity theory and juvenile delinquency: The roles of peers and family monitoring among Malaysian adolescents. *Children and Youth Services Review, 121*, Article 105795. https://doi.org/10.1016/j.childyouth.2020.105795

Montolio, D. & Planells-Struse, S. (2016). How time shapes crime: The temporal impacts of football matches on crime. *Regional Science and Urban Economics*, *61*, 99–113. https://doi.org/10.1016/j.regsciurbeco.2016.10.001

O'Brien, W. (2010). *Australia's response to sexualised or sexually abusive behaviours in children and young people*. Australian Crime Commission. https://apo.org.au/node/22180

Oksanen, A. & Keip, T. (2013). Young people as victims of crime on the internet: A population-based study in Finland. *Vulnerable Children and Youth Studies, 8*(4), 298-309. https://doi.org/10.1080/17450128.2012.752119

Radford, L., Corral, S. Bradley, C., Fisher, H., Bassett, C., Howat, N., & Collishaw, S. (2011) *Child abuse and neglect in the UK today*. National Society for the Prevention of Cruelty to Children.

Rathnayake, R. M. J. C. (2010). *An analytical study of urban space and crime case study-Bambalapitiya* [Master's dissertation, University of Moratuwa]. Theses repository, University of Moratuwa. http://dl.lib.uom.lk/bitstream/handle/123/10275/96418-1.pdf?sequence=3&isAllowed=y

Reyes, H. L., Foshee, V. A., Bauer, D. J., & Ennett, S. T. (2012). Developmental associations between adolescent alcohol use and dating aggression. *Journal of Research on Adolescence, 22(*3), 526-541. http://doi.org/10.1111/j.1532-7795.2012.00799.x

Ristea, A., Al Boni, M., Resch, B., Gerber, M. S, Leitner, M. (2020). Spatial crime distribution and prediction for sporting events using social media. *International Journal of Geographical Information Science, 34*(9), 1708–1739. https://doi.org/10.1080/13658816.2020.1719495

Schlomer, G. L., Cleveland, H. H., Vandenbergh, D. J., Feinberg, M. E., Neiderhiser, J. M., Greenberg, M. T., Spoth, R., & Redmond, C. (2015). Developmental differences in early adolescent aggression: A gene × environment × interventio n analysis. *Journal of Youth and Adolescence*, *44*(3), 581-597. https://doi.org/10.1007/s10964-014-0198-4

Senanayake, S., Gunawardena, S., Kumbukage, M., Wickramasnghe, C., Gunawardena, N., Lokubalasooriya, A., & Peiris, R. (2018). Smoking, alcohol consumption, and illegal substance abuse among adolescents in Sri Lanka: Results from Sri Lankan global school-based health survey 2016. *Advances in Public Health, 2018*(1), Article 9724176. http://doi.org/10.1155/2018/9724176

Shulman, E. P., Steinberg, L. D., & Piquero, A. R. (2013). The age-crime curve in adolescence and early adulthood is not due to age differences in economic status. *Journal of Youth and Adolescence, 42*(6), 848-860. https://doi.org/10.1007/s10964-013-9950-4

Sri Lanka Police. (2021). *Crime Statistics*. Retrieved August 3, 2022, from https://www.police.lk/index.php/item/138-crime-statistics

Steffensmeier, D., Lu, Y., & Na, C. (2020). Age and crime in South Korea: Cross-national challenge to invariance thesis. *Justice Quarterly, 37*(3), 410-435. https://doi.org/10.1080/07418825.2018.1550208

Tilley, N., & Sidebottom, A. (2015). Routine activities and opportunity theory. In M. D. Krohn & J. Lane (Eds.), *The handbook of juvenile delinquency and juvenile justice* (pp. 331-348). John Wiley & Sons. https://doi.org/10.1002/9781118513217.ch21

Ulmer, J. T., & Steffensmeier, D. (2014). The age and crime relationship: Social variation, social explanations. In K. M. Beaver, J. C. Barnes & B. B. Boutwell (Eds.), *The nurture versus biosocial debate in criminology*: *on the origins of criminal behavior and criminality* (pp. 377-396). SAGE Publications Ltd. https://doi.org/10.4135/9781483349114.n24

Valente, R. (2019). Spatial and temporal patterns of violent crime in a Brazilian state capital: A quantitative analysis focusing on micro places and small units of time. *Applied Geography, 103*, 90-97. https://doi.org/10.1016/j.apgeog.2019.01.006

Vidanapathirana, M. (2014). Factors related to wife-battering; a medico-legal analysis. *Galle Medical Journal, 19*(1), 6-10. http://dx.doi.org/10.4038/gmj.v19i1.6958

Walmsley, R. (2018). *World prison population list - 12th edition* (World Prison Brief). Institute for Criminal Policy Research. Retrieved June 6, 2023, from https://www.prisonstudies.org/sites/default/files/resources/downloads/wppl_12.pdf

Wang, Z., & Zhang, H. (2020). Construction, detection, and interpretation of crime patterns over space and time. *International Journal of Geo-Information*, *9*(6), Article 339. https://doi.org/10.3390/ijgi9060339

Wickremasinghe, H. T., & Kaluthanthri, P. C. (2021). Spatial distribution of crimes in urban areas: An insight from Sri Lanka. *Geografia: Malaysian Journal of Society and Space, 17*(4), 207-220. http://doi.org/10.17576/geo-2021-1704-15

Xia, Z., Stewart, K., & Fan, J. (2021). Incorporating space and time into random forest models for analyzing geospatial patterns of drug-related crime incidents in a major U.S. metropolitan area. *Computers, Environment and Urban Systems, 87*, Article 101599. https://doi.org/10.1016/j.compenvurbsys.2021.101599

Xiang, L, Sheng, J., & Liao, P. (2023). Understanding the relationship between the spatial configuration and the crime rate of Downtown Eastside in Vancouver, Canada. *Habitat International, 137*, Article 102847. https://doi.org/10.1016/j.habitatint.2023.102847

Xu, Y., Fu, C., Kennedy, E., Jiang, S., & Owusu-Agyemang, S. (2018). The impact of street lights on spatial-temporal patterns of crime in Detroit, Michigan. *Cities, 79*, 45-52. https://doi.org/10.1016/j.cities.2018.02.021

Yigzaw, Y., Mekuriaw, A., & Amsalu, T. (2023). Analyzing physical and socio-economic factors for property crime incident in Addis Ababa, Ethiopia. *Heliyon, 9*(2), Article e13282. https://doi.org/10.1016/j.heliyon.2023.e13282

Zhang, X., Liu, L., Lan, M., Song, G., Xiao, L., & Chen, J. (2022). Interpretable machine learning models for crime prediction. *Computers, Environment and Urban Systems, 94*, Article 101789. https://doi.org/10.1016/j.compenvurbsys.2022.101789