*J Forensic Sci,* January 2007, Vol. 52, No. 1
doi:10.1111/j.1556-4029.2006.00328.x
Available online at: www.blackwell-synergy.com

*Katherine M. Brown,*[1] *M.A. and Robert D. Keppel,*[2] *Ph.D.*

# Child Abduction Murder: An Analysis of the Effect of Time and Distance Separation Between Murder Incident Sites on Solvability

**ABSTRACT:** Empirical studies of child abduction murder investigations are lacking. Accordingly, an empirical analysis of the effect of time and distance relationships on case solvability in child abduction murders ($N = 735$) was conducted. The murders occurred across the United States from 1968 to 2002. Murder incident components examined were: victim last seen site, initial contact site, murder site, and body recovery site. Time and distance intervals between component pairings were also examined. Descriptive, bivariate, and multivariate analyses were performed to determine if information relating to time and distance intervals between components were critical solvability factors. Results show that information about time and distance increases case solvability. Results also demonstrate that time and distance relationships contribute uniquely to case solvability in murders of abducted children. Findings also indicate that additional factors such as type of forensic evidence, investigative resources, or actions by first responders, may be critical to case solvability.

**KEYWORDS:** forensic science, murder of missing and abducted children, murder, missing and abducted children, solvability, time, distance, clearance, abduction, kidnapping, homicide

Child abduction is every parent's worst nightmare. The only thing more terrifying and traumatic than a child abduction is the murder of an abducted child. To compound the problem, child abduction murders are incredibly difficult to solve and deeply impact law enforcement officials involved in the investigation. Abductions which result in a child's death present great investigative and emotional obstacles for law enforcement officers (1). The rarity of child abduction murders, even among criminal homicides, and their complex, emotion-laden, high profiles, are extremely difficult to investigate (2).

The 1979 abduction of 7-year-old Etan Patz, and the 1981 abduction and murder of 6-year-old Adam Walsh terrified parents and devastated the nation. The public outcry over concern for the safety of America's children resulted in the establishment of the National Center for Missing and Exploited Children (NCMEC) by the United States Congress. Unfortunately, as a result of these events, inflated and unsubstantiated numbers of missing children were widely reported to be over 2 million per year during the mid to late 1980s. The numbers of children who were abducted and then murdered were erroneously reported to be as high as 5000 per year (1).

Studies show that children are murdered in 40% of stereotypical abductions and not recovered in an additional 4% of abductions (3). Fortunately, this occurrence is rare. Approximately 40–150 incidents of child abduction murder occur across the nation each year (2). This figure is less than one half of 1% of all murders committed in this country every year (2). Previous studies have shown that in *c*. 74–76% of abducted child cases, the child was killed in less than 3 h (2,4). Studies also showed that while 22% of the children were still alive at the time they were reported missing, 42% had already been killed before they were reported missing (2). Obviously, time is critical in the report of any missing child to authorities.

While changes in our public policies and laws have made important progress toward protecting our children and keeping families in tact, a vital part of the murder of an abducted child investigation, solvability, has not been adequately addressed by researchers. The dearth of research in this area may be due to limitations in access to sensitive law enforcement data, or lack of expertise in the area. However, because the murder of an abducted child impacts our society in such an overwhelming manner, the absence of literature in this area is disturbing.

### *Challenges to Investigation*

The rarity of child abduction murder creates special challenges for homicide investigation (2). Agencies with limited resources can become quickly overwhelmed when a high profile case occurs (5,6). In addition, the high profile nature of previous cases has created commonly held false assumptions and beliefs about the murder of abducted children (2). Child abduction murder investigations involve multiple agencies, investigators, crime scene technicians, forensic experts, and prosecutors with skill levels by agency varying. This diversity can lead to communication problems and the failure to recognize that some cases may be linked (7). Failure to recognize linked cases is important because offenders transported their victims and disposed of their bodies in a different jurisdiction in 36% of cases (2). Unfortunately, very little has been written about the effectiveness of child abduction investigations specifically and law enforcement investigations generally (2,7–10).

## Solvability

Solvability is the ability of investigators to identify the perpetrator of a crime. The solvability of a case is not dependant on case

[1]College of Criminal Justice, Sam Houston State University, Huntsville, TX 77341-2296.
[2]Department of Criminal Justice, Seattle University, Seattle, WA 98122-1090.

Received 15 April 2006; and in revised form 19 July 2006; accepted 13 Aug. 2006; published 10 Dec. 2006.

clearance. Research has shown that typically a suspect is in custody within 24 h in 66% of murder cases. Further research indicates that if a murder is not solved within 48 h, the solvability of the murder decreases dramatically (10,11). It is clear that time and distance are critical factors in case solvability, yet little empirical research has been conducted in this area (12–16).

### *Effect of Time and Distance on Case Solvability*

The FBI Behavioral Science Unit has addressed time and distance as important factors in profiling violent offenders. The research emphasizes the importance of the time it takes an offender to murder and dispose of the victim in relation to the location where the murder occurred. The research also indicates the importance of the location if the abduction point is different from the body recovery site (17). However, location as a solvability factor in child abduction murders and serial murder cases has been explored by few researchers (18).

A 1990 study by the U.S. Office of Juvenile Justice and Delinquency Prevention examined the time of detention and the distance of transportation after abduction. The research indicates that 2% of abduction cases ended in murder where children were transported over 20 feet or detained for more than an hour. Unfortunately, this study did not address the relationship of time and distance as solvability factors in those cases (19).

### *Components of a Murder Incident*

Perhaps the most comprehensive study on the relationship of time and distance as solvability factors was conducted by Keppel and Weis (20). The study examined the relationship between solvability and time and distance separation between the murder incident sites in homicide investigations. Keppel and Weis conceptualize the crime of murder as an incident (20). Each murder incident may include multiple sites or locations of contact between the offender, or a witness, and the victim. The investigation into a murder emphasizes the search for clues or information about the major investigative sites of a murder incident. The presence of information that establishes the existence of each site, coupled with when and where each site is located within the incident, and the manner in which their relationships affect each other, greatly influences the solution of murder investigations (20,21).

The follow-up investigation of a murder involves the gathering of information about the various components that are locations of victim–offender contact. The types of information crucial to the investigation in order of their usual occurrence within the murder event are:

1. where and when the victim was last seen,
2. where and when the offender initially contacted the victim,
3. where the murder took place, and
4. where and when the body was recovered (20).

Each of these components occurs in a murder and each component is important in a murder investigation. Information about the location and the time of each site within the sequence of the murder incident has an impact on case solvability. In most murder cases, the events occur simultaneously. Research suggests in general murder; events are located in the same place and not separated by intervals of distance or spans of time (2,20,21).

### *Separation of Components by Time and Distance*

The sites within most incidents of murder may become separated by time and distance. The separation may occur in two ways. First, the offender may consciously separate time and distance. The killer may believe that the separation of murder components will delay the discovery of various sites contributing to the destruction of evidence. For instance, the killer may intentionally abduct a child and use a vehicle to transport the child to a remote location to murder the child and yet another location to dispose of the body. As a result, the separation of components by time and distance may inhibit the investigation by creating communication and cooperation problems among police agencies because the locations of all sites are not within the authority of one police agency.

Second, the offender may unintentionally separate the location of components by time and distance. For example, the killer may transport the child with a car because he was unable to lure the child inside by the ruse he planned. Another example would be the transport of the child to another location because the killer would rather not have someone see the sexual assault of the child. These actions do not show a deliberate effort by the killer to delay discovery of the body or conceal evidence, but are simply strategies to avoid detection.

Finally, the time and location of murder incident components may be separated by pure chance (2,20,21). This type of delay would be a situation or event, not in control of the killer. For example, perhaps the killer chose a body disposal site off of a road that was subsequently blocked from access for road repairs. This type of event might delay the discovery of the body, but happened by chance, rather than design of the killer.

Keppel and Weis determined that in general murders when any information on the dates and locations of the murder incident sites is known, the probability of case solution increases (20). The study also found a strong positive correlation between knowing the dates of occurrences for the murder incident locations and the ability to identify a perpetrator (20). Case solvability increases as the time between pairs of murder incident sites decreases (20). In addition, the more investigators know about the distances between the pairs of the murder incident sites, the more case solvability increases (20). When the distance between the locations is less than 199 ft, solvability increases (20). Finally, the study indicates that when the time and distances decrease among pairs of murder incident sites, the solvability of a case increases (20,21).

Keppel and Weis empirically supported what experienced murder investigators know by instinct (20). The more information detectives know about a case; the higher the case solvability will be. However, their study indicates that it is not just any information that will enhance solvability—some information is more valuable and useful than other information in murder investigations (20). There is a clear need for more multivariate analyses to study the role of time and distance as solvability factors in murder investigations. As comprehensive as their study was, Keppel and Weis did not address the factors of time and distance and their relationship to solvability in murder investigations of abducted children (20).

### *Separation of Components by Time and Distance in Child Abduction Murders*

A subsequent study of murders of abducted children by the Washington State Attorney General's office did identify a unique pattern of distance relationships in child abduction murders (2).

Often, the initial contact site is located very close to the victim's last known location. Importantly and conversely, the distance between the initial contact site and the murder site increases to distances greater than 1/4 mile in murders of abducted children. The distance from the murder site to the body recovery site decreases to less than or equal to 199 feet in the vast majority of cases (2).

Time and distance have been examined as part of solvability research for murders in general. However, before this study, the relationship to case solvability has not been examined in murder investigations of abducted children. This research will be used to improve the efficiency and effectiveness of the investigation processes of those murders. The research results from this study are particularly salient to homicide that detectives confronted with an unsolved murder case involving child abduction. In addition, results from this study will help police investigators to efficiently identify strategies and implement tactics which will lead to the capture of child abduction killers and the solution of cases.

## Methods

The objective of the collaborative research project was to examine solvability factors in murder investigations of abducted children. The data were analyzed to determine if time and distance relationships between murder incident component pairings would contribute to case solvability in murder investigations of abducted children. The data used in this study were collected through a cooperative agreement between the Washington State Attorney General's Office and the United States Department of Justice Office of Juvenile Justice and Delinquency Prevention. This dataset will be referred to as the child abduction murder (CAM) dataset.

The CAM data is neither a random sample of CAM cases nor a sample of all CAM occurring in the United States. Data were collected based on voluntary reporting of cases from each law enforcement jurisdiction contacted. Initially, data were collected by interviews with the detectives and the review of investigative case files from 1025 cases. Responses were received from both large and small agencies and departments. The agencies were representative of all regions of the country and 44 states.

Of the original 1025 cases, 621 cases were found to meet the criteria established for inclusion in the original data collection collaboration (2,4). Subsequent cases have been collected for inclusion in the original dataset resulting in 833 child abduction murder cases from murders committed from 1968 to 2002 (4).

### *Case Criteria*

The cases of murder in the original CAM data collection were chosen for inclusion based on the following criteria:

1. The victim was younger than 18 years old (except as described in #3 below), whose body had been recovered, or if the body had not been recovered, the killer was identified, tried, and convicted; and
2. The police agency receiving the initial contact about the case, whether as a missing, abducted, runaway, or dead body case, acted on the premise that abduction was a possibility;
3. The case was part of a series in which at least one victim in the series met the above-stated criteria (2).

Additionally, cases were included in this dataset that were not considered closed in the traditional sense. If the reporting agency believed that abduction was a possibility and began investigating the case as a child abduction case, it was included in the data.

The cases of murder of abducted children to be examined in this research project were selected from the CAM dataset in which the victim was 17 years old or younger, whose body had been recovered, or if the body had not been recovered, the killer was identified, tried, and convicted. On examination, 735 cases in the CAM Dataset met the criteria and were used in this research project.

## Definitions

In order to select appropriate variables for analysis in our study, certain terminologies were defined: abduction, components of the murder incident, time and distance intervals, and solved cases. Once the terminology was defined and the proper parameters set, then appropriate variables were selected for statistical analysis.

### *Abduction*

Defining the terms used in this research project was critical. For instance, the word "abduction" can be interpreted from several different perspectives. For purposes of this research, abduction in the original data collection was defined as

1. The victim was kidnapped,
2. The victim was detained and his or her freedom of movement was restricted,
3. A victim of domestic violence was reported by the family (or someone else) as a missing child, and
4. The police were initially of the opinion that the victim was taken or held against his or her will, whether or not that turned out to be the case in the end (2).

### *Components of the Murder Incident*

1. The victim last seen (VLS) site was defined as the location where and time when the victim was last seen. The VLS was determined from eyewitness information and records indicating when and where the victim was last seen alive.
2. The initial contact (IC) site was defined as the place where and time when the killer initially contacted the victim. The IC was established from evidence indicating that the killer first met the victim at a certain time and at a specific location during the course of the murder incident.
3. The murder site (MS) was defined as the place where and time when the victim sustained the death-producing injuries. The MS was established from evidence, confession of the offender, or other information provided by detectives.
4. The body recovery (BR) site was defined as the location where and time when police, medics, or witnesses found the victim, dead or alive, prior to transportation to a medical facility or morgue (20,21).

### *Time and Distance Intervals*

Time spans between the murder incident sites were examined by calculating the duration of time from one murder component to each of the other components. The length of the separations was measured in hours and minutes. There are six possible pairs of components for which a time span was calculated:

1. VLS to IC,
2. VLS to MS,
3. VLS to BR,

4. IC to MS,
5. IC to BR,
6. MS to BR.

*Spans of Time Between Locations*

The actual time span between murder incident components was examined. The metric time spans between the VLS site to IC site, VLS site to MS, and IC site to MS were then converted into one of the following time interval categories:

1. 0–29:59 min,
2. 30–59:59 min,
3. 1–4:59:59 h,
4. 5–24 h,
5. >24 h.

Because of differing frequency distributions, the VLS site to BR site, IC site to BR site, and MS to BR site pairings' metric time spans were converted into one of the following categories:

1. 0–7:59 h,
2. 8–15:59 h,
3. 16–23:59 h,
4. 24–47:59 h,
5. 48–71:59 h,
6. 72–167 h,
7. 7–14 days,
8. 15–30 days,
9. >30 days.

These categories were based on the natural breaks in the frequency distribution of the CAM data. Once this comparison was made, the time spans were collapsed into two intervals:

1. $\leq$ 24 h,
2. >24 h.

*Distance Between Locations*

In the initial data collection, the distance between each pair of murder components was measured in feet or miles for each pair of components. Then the actual distance was placed into one of the following categories before inclusion in the CAM dataset:

1. 0–199 ft,
2. 200 ft–<1/4 mile,
3. 1/4–<1 $\frac{1}{2}$ mile,
4. 1 $\frac{1}{2}$–<12 miles,
5. $\geq$ 12 miles.

Once this comparison was made, the distance intervals were collapsed into two intervals for further statistical analysis:

1. $\leq$ 199 ft,
2. >199 ft.

The first category was based on the collective experience of several homicide detectives originally consulted by Dr. Robert Keppel (21).

*Solvability*

In the CAM data set, solvability was defined two ways: "Has the offender been arrested, or does probable cause exist for an arrest?" and "Has the investigation resulted in a conviction?" For this research, solvability was based on investigations resulting in an arrest. Cases which resulted in a "Yes" to the question of "Has the offender been arrested, or does probable cause exist for an arrest?" at the time of coding were considered solved for this research project and cases which answered "No" to that question were considered unsolved. Cases coded with "Unknown" as an answer to the question were considered to have missing data and were not included in the analysis.

## Results

Because information known about each murder incident component is critical to murder investigations of abducted children, the components were examined by knowledge of time and distance and separation between components. The variables used for this analysis captured the date of occurrence (exact or approximate), and the type of location and/or the address of that location. The following sections outline what information about the murder incident component was known on time, location, or both in the investigations of child abduction murders contained in this dataset.

As shown in Table 1, the percentage of unsolved murder cases in the CAM dataset was 27.4%. It is important to note that the overall percentage of child abduction murder case solvability for victims, 17 years old and under, is 72.6%. This is slightly lower than the solvability for murder victims in general which has been previously shown to be 77% (21). A reason for this difference could be that adults which were part of a series that involved children were excluded.

*Importance of Information on Time and Place*

Table 2 outlines what information about the murder incident component was known on time, location, or both, in the investigations of CAM. The VLS site is the location about which time is most often known (98.9%). The offender informed police where the MS was or confirmed its location in their statement to police in 55.9% of cases. However, the actual MS is the location least identified by time or place.

This order is unique to child abduction murder investigations. In a general murder, the location of the BR site is the location most often known, followed by the MS, VLS site, and the IC site (21). The data indicates that in child abduction murders the order switches to the VLS site as the location about which information is most likely known. This is likely due to the nature of the victim. Children are missed more quickly than adult victims in some cases, especially small children who are usually in the presence of a caregiver. It is also not surprising that in these types of investigations that the percentage of knowledge about murder incident locations is higher than in general murders because of the high-profile nature of these cases.

An examination of the murder incident components about which both time and place were known produced a decrease in the known percentages. This is not surprising given that much of

TABLE 1—*Child abduction murder (CAM) case solvability.*

| | All Cases in CAM Dataset | | Victims $\leq$ 17 Years Old | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| Solved | 589 | 74.1 | 527 | 72.6 |
| Unsolved | 206 | 25.9 | 199 | 27.4 |
| Unknown | 38 | 4.6 | 9 | 1.2 |
| *N* | 833 | | 735 | |

TABLE 2—*Knowledge of time and place of components.*

| Murder Incident Component | Percent Time or Place Known | Percent Time Known | Percent Place Known | Percent Both Time and Place Known |
|---|---|---|---|---|
| Victim last seen site | 99.3 | 98.9 | 78.1 | 77.7 |
| Initial contact site | 93.5 | 87.5 | 78.2 | 72.2 |
| Murder site | 91.3 | 84.5 | 69.4 | 62.6 |
| Body recovery site | 99.0 | 98.6 | 98.4 | 98.0 |

this information is gathered from witness statements or statements by the killer. The murder incident component about which both time and location is most often known in child abduction murders is the BR site (98%), followed in order by the VLS site (77.7%), IC site (72.2%), and the MS (62.6%) as indicated in Table 2.

*Impact of Time on Case Solvability*

It was predicted that case solvability will be greater when the time is known for each location than when the time is unknown in a murder investigation of an abducted child—When the time of the murder is known, solvability is 80.2%. When the time of the murder is unknown, solvability decreases to a mere 31.6%. The time of the initial contact also exhibits strong solvability (79.7%). When the time of the initial contact between the victim and offender is unknown, solvability decreases to 23.9%. Table 3 illustrates case solvability when the time of occurrence for each location is known.

The knowledge of the time when the victim was last seen and when the body was recovered is shown to have no relationship to case solvability (see Table 3). However, the knowledge of the time of the initial contact between the victim and offender and the murder is shown to have a significant relationship to case solvability. This finding makes the significance of locating information about when the initial contact between the victim and offender and when the murder occurs of paramount importance to investigators. The difference in solvability when time is known for each murder incident component is more striking when shown in graphic form (see Fig. 1).

VLS

It is important to note that the time span between when the victim was last seen and the initial contact with the killer is less than 30 min in over three-fourths of the child abduction murder investigations. The time span is illustrated in Table 4. The data also indicate a very short time frame between when the victim was last seen and the murder. The abducted child is killed in less than 5 h in 82.9% of cases as illustrated in Table 4. An abducted child is murdered in less than 30 min after he or she was last seen in 30.8% of cases. The bodies of abducted children are recovered within 24 h of when the victim was last seen in 37.6% of cases, within 48 h in 49.4% of cases and within a week in 68.5% of cases (see Table 4).

TABLE 3—*Relationship between knowledge of time and case solvability.*

| Murder Incident Component | Time Known | Percent of Cases Solved | *n* | Tau *b* | *p* |
|---|---|---|---|---|---|
| Victim last seen site | Yes | 73.0 | 524 | 0.083 | 0.094 |
| | No | 37.5 | 3 | | |
| Initial contact site | Yes | 79.7 | 505 | 0.416 | <0.001 |
| | No | 23.9 | 22 | | |
| Murder site | Yes | 80.2 | 491 | 0.397 | <0.001 |
| | No | 31.6 | 36 | | |
| Body recovery site | Yes | 72.3 | 518 | −0.046 | 0.111 |
| | No | 90.0 | 9 | | |

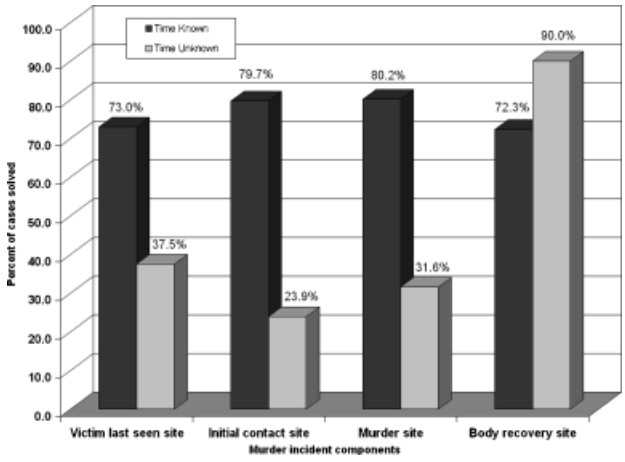


FIG. 1—*Graphic representation of solvability when time is known.*

IC

The data also indicated a short time frame between when the initial contact between the victim and the killer occurred and when the victim was murdered. The abducted child is murdered in less than 5 h after the initial contact with the offender in 85.1% of cases as illustrated in Table 4. The victim is murdered in less than 30 min after the initial contact with the offender in 38.1% of cases.

BR

The victim's bodies are recovered within 24 h of when the offender and victim had their initial contact in 39% of cases, within 48 h in 52.6% of cases and within a week in 73% of cases. The time frame between the initial contact between the victim and offender and when the victim's body is recovered is illustrated in Table 4. The bodies of abducted children are recovered within 24 h of the murder in 46.4% of cases, within 48 h in 57.6% of cases and within a week in 76.3% of cases.

*Time Proximity*

It was predicted that (a) when the time between a given pair of locations is less than 24 h, such a relatively close proximity in time

TABLE 4—*Spans of time between components.*

| Time Interval | Percent of Cases | | |
|---|---|---|---|
| | VLS to IC | VLS to MS | IC to MS |
| 0–29:59 min | 76.3 | 30.8 | 38.1 |
| 30–59:59 min | 7.9 | 16.5 | 15.2 |
| 1–4:59 h | 10.8 | 35.6 | 31.8 |
| 5–24 h | 4.1 | 13.5 | 11.5 |
| >24 h | 0.9 | 3.6 | 3.4 |
| | VLS to BR | IC to BR | MS to BR |
| 0–7:59 h | 17.9 | 20.1 | 26.1 |
| 8–15:59 h | 11.0 | 10.0 | 11.4 |
| 16–23:59 h | 8.7 | 8.9 | 8.9 |
| 24–47:59 h | 11.8 | 13.6 | 11.2 |
| 48–71:59 h | 6.4 | 6.1 | 5.8 |
| 72–167 h | 12.7 | 14.3 | 12.9 |
| 7–14 days | 8.7 | 7.2 | 6.1 |
| 15–30 days | 6.1 | 5.4 | 4.3 |
| >30 days | 16.7 | 14.5 | 13.2 |

VLS, victim last seen; IC, initial contact; MS, murder site; BR, body recovery.

TABLE 5—*Relationship between time span and case solvability.*

| Murder Incident Component Pairing | Time Span | Percent of Cases Solved | *n* | Tau b | *p* |
|---|---|---|---|---|---|
| Victim last seen site to body recovery site | ≤ 24 h | 70.7 | 152 | 0.000 | 0.999 |
| | > 24 h | 70.7 | 251 | | |
| Initial contact site to body recovery site | ≤ 24 h | 78.9 | 131 | 0.097 | 0.055 |
| | > 24 h | 86.3 | 220 | | |
| Murder site to body recovery site | ≤ 24 h | 78.0 | 142 | 0.185 | < 0.001 |
| | > 24 h | 91.3 | 188 | | |

will contribute to the solvability of a case involving the murder of an abducted child; the percentage of cases solved will be greater than when the pair of locations is separated by greater than 24 h. (b) The time proximity of locations will contribute to the solvability of the case even if the locations are not close in time—because of insufficient frequencies in the time interval categories, only the following murder incident components were examined for this hypothesis:

1. VLS site/BR site,
2. IC site/BR site,
3. MS/BR site.

Kendall's Tau-*b* test indicates that part (a) of the research hypothesis is supported for the MS/BR site pairing. There is a statistical significance when the time between the murder and body recovery is less than 24 h solvability decreases. When the time interval is greater than 24 h, 78% of cases were solved while 22% of cases separated by less than 24 h remained unsolved (see Table 5).

Part (b) of this research hypothesis theorized that the time proximity of locations will contribute to the solvability of the case even if the locations are not close in time. This portion of the hypothesis is supported for the MS/BR site pairing. When these locations are separated by more than 24 h case solvability increases to an astounding 91.3%, while solvability of unsolved cases decreases to a mere 8.7%. This suggests that in cases where the offender does not dispose of the body within 24 h of the murder, more incriminating physical evidence may be present which may increase case solvability in murders of abducted children. The time span between other murder incident component pairings shows no significant association with case solvability.

### *Impact of Distance on Case Solvability*

It was predicted that when police investigators know the distance between any pair of locations, this knowledge will contribute to the solvability of a case; the percentage of murder of abducted children cases solved will be greater given this knowledge than when the distances between pairs of locations are not known—the relationship between case solvability and knowledge about the distance between the murder incident component pairings is shown to have a positive association in all pairings except for the VLS site/BR site pairing. Results from Kendall's Tau-*b* test support the prediction that the knowledge of the distance interval between the murder incident component pairings increases case solvability in murder investigations of abducted children (see Table 6).

When investigators know the distance interval between murder incident components, the strongest indicator of solvability is the IC site/MS pairing (84.7%). Each of the remaining four pairings also exhibit high solvability percentages. The MS/BR site pairing closely follows with a solvability percentage of 82%. The VLS site/MS also exhibits a strong solvability percentage of 81.3%. The VLS site/IC site pairing indicates a solvability percentage of 79.7% and the IC site/BR site pairing shows a solvability percentage of 79.5%.

TABLE 6—*Relationship between knowledge of distance and case solvability.*

| Murder Incident Component Pairing | Distance Known | Percent of Cases Solved | *n* | Tau *b* | *p* |
|---|---|---|---|---|---|
| Victim last seen site to initial contact site | Yes | 79.7 | 508 | 0.429 | < 0.001 |
| | No | 21.3 | 19 | | |
| Victim last seen site to murder site | Yes | 81.3 | 494 | 0.441 | < 0.001 |
| | No | 28.0 | 33 | | |
| Victim last seen site to body recovery site | Yes | 73.0 | 512 | 0.053 | 0.203 |
| | No | 60.0 | 15 | | |
| Initial contact site to murder site | Yes | 84.7 | 486 | 0.526 | < 0.001 |
| | No | 27.0 | 41 | | |
| Initial contact site to body recovery site | Yes | 79.5 | 507 | 0.415 | < 0.001 |
| | No | 22.7 | 20 | | |
| Murder site to body recovery site | Yes | 82.0 | 488 | 0.450 | < 0.001 |
| | No | 29.8 | 39 | | |

When investigators do not know the distance interval between the IC site/MS pairing, solvability decreases to 27%. When this information is not known for the MS/BR site pairing, solvability diminishes to 29.8%. The VLS site/MS site also exhibits a solvability decrease to 28%. The VLS site/IC site pairing indicates a solvability decrease to 21.3% and the IC site/BR site pairing shows a solvability decrease to only 22.7%. The difference in solvability when distance is known for each murder incident component is more striking when shown in graphic form (See Fig. 2).

### *Distance Proximity*

The distance between the IC site and the VLS site is less than 199 ft in 64.2% of cases. The distance between locations is shown in Table 7. The distance between the VLS site and the MS is less than 199 ft in 26.6% of CAM cases. The victim's body is recovered less than 199 ft where he or she was last seen in only 15.8% of cases. The victim's body is recovered overone and one-half miles away from where the initial contact with the offender occurred in 53.5% of cases. The distance between the IC site and the MS is less than 199 ft in 34% of cases. The distance between the MS and the BR site is less than 199 ft in 69.1% of cases.

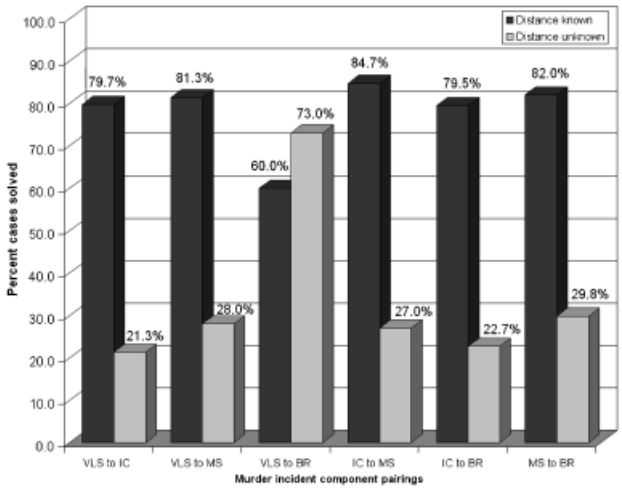


FIG. 2—*Graphic representation of solvability when distance is known.*

TABLE 7—*Distance between murder incident components.*

| Distance interval | Percent of cases | | | | | |
|---|---|---|---|---|---|---|
| | VLS to IC | VLS to MS | VLS to BR | IC to MS | IC to BR | MS to BR |
| 0–199 ft | 64.2 | 26.6 | 15.8 | 34.0 | 19.7 | 69.1 |
| 200 ft–1/4 mile | 15.9 | 19.2 | 16.8 | 14.3 | 15.2 | 6.1 |
| >1/4–1 $\frac{1}{2}$ miles | 8.3 | 13.7 | 13.4 | 11.5 | 11.6 | 4.5 |
| >1 $\frac{1}{2}$–12 miles | 7.2 | 24.5 | 30.5 | 24.4 | 28.7 | 10.8 |
| >12 miles | 4.4 | 16.0 | 23.4 | 15.9 | 24.8 | 9.6 |

VLS, victim last seen; IC, initial contact; MS, murder site; BR, body recovery.

The distance is greater than one-fourth mile between the VLS site and MS (54.2%) and the IC site and the MS (51.8%) in just over one-half of cases. A majority of the cases show a distance of greater than one-fourth mile between the VLS site and the BR site (67.3%) and between the IC site and BR site (65.1%). Table 8 summarizes the key distances between murder incident component pairings.

It was predicted that when the distance between locations or a pair of locations is less than 199 ft, the relatively close proximity of the locations will enhance the case solvability of a murder of an abducted child; the percentage of cases solved will be significantly greater than when the locations are separated by more than 199 ft—only the distance interval less than 199 ft between the MS/BR site pairing indicates a significant effect on solvability in the direction predicted. In general, the results from Kendall's Tau-*b* Test do not support the prediction set out by this hypothesis. The results are shown in Table 9.

### *Time and Distance Interaction Effect on Case Solvability*

It was predicted that when the time between a pair of locations is greater than 24 h and the distance between the same pair is greater than 199 ft, such a relatively distant proximity in time and distance will not contribute to the case solvability of a murder of an abducted child; the solvability will diminish sharply in cases when both the time span and distance interval are shorter for that pair of locations. Because of insufficient frequencies in the time interval categories in the other murder incident component pairings, only the following murder incident location pairings were examined for this hypothesis:

1. VLS site/BR site,
2. IC site/BR site,
3. MS/BR site.

A Discriminant Analysis was performed on relationship of time less than or greater than 24 h and distance less than or greater than 199 ft to case solvability for each pairing.

TABLE 8—*Key distances between murder incident components.*

| | Initial Contact Site | Murder Site | Body Recovery Site |
|---|---|---|---|
| Victim last seen site | ≤ 199 (64.2%) | >1/4 mile (54.2%) | >1/4 mile (67.3%) |
| Initial contact site | | >1/4 mile (51.8%) | >1/4 mile (65.1%) |
| Murder site | | | ≤ 199 ft (69.1%) |

TABLE 9—*Relationship between distance and case solvability.*

| Murder Incident Component Pairing | Distance | Percent of Cases Solved | *n* | Tau b | *p* |
|---|---|---|---|---|---|
| Victim last seen site to initial contact site | ≤ 199 | 77.6 | 177 | 0.039 | 0.329 |
| | >199 | 80.9 | 331 | | |
| Victim last seen site to murder Site | ≤ 199 | 78.9 | 352 | 0.099 | 0.007 |
| | >199 | 87.7 | 142 | | |
| Victim last seen site to body recovery site | ≤ 199 | 71.4 | 421 | 0.087 | 0.011 |
| | >199 | 82.0 | 91 | | |
| Initial contact site to murder site | ≤ 199 | 85.2 | 323 | 0.021 | 0.612 |
| | >199 | 83.6 | 163 | | |
| Initial contact site to body recovery site | ≤ 199 | 79.7 | 408 | 0.011 | 0.784 |
| | >199 | 78.6 | 99 | | |
| Murder site to body recovery site | ≤ 199 | 88.0 | 162 | 0.105 | 0.005 |
| | >199 | 79.3 | 326 | | |

Because one of the independent variables was eliminated from the model by the discriminant analysis for each murder incident location pairing examined, the hypothesis that time spans greater than 24 h and distances greater than 199 ft enhance case solvability is not supported. In addition, it was hypothesized that the solvability would decrease significantly if time and distance proximity were shorter for each murder incident location pairing. This hypothesis is not supported for any murder incident location pairing in child abduction murder investigations.

## Discussion

Results show that when any information on the dates and locations of the murder incident components is known, the probability of child abduction murder case solution increases. There is a strong positive correlation between knowing the time of a murder incident component and the ability to identify a perpetrator. The strongest indicator of solvability, when investigators know the time of a murder incident component, is the MS. The IC site also contributes strongly to solvability when information about the time is known. Unfortunately, little attention is given in homicide investigation courses on how to locate and process this site even though knowing the actual time of the initial contact between the victim and offender or murder increases the ability of investigators to verify or refute an offender's alibi.

This research also shows that in child abduction murder cases, shorter time proximity between murder incident locations has no significant impact on case solvability. However, there is support that case solvability will increase when the MS/BR site murder incident component pairing is separated by more than 24 h. This refutes the general belief that when an offender separates the time between the murder and when he disposes of the victim's body that case solvability will decrease. However, confounding factors associated with child abduction murders could account for this finding such as: the extensive resources provided to child abduction murder investigations which would not be expended in general homicide investigations or the use cold case teams.

Previous solvability research shows that the more investigators know about the distances between the pairs of the murder incident components, the more case solvability will increase; this study shows similar findings. When the distance between the MS and the BR site locations is less than 199 ft, solvability increases. A reason for this finding could be that the murder occurred where the body was recovered, resulting in a greater amount of physical evidence discovered in one location linking the offender to the crime. Distance less than 199 ft between the remaining five

murder incident component locations has no significant impact on case solvability.

Relatively close time and distance proximity between murder incident component pairs does not contribute significantly to case solvability. In addition, when the time and distances proximity decreases among pairs of murder incident components, the relatively distant proximity in time and distance does not contribute to case solvability.

### *Investigative Implications*

These results have important investigative implications. This study is a valuable tool for use in murder investigations of abducted children because the findings add to the understanding of these investigations and indicate which locations are critical to case solvability. Because time and distance do not play the same role in case solvability in CAM investigations as in general murder investigations, there may be other factors, such as type of forensic evidence, investigative resources, or actions by first responders which impact case solvability.

Because child abduction murder investigations are draining on department resources, further research on prioritization of investigation protocols and personnel resources to maximize case solvability is necessary. Fiscal considerations greatly influence investigations, therefore additional research should also be conducted on the resources an agency expends on these types of investigations and their commitment to that resource allocation for the duration of the investigation. In addition, attention should be given to the budgetary process of resource allocation by the appropriate governmental bodies responsible for law enforcement agency budgets.

Research should also be conducted on the types of physical evidence left by the victim or offender during an abduction murder and the impact of that evidence on case solvability. Empirically supported research in this area will enable agencies to focus limited police resources on those items of evidence most likely to influence case solvability. Because additional or different factors may affect whether or not an identified offender is convicted, a closer examination of factors relating to offender conviction should also be undertaken. Finally, a comparison between abduction cases in which a child was recovered alive and those in which a child was murdered would provide valuable—perhaps even lifesaving—information.

Because the occurrence of child abduction murder is rare, it is likely that most jurisdictions will not have experience in dealing with this type of investigation. This research study provides valuable, empirically supported, information to homicide detectives investigating the murder of an abducted child. The information contained within this study will enable police to efficiently allocate resources to the investigation. Investigators can use this information to prioritize how they pursue leads which relate to each murder incident component according to their influence on case solvability. In addition, the results of this study can be used to develop training materials for law enforcement personnel.

## Conclusion

Given the effect of extreme media coverage of child abduction murders, and the intense pressure from victim's advocacy groups, it is surprising that little empirical research has been undertaken before now to determine the effect of time and distance on case solvability. This research study increases the body of knowledge relating to time and distance as solvability factors in child abduction murder investigations. The findings indicate that information about the time and distance are critical solvability factors in murder investigations of abducted children. It is imperative that CAM be further explored in order to give police a larger arsenal of investigative tools and parameters for these types of investigations. The information obtained from this study is also a valuable community resource which will enable the public to better understand the risk of victimization from a child abduction murder and the complex nature of these types of investigations.

The discovery that information about time and distance increases case solvability is hardly unexpected. This research quantified what experienced homicide detectives already know. However, the findings about the nature of the time and distance intervals between murder incident component pairings and their effect on solvability indicate that time and distance relationships operate in a unique manner in murders of abducted children. As tragic as the death of any abducted child is, the greater tragedy would be a case that remained uncleared because local law enforcement investigators were unaware of major factors which would have increased case solvability.

### *Acknowledgments*

The authors wish to thank Scott Vollum, Ph.D., for his help with data cleaning and coding and Kc L. Wendler Deaver, M.Sc., for her help with data verification. In addition, the authors wish to thank Charles M. Friel, Ph.D., and Jerry L. Dowling, J.D., for their contributions to the original study as part of Ms. Brown's thesis committee. Finally, the authors wish to thank the anonymous reviewers for their careful review and valuable suggestions in clarifying this article.

## References

1. National Center for Missing & Exploited Children. Missing and abducted children: a law-enforcement guide to case investigation and program management. Alexandria, VA: The Center, 2000.
2. Hanfland KA, Keppel RD, Weis JG. Investigative case management for missing children homicides. (Cooperative Agreement 93-MC-CX-K006), Attorney General of Washington, Olympia, WA, 1997
3. National Incidence Studies of Missing, Abducted, Runaway, and Thrownaway Children in America (NISMART). Highlights from NISMART bulletins. Washington, DC: U.S. Department of Justice, Office of Juvenile Justice Programs, Office of Juvenile Justice and Delinquency Prevention, 2002.
4. Brown KM. An analysis of the effect of time and distance relationships on case solvability in murder investigations of abducted children. Master's thesis, Sam Houston State University Huntsville, TX, 2005.
5. Beyer KR, Beasley JO. Nonfamily child abductors who murder their victims. J Interpers Violence 2003;18(10):1167–88.
6. Boudreaux MC, Lord WD, Dutra RL. Child abduction: aged-based analysis of offender, victim and offense characteristics in 550 cases of alleged child disappearance. J Forensic Sci 1999;44(3):539–53.
7. Egger SA. The killers among us: an examination of serial murder and its investigation. 2nd ed. Upper Saddle River, NJ: Prentice Hall, 2002.
8. Keppel RD, Birnes WJ. The psychology of serial killer investigations: the grisly business unit. San Diego, CA: Academic Press, 2003.
9. Greenwood P, Petersilia J, Chaiken J. The criminal investigation process. Lexington, MA: D.C. Heath, 1977.
10. Danto BL, Bruhns J, Kutscher AH. The human side of homicide. New York: Columbia University Press, 1982.
11. Lunde DT. Murder and madness. Stanford, CA: Stanford Alumni Association, 1975.
12. Geberth VJ. Sex-related homicide and death investigation: practical and clinical perspectives. New York: CRC Publishing, 2003.
13. Geberth VJ. Practical homicide investigation: tactics procedures and forensic techniques. 3rd ed. New York: CRC Publishing, 1983.
14. Adelson L. The pathology of homicide. Springfield, IL: Charles C. Thomas, 1974.

15. Spitz W, Fisher R. Medicolegal investigation of death: guidelines for the application of pathology to crime investigation. 3rd ed. Springfield, IL: Charles C. Thomas, 1993.
16. Fisher B, Svenson A, Wendel O. Techniques of crime scene investigation. New York: Elsevier Publishing Co, 1986.
17. Ressler RK, Burgess AW, Douglas JE. Sexual homicide: patterns and motives. New York: Lexington Books, 1988.
18. Mott NL. Serial murder: Patterns in unsolved cases. Homicide Stud 1999;3(3):241–55.
19. Sweet RW. Missing children: found facts. NIJ Rep 1990;222:15–8.
20. Keppel RD, Weis J. Time and distance as solvability factors in murder cases. J Forensic Sci 1993;39(2):286–401.
21. Keppel RD. An analysis of the effect of time and distance relationships in murder investigations [dissertation]. Seattle, WA: University of Washington, 1992.

Additional information and reprint requests:
Katherine M. Brown, M.A.
College of Criminal Justice
Sam Houston State University
Huntsville, TX 77341-2296
E-mail: kbrown@shsu.edu