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What Factors Contribute to a Murder Case Being Designated as a Cold Case?

Claudia Yvette Ortiz

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WHAT FACTORS CONTRIBUTE TO A MURDER CASE BEING DESIGNATED AS A
COLD CASE?

A Thesis

by

CLAUDIA YVETTE ORTIZ

Submitted to Texas A&M International University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

December 2018

Major Subject: Criminal Justice

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ABSTRACT

What Factors Contribute to a Murder Case being Designated as a Cold Case? (December 2018)

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Homicide is the most serious form of crime and unfortunately, if you are murdered in America, there is a one in three chance that the police will not identify your killer (Kaste, 2015). Unsolved homicide cases are often referred to as “cold cases.” Very little is understood about cold cases and the circumstances under which a case may go “cold”. To investigate the characteristics of cold cases, data from one of the largest cities in Texas (Houston) will be used to compare similarities and differences from Houston’s cleared homicide cases and cold cases. The factors that are the focus of my research are: victim characteristics of race, sex and, age, crime characteristics of time of day, day of week, seasonality, location of crime, method of death, and motive of death of the victim. The ultimate goal of this research was to build a model of cold cases that can help us to understand what make a case “cold,” why they go unsolved, and identify risk factors of a case that can eventually go cold. After running a binary logistic regression analysis on the data sets provided for this research, some predictors were found to be stronger than others.

DEDICATION

If tears could build a stairway and memories a lane, I'd walk right up to Heaven and bring you
home again.

~Author Unknown

For my cousin, Armando Garza Jr., I love you and I miss you dearly.

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CHAPTER I

INTRODUCTION

If you are murdered in America, there is a one in three chance that the police will not identify your killer (Kaste, 2015). Homicide is the most serious form of crime and unfortunately this crime occurs on a daily basis around the world. Homicide is defined as death resulting from injuries purposefully inflicted by another person, including deaths caused by law-enforcement officers or legal execution (Hammett et. al, 1992). In 2014, the estimated number of homicides in the nation was 14,249 (FBI, 2014); and approximately 1 in every 3 of those cases will go unsolved (Kaste, 2015). According to Xu (2008), the homicide clearance rate has steadily declined in the United States from 91 percent in 1965 to 62 percent in 2005. If a case is unsolved, it gains the categorization of being a cold case. Unless new evidence or leads are uncovered, a cold case can stay “cold” for many years (Fike, 2010). There is no universally accepted metric for when a case becomes “cold” (Davis et al, 2014), it can vary from seventy-two hours to three years, depending on the investigators, to label a case “cold.”

The National Institute of Justice (NIJ) defines a cold case as one in which probative investigative leads have been exhausted (NIJ, 2008). Homicides are often seen as the hardest kinds of crime to solve, and many believe that DNA is the main component of a cold case resolution (Adcock & Stein, 2013). However, relatively little is understood about the characteristics of cold cases compared to cleared (solved) cases, which leaves an important gap in literature and understanding: are there any characteristics of cases that might led us to predict when a case may be solved or turn cold?

The main focus of this research is upon characteristics of the victim and crime that can be used to predict the likelihood of a cold case: essentially, what makes a cold case “cold?” This

research focuses on the comparison of crime characteristics of cleared and cold homicide cases, from Houston, Texas. Using data from the Police Department of Houston, Texas, this research seeks to build a model of cold cases utilizing factors of personal attributes of the victim, spatial aspects of the crime, temporal aspects of the crime, method of death, and motive of death, with the ultimate goal being to predict whether a case is at risk of becoming cold.

There are many different types of crime varying from verbal assault to the fatal crime of homicide. Although homicide is often the topic of media broadcasts, it is not the most common type of crime or even cause of death. According to Medloy, Hempel, Mohandie, Shiva, and Gray (2001), cause of death in 1997 for young persons aged 5 to 24 years old was most likely to be a motor vehicle accident. In fact, suicide was 165 times more likely to cause the death of a young person than school homicides, which are fatal violent crimes in schools, during that same year (Medloy et al, 2001). All crimes have different crime characteristics, and these tend to be grouped into categories of personal attributes of the victim, spatial aspects of the crime, temporal aspects of the crime, method of death, and motive of death. However, systematic investigations of homicides and the characteristics that result in cleared vs. cold cases is underrepresented in the literature. A review of the extant literature reveals a focus on more frequent crime type, and characteristics that only lead to solved cases, rather than a comparison of cleared vs. cold cases across all crime types by researchers in the past (e.g. Roberts, 2007). For example, in one of the few pieces of research in this area, Medloy et al. (2001) evaluated the characteristics of thirty-four adolescent mass murderers (19 years of age and younger) who committed 27 mass murders between 1958 and 1999. The nonrandom sample consisted of males with a median age of 17 years old and with the cause of death of the victim by firearm, cutting instrument, or blunt object. Medloy et al. (2001) identified cases that met their criteria (as listed above) from psychiatric,

psychological, medical, social and criminal computer databases. Also, adolescent mass murder appears to be the exclusive domain of males-to a greater, but perhaps not significant, degree than other violent acts (Medloy et al., 2001). Medloy et al.'s (2001) research provides a category structure for analyzing crime likelihood based upon incident characteristics. Unfortunately, the literature in this field is sparse and so it is currently unknown whether a similar model, which is based upon adolescent mass murders (admittedly, a niche category of individuals), can be applied to "regular" homicide. One of the overall aims of the current research is to investigate whether applying a similar category structure of incident characteristics as Medloy et al. (2001) did, to cold and solved homicide cases, may be able to help to predict if a case may become cold.

What is a Cold Case?

The National Institute of Justice (NIJ) defines a cold case as one in which probative investigative leads have been exhausted (NIJ, 2008). Any unsolved case is considered a cold case and once a homicide is designated a cold case, the investigation may remain in this status for many years. Unfortunately, cold cases tend to become archived after a period of time, and may never be reviewed again (Fike, 2010). The issue of unsolved/cold cases raises many questions, not least of which is what happens to the murderers who are never caught (Stern, 1931)? Compared to other industrialized countries, the United States has a low rate of homicide clearance. For example, in 2002 the homicide clearance rate was 64% in the United States, compared to 95% in Japan, 96% in Germany, and 81% in England and Wales (Roberts, 2007).

Homicide/crime characteristics may play a major role in the differences observed in these rates however, as the homicides in the United States are typically committed with firearms, whereas, homicides in Japan, Germany, England and Wales were typically committed with weapons other than firearms (Roberts, 2007). In a homicide, where the method of death was

committed without a firearm, the offender is more likely to have had physical, close-range contact with the victim, thus producing physical evidence (e.g. DNA) which assists the investigators in solving those cases faster (Roberts, 2007). Homicide clearance is greatly affected by situational characteristics beyond police control, therefore it has been argued that the raw homicide clearance rate may not be a legitimate measure of police performance (Roberts, 2007). In order for a criminal case to be considered cleared an arrest for that incident needs to be made, otherwise it will remain a cold case. As homicide is a statistically rare event, homicide clearance research is extremely limited. Homicide information of a case can be gathered from police departments, medical examiners, or to other officials connected with responding to the incident (Regeoczi, 2008). The difficulty with accessing homicide clearance rates further complicates the aim to build a model of cold homicide cases and may help to explain why homicide clearance has not had a substantial presence in the research literature to date.

What are Incident Characteristics?

The focus of this research is on the crime of homicide, or more specifically, what happens when a homicide investigation goes “cold” (is unsolved). Unfortunately, the literature on cold cases is sparse. Therefore, in addition to the literature on cold cases, the known incident characteristics of homicide cases will also be reviewed. As previously discussed, Medloy et al. (2001) found that the following perpetrator characteristics for the crime of homicide were most common: social isolation (a.k.a. preferring one’s own company over the company of others and/or not having friends), history of bullying, victim of bullying, parents separate/divorced, history of violence, arrest history, substance abuse history, psychiatric history, psychotic at time of the crime, history of sexual abuse, weapons preoccupation, violent nickname, discussed murder, threats to third parties, and precipitating event (meaning to be angry or be immersed in

violent fantasies of revenge). With regards to the crime of homicide, the extant research literature tends to focus on certain categories of crime characteristics (often in isolation of other categories) in order to make sense of crime patterns. For example, the three main studies in this area focus on different aspects of a crime: Medloy et al. (2001) studied the crime characteristics of the perpetrators of mass murders whereas Abrams et al. (2007), Wolfgang (1958), and Pokorny (1965) studied the characteristics of the victims of homicide.

In one of the first documented studies of crime patterns, Wolfgang conducted an in depth analysis of 588 homicides in Philadelphia between the years 1948 and 1952. This study used files from the Homicide Unit of the Philadelphia Police Department, coroner's reports, court records, and prison commitments (as cited in Pokorny, 1965). The crime characteristics that Wolfgang used in his study were as follows: race/ethnic group, sex, method of death, the time of the crime, the location where the crime was committed, the relationship between the offender and the victim, and the distance between the victim's address to the crime scene.

According to a later paper by Collings (1958), a homicide is defined as victim-precipitated. Victim precipitation is where the victim of the crime provoked the criminal act and by modern-day standards, may be called "victim-blaming". In Wolfgang's original study, 150 (26%) of the cases were categorized as victim-precipitated, as being provoked by the victim in some way (Wolfgang, 1958). Out of a total of 588 homicides in Wolfgang's original study, the suspects in 31 felony-murders were convicted of first degree murder and six were sentenced to death (as cited by Collings, 1958). Thus, an overwhelming 557 cases were unsolved at the time of Wolfgang's writings: the issue of cold cases is one that has been persisting since at least the 1950s.

In 1965 Pokorny compared data from the city of Houston, Texas to Wolfgang's data on homicides committed in Philadelphia, Pennsylvania. According to the Census, Philadelphia was more than double the population to that of the city of Houston at the time (United States Census Bureau, 2015). However, Pokorny (1965) found that homicide rates in Houston were approximately double the rates in the larger city of Philadelphia. Furthermore, in both cities, criminal homicide occurs most often between members of the same race (Pokorny, 1965). Although neither Wolfgang (1958) nor Pokorny (1965) concentrated on cold cases, focusing instead on homicide overall, the crime variables they used in their analysis are useful for understanding crime characteristics of solved cases and thus possibly also cold cases.

One of the aims for this research is to determine which variables from solved cases may be absent/different for cold cases. Therefore, the taxonomy of variables used by Wolfgang (1958) and then further utilized by Pokorny (1965), will be applied to the analysis of cold cases to investigate whether the characteristics of cold cases are similar to those of solved homicides cases, or whether they differ.

Young men, particularly young African American and Hispanic men, have been emphasized as victims of homicide in the United States (Abrams, Leon, Tardiff, Marzuk, & Sutherland, 2007). Characteristics such as age, race/ethnicity, and gender can all be described as personal attributes of the victim. In one of the only studies to date to compare multiple categories of crime characteristics, Abrams et al. (2007) compared elderly homicide victims (aged 65 years old and above) with non-elderly homicide victims (aged 18 – 64 years old), recorded by the Office of the Chief Medical Examiner of New York City to try and identify differences in their crime characteristics. Abrams et al. (2007), found that the non-elderly adult homicide victims were more likely to be males, non-White (personal attributes of the victim), and to have died of a

gunshot wound (method of death), in the streets as compared to inside a premises (spatial aspects of the crime). Several studies found that homicides involving younger victims were more likely to be cleared compared with cases involving older victims (Xu, 2008). On the other hand, the elderly were found to have lower homicide rates and were most likely to be female, White, and to have died from non-firearm injuries (Abrams et al., 2007).

In sum, the current literature on homicide characteristics suggests that while younger people are more likely to be victimized than the elderly, they also tend to die of gunshot wounds, be male, and to be murdered outside in the street, rather than inside a premises. In general, the literature on crime characteristics presents a non-unified message regarding the causes of crime or offering any systematic comparison of cold and solved homicide cases. Therefore, the extant literature is currently unable to offer much insight into why some cases are resolved and some go cold.

Unfortunately, the crime characteristics identified in this literature review currently do little to inform whether a case is at risk of going cold or being cleared, primarily because the extant literature focuses on solved homicides. This somewhat begs the question of whether a cold homicide case is simply a homicide case which does not confirm to the above reviewed crime characteristics? Regardless of whether cold cases are characterized entirely differently to solved cases or simply represent an absence of the characteristics present in a cleared case, research to develop an understanding of cold case likelihood could have practical, as well as theoretical importance.

Cold Case Squad/Unit

Many cold case units are reserved for homicide cases (Fike, 2010). The reason for such a focus on homicide crime is that it is considered one of the more serious kinds of crime, and thus

units get “unlawful death” calls on a daily basis, contributing to a high case load (Fike, 2010). Evidence suggests that having a dedicated cold case unit improves the chances of solving cold cases (Kirsch, 2006). According to Davis, Jensen, Burgette, and Burnett (2014), by the late 1980s, the sheer volume of unsolved cases had become overwhelming for many agencies. In response, a number of large agencies instituted cold case squads (Davis et al., 2014). Cold Case Units tend to form as the rate of unsolved homicides increases. According to Kirsch (2006), a cold case squad should consist of experienced and persistent investigators in order to be at its most effective.

The order in which a cold case squad chooses the cases to work on is by selecting those cases that are most likely to be solved. However, this begs vital questions about what makes a case likely to be re-opened and thus solved, and can we reliably predict such a likelihood? In other words, are we using the best metrics to select cases that are most likely to be solved? While this selection criteria is vague and not well reported in the literature (and may indeed vary across Police Departments), what we do know is that the standard of evidence preservation often influences whether a cold case squad will reopen an investigation, such as whether DNA testing is possible (Kirsch, 2006). There is not yet empirical evidence to suggest that cold case squads are effective but there has been empirical work on how case attributes and actions by investigators affect clearance rates for homicides and other crimes (Davis et al., 2014).

It is also advantageous when citizens, interns for example, help out with these cold cases because they come in with a fresh eye and can possibly spot something that the detectives might have missed. Davis et al. (2014) also recommend that a cold case squad include a supervisor or team manager, such as a lieutenant, someone who acts as a liaison among the law enforcement agencies and the local community. There should also be a Sergeant, someone who can coordinate

the daily operations of the team. For example, the Washington Metropolitan Police Department (hereafter MPD) has a cold case unit consisting of twelve homicide investigators and a supervisor (Davis et al., 2014). According to Davis et al. (2014), the MPD reported that it reviews 60-70 unsolved cases annually and clears about 10 cold cases per year.

The future of units within police departments that are solely dedicated to cold case resolution is relatively secure as long as the financial and staffing resources exist to supply them. Funding needs to be available for these units, if it is not, then the fear is that this work will be left to occur only in a certain officer's "down time" which is likely to leave many unresolved issues for the police and the families of the deceased.

Priority of Cold Cases

Adcock and Stein (2013) have developed models that prioritize cold cases in terms of their ability to potentially be solved if re-opened. The model initially focuses the evaluation on whether or not the case contains physical evidence, especially evidence that might identify a particular person of interest through either DNA or Latent Prints (Kirsch, 2006). According to the Bureau of Criminal Apprehension, Latent Prints are an impression of the friction skin of the fingers or palms of the hands that has been transferred to another surface (Bureau of Criminal Apprehension, 2016).

Adcock and Stein's (2013) model steps are as follows: (1) consolidate cases, which is to combine multiple unsolved cases into one proceeding, (2) control log and database, which is to have everything on the cases well organized, (3) review evidence and document, (4) decide if the case is a priority or if it is not suitable yet, (5) Assign case, and send evidence to lab, and (6) 30-60 days later the evidence is returned and you can notify the family and initiate investigation. For those cold homicide cases with no evidence, detectives are encouraged to discuss the concerns

with the District Attorney (Adcock & Stein, 2013). While this model provides structure in terms of selecting and prioritizing a cold case, steps such as “decide if the case is a priority...” are vague and little if any, guidance is offered on how such priorities are arrived at. It is hoped that by taking a method of conducting research on solved cases, namely categorizing crime aspects in defined crime characteristics, some structure and science-based rigidity can be brought to this process.

Cold Case Evidence

Homicides are often seen as the hardest kinds of crime to solve, and many believe that DNA is the main component of a cold case resolution (e.g. see above model by Adcock & Stein, 2013). However, according to Adcock and Stein (2013) DNA only resolves approximately 30 percent of all homicide cases. A more recent area of consideration regarding effective case clearance has been the availability and use of analytical procedures, such as blood spatter analysis, voice stress analysis, and other forensic tools that are used in an attempt to solve cases on a day-to-day basis (Keel et al., 2009). According to Keel et al. (2009), testing DNA for evidence and blood spatter patterns can be used to interpret the possibilities of what might have happened at the crime scene, from the weapon that was used, to the exact actions that led to the death of the victim. Voice stress analysis is the test that is used to detect deception in witnesses, persons of interest and/or, suspects by detecting changes in the frequency, duration and intensity of vocal patterns as they describe their alibi and/or interrogated.

How To Study Homicide Cases

Detectives investigating homicides that are not cleared quickly run the risk of encountering offenders who have long fled the scene, witnesses who have forgotten key information or cannot be located again, and tainted physical evidence, thus increasing the

difficulty of solving the crime (Regeoczi, 2008). The United States uses two national data collection systems to track detailed information on homicides: The Federal Bureau of Investigation's Supplementary Homicide Reports and the Centers for Disease Control and Prevention's Fatal Injury Reports (U.S. Dept. of Justice, 2014). These systems were developed to improve our ability to produce national statistical systems. The police solve approximately 20 percent of all crime indexed by these systems each year (Walker & Katz, 2005). Walker and Katz (2005) used the Federal Bureau of Investigation's data from 2002 on crimes committed in the United States which were cleared by arrest. The data showed that homicides had a 64 percent clearance rate (Walker & Katz, 2005).

According to Roberts (2007), one perspective on homicide clearance by arrest argues that the police may dedicate more of these resources, and thus increase the likelihood of clearance of a homicide, by police discretion based upon victim characteristics or personal attributes of the victim. Robert's (2007) found that incidents with female or younger victims were more likely to be cleared than incidents with male or older victims. The second perspective, which is contradictory to the first, argues that because of strong organizational and public pressure to clear homicides, police respond to all homicide cases with maximum willingness and effort regardless of victim characteristics (Roberts, 2007).

Roberts (2007) goes on to argue that immediate situational characteristics of a crime (e.g. physical evidence and information) are more important than victim characteristics in clearing homicides. Such a reliance on situational characteristics of a crime may suggest that these characteristics may be more important than the personal attributes of the victim with regards to the likelihood of solving a homicide case in the cases reviewed by Roberts (2007). However, it

should be noted that Roberts (2007) view is not shared by all in the field and thus, is somewhat controversial.

Stern (1931) proposes three methodologies for obtaining data to study homicides cases: the first methodology is to review leading newspapers and pick out felonious homicides that were not cleared by the police, the second methodology is to scrutinize the death certificates on file at the State Board of Health, and the third methodology is to obtain information directly from the county's coroners. Ultimately, Stern (1931) settled upon obtaining information directly from the county's coroners by means of a short questionnaire (Stern, 1931). This methodology was also used by Wolfgang (1958) and Pokorny (1965) where they used police files and coroner's reports to collect their data. Although Stern (1931) settled on this methodology, and it was replicated by Wolfgang (1958) and Pokorny (1965), that does not mean the methodology is without limitations.

The questions that were used in Stern's questionnaire for the coroners are as follows: (1) Name of person murdered, (2) Date of homicide, (3) Place of homicide, and (4) Probable cause of homicide (Stern, 1931). When asked, some coroners would give answers such as, "None that I know of" and "There have been no murders that have not been solved to my knowledge." As a result, 22.54 percent of all homicides committed in Wisconsin were categorized as never solved (Stern, 1931). At the end of this study, Stern (1931) mentions that a further and more complete study of the problem of unsolved homicides is necessary, however, to date, very few further studies of cold cases have been published in the literature. Although few research endeavors have sought to investigate the issue of cold cases, Police Departments have reacted to the issue of cold cases by forming Units dedicated to their investigation.

Interestingly, Lee's (2005) analysis shows that the strength of a case demonstrated by the weight of evidence and willingness of eyewitnesses to come forward, were shown to be significant predictors of case clearance. However, there is a well-established body of literature which argues that reliance solely on an eyewitness to solve a crime may be problematic and while may lead to a conviction, can lead to a wrongful conviction. Psychologist Elizabeth Loftus, the leading expert on the subject of eyewitness memory, was one of the first to warn that despite the importance of eyewitness identifications, they are not always reliable (Loftus, 1992).

According to Marsh and Greenberg (2006), it is well known, both within the legal community and the general public, that eyewitness testimony has a strong impact on criminal investigations and courtroom verdicts; however, research conducted in the last 25 years demonstrates that eyewitness recall is often erroneous, distorted, easily influenced by others, and can result in innocent persons being wrongly accused and imprisoned (e.g. Kassin, Tubb, Hosch & Memon, 2001; Houston, Clifford, Phillips & Memon, 2013; Houston, Hope, Memon & Read, 2013; Marsh & Greenberg, 2006). Subsequently, an entire field of research has been devoted to the study of the errors that occur in memory for crimes (see Wells, 1978; Wells, Memon & Penrod, 2006 for reviews).

Modeling the Likelihood of a Cold Case

Wolfgang's (1958) in-depth analysis of 588 homicides in Philadelphia between the years 1948-1952, is one of the only studies to systematically evaluate cold homicide cases in this way. Wolfgang (1958) relied on variables of race/ethnic group, sex, method of death, time of the crime, location of the crime, relationship between offender and the victim, and the distance between the victim's address to the crime scene, as predictors of homicide (Pokorny, 1965). From the scant literature available on actual cold cases, we know that in Houston (Pokorny,

1965) as well as in Philadelphia (Wolfgang, 1958), criminal homicide occurs most often between members of the same race, that the persons involved tend to be relatives or friends rather than strangers, that males are much more frequently involved (both as offenders and victims) than females, and that the most likely hours for a criminal homicide to be committed are between 8:00 p.m. and 2:00 a.m. (Pokorny, 1965).

The research investigating a possible relationship between season, time of day and crime likelihood is sparse and has produced conflicting results. For example, Lester (1979) reviewed the research on homicide and concluded that there was no seasonal variation in homicide; however, homicide was more common on weekends. Lester's (1979) study consisted of suicides and homicides in the United States from the year 1973. The data was obtained from the Vital Statistics of the United States, Volume 2 (Lester, 1979). Although Lester (1979) concluded that there was no seasonal variation on homicide, the analysis indicated that homicide was most common in July to September and increased again in December (Lester, 1979).

Cheatwood (1988) mentions that the hypothesized existence of a relationship between weather and violent crime is one of the oldest propositions in criminology. The central question is whether there is a relationship between season and homicide (Cheatwood, 1988). Cheatwood's (1988) study consisted of all homicides from 1974 through 1985 reported by the Federal Bureau of Investigation in the Uniform Crime Reports (hereafter UCRs) for a sample of 221,468 cases. The data was analyzed using cross-tabulation and chi square testing (Cheatwood, 1988). Cheatwood's (1988) results showed that there was no "season" for homicide, however there was a slight, though-not statistically-significant finding of more homicide cases in the summer (Cheatwood, 1988). Cheatwood (1988) concluded that months in which homicide rates are most likely to be high are December, July, and August; however, these months do not share any

features of weather, length of day, temperature, or other physical characteristics that can explain their tendency to be high homicide months (Cheatwood, 1988).

Tennenbaum and Fink (1994) also investigated whether a relation exists between crime (especially violent crime) and season of the year. For example, it is commonly believed that higher air temperatures increase a propensity for violence (Tennenbaum & Fink, 1994). Tennenbaum and Fink (1994) retrieved their data from the Supplementary Homicide Reports (SHRs) of the UCRs. To test whether the level of homicide is different in some months compared to others, Tennenbaum and Fink (1994) conducted a regression with 11 dummy variables to represent the 12 months of the year. Tennenbaum and Fink (1994) analysis resulted in only three months having statistically significant coefficients (February, July, and August).

Wellford and Cronin's (1999) study examined 798 homicides that occurred in four large United States cities during 1994-1995. Two data collection instruments were utilized to provide information for this study. The Homicide Attribute Coding Instrument (HAC), which provides a detailed description of the circumstances surrounding the homicide case, along with information regarding prior criminal records of victims and offenders, relationship between the victims and offenders, drug use by the offender or victims at the time of the incident, the number of eyewitnesses, and suspected motivation for homicide. The investigative instrument, which provides information such as the status of the case, the number of detectives assigned to the case, what evidence was found at the crime scene and what types of checks and tests were performed on any evidence found, whether search warrants were issued, who was interviewed, and what information was obtained by following up on the initial stages of the investigation (Wellford & Cronin, 1999). Wellford and Cronin's (1999) focus was the effect of case characteristics on the likelihood of a case being solved. The variables from Wellford and Cronin (1999) were entered

into a series of multivariate analyses. Wellford and Cronin (1999) found that cases in which drugs were a factor were less likely to be solved, as well as cases where no weapon was found at the scene, if the incident occurred in a public area, and if friends of the victim were interviewed as eyewitnesses (Wellford & Cronin, 1999).

In a more recent investigation of homicide clearance, Regoeczi et al. (2000) developed a model for predicting homicide clearance incorporated the variables of gender, race, age, weapon, and circumstances surrounding the offense (Regoeczi et al., 2000). The United States homicide data sets in Regoeczi et al.'s (2000) study were generated from the Federal Bureau of Investigation's Supplementary Homicide Reports (SHR) for the years 1976 through 1992, resulting in a data set of 341,369 cases. Logistic Regression analysis was used to determine the factors that influence the probability of a homicide being cleared (Regoeczi et al., 2000). Results showed that if the victim is female, non-white, and under the age of 10, the chances of the cases being cleared increases; however, if the victim is male, white, and above the age of 10, the chances of the case being cleared decreases (Regoeczi et al., 2000). This research begins to suggest that a confluence of factors play into the likelihood of case resolution, rather than one factor in isolation.

With that in mind, Addington's (2007) study focused on the characteristics of homicides that are cleared quickly compared to those that take longer to clear, as well as those that are not cleared. This study utilized National Incident-Based Reporting System (NIBRS) data from the years 2000 through 2002 to examine time to clearance, in particular the factors associated with homicides that are cleared quickly as compared to those cleared over a longer period of time or not cleared at all. NIBRS provided information for 5,706 homicide victims and the study's results showed that homicides involving a female and child victims are more likely to be cleared,

race does not appear to be a factor in clearance, and homicides that occur at home are more likely to be cleared (Addington, 2007). However, homicides in which firearms were used are less likely to be cleared (Addington, 2007), which supports the arguments of Roberts (2007) regarding the use of firearms reducing clearance rates potentially due to lack of direct person-to-person contact with the victim.

In 2008, Regoeczi updated the data reported in Regoeczi et al. (2000) with data gathered from FBI's NIBRS database for the years of 1996-2002. The focus of Regoeczi's (2008) study was on victim and incident characteristics as predictors of whether a homicide case will be cleared and the timing of that clearance. To that end, Regoeczi (2008) focused on two dependent variables, which consisted of a dichotomous measure (cleared vs. uncleared) with the other being a continuous measure (number of days until case was cleared or has remained unsolved) of clearance (Regoeczi, 2008). In line with Regoeczi's previous research, Regoeczi (2008) found that cases involving younger victims and females increased the likelihood of a cases being cleared. Furthermore, Regoeczi (2008) found that a case is less likely to get solved if the circumstances were unknown and if the incident occurred in a nonresidential location (Regoeczi, 2008).

Xu (2008) took a slightly different approach and investigated the effects of homicide event characteristics on the decline in homicide clearances with a longitudinal approach. Xu (2008) utilized the Chicago Homicide Data (CHD) from 1966-1995, using two different longitudinal procedures: pooled cross-sectional time series (referred to as CSTS) and the autoregressive, integrated, and moving average modeling technique (referred to as ARIMA/ARMA). Xu's (2008) variables that were analyzed resulted in characteristics such as: stranger relationship, Latino victim, and vehicle body location (location of the vehicle where a

body was found) were significantly and consistently associated with the decline in the homicide clearance rate in the city of Chicago during the years 1966-1995 (Xu, 2008). However, according to Xu (2008) previous studies have identified the following characteristics of homicide as being significantly associated with clearance rates: age of victim (personal attributes of the victim), home body location (spatial aspects of a crime), stranger offender-victim relationship, and use of firearms (method of death) (Xu, 2008).

Additionally, Davis et al. (2014), investigated whether it is possible to predict which cases are likely to be solved based on information available at the start of the cold case investigation. The authors interviewed investigators and reviewed 189 solved and unsolved cold cases in Washington, D.C., to determine whether there are factors that can predict cold case solvability (Davis et al., 2014). According to Davis et al. (2014), seven categories were collected which includes: information about the victim, crime context, motivation for the crime, information about suspects, witnesses, and physical evidence. Davis et al. (2014), found that cases were less likely to be cleared if the cold case investigation was initiated due to family pressure or triggered by the passage of time, if the victim was African American, a prostitute, or drug user, or if there had not been a struggle preceding death. Further, clearance was more likely if the victim had been a gang member (Davis et al., 2014).

However, the strength of conclusions that we can draw from Davis et al. (2014) are somewhat limited due to the potential for investigator bias in their sampling strategy. Rather than selecting their cold cases randomly, Davis et al. (2014) relied on cold case investigative staff to select the cold cases for the research team to review. This kind of selection criteria can allow biases to creep into the data as investigative staff may have selected either very difficult/unusual

cold cases in the hope that further analysis may shed new light on the case, and/or cases which shine a favorable light on the original officers' handling of the cases.

Interim Summary

As can be seen from the extant literature, there is what appears to be the beginning of consensus around some crime characteristics such as age and gender of the victim (Regoezi et al., 2000; Regoezi, 2008) however consensus does not currently exist around which crime characteristics are most important for the resolution of a homicide case (e.g. Davis et al., 2014; Xu, 2008). Furthermore, the research literature which specifically focuses on cold cases is sparse and largely outdated (Pokorny, 1965; Wolfgang, 1958). Therefore, very few insights can be gained from the current literature as to what may lead to a homicide case going unsolved and thus, going cold. The ultimate goal of the current research is to start to bridge this gap in the literature and develop an understanding of the differences between solved and cold homicides cases. The ultimate goal is to be able to build a model that allows the prediction of the likelihood of a homicide case going cold. The model will be built utilizing crime characteristics from solved cases to model whether similarities or patterns between characteristics present in solved and cold cases can be identified to understand what cold cases are, why they go unsolved, and identifying risk factors of a case that may eventually go cold. Ultimately, this study aims to investigate the predictive ability of crime characteristics previously identified in the literature, such as personal attributes of the victim, spatial aspects of the crime, temporal aspects of the crime, method of death, and motive of death, to predict the likelihood of a case becoming cold. In the following sections, the literature on crime characteristics will be further broken down into categories of personal attributes of the victim, spatial aspects of the crime, temporal aspects of the crime, method of death, and motive of death. These specific categories of crime characteristics have

been identified from the extant literature as being the most consistently present and thus, will be investigated in the current research (Abrams et al., 2007; Addington, 2007; Cheatwood, 1988; Davis et al., 2014; Lester, 1979; Medloy et al., 2001; Pokorny, 1965; Regoeczi, 2000; Regoeczi, 2008; Roberts, 2007; Stern, 1931; Tennenbaum & Fink, 1994; Xu, 2008; Wellford & Cronin, 1999; Wolfgang, 1958).

Review of the Literature on Crime Characteristics of Solved Homicide Cases

Personal attributes of the victim typically refer to characteristics such as victim sex, age, race (e.g. Xu, 2008). However, the utility of such characteristics in question: Xu's (2008) model showed consistently that the victim's age, sex, and prior record in a community area does not have a significant effect on homicide clearance. With regards to sex, it is interesting to note that in the studies thus far reviewed, both the offenders and victims were mostly males. However, the picture regarding sex and clearance rates is confusing, as according to Roberts (2007), Regoeczi et al. (2000) and Regoeczi (2008) incidents with female or younger victims were more likely to be cleared. Therefore, victim sex will be investigated as a possible predictor of cold/cleared cases to try and bring some consistency to the question of sex and homicide clearance. With regards to race, the literature is also at odds, Wolfgang (1958) found that homicides with non-White victims were more likely to be cleared. However, Davis et al. (2014) found that cases were less likely to be cleared if the victim was African American. As Davis et al. (2014) is the more recent study, it is possible that the Wolfgang (1958) finding is simply outdated now. In the interest of investigating these diverging findings, race will be investigated as a possible predictor of case clearance in the current thesis.

Spatial Aspects of the Crime. According to prior research, homicides that occurred inside homes have a better chance of being cleared compared with those that occurred at non-

residential locations (Xu, 2008). Furthermore, Davis et al. (2014) discovered that bodies found in vehicles are the least likely to result in a cleared case compared to any other crime location. The findings of Xu (2008) and Davis et al. (2014) appear to start to build a picture of the predictive abilities of the spatial locations of the crime with regards to clearance rates. It may be possible that when a crime occurs in a home it is easier to investigate, and any biological (e.g. DNA, blood) evidence may stay “fresh” for longer when in a temperature controlled environment such as a home. However, if the body is found outside, or in a vehicle, the environment is not as controlled as in residential property and therefore the physical evidence may become denatured, contaminated or destroyed. Furthermore, with victims found in vehicles especially, it is not illogical to argue that there is an increased likelihood that the homicide may have happened at a different location to where the body was discovered, thus resulting in a lack of physical evidence of the homicide act itself being available at the site of body discovery.

Temporal Aspects of the Crime. Homicides have not been found to have a seasonal pattern in most previous studies, however, the findings of Tennenbaum and Fink (1994) regarding a seasonality of homicides are interesting and merit further research. According to Tennenbaum and Fink (1994), it has long been assumed that there is a relation between crime and season. For example, it is commonly believed that heat causes a propensity for violent crimes (Tennenbaum & Fink, 1994). While Tennenbaum and Fink’s (1994) study found that the months of February, July, and August produced statistically significant coefficients for predicting increases in homicide rates, Cheatwood (1988) found no statistically relationship between seasonality and homicides. If anything, Cheatwood (1998) found trends that suggested most homicides occurred in July, August, and December. Furthermore, Lester (1979) found no seasonal variation in homicide but found four months showing a peak for homicides, which were

July, August, September, and December. Most homicides, for the purpose of Lester's (1979) study, also showed a peak occurring during the weekend (Saturday and Sunday). Therefore, there appears to be a growing pattern in the data for homicide rate increases in, at the very least, the months of July and August.

Method and Motive of Death. Xu's (2008) model showed that the percentage of homicides involving firearms has no significant effect on case clearance over time (Xu, 2008). However, Xu (2008) reported that homicide cases in which guns were used may be less likely to be cleared. Using firearms allows the offender to have no physical contact with the victim and to leave the scene quickly making it difficult for the police to collect forensic evidence (Xu, 2008). These findings inform two of the research questions of this thesis: Do cases that involve gunshot wounds end up being at increased risk of becoming a "cold" case? Does the motive being unknown/a lack of motive increase the likelihood the case will turn cold?

Building a New Model

To summarize, weapons that are identified as producing contact with the victim are predominately a knife or the perpetrator's hands, while crimes involving a firearm are less likely to be solved. Also, with regards to spatial aspects, when the crime takes place at home in comparison to any other location, the chances of solving the homicide increase (Regeoczi, 2008). Situational characteristics such as whether the offender was under the influence of alcohol or other drugs, non-stranger offenders, and concomitant serious offenses, were also found to significantly increase the odds of homicide clearance (Roberts, 2007). Other characteristics of a homicide case clearing are those cases involving child victims, which would fall under the personal attributes of the victim. In particular, children are most often killed by someone known to them, making it more likely the homicide will result in arrest (Regeoczi, 2008).

Wellford and Cronin (1999) found that in order for a homicide case to be solved the following characteristics need to be present: the offenders were Hispanic rather than African American, offenders were not drug buyers, and the victims were killed with non-firearm injuries (Wellford & Cronin, 1999). Furthermore, Roberts (2007) found that incidents with personal attributes of female or younger victims were more likely to be cleared. The findings of Wellford and Cronin (1999) and Roberts (2007) lend credence to the argument that characteristics of the victim may motivate the investigating officer to devote more resources to solving the crime, and this may be especially the case when the victim is a child, or female.

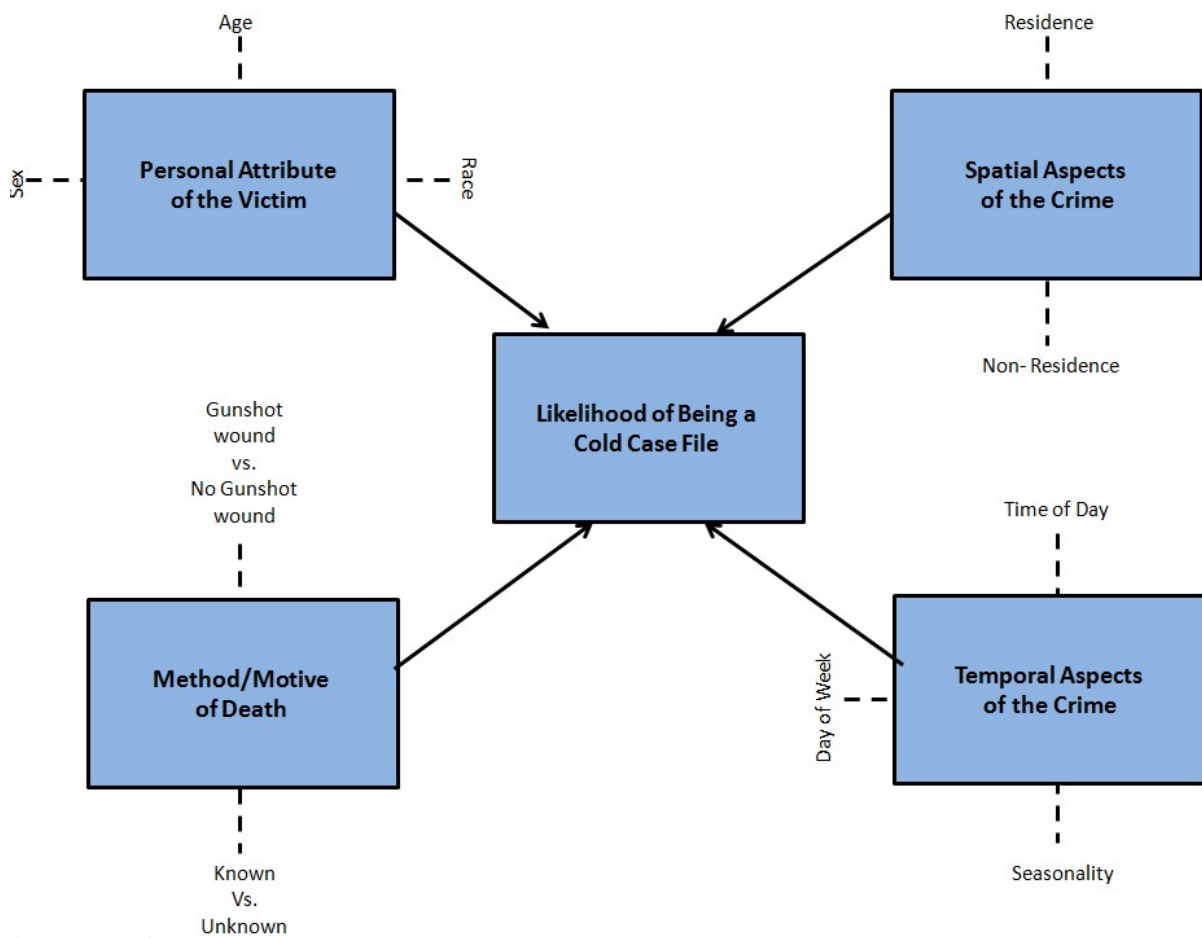
Taken together, the reviewed literature begs a couple of questions: is building a model of cold cases as easy as looking at the incident characteristics which predict solved cases and if some are not present then we can predict the case will go cold? For example, Lee (2005) found that homicide incidents between strangers were less likely to be cleared than those between non-strangers (see also, Roberts, 2007). Some other incident characteristics on a homicide case not being solved are using firearms on the victim, which require no physical contact, and for the majority of unsolved cases, the victims were male. Also, cases that involve drugs or have no eyewitnesses were found to be less likely to be solved (Wellford & Cronin, 1999). The purpose of this research is to address this very question from an evidence/data driven angle. In the next sections, the variables that will be analyzed in this research to build a model of cold cases likelihood will be discussed. The variables identified from the extant literature are: sex, age, race, location of crime, time of day, day of week, seasonality, method of death, and motive of death. These variables will be operationalized in order to run the analysis in the attempt to obtain the results on whether these variables are predictors of a homicide case going cold.

CHAPTER II

THE CURRENT RESEARCH: METHODOLOGICAL CONSIDERATIONS

The purpose of this research is to investigate whether identifying the incident characteristics of a homicide case can accurately predict the likelihood of whether that case will be solved or turn cold. Figure 2.1 shows the four main components of this research: personal attributes of the victim, spatial aspects of the crime, temporal aspects of the crime, method and motive of death.

Figure 2.1 Conceptual Framework for this Study



Based upon the extant literature, the categories depicted in Figure 2.1 will be the main categories for the current investigation of incident characteristics of a homicide case with regards to predicting whether a case is a risk of potentially becoming cold. For personal attributes of the victim the variables identified for use in this research are: sex, age, and race (e.g. Davis et al., 2014; Regoeczi, 2008; Roberts, 2007; Wolfgang, 1958; Xu, 2008). For spatial aspects of the crime, the variable identified is location of crime with the categorization of residence versus non-residence (e.g. Davis et al., 2014; Xu, 2008) For temporal aspects of the crime, the variables identified are: time of day, day of week, and seasonality (e.g. Tennenbaum & Fink, 1994). The variable of method of death, is categorized as gunshot wounds versus no gunshot wound, and for motive of death the categorization is known versus unknown (e.g. Xu, 2008).

Statistics of the City Selected for Analysis

The city of Houston, Texas was identified for this study as Houston is the fourth most populated city in the United States and is located in Texas, where this research is based. The Houston Police Department assisted in the research and provided a full data set for their cleared and cold cases from the years 2006 - 2015. (See Appendix D-E for correspondence related to this request). The main demographics of Houston, Texas were obtained through the Census of 2010 and can be found below in Table 2.1.

Table 2.1 Population of Houston, Texas, 2010

Population Demographics	N
Race	
White	1,060,222
Other	1,039,229
Gender	
Males	1,053,517
Females	1,045,934

Table 2.1 Continued

Total	2,099,451
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Data Selection and Analysis Strategy

The method used in this study is a non-reactive data collection method known as existing government statistics and uses a quantitative content analysis of records provided by Houston Police Department. In a non-reactive research, subjects are unaware they are being studied, and therefore have not given consent to be part of a research study. However, the use of secondary data sets do come with concerns regarding internal validity of the method of data generation and reporting and external validity with regards to the generalization of the data.

The target population are the victims of the homicide cases from the years 2006-2015. The data sets that were provided from Houston Police Department are “Cold Cases” with 962 unsolved homicide cases and “Cleared Cases” with 2,088 providing a total of 3,050 cases. Both data sets are from the years 2006-2015. The data sets represent a random sample from a super population. The cases can be found separated by year in Table 2.2.

Table 2.2 Total Number of Homicide Cases

Year	Cold Cases	Cleared Cases
2006	126	266
2007	134	272
2008	97	262
2009	79	202
2010	71	234
2011	56	177
2012	75	152

Table 2.2 Continued Total Number of Homicide Cases

		162
2014	98	171
2015	151	190
Total:	962	2,088

n=3,050

CHAPTER III

OPERATIONALIZATION AND MEASUREMENT OF VARIABLES

The independent variables are as follows: race, sex, age, time of day, day of week, seasonality, location of crime, method of death, and motive of death of the victim. The dependent variables are whether the cases from the data sets are Cold Cases or Solved Cases. Since we were looking into identifying risk factors that can potentially make a case go cold; the coding for “Cold Case” is (1) and the coding for “Solved Case” is (0).

Measures of Personal Attributes of the Victim

Census Demographics for Houston, Texas, show that there are more Whites than any other race in the population. However, within the data sets provide by Houston Police, the majority of homicide victims were African American. For the purpose of this research, therefore, the operationalization of race was coded as “African American” (1) and “Other” (0). Based upon the extant literature, it would appear that the majority of homicide offenders and victims are males. Therefore, the coding for sex was “Males” (1) and “Females” (0). Frequencies for the variable of Age, revealed that most of the homicide victims were from the ages of 15 to 60 years old. Therefore, the variable of age was operationalized as years ranging “15-60” (1) and “Other” (0).

Measures of Spatial Aspects of the Crime

According to Abrams et al. (2007), homicide is most likely to occur in a public space, and victims are most likely to be non-White in race and young of age. Therefore, for the current study, the variable “Location of Crime” was coded as “Non-Residence” (1) and “Residence” (0) and according to prior research, homicides that occur outside of a residence have a higher risk for becoming cold cases, so this variable is of special interest.

Measures of Temporal Aspects of the Crime

The variable “Day of Week” was coded as “Weekend” (1) and “Weekday” (0). The variable for “Time of Day” was coded as follows: 0000-0559 = Night, 0600-1659 = Day, and 1700-2359 = Night. Then Night/Day was coded as “Night” (1) and “Day” (0). Homicides have not been found to have a seasonal pattern in most previous studies, however, evidence shows that homicides happen more in the summer than in the fall or winter (Tennenbaum & Fink, 1994). After running the data for Seasonality, the frequency distributions showed that spring had more cases than summer, followed by winter, then fall. Therefore, the data sets were collapsed across seasons and coded the variable for Seasonality as “Hot” (1) and “Cold” (0). “Hot” stands for the hot months, which are March, April, May, June, July, August, and September (Spring and Summer). “Cold” stand for the cold months, which are October, November, December, January, and February (Fall and Winter).

Measures of Method and Motive of Death

For the variable “Method of Death,” victims murdered by gunshot wounds had a higher risk of the case becoming cold rather than those victims killed by a more personal object, such as, a knife. In a homicide committed without a firearm, the offender is more likely to have had physical, close-range contact with the victim, thus producing physical evidence which assists the investigators to clear those cases faster (Roberts, 2007). Therefore, the variable was coded as “Gunshot Wound” (1) and “No Gunshot Wound” (0). For the variable motive of death, after running a frequency distribution, the variable was coded as “Unknown” (1) and “Known” (0).

Data

The data used in this research was obtained through the Police Department of Houston, Texas. Sergeants in charge of the homicide/cold case units provided all data sets from cleared

and cold homicide cases in the years ranging from 2006 through 2015 (see Appendix D-E for correspondence). The purpose of the analysis was to compare the different factors from the cold cases to the cleared cases in order to detect similar characteristics between cold and solved homicides. The overall aim is to identify factors which can ultimately be used to model the likelihood for a case to end up as a cold case. Binary logistic regression will assist in the investigation of the likelihood that a given crime characteristic is present in a cold and solved homicide case.

CHAPTER IV

RESULTS

Based upon the extant literature reviewed in this research, the following variable categorizations are being treated as predictors for a case eventually becoming cold: if the victim is a male, of African American ethnicity, within the age range of 15 to 60 years, the crime occurs on the weekend during the night on a hot weather month in a non-residence premise with a gunshot wound injury and the motive being unknown. The data sets contained a total number of 3,050 cases for both cold and cleared homicide cases. However, not all cases were provided with complete information, and therefore, after deleting cases that were incomplete so as to remove attempted interpretation of incomplete data as a threat to internal and external validity, the new total number of cases is 2,710.

Table 4.1 Descriptive Analysis of Factors Present for Cold Cases

Factor	N	Frequency/%
Victim Race		
Black	461	48.3
Other	494	51.7
Victim Sex		
Male	849	88.9
Female	106	11.1
Victim Age		
15-60	900	94.2
Other	55	5.8
Day of Week		
Weekend	480	50.3
Weekday	475	49.7
Time of Day		
Night	698	73.1
Day	207	21.7
Seasonality		
Hot	505	52.9

Table 4.1 Continued Descriptive Analysis of Factors Present for Cold

Cold	450	47.1
Location of Crime		
Non-Residence	589	61.7
Residence	366	38.3
Method of Death		
Gunshot Wound	764	80
Non-Gunshot Wound	191	20
Motive of Death		
Unknown	403	42.2
Known	552	57.8

Descriptive analysis for the factors presented for cold cases is presented in Table 4.1. The table displays the variables in the same order in which they were operationalized in Chapter 3. For the variable of race, there were a total of 461 African American victims comprising 48.3% of the cold cases. Non-African Americans had the majority of the cold cases with a 51.7%. For the variable of sex, there were a total of 849 male victims, comprising 88.9% of all the cold cases. For the variable of age, there were a total of 900 cold cases with victims between the ages of 15-60 years old, comprising 94.2 % of all the cold cases. There was a very small amount (5.8%) of cold cases involving victims with ages other than 15-60 years old. For the variable of day of week, with a slight majority of the cold cases, weekend had the most cases comprising 50.3%. For the variable of time of day, there were a total of 698 cold cases that occurred during the night and 207 cold cases that occurred during the day.

For the variable of seasonality, there were a total of 505 cold cases, which was only slightly more than 50%, that occurred during hot months rather than cold months. For the variable of location of crime, there were a total of 589 cold cases that were committed in a non-

residence location and 366 of the cases were committed at a residence. For the variable of method of death, there were a total of 764 cold cases where the injury code was a gunshot wound, comprising 80% of the cases. On the other hand, 191 of the cold cases had the injury code of something other than a gunshot wound, comprising only 20% of the cold cases that were analyzed. For the variable of motive of death, there were a total of 403 cold cases where the motive was unknown and 552 cases where the motive was known.

Table 4.2 Descriptive Analysis of Factors Present for Solved Cases

Factor	N	Frequency/%
Victim Race		
Black	910	51.9
Other	845	48.1
Victim Sex		
Male	1376	78.4
Female	376	21.4
Victim Age		
15-60	1537	87.6
Other	218	12.4
Day of Week		
Weekend	896	51.1
Weekday	859	48.9
Time of Day		
Night	1219	69.5
Day	528	30.1
Seasonality		
Hot	946	53.9
Cold	809	46.1
Location of Crime		
Non-Residence	975	55.6
Residence	780	44.4
Method of Death		
Gunshot Wound	1231	70.1
Non-Gunshot Wound	524	29.9
Motive of Death		
Unknown	45	2.6
Known	1710	97.4

Descriptive analysis for the factors presented for solved cases is presented in Table 4.2 above. For the variable of race, there were a total of 910 solved cases where the victim was African American and 845 cases where the victim was non-African American. For the variable of sex, there were a total of 1,376 solved cases where the victim was male and only 376 cases where the victim was female. For the variable of age, there were a total of 1,537 of the solved cases where the victim was between the ages of 15-60 years, comprising with 87.6% of the cases. For the variable of day of week, with a slight difference, there were a total of 896 solved cases that occurred on the weekend and 859 cases that occurred during a weekday. For the variable time of day, there were a total of 1219 of the solved cases that occurred during the night comprising 69.5% of the cases.

For the variable of seasonality, there were a total of 946 solved cases that occurred during the hot months and 809 cases that occurred during the cold months. For the variable location of crime, there were a total of 975 solved cases where the crime occurred in a non-residence location and 780 cases occurred in a residence. For the variable of method of death, there were a total of 1,231 solved cases where the victim had the injury code of a gunshot wound and 524 cases where the victim was killed with something other than a firearm. For the variable of motive of death, there were a total of 1,710 solved cases where the motive was known, comprising 97.4% of the cases. Only 45 of the solved cases reported having an unknown motive.

Table 4.3 Descriptive Analysis of Factors Present for Cold and Solved Cases Combined

Factor	N	Frequency/%
Victim Race		
Black	1371	50.6
Other	1339	49.4
Victim Sex		

Table 4.3 Continued Descriptive Analysis of Factors Present for Cold and Solved Cases Combined

Male	2225	82.1
Female	482	17.8
Victim Age		
15-60	2437	89.9
Other	213	10.1
Day of Week		
Weekend	1376	50.8
Weekday	1334	49.2
Time of Day		
Night	1917	70.7
Day	735	27.1
Seasonality		
Hot	1451	53.5
Cold	1259	46.5
Location of Crime		
Non-Residence	1564	57.7
Residence	1146	42.3
Method of Death		
Gunshot Wound	1995	73.6
Non-Gunshot Wound	715	26.4
Motive of Death		
Unknown	448	16.5
Known	2262	83.5

Descriptive statistics for the factors presented for cold and solved cases combined are presented in Table 4.3, thus giving an overall picture of all homicides which occurred in the time period of interest. For the variable of race, there was a total of 1,371 African American victims comprising 50.6% of the all the cases. Thus, African American victims were in the slim majority in the data sets provided by Houston Police Department. For the purpose of binary logistic regression analysis, the variable of race was therefore coded as African American = 1 and Other = 0, making African American race the predicting characteristic.

For the variable of Sex, there were a total of 2,225 male victims (82.1%) and a total of 482 female victims (17.8%). Therefore, in the cases provided, the majority of the homicide victims were males. For the purpose of logistic regression analysis, the variable of sex was coded as Males = 1 and Females = 0, making Males the predicting characteristic. For the variable of Age, there were a total of 2,437 victims between 15 – 60 years and 213 victims with the age categorize as Other. Therefore, the victims between 15-60 years of age compromise 89.9% of the cases provided on the data sets and ages with Other had a 10.1% of the cases. For the analysis, the variable of Age was coded as 15-60 = 1 and Other = 0, making cases with 15-60 years of age the predicting characteristic.

For the variable of Day of Week, there were a total of 1,376 cases that occurred on the weekend (50.8%) and 1334 cases that occurred on a weekday (49.2%). The variable was coded as Weekend = 1 and Weekday = 0, making Weekend the predicting characteristic. For the variable of Time of Day, multiple steps had to be done. The predicting characteristic for Time of Day is that cold homicide cases occur at night time. Therefore, time 0000-2359 had to be broken down into three parts. The time was coded as follows: 0000-0559 = Night, 0600-1659 = Day, and 1700-2359 = Night. The frequencies showed that there were 1,917 cases that occurred at Night (70.7%) and 735 cases that occurred during the Day (27.1%). Then, for the binary logistic regression the variable of Time of Day was coded as Night = 1 and Day = 0, making Night the predicting characteristic.

For the variable of Seasonality, there were also a few steps that had to be taken before getting to the conclusion of this variable's coding. A frequency distribution was run for the variable of Seasonality. After that, the total number of cases that occurred in the summer and spring were added together, as well as the total number of cases for fall and winter. Then the

variable was operationalized as summer and spring = “Hot” and fall and winter = “Cold”. There were 1,451 cases that occurred in the Hot months (53.5%) and 1,259 cases that occurred in the Cold months (46.5%). The variable of Seasonality was coded as Hot = 1 and Cold = 0, making Hot months the predicting characteristics.

For the variable of Location of Crime, there were a total of 1,564 cases (57.7%) where the crime occurred at a non-residence location and 1,146 cases (42.3%) where the crime occurred at a residence location. In this case, the majority of homicides occurred at a non-residence location. For the analysis, the variable of Location of Crime was coded as Non-Residence = 1 and Residence = 0, making crimes occurring at a Non-Residence the predicting characteristic.

For the variable of Method of Death, there were 1,995 cases (73.6%) where the injury was with a gunshot wound and 715 cases (26.4%) where the injury was with a non-gunshot wound. For this data set, the majority of the victims were killed with a gunshot wound. The variable for Method of Death is coded as Gunshot Wound = 1 and Non-Gunshot wound = 0, making death by Gunshot Wound the predicting characteristic. For the variable of Motive of Death, there were 448 cases (16.5%) where the motive was unknown and a total number of 2,262 cases (83.5%) of the cases where the motive was known. For the binary logistic regression analysis, the variable for Motive of Death was coded as Unknown = 1 and Known = 0, making Unknown the predicting characteristic.

Table 4.4 Omnibus Tests of Model Coefficients

	Chi-Square	df	Sig.
Step 1	769.668	9	0.000
	769.668	9	0.000
	769.668	9	0.000

The Omnibus Test of Model Coefficient indicates if the model is significant and it also shows whether the variables being analyzed are statistically associated. The p-value of .000 (found in the “Sig.” column in Table 4.4) suggests that our model is a significant model as the probability of random error variance value is below alpha criterion ($\alpha = .05$). Therefore, the data suggest that there is a significant statistical association between the variables that were analyzed, because the probability level is lower than alpha.

Table 4.5 Model Summary

Step	-2 log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	2632.264a	0.252	0.349

The Model Summary results are presented in Table 4.5. This table shows us how well the logistic regression model fits the data and the table also shows that the analyzed model is a statistically significant better model. The data also suggests that our model is accounting for 35% of the variance in the data, meaning it is moderately strong model.

Table 4.6 Binary Logistic Regressions for Predicting Case Outcome

Incident Characteristics	B	Sig.	Exp (B)
Race	-0.324	0.001**	0.723
Sex	0.649	0.000***	1.914
Age	0.43	0.023**	1.538
Day of Week	-0.032	0.739	1.968
Time of Day	0.298	0.010**	1.348

Table 4.6 Continued Binary Logistic Regressions for Predicting Case Outcome

Seasonality	-0.073	0.510	0.929
Location of Crime	-0.058	0.558	0.944
Method of Death	0.457	0.000***	1.580
Motive of Death	3.408	0.000***	30.192
Constant	-2.461	0.000	0.085

*=p<.05, ** = p<.01, *** =p<. 001

However, while all variables were predictive of the case being cleared vs. cold for the current data sets, not all variables predicting likelihood of a cold case status have the same strength. Table 4.6 shows the binary logistic regression results for this study, and under the column “Exp (B)” is the number of the likelihood a case will become cold. If that number is greater than 1, then the variable is a strong predictor, and if the number is less than 1, then the variable is a weak predictor. For example, the victim being African American decreases the likelihood that the case will become cold, but only by 0.7 times.

The results of the binary logistic regression analysis are presented in Table 4.6. The data sets were analyzed to investigate whether the variables from this research were significant predictors of a case eventually becoming a cold case. By looking at the results in the “Sig” column of Table 4.6, we can conclude that six out of nine variables are significant predictors of homicide cold cases. In this research, the predictors of a cold case, in order from strongest to weakest are as follows: Motive of Death, Day of Week, Sex, Method of Death, Age, Time of Day, Location of Crime, Seasonality, and Race.

The findings suggest that for the Race variable, when there is an African American victim, the odds that a case will become cold decreases by .723 times. For the Sex variable, when a homicide case has a Male victim, the odds that a case will become cold increases by 1.914 times. For the Age variable, when a homicide victim’s age is between 15-60 years, the odds of

that case becoming cold increases by 1.538 times. For the Day of Week variable, when a homicide occurs on a Weekday, the odds of the case becoming cold increases by 1.968 times. For the Time of Day variable, when a homicide occurs at Night, the odds that a case will become cold increases by 1.348 times. For the Seasonality variable, when a homicide crime is committed during a hot season (Spring and Summer), the odds of the case becoming cold decreases by .929 times. For the Location of Crime variable, when a homicide is committed away from the residence (non-residence premise), the odds of the cases becoming cold decreases by .944 times. For the Method of Death variable, when the injury of a homicide is with a gunshot wound, the odds of the case being cold increases by 1.580 times. For the Motive of Death variable, when there is no motive known for a homicide case, the odds of the case being cold increases by 30.192 times. Overall, this means that when a homicide case is presented with a victim being a male, with the age range between 15-60 years, where the crime occurred during the weekend at night time, with a gunshot wound, and the motive being unknown, it is very likely the case will become cold.

CHAPTER V

DISCUSSION

Homicide is the most serious form of crime and startlingly 1 in every 3 homicide cases in America goes unsolved (Kaste, 2015). If a case is unsolved, it gains the categorization of being a cold case. The main focus of this research was to investigate characteristics of the victim and crime that can be used to predict the likelihood of a cold case: essentially, a main research question was what makes a cold case “cold?” One of the overall aims of this research was to investigate whether applying a similar category structure of incident characteristics to cold cases as is identified in solved cases, can help to predict if a case may become cold. In other words, do cases become cold simply because of a lack of incident characteristics present in solved cases, and if so, which ones?

The research question of this study was, can predictors such as: age, sex, race, location of crime, time of day, day of week, seasonality, method of death, and motive of death be used to predict whether a case is at risk at becoming cold? Based upon current data, crime characteristics, typically found in solved homicide cases do apply to those cases that have the status of a cold case. For example, the data sets that were provided by the Houston Police Department, contained the exact same crime characteristics for solved homicide cases as well as the cold cases. As the data sets for cold and solved cases included the same variables/categories, this begins to suggest that the police utilize such incident characteristics of homicide cases to code them into their systems, and thus they could be useful in furthering our research based understanding of cold cases.

The results of this current analysis also support the historical findings of Wolfgang (1958) and Pokorny (1965) which focused on homicide cases and used the majority of the same

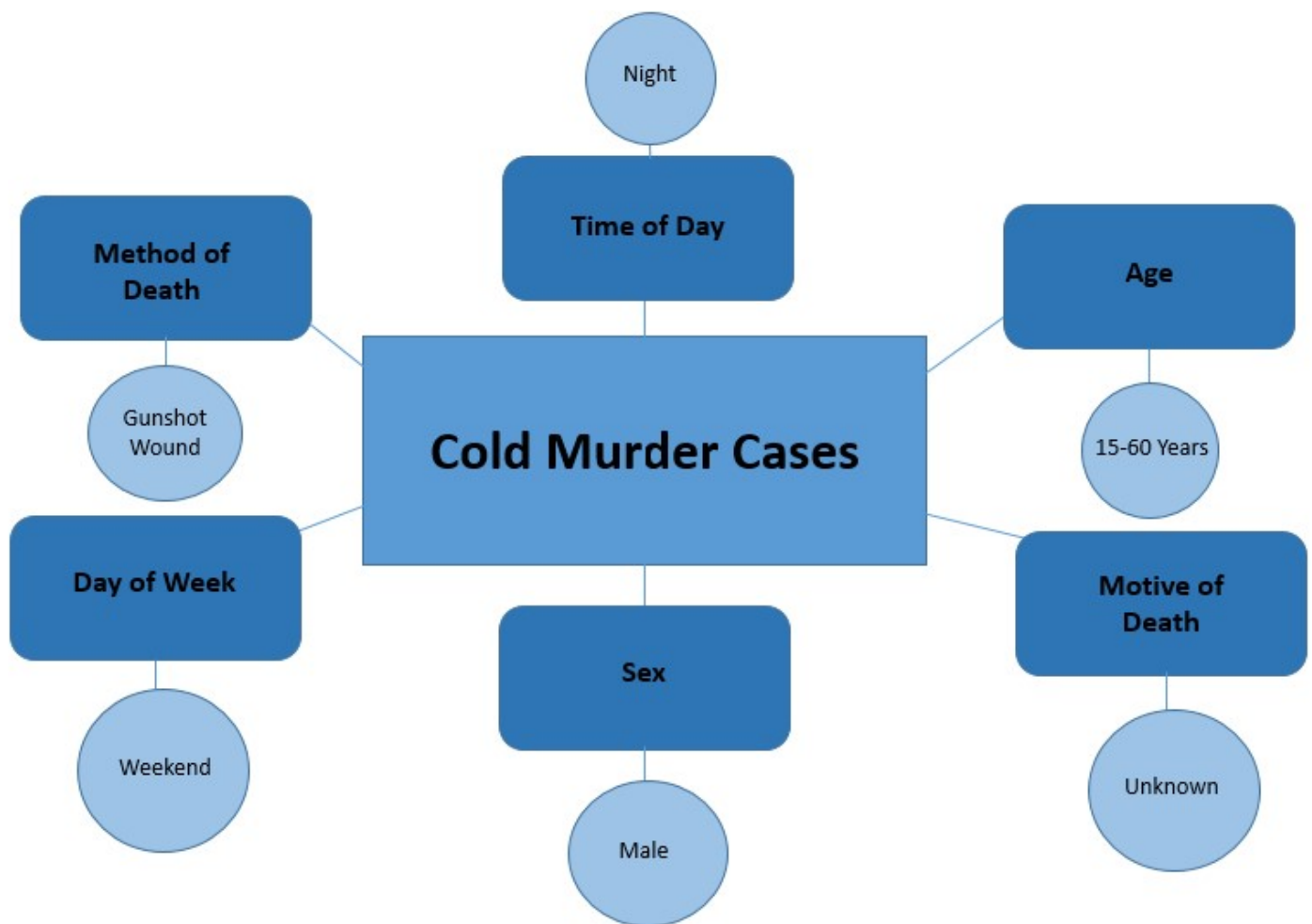
variables that were identified for this research. Wolfgang (1958) and Pokorny (1965) found that criminal homicide occurs most often between members of the same race, that the persons involved tend to be relative or friends rather than strangers, that the males are much more frequently involved (both as offenders and victims), and that the most likely hours for a criminal homicide to be conducted are between 8:00 p.m. and 2:00 a.m., which is very similar to the model which emerged from the data from Houston, Texas.

The present research utilized binary logistic regression to facilitate an investigation of the likelihood a given crime characteristics are present in a cold and solved homicide case. After running a binary logistic regression analysis on the data sets provided for this research, some predictors were found to be stronger than others. The results suggested that the strongest predictors of a case being at increased risk of becoming cold are the following incident crime characteristics: if the victim was male, between 15-60 years of age, if the crime took place between the hours of 5:00 p.m. to 6:00 a.m., if the crime occurred during the weekend (Friday-Sunday), if method of death is a gunshot wound, and if the motive of the crime is unknown. The remaining predictors (Race, Seasonality, and Location of Crime) are not considered strong predictors because under the “Exp(B)” column in Table 4.6, these predictors resulted in having a number lower than 1.

Abrams et al. (2007) found that the non-elderly adult homicide victims were more likely to be male, non-White, and to have died of a gunshot wound, and that the crime was more likely to have happened in the streets compared to inside a premise. In the extant literature, when the method of death was a gunshot wound then that case had an increased chance of becoming cold, and this finding was supported by the current analysis gunshot wounds were a predictor of the case becoming cold. There are many possible explanations for this kind of finding, the one

offered most frequently in the literature is that a crime committed without a firearm results in a greater likelihood that the offender had physical contact with the victim, thus producing physical evidence which assists in closing cases faster (Roberts, 2007). In cases where a gun is used to cause death, the perpetrator may never have come into physical contact with the victim, and therefore evidence such as DNA is unlikely to be present, thus increasing the likelihood of the case becoming cold. Below you will find a figure summarizing the strongest predictors of cold case likelihood.

Figure 5.1 Model Produced from the Analysis



The current data suggest that predictors such as age, sex, race, location of crime, time of day, day of week, seasonality, method of death, and motive of death can be used to predict the likelihood of a case being at risk of becoming a cold case. Six out of nine predictors are strong predictors in identifying the risk factors of a case eventually becoming cold. For the purpose of this study, the strong predictors are the following: sex, age, day of week, time of day, method of death and motive of death. The variables of race, seasonality, and location of crime are considered, in this study, as weak predictors. On the other hand, the variable of Sex shows that if the homicide victim is a male the likelihood that the case will become cold increases by 1.914 times. These results support the work of Roberts (2007), who found that cases with female or younger victims were more likely to be cleared, meaning that males and older victims' homicide cases were less likely to be solved.

The variables used as predictors in this research, there were some that were strong predictors or statistically significant and there were three variables that were not. However, in the previous studies mentioned before, there were variables that were strong variables in one study and then a weak variable in another study. Figure 5.1 summarizes the results of the current research, which are the crime characteristics indicated by this research to be those to be aware of in a homicide case to predict if that case will go cold or unsolved. For example, if the victim is male, between the ages of 15-60 years, if the crime occurred at night (5: 00 p.m. through 6:00 a.m.), on a weekend (Friday-Sunday), if the injury code was a gunshot wound, and if the motive of the homicide was unknown. The variable that had surprising result as a predictor of the likelihood of a case going cold was the motive of death variable. In the data for cold cases, the variable for motive of death had a total number of 403 cold cases with the motive as "Unknown" and 552 cases with the motive as "Known." In the data for solved cases, the variable for motive

of death had a total number of 45 solved cases with the motive as “Unknown” and 1,710 cases with the motive as “Known.” However, according to the results, if the motive of the crime was unknown the odds of a case becoming cold increases by 30.192 times, which makes the variable of motive of death the strongest predictor in this research.

For the variable of seasonality, the results showed that if a crime occurred during the hot months (Spring and Summer) the odds of the case becoming cold decreases by .929 times, which makes the variable of seasonality a relatively weak predictor. Although, according to Cheatwood (1988), the hypothesized existence of a relationship between weather and violent crime is one of the oldest propositions in criminology. Lester (1979), Cheatwood (1988), and Tennenbaum and Fink (1994) found in their individual studies that there is no statistically significant relationship between season and homicide. However, 3-4 months during the year were identified as homicide peaks (e.g. July, August, and December). The results of this research start to bring some cohesion to this literature.

Limitations

One limitation of this research is the method of data entry: the data were manually entered by the Houston Police Department from the original hard copy police reports. Manually entering thousands of records increases the likelihood of human error being present, just a little mistake when inputting records could have meant a victim was coded as African American when they were White, or the location of death was recorded as inside a premises when it was outside. Furthermore, data could have been lost as the data entry occurred. Missing data in particular was a concern for this research as even before the analysis began, 340 cases had to be removed from the data sets due to their records being incomplete. Removing the incomplete records from analysis reduces bias and allows a more even statistical comparison to occur, however it cannot

protect against errors in data entry. For this reason, all data and outcomes must be interpreted with this limitation in mind. Furthermore, a strong recommendation would be for future researchers in this area to visit the police department in order to gain access to the actual file/case report and create the digital data sets themselves. While research staff manually inputting the data from existing records will be time consuming, it will provide a familiarity with the data that is essential for this kind of research and analysis, and would hopefully cut down on data entry mistakes.

Recommendations and Future Directions

One question often posted in the cold case literature is whether a cold case is simply a case which lacks the incident characteristics of a solved case. Data from the current research lends some support to this theory, for example, the variable motive of death was the strongest predictor of a case becoming cold: if the motive would have been known then there is a higher chance that the case will be solved. However, the presence of gender and age factors, as well as time of day factors, suggest there is more to a case becoming cold than motive not being known. Therefore, the main recommendation from this research is for homicide units to be on the lookout for more than a missing eyewitness or motive being unknown when assessing the risk of a case going cold. The findings from the current research suggest that incident characteristics of victim is male (sex), ages between 15-60 (age), crime occurring on Friday-Sunday (weekend), crime occurring from 5:00 p.m. – 6:00 a.m. (night time), victim with an injury code of a gunshot wound (method of death), and the crime's motive being unknown (motive of death), should also be closely attended to when assessing the likelihood of a case going cold.

The field of research on cold cases is sparse, there is a lack of literature on the topic, with most of the current literature in this area instead focusing on how to solve homicide cases. This

research should therefore be treated as a first, cautious investigation of the role of crime/incident characteristics in predicting the likelihood of a homicide case turning cold. There are many possible areas of replication and expansion of this research, the first step recommended is to compare and contrast solved and cold homicide cases in different states. Is it possible that the incident characteristics which predict on increased likelihood of a case becoming cold, vary across state lines? Will different results be presented if the crime took place in rural areas rather than urban areas? Eventually, a future step of this research once a thorough data-driven understanding of cold cases predictors has been established, could be in conducting interviews with police officers about their perception of cold cases – why do they think a case goes cold? Are there any steps they think can be taken to prevent a cold case designation? Furthermore, an investigation of how cold cases are eventually solved would add an additional layer of understanding to this phenomenon. Was it as simple as discovering the motive? Or are different variables at play in the solving of a cold case than are in the prediction of the likelihood that a case will become cold in the first place? This would be interesting avenue of future research because it will facilitate an investigation of the perceptions and work involved in cold cases, and in the eventual solving of cold homicide cases. The study and scientific understanding of cold cases is an emerging area to pursue, full of areas for development and future research that has practical, as well as theoretical importance.

CHAPTER VI

CONCLUSION

The aim of this research was to understand why a given homicide case may go “cold”, whereas the next one may be solved. Incident characteristics that have been useful in the extant literature to predict solved homicides, such as type of weapon used (method of death), sex and age of the victim (personal attributes of the victim), were investigated to determine whether their absence can be used to predict or identify when a case may be likely to turn cold. Some support was provided for this theory of cold cases, for example a lack of motive was the strongest predictor of whether a case would become cold in the current research. However, overall certain incident characteristics were found to predict an increased likelihood of a case becoming cold: when a homicide case is presented with a victim being a male, with the age range between 15-60 years, where the crime occurred during the weekend at night time, with a gunshot wound, and the motive being unknown, it is very likely the case will become cold. Unfortunately, it is abundantly clear that there is a dearth of research when it comes to this topic and the logic that the absence of a crime characteristic which can be found in a solved case, is going to lead to a cold case, has been untested in any systematic, reliable way, up until this point. However, this research has produced a model which illustrated that cold cases likelihood is more complex than simply being a lack of characteristics that lead to a solved case. The substantial lack of research consideration for cold cases makes this an exciting area of research to pursue.

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APPENDICES

**APPENDIX A – INITIAL CONTACT WITH HOUSTON POLICE DEPARTMENT
HOMICIDE UNIT TO REQUEST RECORDS**

TEXAS A&M INTERNATIONAL UNIVERSITY
A Member of The Texas A&M University System

Sgt. J. J. Brooks,

My name is Claudia Ortiz and I am a graduate student at Texas A&M International University. My major is in Criminal Justice and I am starting to write my thesis paper. I am very interested in the topic of cold cases, especially relating to murder cases, and want to understand more about why certain murder cases go “cold”. My ultimate goal is to build a model of cold cases to see if there are similarities or patterns between characteristics of cold cases that can help us to understand what cold cases are and why cases go unsolved. The variables that I am interested in learning more about with regards to cold cases are as follows:

- Race of victim
- Ethnic group of victim
- Sex of victim
- Method of death (stabbing, shooting, beating, other)
- Hours (the time that the crimes occurred)
- Place the crime was committed

I was hoping to discuss my research with you. I would be very interested to set up a meeting with the detectives involved with cold murder cases to talk about these cases. Thank you for your time and if you have any questions please feel free to contact me.

Thank you again,

Claudia Ortiz
Claudia.ortiz@tamiu.edu

**APPENDIX B – CONTINUED CONTACT WITH HOUSTON POLICE DEPARTMENT
HOMICIDE UNIT TO REQUEST RECORDS**

From: "Sosa, Jesus" <Jesus.Sosa@HoustonPolice.Org>
Date: November 18, 2015 at 12:22:08 PM CST
To: "Claudia.ortiz1013@gmail.com" <Claudia.ortiz1013@gmail.com>
Subject: Your request

Ms. Claudia Ortiz,

I was assigned to respond to the request you submitted to Sergeant Brooks.

Due to the confidentiality of murder cases; you will have to make an open records request through the Media Relations- Public Information Office. The number you need to call is 713-308-3200.

Jesus "Jesse" Sosa
Investigator
Homicide Division
Cold Case (Squad 2)
Work: 713-308-3662
Cell: 281-787-1944

Work Cell: 281-546-1177

E-mail: Jesus.Sosa@HoustonPolice.Org



APPENDIX C – HOUSTON PD OPEN RECORDS REQUEST SUBMISSION CONFIRMATION

From: HPD - Open Records <HPD.OpenRecords@HoustonPolice.Org>

Date: January 29, 2016 at 2:09:43 PM CST

To: Claudia Garza <claudia.ortiz1013@gmail.com>

Subject: Automatic reply: OR#15-8353 - Responsive Documents

This automatic response is your confirmation that the email you sent was received. Thank you for contacting us.

Our office hours are Monday - Friday, 8am - 5pm (excluding holidays).

Please be aware that it will take us approximately 10 business days to respond to you regarding your request. Please submit your request only once by email, fax, US mail or in person.

Did you include your postal mailing address with your request? Please be aware that we do not fax or email responsive documents; you must include your mailing address.

For more information on Public Information requests and the Open Records process, please see the following page of the HPD web site:

http://www.houstontx.gov/police/public_information.htm

Here are some frequently asked questions and answers:

1. How will I be charged? How can I pay for the information?

Answer: If the total amount of your responsive material is less than \$5 (five dollars), we will send the information to you by US Mail along with an invoice for the cost. If the total is greater than \$5 (five dollars), we will send you an invoice for the material. Once you've paid the invoice, we will send you the responsive documents. If the total will be over \$40 (forty dollars), we will send you a cost estimate for your approval before we proceed with the work. If the total will be over \$100 (one hundred dollars), we will send you a cost estimate and require a deposit before we proceed with the work. When you are invoiced, please submit payment by check or money order only according to the instructions given in your invoice.

2. Why does it take so long to process my request? Can you expedite my request?

Answer: We have a very small yet extremely dedicated staff working approximately 700 pending requests at any given time. Each Open Records staff member is committed to processing each request

as quickly as possible, according to various statutes that govern the release of public information. Requests are assigned in the order in which they are received. Some requests take only a few days to process, while others may take months. In order to be fair to all of our requestors, we are not able to give a higher priority to your request. We do assure you, however, that we will do our best to respond to your request as promptly as possible, while still maintaining accuracy and providing excellent customer service to all of our requestors.

3. Did you receive my request? What is the status of my request?

Answer: If you are receiving this response, then we did receive your request. You may feel free to contact us at the number below if you want to check on the status of your request, but please wait at least 10 business days before calling. It is unlikely that we will be able to process your request in fewer than 10 business days. (Please remember that weekends and holidays do not count as business days.)

Thank you,

Houston Police Department

Public Affairs / Open Records Unit

1200 Travis, 21st floor

Houston, TX 77002

(713) 308-3200 (ask for the Open Records Unit)

hpd.openrecords@houstonpolice.org

APPENDIX D – HOUSTON PD OPEN RECORDS REQUEST FOR COLD CASES

From: HPD - Open Records <HPD.OpenRecords@HoustonPolice.Org>

Date: January 8, 2016 at 2:43:26 PM CDT

To: Claudia Garza <claudia.ortiz1013@gmail.com>

Subject: OR#15-8353 - Responsive Documents

Dear Claudia Garza,

Attached are all the open murder cases since 2006. The meaning for each of the open cases referenced in the header titled CStatuses are:

OPNI: open pending new information
 OPEN: open
 OCFW: open charges filed wanted,
 ORGJ: open referred to the grand jury, and
 ONAL: open pending lab analysis

Please be aware the DOBs are not releasable.

Joe Zapata
 HPD Open Records Unit
 713-308-3264

From: Claudia Garza [mailto:claudia.ortiz1013@gmail.com]

Sent: Thursday, December 17, 2015 2:29 PM

To: HPD - Open Records

Cc: Houston, Kate A.

Subject: (mb 15-8353) Open Record Request: Claudia Ortiz Research Thesis- TAMIU

My name is Claudia Ortiz and I am a graduate student at Texas A&M International University. My major is in Criminal Justice and I am starting to write my thesis paper. I am very interested in the topic of cold cases, especially relating to murder cases, and want to understand more about why certain murder cases go "cold". My ultimate goal is to build a model of cold cases to see if there are similarities or patterns between characteristics of cold cases that can help us to understand what cold cases are and why cases go unsolved. The variables that I am interested in learning more about with regards to cold cases are as follows:

- Race of victim
- Ethnicity of victim
- Sex of victim

- Gender of victim
- Method of death (stabbing, shooting, beating, other)
- Time of day (the time that the crimes occurred)
- Location of crime (address)
- Victim and offender relationship
- Victim's address

P.S. I CC my Thesis advisor, Dr. Kate Houston.

Thank you for your time and if you have any questions please feel free to contact me.

Claudia Ortiz

Claudia.ortiz@tamiu.edu

Claudia.ortiz1013@gmail.com

APPENDIX E – HOUSTON PD OPEN RECORDS REQUEST FOR CLEARED CASES

From: HPD - Open Records <HPD.OpenRecords@HoustonPolice.Org>
Date: May 10, 2016 at 2:20:32 PM CDT
To: Claudia Garza <claudia.ortiz1013@gmail.com>
Subject: OR#16-3409 - Responsive Documents

Dear Claudia Garza

Attached are the cleared murder cases from 2006 – 2015.

Sincerely,

Joe Zapata

HPD Open Records Unit

713-308-3264

From: Claudia Garza [<mailto:claudia.ortiz1013@gmail.com>]
Sent: Wednesday, May 04, 2016 3:07 PM
To: HPD - Open Records
Subject: (jz 16-3409) OR#15-8353 - Responsive Documents

Good Afternoon Mr. Zapata,

Back in December, I had asked your department for a database file on cold murder cases. You sent me a file that included data from 2006-2015. Thank you so much for your cooperation, but now I am taking my Thesis to another route. My committee advised me to compare the same characteristics you provided me on the file to the characteristics from solved/clear murder cases. If you can provide me with a database file on those solved cases for the same range of years, I would really appreciate it.

Thank you so much for your cooperation and for your time!

Claudia (Ortiz) Garza

VITA

Name: Claudia Yvette Ortiz

Education: B.A., Psychology, Texas A&M International University, 2014 (5 years)