DOES DNA AND VIDEO SURVEILLANCE ASSIST IN SOLVING HOMICIDES?

by

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Abstract

In 1961, the first year in which comparative homicide data was recorded, in Canada, police solved 95% of all homicides across the provinces. In contrast, in 2010, Canadian law enforcement solved 20% fewer homicide cases despite the fact that there had been a dramatic 30% decrease in homicides since the mid-1990s. Considering the major scientific and technological advances, such as DNA analysis and video surveillance, the decrease in homicides solved seems notable. The author analyzed the effect that DNA and video surveillance had towards solving homicide cases, by examining five years of cases investigated by the Vancouver Police Department's Homicide Unit. DNA was found to have a limited effect, while video surveillance contributed to over half the homicide cases. As these investigative techniques, can be resource intensive and time consuming, police need to be aware as to prioritize their actions in this era of increased accountability.

Keywords: DNA, video surveillance

Table of Contents

List of Tables

Introduction

In 1961, the first year in which comparative homicide data was recorded, in Canada, police solved 95% of all homicides across the provinces (Statistics Canada, 2016). In stark contrast, in 2010, Canadian law enforcement solved 20% fewer homicide cases despite the fact that there had been a dramatic 30% decrease in homicides since the mid-1990s. Considering the major scientific and technological advances, such as DNA analysis and video surveillance, that, by then had become available to law enforcement, the decrease in homicides solved seems even more remarkable. In effect, fewer homicides were solved at a time when the total number of cases had sharply decreased and the technology available to assist detectives' investigations had greatly improved. Given the decrease in homicides, advances in technology, and improvements in procedures utilized by police forces that had become more experienced in homicide investigations, the expectation was that the homicide solve rate would have increased significantly, and certainly would not have decreased. The obvious question that arises then is, why were homicide detectives solving more cases 50 years ago, than better-equipped, more experienced detectives are able to solve today? Moreover, is it even appropriate to expect that sweeping advances in science and technology should necessarily have a significant impact on homicide solve rates?

Some researchers have pointed to the nature and motive behind homicides in the past, compared to the contemporary period, as an explanation for this phenomenon. For example, 40 years ago, homicides were more a personal matter between the victim and suspect, who often knew each other (Burney, 2009). Homicides that were domestic-based, alcohol-fueled between friends, or the result of altercations between rivals were solved at

a much higher rate (Roberts, 2007). Traditionally, to begin an investigation, a homicide detective would focus on the specifics of the victim, and usually, the suspect was not very far removed from the victim. Cases were solved not so much by technology or the analysis of physical evidence, but by evidence provided by witnesses and confessions obtained from suspects (Burney, 2009). In decades, past witnesses did not have the same reticence about talking to the police; they still saw cooperating with the police and the courts as part of their civic duty (Roberts, 2007). Moreover, witness testimony carried more evidentiary weight, mainly because it was often the only evidence available (Burney, 2009). Crime scene analysis for physical evidence was much simpler, and simply locating a fingerprint from a possible suspect was very effective in successfully solving a case.

Over time, as in every professional field, the technological ability to solve homicides increased. Two areas that have seen a rapid and substantial increase in homicide investigations are the use of DNA analysis and video surveillance. While the type of forensic analysis available for exhibits obtained from a crime scene can give the police very accurate identifications from the smallest particle of human biological material, there still remains the very real fact that DNA can only identify a suspect if there is an available sample of the suspect's DNA. In other words, technology can aid the police in confirming that they have the right suspect, but first they must identify the suspect, and quite commonly that comes down to the ability of the homicide detectives to identify and talk with witnesses, and to conduct effective interviews. Much the same can be said for video surveillance, and the perception that video images can be enhanced to

such a degree that they can be helpful in identifying a suspect (Haggerty & Ericson, 2000).

Contemporary representations of crime in the media, including vastly popular television crime shows, are one reason for the increased production of surveillance images and the expectation that the police will be able to recover DNA samples at a crime scene. The aptly named “CSI Effect” refers to the rise in the public's expectations, after viewing CSI and other crime dramas, that DNA evidence will be recovered and that the DNA will contribute to the solving of a homicide. Jurors of today understand and respect forensic evidence (Cosh, 2012). For example, a small, but significant amount of research has concluded that, while most jurors may realize that television does not reflect real life, they generally presume that DNA samples will be present at homicide scenes. A prosecutor finds it necessary to explain, for example, why DNA was not located at a particular crime scene (Schweitzer & Saks, 2007). Moreover, the “CSI effect” can place a greater burden on the prosecution to provide better forensic evidence to jurors, because as viewers of crime dramas, they sometimes find that the forensic evidence presented to them in court does not meet their expectations and, therefore, may appear less impressive and convincing to them (Cosh, 2012). The prosecution, wanting a strong case to present to the court, and being aware of the “CSI effect,” may well demand additional forensic evidence, which can place substantial pressure on the police (Schweitzer & Saks, 2007). Given this, prosecutors and the police must be much more knowledgeable and proficient in these areas and others, such as cellular phones and social media, to investigate, clear, and prosecute a homicide.

Interestingly, the same types of homicides that have historically been solved at a high rate, namely acquaintance homicides, continue to be solved at the same or even higher rate today (Burney, 2009). One could argue it is because of the aforementioned advances in technology. The suspects are already known, or easily found, so the DNA and video surveillance make identifying the suspect much more certain. However, there are a growing proportion of homicides that are gang-related in British Columbia (Cotter, 2013). Gang members and drug dealers are being murdered by members of their own groups, who are not likely to talk to the police. Moreover, gang members are murdered by rival gangs. Occasionally, gang-related murders will also result in the killing of an unrelated, innocent victim. Witnesses, whether they are related to gang activity or not, can feel intimidated by the threat of being killed themselves if they cooperate with the police in a gang-related homicide. In these cases, investigations that are dependent on witnesses or people with knowledge of the event to talk to the police or to confess to the crime are much less likely to be solved (Burney, 2009). In Canada, true stranger-on-stranger homicides, despite technological advances, continue to have a high likelihood of not being solved (Mulligan, Axford, & Solecki, 2015) because motive can be very difficult to determine. If the killer plans out the homicide, less forensic evidence may be left behind for the police to find, as the killer will actively try to thwart the police by cleaning the crime scene after the commission of the homicide (Beauregard & Martineau, 2014). Furthermore, the connection that is present between acquaintance homicides is not present making any connection between the suspect and victim harder or impossible to identify Roberts, 2007).

Recent research has indicated that police officers, namely ambitious, creative, and energetic homicide detectives, can and do make a difference in the solve rate (Carter & Carter, 2016). Interestingly, while experience in the specific field of homicide investigations is valuable, it is not as a large a factor that people might presume. It appears that the best model is pairing experienced detectives with new detectives, working in a team environment, and bringing a sense of accountability to the team and the public (Braga & Dusseault, 2016). Cases get cleared more often when the detectives have the necessary time to devote to the investigation, when they are part of a specialized unit, and, especially in the case of gang homicides, have the required resources (Carter & Carter, 2016; Armstrong, Plecas, & Cohen, 2013). Examples of resources would be the availability to pursue more sophisticated investigative techniques, such as intercepting private communications from the suspects from both phone calls and text messages.

While there is a significant amount of published material on homicides, there has not been a lot of research into what technologies help to solve homicides and how effective and efficient these approaches are. When considering DNA, the research literature has focuses on the science behind DNA and new and improving techniques to obtain DNA from smaller sources, but not on their actual contribution to solving homicides (Wilson, Weisburd, & McClure, 2011). Similarly, the effect of video surveillance continues to be largely unknown, as the literature has tended to focus on the technical aspects of video and video cameras, and whether video surveillance has an effect on the public's sense of safety and crime rates (Verga, 2010). The main purpose of this major paper is to provide insight into how much DNA and video surveillance can help homicide detectives solve murders. This major paper will also explore the question

of why the homicide solve rate in Canada has decreased over the last few decades when the total number of homicides per year has decreased, and there has been an increase in the use of DNA and video surveillance in homicide investigations. Finally, this major paper will provide recommendations that homicide investigators should consider when using these technologies and make comment on the need to properly resource sections within police agencies tasked with assisting homicide investigations. As there is a paucity of research into these issues, a five-year sample of homicides in Vancouver, Canada was analyzed with the expressed purpose of ascertaining what and how much of a role DNA and video surveillance has played in both unsolved and solved cases.

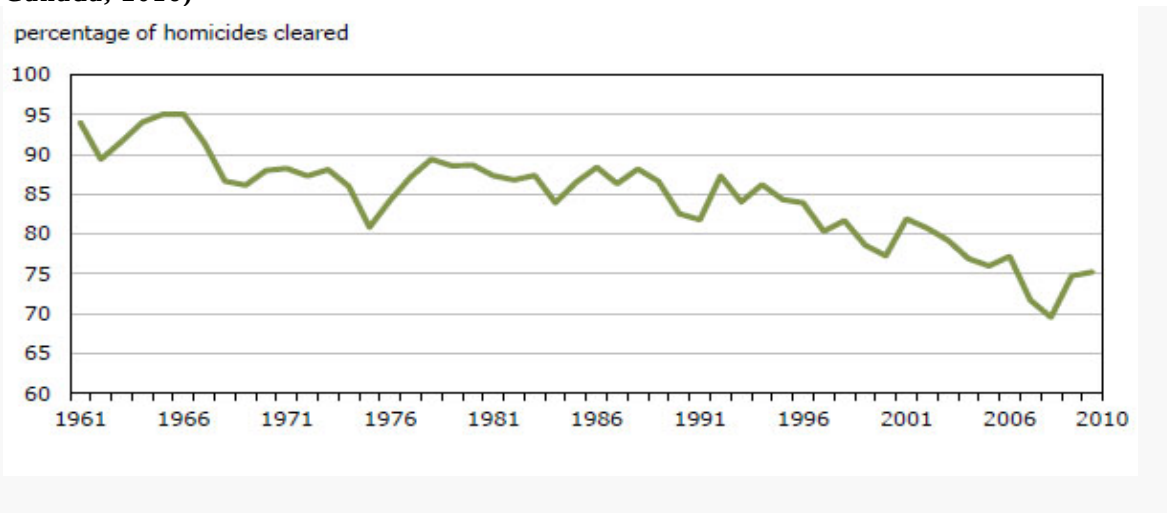
It should be noted that the terms ‘solved’ or ‘cleared’ are used synonymously by Canadian police to describe homicide incidents where a police investigation has resulted in identifying a suspect and the police have recommended the laying of a criminal charge. (Mulligan, et al., 2015). Most commonly, the criminal charge is for manslaughter, 2nd degree murder, or 1st degree murder. Occasionally, a cause death by criminal negligence charge is appropriate and approved. It is important to note that the police, while they are concerned whether an accused is acquitted, pleads guilty, or is convicted at trial, the final disposition of the case does not factor in whether the homicide will be considered as ‘solved’. For the purposes of Statistics Canada’s annual homicide survey, police report a case solved or ‘cleared’ when a charge has been laid or when the police recommend a charge and the Crown lays none. The police also count a case as solved in those situations where the prime suspect(s) is considered chargeable, or dies by committing suicide, or through some other cause (Talaga, Edwards, Rankin, & Bruser, 2015).

Literature Review

The base rate for homicides in Canada is very low, accounting for 1% of all crimes (Corrado & Cohen, 2014). Between 2011 and 2015, homicide rates per 100,000 population dropped with a small increase in 2015. Specifically, the homicide crime rate was 1.76 in 2011, 1.58 in 2012, 1.45 in 2013, 1.47 in 2014, and 1.68 in 2015 (Statistics Canada, 2016). Over those five years, Canada averaged 557 murders per year. The most common methods used to commit homicide between 2011 and 2015 in Canada were firearms, stabbing, and beatings; accounting for approximately 85% of all homicides (Statistics Canada, 2016).

As mentioned above, in Canada, homicide clearance rates have increased slightly in recent years; however, there has been a noticeable decline over the past 50 years. Homicide clearance rates have dropped to about 75% nationwide from about 95% in the mid-1960s (See Table 1). By comparison, the homicide rate peaked in the mid-1980s and 1990s, and has generally declined since.

Table 1: Percentage of Homicides Cleared by Police Services in Canada (Statistics Canada, 2016)



Many theories have developed to explain the decline in homicide clearance rates, the most prevalent being the changing nature of the characteristics of specific homicide events. For example, gang-related homicides, which are widely considered more difficult to solve, increased sharply between 1993 and 2008 (Cotter, 2013). Between 2000 and 2010, 42% of gang-related homicides were reported solved by police agencies, while 88% of non-gang-related homicides were cleared. A similar statistic was seen in relation to homicides committed by firearms (56 per cent solve rate) versus homicides committed by other methods (88 per cent) (Mulligan et al., 2015). The fact that guns are used in a higher rate of gang homicides (Cotter, 2013), helps explain the lower solve rate, especially when combined with the availability of DNA left at the crime scene. Traditionally, domestic homicides have been solved at a very high rate and this continues to be the case (Mahoney & Turner, 2010). Females are less likely to be victims of homicide than males, and homicides involving female victims are more likely to be solved, namely because the suspect is known to the victim in some fashion (acquaintance or intimate relationship). Finally, females are very rarely the victims of gang murders, accounting for just 10% of victims (Mahoney & Turner, 2010).

Homicide clearance rates are affected by many factors. In the past, there was the belief that the police would value certain types of homicide victims over others, which affected the allocation of resources to solve certain types of homicides. For example, a homicide of a wealthy person would be given more attention than a homicide of a street prostitute. However, research conducted by Armstrong, Plecas, and Cohen (2013) found no support for this contention among unsolved homicides in British Columbia. Roberts

(2007) suggested that it was situational factors or the circumstances related to the homicide event that best predicted homicide clearance rates, not victim characteristics.

Other research has indicated that when an area has less collective efficacy, more distrust towards the police, and a greater tolerance for violence, this can contribute to reducing homicide solve rates (Braga & Dassault, 2016). Moreover, there are factors beyond the control of the police that make homicide cases more difficult to solve, such as if the homicide occurred outside, no one witnessed the event, the homicide was drug or gang-related, or the murder weapon was not found at the crime scene (Richardson & Kosa, 2001). Carter and Carter (2016) examined investigative practises in seven cities with greater than an 80% solve rates and found that these cities had a strong community policing presence, collaborated well with external agencies, and had a culture dedicated to innovation. Richardson and Kosa (2001) echoed this finding, as well as the need to have an effective case management system. Other factors that can play a role in whether a homicide is solved include low response times to the event, the actions of the first officer at the scene, the number of detectives assigned to the case, crime scene documentation, effective witness interviews, a shared computer database, and positive interactions with the prosecutor's office (Braga & Dusseault, 2016). The influence of physical evidence on investigative success is less well researched. The existing body of research suggested that developing a better body of knowledge and understanding on how evidence is used was as important as understanding the quantity of evidence collected, the kinds of forensic tests conducted, and the quality of forensic work (Schroeder, 2009).

DNA: What Is It?

During the commission of an offence, an offender(s) may leave behind trace physical evidence at the crime scene or on the body of the victim. This potential source of physical evidence is known as deoxyribonucleic acid or DNA. It is essentially a genetic fingerprint that can be extracted from blood, hair, semen, or saliva. Briefly, DNA is a long, double-stranded molecule that looks like a twisted rope ladder or double helix (Smith & Mann, 2015). It is the fundamental building block for a person's genetic makeup and is found in virtually every tissue in the human body (Castro & Coyle, 2011). Over time, technology has improved to the point that a DNA sample can be obtained from an incredibly small amount of human biological material. This sample can be analyzed to create a DNA profile that can identify or clear an accused person. As well, a DNA profile can be compared to a different DNA profile that was obtained from a different biological sample. If the profiles match, the two samples come from the same person (Wilson, Weisburd, & McClure, 2011).

The Locard exchange principle contends that "whenever two objects come into contact, a mutual exchange of matter will take place between them" (Schroeder, 2009: 322). In the early 1990s, the forensic serology or "trace" required to develop a DNA profile was relatively large and mainly consisted of blood that was visible at the crime scene (Minor, 2013). By the late 1990s, a new DNA typing method (short tandem repeat) was introduced and the quantity of DNA required was dramatically reduced (Caddy, 2001). More recently, DNA profiles are being developed from sources of evidence where there was seemingly no bloodstain or bodily fluid present (Castro & Coyle, 2011). This has resulted in 'touch" or "trace" DNA; the idea that skin cells are sloughed from the skin

to an object merely by touching the object. However, just because a person touches something, does not mean that a meaningful DNA profile can be developed. What the person is wearing, the amount they are perspiring, the roughness of the surface, and other factors will affect the likelihood that trace evidence is left behind (Caddy, 2001). A new technique, known as low-copy-number analysis, can develop a full DNA profile from as small a sample as 10 trillionths of a gram of genetic material, by amplifying DNA fragments into a sample large enough for testing (Shaer, 2016). While this is a significant scientific breakthrough, the technique carries a higher risk of sample contamination, which could implicate someone who never came close to the crime scene (Shaer, 2016). This is important to remember because given that the rates of transfer are dependent on many factors, the mere presence of DNA at a crime scene does not necessarily put the accused in the crime scene at the time of the murder. Similarly, just because an accused's DNA is not found at a crime scene does not mean that he/she was not there. Context is needed as is the existence of other corroborative evidence.

While there is a considerable amount of literature describing what DNA is, the techniques that are used to obtain DNA from crime scenes and people, and the importance of nullifying cross contamination (Castro & Coyle, 2011), there is little empirical research on the contributions of DNA evidence in criminal investigations (Wilson, Weisburd, & McClure, 2011), even though the police routinely collect and store DNA profiles with the hopes that DNA evidence will help solve crimes. To say that DNA evidence could be considered a valuable investigative tool would be an understatement. One Australian study (Roman, Reid, J., Reid, S., Chalfin, Adams, & Knight, 2008) tested the effect that mandatory DNA testing on prison inmates had on clearance rates for eight different crime

types. Of particular note was the positive linear trend for sexual assaults, with an 18% increase in cleared files and a 50% improvement in the charge rate just 12 months after the DNA sample was submitted to the country's databank (Smith & Mann, 2015). Another striking observation involved property crime. Roman and his colleagues (2008) conducted a randomized study and found that, in cases where DNA profiling was used, twice as many suspects were identified, subsequently arrested, and charged. Furthermore, this study found that DNA profiling was five times more likely to result in the identification of a suspect compared with fingerprint evidence (Roman et al., 2008). With respect to homicides, this same study found that when DNA evidence was available, those cases were 14 times more likely to have charges approved, and that juries were 23 times more likely to convict (Roman et al., 2008; Shaer, 2016).

Most developed countries have DNA databanks with virtually identical goals, specifically to link crimes together where there are no identifiable suspects (scene to scene comparison), assist in identifying suspects, eliminating suspects where there is no match between crime scenes, and determining whether a serial offender was involved. The largest database is in the United States. As of 2014, the US National DNA Index System (NDIS) contained 11,164,117 convicted offender DNA profiles, 2,026,761 arrestee profiles, and 583,444 forensic profiles. The Combined DNA Index System (CODIS) had 261,703 hits between individuals and crime scenes associated with 250,230 investigations (FBI 2014). In Canada, the use of a National DNA data bank (NDDB) has been in effect since the DNA Identification Act on December 10, 2000 (RCMP, 2016). This legislation allowed a DNA databank to be created and amended the Canadian Criminal Code to provide a mechanism for a judge to order persons convicted of specific

and designated offences to provide either a blood, buccal, or hair sample from which DNA profiles could be developed (RCMP, 2016). The NDDB conducts the following comparisons to assist in criminal investigations:

- “DNA profiles developed from crime scene samples are compared against DNA profiles from other crime scenes to identify potential links between different investigations and assist with solving these crimes. “Forensic Hit" is a term used to indicate a DNA match between DNA profiles within the Crime Scene Index (CSI).”

- “DNA profiles developed from crime scene samples are compared against convicted offender DNA profiles to associate an offender with a particular crime. “Offender Hit" is a term used to indicate a DNA match between a crime scene DNA profile in the CSI and the DNA profile of a convicted offender in the Convicted Offenders Index (COI).” (RCMP, 2016).

As of 2016, the NDDB has 444,152 DNA profiles, 326,989 convicted offender profiles, and 117,163 profiles contained in the crime scene index. Of interest, the NDDB advises that 5,622 investigations were assisted through either offender or forensic hits (RCMP, 2016). Finally, the NDDB has assisted in 2,699 homicide cases since June 30, 2000 to March 31, 2016. Of note, since the beginning of 2000 to the end of 2015, Canada had 9285 homicides (Mulligan, et al., 2015). This represents a 29% ‘assistance rate’ by the NDDB in homicides, which would be considered as excellent, especially when we compare the “assistance rate” that the NDDB provided in the Vancouver Police Department’s cases, that will be discussed later in the paper.

Video Surveillance

Video surveillance or Closed Circuit Television (CCTV) has been in use since the 1970s to monitor public spaces for crime control and, more recently, to monitor for potential terrorist activity (Mateescu, Rosenblat, & Boyd, 2015). The use of CCTV is

based in deterrence theory, in that the known presence of the cameras would deter a criminal's activity for fear of being apprehended. The idea is that being seen doing something wrong would lead a rational person to avoid that behavior, as being observed increased the likelihood of identification, apprehension, and negative outcomes (Verga, 2010). Previous research has shown that the presence of CCTV has contributed to a decrease in crime. For example, some research has demonstrated a 16% decrease in crime in areas where CCTV was present (Nieto, 1997; Farrar, 2014). However, this decrease was largely seen in parking lots where property crime to vehicles occurred, the same reduction was not experienced for violent crime (Nieto, 1997; Farrar, 2014). In other research, a 7% decrease was observed in city centers and public housing communities (Welsh & Farrington, 2007). CCTV in public transport systems seemed to have a greater effect, as a 23% decrease in crime was observed, but it was argued that CCTV systems could not be credited exclusively for the decrease (Welsh & Farrington, 2009). CCTV cameras also have the potential of creating unintended effects, one being the "halo effect" where there is the potential for greater security in areas outside of the camera view. More common is the idea of a "displacement effect", which proposes that antisocial or criminal behaviour relocates to another part of the city where there are not surveillance cameras (Piza, Caplan, & Kennedy, 2014). Video surveillance could also promote a false sense of security for the public without having any measurable reduction or positive effect on crime. Finally, and an area that little empirical research has been done, is that more crimes could be reported to the police as a result of CCTV, thus leading to a perceived increase in crime (Kille & Maximino, 2014).

As mentioned above, research on video surveillance has primarily focussed on its effectiveness in reducing crime in an area, the effect that video surveillance can have on the public's sense of safety, and privacy issues around the use of CCTV in public spaces (Wilkinson, 2010). There is a dearth of research on how effective video surveillance is in solving crime, particularly homicides. Given that it is expected that the use of CCTV will increase, it is important to determine the most effective ways that this technology can contribute to solving homicides (Deisman, Derby, Doyle, Leman-Langlois, Lippert, Lyon, Pridmore, Smith, Walby, & Whitson, 2009). According to industry experts, the global video surveillance market is expected to increase from $11.5 billion in 2008 to $37.7 billion in 2015. A 2013 New York Times/CBS poll found that 78% of respondents supported the use of surveillance cameras in public places (Kille & Maximino, 2014).

Police authorities are prone to point to spectacular successes, starting with the 1993 murder of two-year old James Bulger in the United Kingdom by two ten-year old boys (Wilkinson, 2014). In this case, video surveillance played a significant role, as it depicted James Bulger being led out of the shopping mall by the suspects. More recently, crucial images were widely distributed to the public to help identify the suspects in the Boston Marathon bombings. A recent Chicago Tribune opinion piece advised that surveillance cameras helped solve 4,500 crimes over a four-year period, but the writer noted that more than one million are estimated to have taken place over that same time period (Kille & Maximino, 2014). If we were to extrapolate those figures, surveillance cameras' contribution was 0.05%. In the United Kingdom, which has the most extensive CCTV integration in the world, with estimates that an average person is caught on camera as many as 300 times daily, the number of solved crimes appears to be dropping. As

recently as 2010, an internal Metropolitan Police Force report concluded that for every 1,000 cameras in London, less than one crime is solved per year (Press Association, 2009; Hope, 2010).

While it is not clear how effective video surveillance is in solving crimes, what is clear is that this technology comes with a significant commitment of human resources and workload (Wilkinson, 2010). This increased workload can be related to staffing a video services unit, who, typically, have to re-prioritize other investigations when video surveillance from a homicide is collected. This can be a detriment to the investigation of less serious crimes. As well, given the sheer volume of video analysis that can be required, this will force a police organization to have officers who are less or not trained in surveillance image processing doing the work.

Two problems can arise from this type of situation. First, inefficiencies increase, as the untrained officers simply take longer to carry out the same tasks as a forensic specialist. Second, downgrading may also shift the priorities of those officers whose efforts may be better used elsewhere, such as interviewing witnesses. Haggerty and Ericson (2000) commented on when more surveillance images are made available to the police for investigative purposes, the police's ability to process these images is lessened and the surveillant assemblage does not operate efficiently. The surveillant assemblage is the realization that there is no one "Big Brother" watching everyone, rather it is many sources of data and information. For this to work effectively requires cooperation between various organizations and work units. Over time, despite the growth of the surveillant assemblage and the proliferation of video surveillance, the ability to act on the

information from the surveillant assemblage has not increased at the same rate (Wilkinson, 2010).

A typical homicide investigation, prior to the proliferation of video surveillance, would require police officers to canvas the scene for eyewitnesses to get an account of the events that occurred. Now, in addition to canvassing the scene this way, the police must also assess whether the crime was captured on video surveillance. This requires more investigators and a longer time period. This 'video canvass' includes canvassing other businesses in the area for additional surveillance images that may show the suspect. After talking to the eyewitness and taking a statement, it is now a 'best practice' for the police officer and witnesses to watch the video together during which the police officer takes notes and compares the eyewitness' claims with what is shown in the surveillance images (Wilkinson, 2010). This also ensures that the date and time on the system corresponds with the timeframe of the alleged occurrence and any discrepancies are accounted for, critical for admission to court. If appropriate, the video is then taken as evidence for use in the homicide investigation.

The business' video surveillance system set-up also influences police workload. Police collection of the surveillance images for evidence can be as simple as the removal of a VHS tape or making a copy of the digital files onto a USB drive. However, the process often can be more complicated and require the video surveillance system installer to attend the scene to copy the images. The technical knowledge or ability of a business owner or employee operating the system determines whether the system installer or a more qualified employee needs to be called to assist. To obtain the best quality evidence, it may be necessary for the police to duplicate the hard-drive of the video surveillance

system. This requires the system to be off-line for a period of time. This has an effect on both the police, as they must take the time necessary to copy the hard drive, and the business whose system is out of order for up to several hours to many days. Then, the forensic video analyst takes the images and converts the images so they can be reviewed. An investigator is now required to watch the video, mark the times that a suspect or witness is seen, and create an appropriate follow-up for investigators that are going to conduct interviews, all with the intention of either moving the case forward or potentially not finding any images of value. This all requires many hours, and some would question if the results match the effort.

Study Methodology

To analyze the effect that DNA and video surveillance had towards solving homicide cases, five years of homicides investigated by the Vancouver Police Department's Homicide Unit were examined. The dataset consisted of all 53 homicide events that occurred during 2011 to 2015. Both unsolved and solved cases were analyzed. The year 2016 was excluded as a number of cases were still under active investigation and, therefore, the results of the investigative technique (e.g. the results from DNA testing) were not known at the time of the writing of this major paper. The time period prior to 2011 was not chosen as the particular investigative strategies of video surveillance and DNA testing had not been necessarily constant and a regular investigative strategy. Choosing the most recent five-year period increased the confidence level that practises had not changed by investigators, thereby not affecting the reliability of the results. An example of this was found in the area of video surveillance. In almost

every case, the investigators would at the very least conduct some kind of video canvass in the neighbourhood that the homicide occurred, even though the probable chances of obtaining any video images appeared unlikely.

A common practise by many homicide units across Canada is that they maintain homicide statistics to comply with annual reporting to Statistics Canada and to assist in recognizing any trends or linkages from case to case. This data is maintained in a spreadsheet with over 30 different variables, with the information being inputted by the section analyst, from information provided from the lead investigators of the specific homicide files. The author of this major paper read each file to ascertain what, if any, involvement DNA or video surveillance had in contributing to the solve status of the file. Specifically, data was collected to answer the question of whether DNA or video surveillance identified a suspect that was not previously known to the investigative team, whether the investigative team chose to conduct a particular investigative technique to try and derive evidence from DNA or video surveillance, if DNA or video surveillance contributed to solving the case, or if these two techniques had no bearing on the case. In other words, was any evidence obtained from either the forensic or video analysis?

Recognizing that many variables can affect the likelihood of a homicide being solved, other variables were collected, such as whether the homicide was associated to gang activity, domestic or family related, or a casual acquaintance. The research literature indicates that these three associations traditionally get solved at different rates, with domestic murders being solved at the highest rate, followed by casual acquaintance, and finally gang homicides (Armstrong, Plecas, & Cohen, 2013). The mechanism of death (firearm, knife, or blunt force) was also analyzed, as research shows that homicides

carried out by firearms are solved at a lower rate than homicides followed by stabbings and blunt force trauma (Cotter, 2013). Finally, whether the homicide occurred in a public place or a private dwelling was examined.

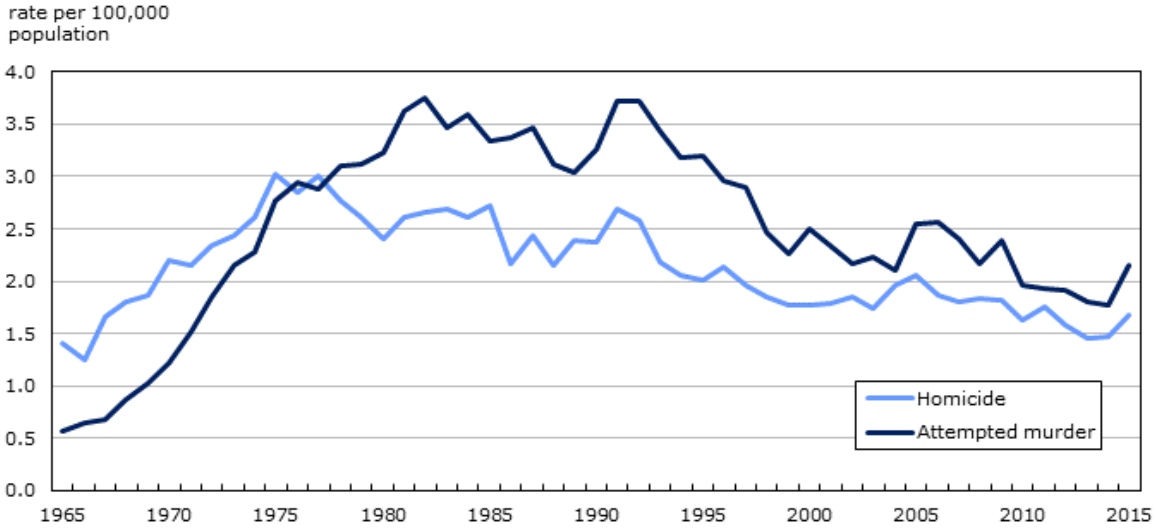
The Vancouver Police Department uses the same major case management practises and a consistent file management system that is used across Canada. More specifically, homicide units use a system of task action reports and file tree systems to organize and write their reports to crown counsel. This practise of file management ensured that the data used in this study derived from a consistent style of report that was very familiar to the author.

Data Results

Of the 53 cases, 39 cases were considered solved, while 14 remain unsolved. This represented a 74% clearance rate, which closely matched the national clearance rate of 75% and was a little higher than the provincial average of 67% (Statistics Canada, 2016). Over the five-year period, the number of homicides fluctuated from a high of 15 in 2011 and 2015 to a low of six in 2013. Of note, these six homicides represented the lowest number of homicides for Vancouver over the last 50 years. As well, this relatively low number of homicides over the five years matched the homicide trends that have occurred across Canada where homicide rates have seen a slow, but steady downward trend since a peak 20 years prior to the study period (see Table 2).

Table 2

Homicides and attempted murders, Canada, 1965 to 2015

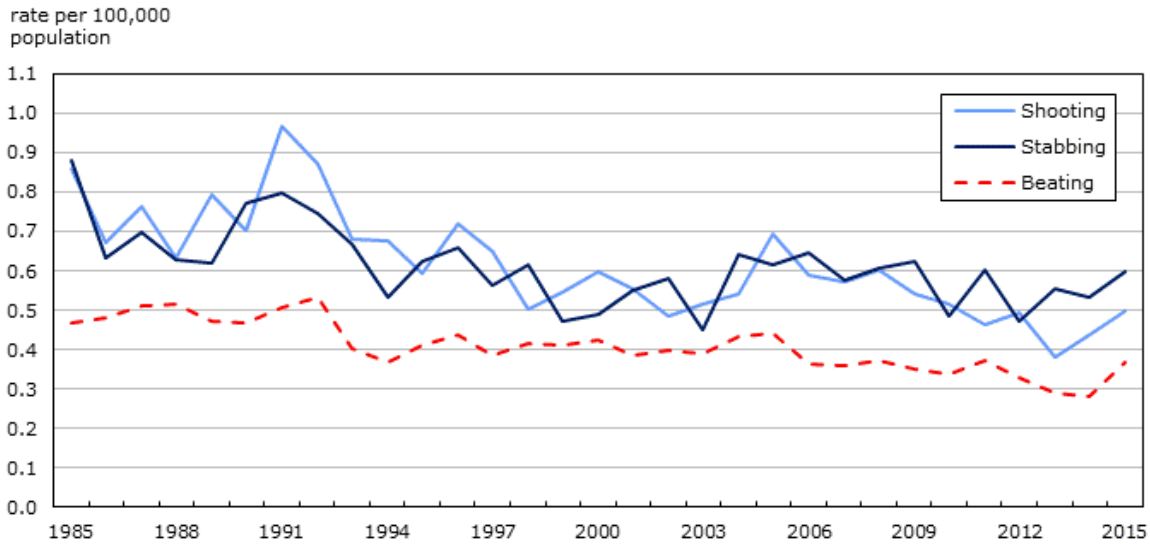


Note: Additional data are available on CANSIM (252-0051). Populations are based upon July 1st estimates from Statistics Canada, Demography Division.
Source: Statistics Canada, Canadian Centre for Justice Statistics, Homicide Survey.

The homicides that occurred in Vancouver were similar to those occurring in other jurisdictions in Canada in several other ways. The mechanism of death or 'causation' was by knife or stabbing in 19 cases (36 per cent), blunt force in 17 cases (32 per cent), shootings with 15 cases (28 per cent), and two cases where asphyxiation was the cause of death. This is similar to national averages in Canada where stabbings generally account for the highest percentages of homicides followed by shootings and blunt force (see Table 3). Interestingly, six of the blunt force cases in this study were classified as closed head injuries. Commonly, the victim was punched in the face, fell back, struck his head on the pavement, and suffered a traumatic brain bleed. This is important from a DNA perspective, as DNA from the suspect being transferred onto the victim's body never occurred or at least was never located.

Table 3

Homicides, by most common method, Canada, 1985 to 2015



Note: Populations are based upon July 1st estimates from Statistics Canada, Demography Division.
Source: Statistics Canada, Canadian Centre for Justice Statistics, Homicide Survey.

With respect to demographics, females accounted for 13 (24 per cent) of the victims. In Canada, males are 3.5 times more likely to be the victim of homicide (Statistics Canada, 2014), which is slightly higher than the experience in Vancouver. The average age of a female victim in the sample was 46 years old, with a range of 28 years old to 85 years old. Male victims were, on average, 38 years old, with a range of 15 years old to 80 years old. One statistic that was consistent with the rest of the country was that the male victims in the sample group who were involved in homicides that were gang-related had an average age of 28 years old; over ten years younger than the national average (Statistics Canada, 2014). Of the 39 cases that were solved, males were responsible in 36 of the cases (93 per cent), while females were charged in three cases (7 per cent). Females charged with homicide were, on average, 30 years old, while males were, on average, 33 years old. Of note, these results exclude two cases where the accused

were 80 and 66 respectively. If these two accused were included in the analysis, the average age increased by three years. Still, the sample confirms that, in general, younger males are the predominant demographic involved in committing homicides (Armstrong, Plecas, & Cohen, 2013).

The majority (60 per cent) of homicides occurred in what would be classified as a public place. There is some debate on what is considered a public place, but, for the sake of this study, a public place included parks, the street, restaurants, a hallway or lobby of a rooming house, or a car parked in a public place. A private place was defined as when the homicide occurred inside the suspect, victim, associate's residence or the yard of a residence (see Table 4).

Table 4: Location of Homicide

Location Type	Homicides	Percentage
Park	**3**	**6%**
Street	**19**	**36%**
Restaurant	**3**	**6%**
Hallway/Lobby	**4**	**8%**
Car	**3**	**6%**
Residence	**20**	**38%**
Yard of Residence	**1**	**2%**

Research has shown that the relationship of the victim to the suspect can have a substantial effect on the solve rate (Richardson & Kosa, 2001). Generally, victims of homicide that are either in family or intimate relationships with the offender are solved at a very high rate, while stranger-involved homicides are solved at a much lower rate. This was not the case with the results in this sample. Here, the overriding factor that seemed to affect the solve status was whether the homicide was gang-related. There was an even distribution in this sample on the variable that capture the relationship between the

offender and the victim, such as stranger, acquaintance, gang acquaintance[1], drug or street crime relations, and family/friends (see Table 5). Strangers were classified as the victims and suspect(s) not knowing each other and there was no evidence to believe that they had ever met prior to the incident. Acquaintances could be people who lived in the same building or the victim and suspect knew each minimally from seeing each other on the street. Gang acquaintances could be a little bit more difficult to define. In these cases, it was clear that the victim was not randomly chosen, but targeted because of some perceived transgression related to activities associated with being involved in a gang or organized crime.

A number of the victims were involved in either street or drug crime at the street level. Commonly, a disagreement or altercation preceded the event and was related to the victim and suspect's drug activity. Finally, as is common in all of Canada, but still a rare occurrence overall, were homicides that were carried out by either family members to another person in the family, such as a son killing his mother, a husband/boyfriend killing his partner, or friends killing one of their friends.

Table 5: Relationship between Victim and Offender

Relationship to Victim	Homicides	Percentage
Stranger	**10**	**19%**
Acquaintance	**13**	**24%**
Gang Acquaintance[1]	**15**	**28%**
Drug/Street Crime	**3**	**6%**
Family/Friend	**12**	**23%**

The motive for any homicide is always an important predicator on solve rates. In a few the homicide cases, there may have been dual motivators. For example, an altercation

[1] It truly is not known if the victim and suspect were acquaintances in the classical sense, as many of these cases are unsolved

between two people, but the suspect, suffering from a mental disorder reacted in an atypically violent manner. However, for this study, only the predominant motive was considered to reduce the amount of subjectiveness that a dual motive would provide (see Table 6). In many of the cases, some kind of altercation occurred before the actual homicide. These ranged from disagreements that started in drinking establishments, or one person owing another person money, to disagreements over drug transactions or territory disputes. Gang-related homicides accounted for 28% of the cases from the sample, which was slightly higher than the rest of Canada where gang homicides account for 17% of all homicides (Mulligan et al., 2015). Family-related homicides only accounted for five homicides involving intimate partner relationships. There was only one family-related homicide each year in this study, with the exceptions of no cases in 2013 and 2014 having two cases. In total, family-related homicides represented 9% of the total number of homicides in Vancouver, which was nearly half the proportion (16 per cent) for Canada overall (Mulligan et al., 2015). The remaining motivators, namely, robbery, mental illness, and one sex-based case were found in a minority of cases. There were three incidents where ‘innocent’ victims were killed. These cases involved a person trying to break up a fight and getting grievously injured themselves to a person being attacked for no apparent reason while sitting on a park bench

Table 6: Homicide Motives

Possible Motive for Homicide Event	Homicides	Percentage
Altercation	**20**	**37%**
Family Violence	**8**	**15%**
Robbery	**2**	**4%**
Mental Illness	**3**	**6%**
Sexual	**1**	**2%**
Innocent Victim	**3**	**6%**
Gang	**15**	**28%**
Other	**1**	**2%**

Regarding the 14 unsolved cases of homicide, some very similar themes were found regarding mechanism of death, location, manner in which the homicide was carried out, and victim associations. Half of the cases were shootings, while 13 of the 14 cases were considered to be gang-related. The one unsolved case that was not gang-related was drug-related and the method of death was a stabbing. Of the 12 gang-related homicides, 11 of them occurred in public, the majority occurring on the street. One case occurred inside a residence. In effect, of all the gang-related homicides in this sample (n = 15), only two (13 per cent) were solved. It was also common in the gang-related homicides for the victim to be either in a vehicle or getting out of a vehicle when they were shot at close range. It was also common for the offender(s) to flee the scene immediately after the shooting. Often, these homicides would occur at night and in residential areas that greatly affected both the quality and amount of any video surveillance that might be available to investigators. The manner in which these homicides were carried out also reduced the chance for any meaningful DNA to be found at the scene, especially DNA associated to the suspect.

Of the 14 unsolved cases, a canvass of the area for any video surveillance (commonly called a ‘video canvass’) was conducted in 13 of the cases. The one case

where it was not conducted was because the homicide occurred inside a residence. In two of the cases, video surveillance was located that identified a possible suspect vehicle. In four of the cases, video surveillance was located in the area, but it did not show any movements of suspects or victims, and in three of the cases, no video surveillance was found. Four of the cases resulted in video contributing or assisting in identifying possible suspects. As mentioned above, there is a dearth of research regarding the effectiveness of video surveillance in solving crime, especially homicides. The fact that four cases produced some results in unsolved cases represents a 31% 'assistance' rate. However, what this result also indicates is that simply having video surveillance in the majority of instances does not provide the police with the necessary evidence to forward a report to crown counsel, a 'solve'.

For all of the 14 unsolved homicides, a forensic identification team attended the scene with the intention of locating and collecting any forensic evidence, be it fingerprints or DNA. However, the manner that the majority of the unsolved murders were carried out, namely public shootings, greatly reduced the likelihood that any DNA from the suspect was left at the crime scene. In 11 cases, no suspect DNA or human biological material was located. In one case, a crime scene index 'hit' was made; however, the owner of the DNA remained unknown (the person was at two crime scenes). Two cases resulted in confirming suspects from the convicted offender index. However, it should be noted that the police were aware of who the suspects were in these respective homicides prior to obtaining the confirmation from the National DNA Data Bank.

In the sample, 39 of the homicide cases were considered solved. While there are numerous reasons that can contribute to a case being solved, it is noteworthy that when it

comes to the area of video surveillance, the results were decidedly better than experienced with the unsolved cases. That is not to say that a case that does not have any video surveillance evidence cannot be solved, but when you couple the lack of video surveillance with no DNA, no witnesses to the actual event, no cooperating witnesses as the investigation progresses, and limited opportunity to conduct more sophisticated investigative techniques, such as wiretap, undercover operation, or a police agent, solving a homicide will prove to be extremely difficult.

Regarding the 39 solved cases in this sample, the motivations and characteristics of the events for solved cases were different than the unsolved ones. Generally, the sample showed that a higher percentage of homicides would fit into the 2nd degree murder or manslaughter category, where the suspect's actions were more impulsive, rather than well thought out. Also, the homicides occurred in more densely populated areas of the city where there was a greater opportunity for the offence to be captured by video surveillance. In the solved cases, video surveillance was not present in 20% of the investigations. Again, video surveillance canvasses were conducted in the majority of cases. But, this is one way in which the findings differed between the solved cases and unsolved cases. In rare occasions, video surveillance did identify a suspect that was not previously known to the police investigators. This was accomplished in one of three ways:

(1) A surveillance image of sufficient quality was distributed to patrol officers in the area, who recognized the individual depicted in the image and provided a name for the suspect. It is important to realize; however, that the suspect, prior to the homicide, had a criminal record and was involved in crime, otherwise the patrol officers would probably have not known the suspect;

(2) images were shown to civilian witnesses that resided in the vicinity of the homicide, and they were able to provide a name for the suspect; or

(3) In one case, an image was put out to the media, where the public recognized the suspect and provided information on the identity of the suspect. This particular case would not have been solved if it were not for the video surveillance.

In almost half of the cases, video surveillance could put the suspect in the area either before or after the homicide event. In other words, the video surveillance provided some contributory evidence. Perhaps most exciting was when either a portion of the homicide event or the entire event was captured on video surveillance (see Table 7).

Table 7: Characteristics of Video Surveillance

	Percentage
Video canvass done	**92%**
Video contributed to the movement of the suspect in area	**41%**
Video was located, but not a factor	**18%**
Video assisted in identifying the suspect	**13%**
Showed portion of entire event	**13%**
Video linked a vehicle	**5%**
No video was located	**3%**

Again, for all the solved homicides, a forensic identification team attended the scene. Perhaps surprisingly, the rate of 'success' when it came to DNA was similar to the unsolved cases. In most cases, either no DNA was located or it was not a factor in solving the case. In only one case was the suspect confirmed through the convicted offender index, and in no cases, was a crime scene index 'hit' made. Rather, DNA contributed to what the investigators already knew. DNA confirmations were not obtained from the known offender data bank or crime scene index, but through obtaining a sample of DNA

from the suspect (either through DNA warrant or cast-off). Then, in a minority of instances, a match was obtained with a DNA sample from the scene or weapon. More commonly, when a weapon (i.e. a knife) was recovered, the victim DNA would be found on the weapon, but not the suspect's DNA (see Table 8).

Table 8: Characteristics of DNA Use in the Sample

	Unsolved	Solved
Confirmed suspect through databank hit	**2**	**1**
No suspect DNA, not a factor	**11**	**11**
Crime Scene Index 'hit'	**1**	**0**
Suspect DNA found at crime scene	**0**	**3**
Victim DNA on weapon	**0**	**5**
Victim and suspect DNA on weapon	**0**	**3**

A summary of the findings from the dataset indicated that DNA played a very small role in the outcomes of the investigations. In the majority of the gang-related homicides, no DNA was located, and in the two cases where DNA was found, the suspects in the cases were already known to the police. In a minority of cases, victim DNA (by way of blood) was found on the murder weapon, and, in the rare occasion, suspect DNA was also found on the weapon (by way of human biological material other than blood). However, in these cases, the suspect was known or had already been arrested for the homicide, thus the DNA mainly served to confirm what the police already knew. The NDDB was an extremely small contributor to the outcomes of the cases. Conversely, video surveillance was a positive contributor in over half of the homicides. Video images assisted in identifying witnesses, who then could provide information about a potential suspect, or identified suspects when the suspect images were made available to patrol officers in the area, who then made a positive identification. In a small number of cases, the video captured a part of the actual homicide, which helped determine whether the

cases were manslaughter or 2nd degree murder. In one case, the images from the homicide were of sufficient quality and presented to the public, who then provided the suspect identity. The suspect would most probably never have been identified if it were not for the video surveillance.

Discussion

Many of the findings from this study, regarding the demographics of victims and accused persons, method of death, location of the homicide, and possible motivations are consistent with national trends over the same time period. The results of this study, namely that gang-related homicides are solved at a lower rate are well established in the literature (Roberts, 2007). Couple this with a lack of forensic evidence, little to no video evidence, uncooperative or no witnesses, and suspects that will try and employ countermeasures to thwart the police, it is understandable that these cases would be extremely difficult to solve. While there is a paucity of evidence that exists on this subject, the idea that suspects are aware of DNA and video, and do things to defeat these investigative avenues is not a novel concept. When we look at the sheer lack of video found in gang-related homicides, it could be surmised that the time of day (night), and the location of the event (residential) play a contributing factor to the inability of video evidence assisting investigators. Both the time of day and the location greatly affect the quality of any images obtained, so that any images are not of sufficient detail to provide any real evidentiary value. As well, while not seen in these findings, namely because so little amount of video was actually obtained in gang-related homicides, is the idea that suspects will wear clothing to defeat video. The suspect can do this when he simply

lowers his chin and wears a hoody with the hood pulled over his head. Much the same can be said for countermeasures with DNA. Again, the sheer lack of it suggests that offenders are at least aware of it. While the use of a firearm is an obvious choice because it is an effective way to carry out a homicide, it also means that the suspect does not have to touch the victim or get that close to the victim, thus reducing the chance for any trace evidence. We also have to consider that in planned homicides, suspects will either wear clothing, such as gloves, or clean the firearm both before and after the homicide in an attempt to eliminate the chance of DNA being obtained from physical items (Beauregard & Martineau, 2014). Simply put, most, if not all, gang murders are planned, some more than others, and given even basic knowledge, either gleaned from peers and/or television, it is not that difficult for suspects to thwart the investigative avenues of video surveillance and DNA evidence.

It is important to note that of the two gang-related homicides that were solved, DNA evidence did not play a role, but video surveillance did. Namely, images of the suspects gave the investigators a good idea of who they should be looking for and the impetus to contribute the resources to the investigation. It could be surmised that when no evidence is obtained from the scene, and the investigators are essentially starting from "zero", it would be difficult for police managers to approve the use of expensive resources, unless some very compelling evidence is gleaned from some other source. Armstrong and her colleagues (2013) summarized that resources, and the need for additional resources, plays a critical role in whether gang-related homicides are solved. This study supports that finding and adds that, in gang-related homicides, there is often little evidence available or easily accessible. But, when there is evidence, this can serve as

a “tipping point” to justify the considerable expense to further investigate using more sophisticated techniques, such as authorizations to intercept private communications or police agents.

While DNA contributed very little to the unsolved cases in this study, it was a factor in the solved cases, but not to the extent that the NDDB has suggested in their literature. Of the 39 solved cases, the NDDB contributed to one case. Research in this area, particularly with the NDDB, supports the opinion that the NDDB does little to contribute to solving homicides (Plecas, Cohen, & Armstrong, 2012). In the sample used for this study, DNA evidence supported findings, but never did it provide an identity of a suspect that was not previously known by the investigators. Research supports the notion that the context of where and on what surface the DNA profile is found is important. It is also suggested that more evidence is needed, as DNA alone will not necessarily provide the answers (Cale, Plecas, Cohen, & Fortier, 2010). Interestingly, the largest contribution that DNA played was in the charge approval process, rather than the investigation itself. An example of this was when the murder weapon was recovered (commonly at the homicide scene, less commonly on the suspect) and DNA was used to confirm that the weapon was the weapon used. Most often, this DNA was in the form of blood from the victim. Less often, and given the belief that touch or transfer DNA is common, is that DNA from the suspect was rarely found. In many of these cases, the suspect was already arrested and their DNA was obtained by way of a DNA warrant.

However, it does appear that Crown Counsel recognizes the importance of DNA. Namely, when suspect DNA was found on a weapon that could be linked to a homicide, this represented compelling evidence that was free of any human interpretation. An

example would be when a knife was found at the crime scene, and all a witness could say was that he saw the suspect holding a knife (without any description of the knife). Coupling this witness statement with DNA evidence increases the confidence that an investigator and Crown Counsel have in the identification of the murder weapon. Put another way, having the presence of suspect DNA on an item at a crime scene is rarely enough. There needs to be an additional means to put the suspect at the scene or touching the weapon at the time of the homicide event to be able to say that the suspect used the weapon in the murder.

Video surveillance had a decidedly larger impact than DNA in solving homicides. In a number of cases, video canvasses were undertaken in situations where it could be argued that the evidence without the inclusion of video would be more than sufficient to get charge approval. This is an interesting observation, especially when this particular technique is seen as being quite resource intensive. An example of this is in the case of a domestic homicide where there is no doubt who the suspect is. The solve rates in these types of homicides has historically been very high and remains so. Prior to the widespread availability of video surveillance, video evidence did not form part of the case as it did not exist. It could be argued that in these types of cases, video evidence is still not required, yet investigators are going that extra step to locate it. There are two possible theories for this outcome. First, investigators are simply conducting a video canvass out of habit or a matter of course. Second, they recognize the importance of this evidence and, rather than just “solve” the case, they want to put the best case forward to Crown Counsel.

The results of this research study suggest that the claim that there is only a slight increase in the solvability of cases that use surveillance images may be false (Wilkinson,

2010). However, while this study demonstrated that there was improvement or contributory factors in solve rates; this comes at a huge cost in terms of human and financial resources. For example, police departments; have had to add more investigators to handle the same amount of homicides because there is more evidence and more data. The increased workload highlights that video surveillance provides an image that is "a mile wide, but only an inch deep" because it does not in itself provide detailed knowledge about the person whose behavior is being momentarily captured and made visible. The research of the Vancouver cases shows this. While video was located, it was only through effective witness interviews that the identity of the suspect or other witnesses that were in the area was located. However, increasing the amount of surveillance, in terms of the amount of data collected and in the workload of the police, does not guarantee that a homicide case will be solved. Much the same as DNA, it forms a part of the puzzle.

Recommendations

The results presented in this major paper highlight two main themes; video surveillance does contribute to solve rates, while DNA does so to a far less degree. Further, the DNA results are not unique to Vancouver; some research has found similar results across the United States, with forensic science playing a far smaller role than the public believes in solving homicides (O'Brien, 2010). Given that in the majority of cases DNA is not located or found on exhibits, it would appear that decreasing the amount of time it takes to obtain results from DNA labs would have a minimal effect on solve rates. Currently, the DNA lab in British Columbia strives, and, in large part, provides results within 40 days from submission (Plecas, Cohen, & Armstrong, 2012). Given this, there

would not be a need to actively pursue and put mechanisms in place, which comes with an expense, to decrease the "turn-around time" from a solvability point of view. However, the idea of having shorter turn-around times or even the capability of getting DNA results at a crime scene would increase efficiencies and, therefore, an argument could be made that DNA will continue to contribute, to some degree, to homicide solve rates. For example, currently, police forensic technicians attend a crime scene and collect items that they believe will have the highest probability of having human biological material that will be suitable for DNA testing; however, many of these items will not. But, the police do not know this until they submit the samples into the local DNA lab and receive the results. In many cases, the items have to be prioritized, and not all the exhibits can be submitted at once. The technology does exist (CBC, 2016) where portable DNA analyzers could be made available at a crime scene, the police could test an item, if the item did not have DNA present, then that item could be prioritized accordingly. Moreover, the police could collect only the items with enough human biological material to get a DNA sample suitable for comparison. This could provide police investigators an indication of where to concentrate their investigation, rather than having to wait for the DNA lab's analysis. In other words, if it is determined that the crime scene itself is not going to provide any evidentiary value, from a forensic point of view, investigators can quickly determine this and move onto an area of investigation that will.

As video surveillance does make a positive contribution to solving homicides, it is important that the necessary resources, including people to canvass for the video, download the video, process the video for court, and view the video for any evidentiary value, are hired and well trained. Failing to recognize the considerable human and, by

extension, financial costs will result in evidence being missed, or, in other cases, result in video resources getting short shrift. While there is a lack of research on the effectiveness of video surveillance in solving homicides, it stands to reason that capturing an image of suitable quality can aid investigators. However, it is still, in some situations, like finding a "needle in a haystack", and when you increase the sheer amount of video to be viewed, images can be missed. This can be a delicate balancing act that police investigators need to be cognizant of. Generally, in urban environments, a video canvass is one of the first tasks an investigative team will do, as a variety of sources of surveillance video save or retain the video for different lengths of time. At this early stage in the investigation, it is very possible that little is known about the motive, suspect, victim, and witness identities. So, the investigative team is left in the unenviable position of having to gather everything, or risk the chance of losing it forever. But, once the task of obtaining the video surveillance is over, investigators need to weigh the specific characteristics of the case, and prioritize the various videos that need to be viewed. The amount of time that will be required for viewing video will vary depending on what evidence is found through other investigative channels. Of note, in many cases, video surveillance supports what is found through other means.

It is important to understand that, regardless of their individual and relative contributions to solving homicides, DNA and video surveillance are likely here to stay. However, prosecutors and police investigators need to realize that both investigative techniques, depending on the quality of the evidence, will only contribute so much to solvability. The absence of a particular piece of evidence does not mean that a homicide suspect was not necessarily there, but just that the forensic evidence was either not

detected or not there. It is understandable that prosecutors want that piece of evidence, such as the entire homicide captured on video surveillance, but, in reality, this rarely happens. They need to understand this, and develop other sources of evidence, rather than relying primarily on video surveillance or DNA.

In Canada, full disclosure of the case is required. This has created an extremely complex and time consuming situation; one that police managers need to be aware of and have a full appreciation of. Commonly, the actual disclosure of the case, in terms of time, will exceed the time to investigate the event. The more investigative techniques that are added, the corresponding increase in resources that will be required for disclosure. It is a difficult balancing act, but investigators need to prioritize their investigative techniques as well. If a case is proven and there is strong evidence pointing towards a particular suspect without employing certain investigative techniques, it is important for those investigators to consider not engaging in them. Homicide investigations should never be a matter of "checking the boxes" and not all investigations require every available investigative technique.

Conclusion

The findings in this study will perhaps come as a surprise to police and the public enriched on CSI, less so to experienced homicide investigators. The belief that video surveillance images can be enhanced, that video is everywhere in an urban setting, and that these video surveillance images are immediately available for viewing to both the public and other police officers is not true. Rather, the video surveillance must be analyzed and compressed into a viewable format and prepared in a forensically consistent

manner for presentation in court. This requires both personnel with training and takes time. Second, and an aspect that is rarely taken into account, is the video has to be viewed. In other words, an investigator has to sit in front of a video terminal and view video for potentially many hours. Invariably, an element of human error can present itself, where an image or event is so quick, that it is simply missed by the viewer. There is no doubt that video can be a contributing factor towards solving murders, as the Vancouver sample used in this major paper clearly demonstrates. Based on the Vancouver Police Department's recent experience, in the unsolved cases, video surveillance played a very small role simply because there was none, while in the solved cases video surveillance contributed to the positive outcome in the majority of cases. The research on the effectiveness or how much video surveillance assists in solving murders is non-existent outside of anecdotal accounts for specific cases. Further, there is little longitudinal data indicating how effective video surveillance systems actually have been in reducing crime rates. There is a small amount of evidence that video surveillance can reduce property crime, but that same claim cannot be made regarding violent crime.

Much has been written and many people believe that DNA "solves murders" (Shaer, 2016). In fact, this study shows that rarely are hits obtained from the NDDB to identify a suspect not already previously known to the police. However, while the offender data bank is large, it would stand to reason that, as more DNA profiles are uploaded, the number of identifications would increase. Given rates of transfer, the mere presence of DNA at a crime scene should not be enough for a prosecutor to obtain a conviction, nor should the absence of DNA mean that a charge cannot be approved.

Context is needed. A better understanding, nationwide, is necessary for both prosecutors and police, so they can truly appreciate the infallible qualities of DNA.

Homicide solve rates have decreased in Canada from a high in the 1960s to today, but this can be explained by several factors, rather than the effectiveness of DNA or video surveillance. This research clearly shows, as in much of the rest of the country, that when homicides are gang-related and the weapon used is a gun, the solvability of these cases becomes very challenging. Often, investigators will know who the suspects are in these cases, but, due to a myriad of reasons, such as uncooperative witnesses, a recommendation for a charge cannot be made. It is important to note that resources are required to solve homicides. This is particularly true when the investigative avenue of video surveillance, which appears to be sought on virtually every homicide case in an urban environment, is used. There is no doubt that video surveillance does make a contribution towards solving homicides; however, this is often at the expense of other crimes, which simply receive less priority. There is no doubt that homicide investigations have become increasingly more complex, and that such technologies as DNA and video surveillance (just to name two) are going to continue as tools for investigators. Police Managers need to realize that they are only tools, and especially in the area of video surveillance can consume an enormous amount of time. However, this study does show that when resourced properly, positive results can be obtained.

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