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Sexual Homicide: A Spatial Analysis of 25 Years of Deaths in Los Angeles

ABSTRACT: Although it has been frequently studied over the last 100 years, empirical studies of sexual homicide are lacking. The majority of the existing studies have been descriptive in nature. In this study, we consider the spatial geometry of sexual homicide and the impact of time and distance on case solvability. An analysis of sexual homicides (*n* = 197) from 1980 to 2004 for Los Angeles County was conducted. Offender and victim journey to encounter site, journey to body disposal site, and journey-after-crime trips were examined. Descriptive and bivariate analyses were performed to examine victim, offender and case characteristics. Using logistic regression models both time factors and offense geometries were found to be significant predictors in case solvability. Simpler geometries are significantly more likely to be solved than cases with complex geometries and the longer a case remains unsolved the less likely it is that it will be closed. The results provide support for some of the findings from earlier descriptive studies and extend our understanding of the spatial geometry of sexual homicide.

KEYWORDS: forensic science, sexual homicide, homicide investigation, solvability, journey-to-crime, journey-after-crime

Rage, revenge, profit. These are motives for homicide which we can all understand. However, there is perhaps no motive for homicide that confounds and disturbs both the criminal justice system and society as large as much as sexual homicide. In fact, in a comprehensive study of public perceptions, sexual homicide ranked second only after the bombing of inhabited buildings in severity (1). As entering the forensic lexicon with the seminal work of von Krafft-Ebing (2) more than 100 years ago, "lust murder" or sexual homicide has captivated and frustrated investigators, criminalists, and medical examiners.

Definitions of sexual homicide vary considerably with several authors making their contribution (3–6). Perhaps the most forensically concise definition is that employed by Meloy (6). He proposes that a sexual homicide is one in which there is physical evidence of sexual activity which has occurred in close temporal and physical proximity to the murder or when there is a legally admissible statement by the perpetrator of sexual activity. The differences in definitions may be one factor contributing to varying estimates of the prevalence of sexual homicide (5).

In reality, sexual homicide has a low base rate of occurrence with historical frequencies estimated from <1% to about 4% of all homicides for North America (5,6). While there has been considerable empirical attention paid to sexual homicide for more than a century there is relatively little substantive research on the phenomenon (5,7). In this study, we examine offense characteristics in the context of the travel behaviors of the offenders and the victims in all sexual homicides for Los Angeles County for the 25 year period from 1980 to 2004.

Cohen and Felson (8,9) suggest that crimes are most likely to occur when a motivated offender and suitable target come together in time and space in the absence of a capable guardian. In the case of sexual homicide, the first assumption is that the offender is sexually motivated. There is evidence that most sex crimes are

committed by offenders who begin their travel for this specific purpose (10). It is often only in the retrospective examination of cases it becomes apparent that offenders who commit sexual homicide are sexually motivated. However, it should be acknowledged that the motivational components of actual intent may vary considerably among offenders.

Felson's (9) observation that it is convergence in time and space by the offender and target that shifts the emphasis away from the offender and encourages consideration of the victim and the function of location in the selection of a suitable target. Expanding on the concepts of routine activities, Brantingham and Brantingham (11) predict that the most likely locations for this convergence are the areas in which their individual activity spaces intersect. An activity space is the area covered by an individual in the course of their routine activities. This is defined by anchor points such as a residence or work location, and the paths or routes that connect them (Table 1). An offender's activity space also includes the area where he actively searches for suitable targets.

These concepts were utilized by McEwen and Groff (12) in developing a paradigm for evaluating the geometry created in the travel of offenders and victims in homicides (12). These three points apply when there are three known locations related to the crime: the offender's residence, the target's residence and the incident location. When all three points converge, the geometric pattern of the homicide becomes that of a Dot. This represents the simplest geometric pattern as all three sites are the same location. A Line is formed when either the offender or victim travels to the offense location and at least one of the three points is separate from the other two. Finally, a Triangle results when the offender and victim both travel to the offense site. From this basic geometry comes a straight forward system of assessing the solvability of sexual homicides by spatial analysis.

Rossmo (13,14) developed a system for identifying key sites in an offender's crime activity space. The first critical location is the encounter site (E). This is the place where the offender first encounters and targets a particular victim. Most obviously, this is at least one of several possible locations where the activity space of the offender intersects with that of the victim. It also represents

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TABLE 1—*Sample size by location.*

Location	Frequency	Percent of Total ($n = 197$)
Incident/occurrence site	197	100
Victim residence	192	97.5
Encounter site	136	69
Attack site	127	64.5
Murder site	126	63.9
Offender residence	110	55.8
Postoffense location	98	49.7

a critical decision-making point for the offender as he may select his victim out of many potential targets at the E. This meeting in time and space typically occurs when the routine activity of the victim intersects the hunting area of the offender.

Rossmo's (13) second critical location is the attack site (A). The attack site is where the first instance of criminal assault occurs although contact may have occurred at the E or somewhere between it and the A. The assault may be a simple battery to gain control of the target, abduction, or the sexual assault. Psychologically, it is the point where the offender makes the critical decision to engage the victim. Although this is clearly a crime scene, like the E, this location is often unknown to the investigators unless it is also the site at which subsequent events in the crime sequence occur. It is therefore often not processed by criminalists.

The third location is the murder site (M) where the actual murder occurs. Again, even though this is a critical crime scene it often remains unknown to authorities. This location may be of the offender's choosing or it may be a location dictated by the evolution of events during the commission of the crime. If it is separate from the E and A, it represents another critical spatial decision. This is especially true when the site is chosen beforehand. Those who come to it by chance may have done so because of a lack of organization, loss of control over the victim, or a sudden threat of discovery. Either instance is accompanied by a key psychological choice to escalate the severity of a sexual assault to a homicide. Therefore if this site is discovered, scene indicators coupled with physical evidence may yield significant insights into the rationale of the offender.

The final location in the model is the body Disposal site (D). This is the location where the decedent's body is left after the murder. It is also the place most likely to be the designated incident location. The body D is typically the first actual crime scene worked by the investigative team. While it is generally rich in both physical and behavioral evidence, it must be recognized that this evidence is far from complete. If the D is separate from the preceding event sites, then it represents a critical decision-making point (15). Transporting the body to and actions taken at the D occur during a period when the risk of discovery for the offender may impact decision-making.

Rossmo (13) notes that all four event sites may occupy the same physical place (EAMD), may be separated in time and space (E → A → M → D) or may exist in any of the possible event combinations. The specific pattern produced in any single murder speaks to both the spatial and psychological behavior of the offender.

The spatial behavior is an intentional goal-oriented aspect of the offender's modus operandi. However, his decision-making may represent a bounded rationality (15) with less Laplacean considerations for the costs and benefits than fast and frugal decision-making (16). Therefore, analysis of these behaviors provides insight into the offender's psychological state and decision-making processes. The more impulsive offender who spots his target while on the prowl, breaks into her home, rapes and murders her, leaving the body in a disorganized crime scene (EAMD) represents an example at one end of this spectrum (17). The more ritualistic offender, who identifies his target from afar, stalks and abducts her, transports her to a preplanned site where she is sexually assaulted and murdered, and then disposes of the stripped body in a flowing river (E → AM → D) is behaviorally a very different entity. Analysis of the crime travel behavior can provide useful knowledge about both the modus operandi and ritual of these sexual homicide offenders.

The final offense-related location is determined by the postoffense travel. It would be the point at which the crime-related travel sequence of the offender terminates. Knowledge of distance and direction traveled following disposal of the body may help to inform the investigative process.

It is the purpose of this analysis to attempt to move the body of literature on sexual homicide forward by examining offender, victim, offense characteristics, and offense spatial behavior and then model those characteristics which contribute to case solvability.

Methods

This study was based on a review of all cases ($n = 197$) of sexual homicide investigated by the Los Angeles Sheriff's Homicide Bureau from January 1, 1980, to December 31, 2004. These were identified through the Bureau's Case Management System—a data base which compiles and tracks several different types of homicides (e.g., gang-related, domestic, or child). From these cases, 199 individual victims were identified. The investigative file for each case was reviewed to collect victim and offender demographics and case related characteristics in addition to victim residence, offender residence (when known), and incident location. Using the EAMD model, event locations were also collected to the extent these could be identified from the investigative records. Finally, where the relevant information was available, the postoffense movement was obtained.

The majority of this information was identified in the form of street addresses. However, a substantial number of locations had to be determined from descriptive information in the file. Once these locations were identified, the latitude and longitudinal coordinates for each location was obtained using Google Earth™ (18). These coordinates were used to geocode the data into Geographic Information System mapping software (ESRI's ArcGIS, version 9.1).

Once this data was geocoded, the Euclidean distance (straight-line or "as the crow flies") for each possible pair of points was calculated. It was decided to use these straight line trips as a proxy for the actual street network trips between points as the actual offender routes over the street network could not be determined with any degree of accuracy from the case files. Further an unknown number of intermediate trips for varied purposes may have begun from some other location than that used for the calculation. The use of Euclidean distances for these trips is a suitable proxy for the actual travel distances of these offenders (12). For each trip, the trip length in miles and the trip compass direction was calculated. Rhodes and Conly (19) have noted the strong correlation between road distance and straight line distance for journey-to-crime trips. Similarly, the linear mean direction is a good proxy for the varying travel directions any one trip may actually involve. These trip calculations may be a limitation of the study but they provide the most representative data with respect to victim and offender travel behaviors.

Results

Victim and Offender Demographics

The victim and offender demographics are described in Table 2. This information was derived from the case files for each of the

TABLE 2—*Victim and offender demographics.*

	Offender		Victim	
	Frequency	Percent	Frequency	Percent
Gender				
Male	139	98.6	38	19.1
Female	2	1.4	161	80.9
Total	141[*]	100	199	100
Race				
Asian	0	0	7	3.6
Hispanic	44	31.4	43	21.6
American-Indian	0	0	1	0.5
Black	40	28.6	54	27.1
White	56	40	94	47.2
Total	140*	100	199	100

*Refers to known, primary offenders only.

TABLE 3—*Victim race by offender race.*

	Offender Race					
	White		Black		Hispanic	
Victim Race	Frequency	Percent	Frequency	Percent	Frequency	Percent
Native Am	1	1.8	0	0	0	0
Asian	4	7.1	1	2.5	0	0
Hispanic	6	10.7	2	5	21	47.7
Black	4	7.1	27	67.5	2	4.5
White	41	73.2	10	25.0	21	47.7
Total	56	100	40	100	44	100

TABLE 4—*Victim and offender age characteristics.*

	Offenders ($n = 133$)	Victims ($n = 198$)
Age		
Mean	27.8 years	34.1 years
Median	25 years	29 years
Range	14–55 years	1–91 years
Victim age by ranked category	Frequency	Percent
Mid-age adult (35–59)	52	26.3
Adult (26–34)	48	24.2
Young Adult (18–25)	44	22.2
Minor (<18)	33	16.7
Older Person (60 and older)	21	10.6
Total	198	100
Offender age by ranked category		
Young Adult (18–25)	57	42.9
Adult (26–34)	34	25.6
Mid-age adult (35–59)	32	24.1
Minor (<18)	10	7.5
Older person (>60)	0	0
Total	133	100

identified sexual homicides. In the 197 individual cases, there were 141 primary offenders and 199 victims identified. There were an additional 11 male co-offenders and two female co-offenders for an actual total of 154. Nine percent of the known cases had multiple offenders. This analysis is based on the primary offender, who was identified as the actual perpetrator of the murder in every case. In several cases with multiple offenders, the secondary offender did not participate in killing anyone, however each was convicted of murder based on their complicity in events leading up to the act.

Like most violent crime, the majority of the perpetrators were males, although including secondary offenders, 2.5% were female. The vast majority (80.9%) of the victims were female. However, approximately one victim in five was a male.

Race and ethnicity presented an interesting challenge. The LASD (like many police agencies) uses only four designators for noting race in its reports. These include white (W), black (B), Hispanic (H) and Asian (A). It was interesting to note in the file review that several of the victims were immigrants from Sub-Saharan Africa (black, but not African-American), although none of the perpetrators were.

Using the racial composition of the population of Los Angeles County as a point of comparison for the expected values, a significant chi-square ($\chi^2 = 107.35$, d.f. = 4, $p < 0.001$, Cramer's $V = 0.539$) shows that both Hispanics and Asians are under-represented and whites and blacks are both over-represented in the victim pool. A similar comparison of offender racial make-up produced a significant chi-square ($\chi^2 = 59.62$, d.f. = 2, $p < 0.001$, Cramer's $V = 0.426$). For offenders, both whites and Hispanics were disproportionately under-represented and blacks were over-represented (there were no identified Asian perpetrators). In both cases, the Cramer's V statistic indicates that these significant relationships have a moderate effect size.

A more interesting analysis of the racial relationships between victim and offender can be seen in Table 3. Not surprisingly, these offenses are predominantly intra-racial. Just slightly more than a quarter of all offenses committed by white offenders are cross-racial, with the largest single category of inter-racial offenses being perpetrated against Hispanics. Likewise, with Hispanic offenders we see a pattern wherein they perpetrate against other Hispanics and whites with an equal frequency. For black offenders, slightly more than two-thirds of their offenses are intra-racial and one-fourth of the cases are cross-racial offenses against whites.

From the perspective of criminal investigative analysis a white victim fell prey to a white offender three-quarters of the time, a black victim to a black offender two-thirds of the time and a Hispanic victim to a Hispanic offender about half the time. Likewise,

about one-fourth of the time a black offender killed a white victim and about half the time a Hispanic offender killed a white victim. It was also interesting to note that in a region that has been plagued in recent years by internecine gang warfare, among sexual homicides it was relatively rare that blacks targeted Hispanics or that Hispanics targeted blacks.

Victim and offender age characteristics hold few surprises. In Table 4 we can see that both victim and offender mean age is slightly older than those found for general crime demographics, and the median values indicate that there may be a few older offenders and victims who are slightly skewing this distribution (see Fig. 1). In both cases the distribution has a slight positive skew (victim age skew statistic = 0.928, SE = 0.173; offender age skew statistic = 0.736, SE = 0.210) indicating that the overall distribution slightly favors both older victims and offenders.

Perhaps one of the most interesting aspects of the age demographic is the range of ages for both victims and offenders. It is obvious that neither the very old nor the very young are safe from sexual homicides. This, in fact, may be one of the characteristics of this crime that differentiates it from other motivational causes of homicide. With respect to offender age characteristics, a quick glance at Table 4 shows that sexual homicide is not the near exclusive province of the 18 to 25-year-old offenders.

In fact, if the two mid-range adult categories are collapsed (26–59 years), they constitute almost half (49.7%) of all the offenders. Only 7.5% of the offenders in this study were minors and there were no older perpetrators.
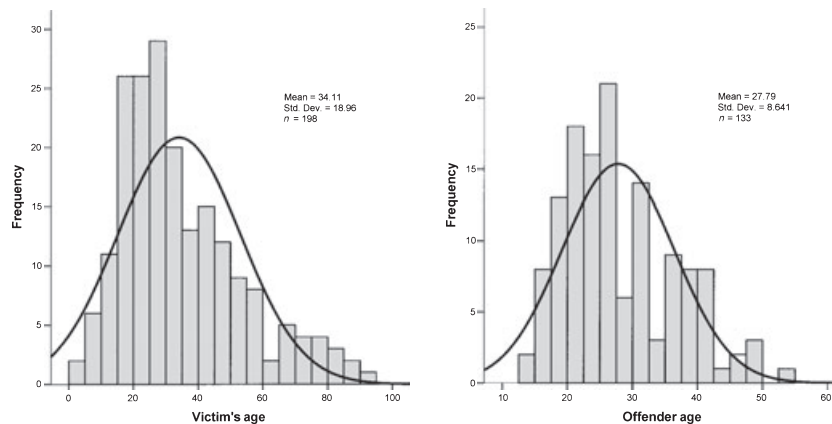
FIG. 1—*Age distribution.*

TABLE 5—*Offense characteristics.*

	Frequency	Percent
Case status		
Closed by arrest	105	52.8
Open-active	84	42.2
Closed by exceptional means	7	3.5
Open-suspended/inactive	2	1.0
Other	1	0.5
Total	199	100
Cause of death		
Close contact (ligature or manual strangulation, asphyxia)	80	40.2
Contact weapon (edged)	39	19.6
Distant weapon (gun)	39	19.6
Aggressive violence (blunt force trauma)	30	15.1
Unknown cause	11	5.5
Total	199	100
Other characteristics		
30-day unsolved case	117	59.6% of total (*n* = 196)
180-day unsolved case	101	51.5% of total (*n* = 196)
Victim a prostitute	38	19.1% of total (*n* = 199)
Homosexual murder	28	14.1% of total (*n* = 199)

Victim age characteristics are most surprising in the tendency for victims in the middle years to be over-represented. Slightly more than a quarter of the victims were in the 35- to 59-year-old group and the next highest was the 26- to 34-year-old group. An informal comparison with data from the Supplemental Homicide Reports for Los Angeles County shows in a 20-year average that about 15% of homicide victims were minors and slightly <5% were older persons. The sexual homicide data, while only slightly greater for minors, shows that almost twice as many older persons were victims of sexual homicide than would be expected. More than a quarter of all the sexual homicide victims were from what we would consider the most vulnerable segments of society, minors and the elderly.

Case Characteristics

Switching from a focus on individual victims and offenders, we will now examine the offense characteristics. The overall clearance rate for these sexual homicides is 56.8%. However, even though this number may be lower than the national average of 66% for all homicides (20), only 1% of these cases were placed in an Open-Suspended/Inactive status. The other 42.2% of the uncleared cases are, in fact, still active with the Homicide Bureau. Anecdotally, a

surprising number of these open/active cases were cleared even after 20 years. This was primarily as a result of the application of emerging forensic technology and the availability of the CODIS database. In their descriptive study of sexual homicide in Canada, Roberts and Grossman (5) reported an initial cleared-by-arrest rate of 75% with an additional 1% cleared-by-other-means when the suspect committed suicide. These authors indicated that these clearance rates were similar to the rates reported for all homicides. They did note, however; that more of these cases remained in an unsolved category over time. They attribute this difference to a higher rate of stranger homicides.

One critical indicator for understanding sexual homicide is the cause of death for the victim. The choice of weapon in a homicide is considered from the psychological perspective in criminal investigative analysis to glean information about the nature of the relationship between offender and victim. Essentially, some methods of murder require more "intimate" contact than others. Perhaps the most intimate of these is the use of the offender's own hands, in direct contact with the victim, to affect the murder. In that context, all murders by asphyxia, including manual and ligature strangulation, smothering and drowning could be considered among the most intimate. Asphyxial death comprised the single largest category in this study (40.2%).

Firearms (distant weapons) and edged (contact) weapons were tied for the next most frequent means of dispatching the victim. By contrast, Kraemer, Lord and Heilbrun (21) found in their comparative analysis of single and serial homicide that gunshot wounds followed by stab wounds were the most frequently occurring causes of death in single homicides (56% cumulatively). In serial homicides, however, these two were tied for the third most frequent cause (15% each) while strangulation accounted for 47% of the deaths. Kraemer et al. noted that most of their serial homicides were sexual in nature.

Blunt force trauma, more than any other cause of death, is consistent with the catathymic release of anger on the part of the offender. Thirty of these cases (15.1%) listed blunt force trauma as the cause of death. In the file review, it was observed that in many cases there was evidence of blunt force trauma to the victim in the autopsy report, even though the cause of death was attributed to some other means. The prevalence in crimes of sexual murder may suggest a greater frequency of an underlying catathymic motivational process than is currently supported in empirical research.

It was also noted that in almost one case in five the victim was a prostitute. A recent report on the extent of prostitution related murder in the United States (22) noted that female prostitutes, as a

TABLE 6—*Case status by prostitute murder.*

| Case Status | Prostitute Murder | | | | | |
| | Yes | | No | | Total | |
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Open	29	76.3	57	35.4	86	43.2
Cleared	9	23.7	104	64.6	113	56.8
Total	38	100	161	100	199	100

class, account for the highest rate of homicide victimization of any other group of women. They found that most prostitute murders are perpetrated by client-johns, and that when their clients are killed it is most often at the hands of a prostitute. In this sample, there were a total of 38 murders involving prostitutes.

It is not surprising to find that prostitute murders have a very low clearance rate (see Table 6). The majority of these crimes are perpetrated by strangers who target very high-risk victims. In fact, when we remove the prostitute murders from the overall sample it has a positive effect on the statistics for all other sexual homicides, raising the nonprostitute victim clearance rate to 64.6%. This relationship is significant with a moderate effect size ($\chi^2 = 20.97$, d.f. = 1, $p < 0.001$, $\Phi = 0.325$).

A logistic regression was conducted on this data to determine to what extent a prostitute murder might predict whether or not the case was cleared. The regression results indicate this single parameter (prostitute murder) was a reliable indicator of the likelihood a sex murder would not be cleared (-2 Log Likelihood = 9.232, $\chi^2 = 21.324$, d.f. = 1, $p < 0.001$). The model correctly classified 66.8% of the cases. The regression coefficients can be found in Table 7. The Wald statistic indicates that prostitute murder correctly predicts case clearance. The odds ratio indicates that if a case is a prostitute murder it is almost six times more likely that the case will remain open/unsolved.

In an exploration of case status within other victim categories, an examination of those offenses with minors produced some interesting findings. As can be seen in Table 8, if the victim was a minor there was a slightly greater likelihood that the case would be cleared by arrest or exception than if they were not a minor. This contingency table resulted in a nonsignificant $\chi^2 = 2.577$, d.f. = 1, and $p = 0.108$. However, a logistic regression suggests that this is a weak predictor model ($\chi^2 = 2.66$, d.f. = 1, $p = 0.103$; 57.1% of cases correctly classified, and Wald = 2.521, $p = 0.112$, odds ratio = 1.917).

TABLE 7—*Regression coefficients for prostitute murders.*

	B	Wald	d.f.	p	Odds Ratio
Prostitute murder	1.771	18.164	1	<0.001	5.879
Constant	−1.170	9.403	1	0.002	0.310

TABLE 8—*Case status by minor victim.*

| Case Status | Minor Victim | | | | | |
| | Yes | | No | | Total | |
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Open	10	30.3	75	45.5	85	43.2
Cleared	23	69.7	90	54.5	113	56.8
Total	33	100	165	100	198	100

TABLE 9—*Regression coefficients—unsolved-case status.*

	B	Wald	d.f.	p	Odds Ratio
180-day unsolved	3.595	73.091	1	<.001	36.4
Intercept	−1.386	29.212	1	<.001	

Finally, we examine unsolved case status and the impact on clearance. In this instance, we examined cases which were 30-days unsolved and cases that were 180-days unsolved. This is a functional definition of time to arrest but may be considered in the context of a solvability factor.

A stepwise logistic regression was performed to ascertain the extent to which unsolved case status could be used to predict case clearance. The results indicate that the 180-day unsolved case status was a good predictor, whereas the 30-day unsolved case status was not. This was a reliable model for distinguishing which cases were cleared and those which remained open (-2 Log Likelihood = 13.113, $\chi^2 = 108.465$, d.f. = 1, $p < 0.001$). The model correctly classified 85.2% of the cases. The regression coefficients can be found in Table 9. The Wald statistic indicates the 180-day cutoff is an accurate indicator of clearance probability. The odds ratio indicates that if a case is unsolved at the end of 180 days it is 36 times more likely that the case will not be cleared by arrest or exception.

The most recent case included in this sample was closed by arrest on November 13, 2005. The most recent case that was still open on July 31, 2006 had a discovery date of March 20, 2003, and had been in an open/active status for 1229 days.

Epidemiology

There is a general consensus that sexual homicide is a low-occurrence phenomenon. Reviews by Roberts and Grossman (5) and Meloy (6) of Canadian and U.S. statistics indicate the base rate is probably somewhere between 1% and 4% of all homicides. In a 10-year study of serial sexual homicides, McNamara and Morton (23) found a base rate of only 0.5%. The problem inherent with these estimates is that in both U.S. and Canadian national-level data, many sexual homicides are not directly identified as such. Fortunately we are able to give a more accurate estimate of this base rate for Los Angeles. Sexual homicide incident data was compared with the total homicide incidents for Los Angeles County from 1985 to 2004. This resulted in a mean base rate of 4.33% and a median base rate of 3.83% with a range from 0.59% to 9.15% (see Figs. 2 and 3). Looking at the 20 years in the aggregate, the probability of any murder being a sexual homicide is $p_{(\text{sexual homicide:murder})} = 0.043$. The conditional probability of any violent crime being a sexual homicide is $P_{(\text{sexual homicide:violent crime})} = 0.0006$, an extremely low probability.

Spatial Characteristics

In recent years there has been an emerging literature in the journey-to-crime research on homicide (12,24,25). However, only one other study could be identified that examined the spatial aspects of sexual homicide in serial murder cases (25). Rossmo (14) has written about the movement behavior of homicide offenders and identified four distinct locations in the development of the geographic profile of an offender. His EAMD classification is useful in analyzing the spatial behavior in sexual homicides. Rossmo points out that some, all, or none of these sites may be co-located. To the extent that the sites are not, they necessitate offender travel. The following is an examination of those travel behaviors.
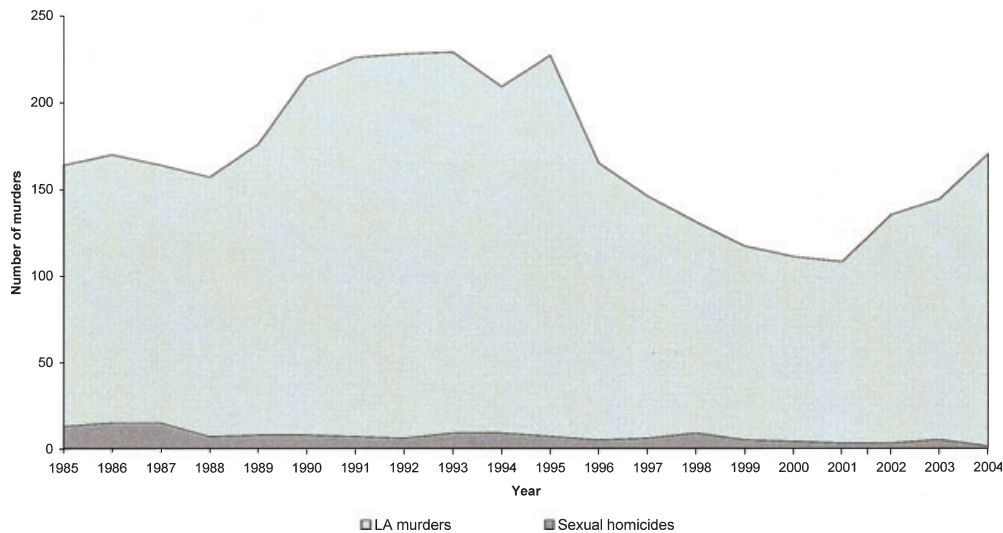
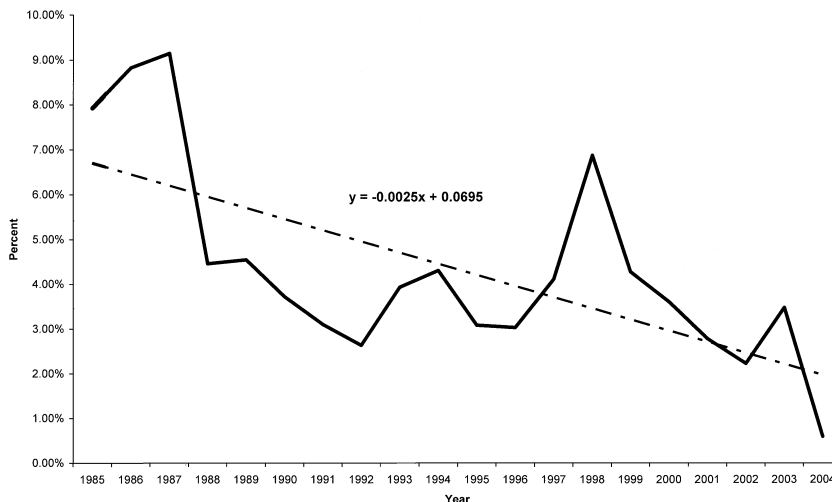FIG. 2—*Sexual homicide as a proportion of all murders (1985–2004).*

FIG. 3—*Sexual homicide trend as a percentage of all homicides (1985–2004).*

In general, there are three different methods of estimating actual offender travel. There is, of course, the actual pathway the offender traveled over the street network during the commission of the offense. This is rarely discoverable, especially in a retrospective study, without interviewing the offender. This distance reflects either "wheel" distance or "taxicab" distance (26), and would be the most technically accurate measure if available. In an urban environment where the street network is laid out in a grid system, another method of indirect distance measurement is Manhattan distance. Manhattan distances are essentially the sum of the vertical and horizontal trips from one location to the next (no diagonal travel across the grid). Finally, offender travel behavior can be measured as the direct distance between two locations. This is often referred to as "as-the-crow-flies" or Euclidean distance. Prior homicide research (12) has established that these different measures are highly correlated and exhibit a consistent differential. Euclidean distances will be used to analyze offender and victim movement for this study.

We will first examine the basic offense geometry by looking at three different relationships: victim residence to body dump site, offender residence to body dump site and the distance between offender residence and victim residence. In looking at this travel geometry we will consider both the aggregate data, including zero-distance "trips" and then separate the data with the zero-distance trips removed. An example of a zero-distance trip would be when the victim's residence is also the body D.

The following two tables (Tables 10 and 11) provide some insight into the journey-to-crime behavior of both the offenders and their victims. In the first table (Table 10) the relevant distances between all the known addresses were calculated. In this table the

TABLE 10—*Journey-to-crime trips in miles.*[*]

	Victim Residence to Body Disposal	Offender Residence to Body Disposal	Offender Residence to Victim Residence
Number of trips	191	110	108
Mean	33.38	43.86	57.71
Median	0.79	1.28	1.34
Range	0–2276.3	0–3410.87	0–3410.87

[*]Includes zero-distance "trips."

TABLE 11—*Journey-to-crime trips—zero-distance trips excluded (miles).*

	Victim Residence to Body Disposal	Offender Residence to Body Disposal	Offender Residence to Victim Residence
Zero-distance trips	79	21	18
Number of trips	112	89	90
Mean	56.92	54.21	69.25
Median	4.62	2.43	2.88
Range	169 ft–2276.3 miles	21 ft–3410.87 miles	21 ft–3410.87 miles

TABLE 12—*Journey to encounter site.*

	Victim Residence to Encounter Site	Offender Residence to Encounter Site
Zero-distance trips	70	22
Number of trips*	63	79
Mean	52.13	57.32
Median	1.39	1.67
Range	42 ft–1429.38 miles	32 ft–3410.87 miles

*Calculations based on nonzero trips only.

zero-distance "trips" were included in the computations to give a greater perspective on the journey-to-crime issues. The most striking characteristic to emerge is the extreme skew in the distribution of crime trips. While there are a few extreme distances traveled, the vast majority of trips are actually very short. To that end, it is probably best to use the Median to indicate the "typical" trip because of the distortion of the Mean by the extremes.

The more informative data is in Table 11, which removes the effect of the no travel (zero-distance) "trips" from the computation. First, it is important to recognize that 41% of the victim-to-body dump links were zero-distance (the sites were co-located). In other words, the victim's residence is the body dump site in 41% of the cases. A surprising one in five of the offender-to-body disposal trips involved no travel. Of these 21 no travel offender-to-body dump "trips," 85.7% have been cleared, with 14.3% still in an open status. Examining the median journey-to-crime figures, we can see that most of the offenses involve travel geometry of less than five miles. However, even a five mile trip represents about 20 square miles of activity area. In a densely packed urban area like South Central Los Angeles this covers tens of thousands of residents.

A comment on some of the extreme distances is warranted. In the case of the victim-to-body disposal trips, the extreme distance trips represent harm coming to out of town travelers. In one case, it involved the abduction of a young woman from the bus terminal within a short time after her arrival in Los Angeles. If a local motel or hotel residence could be established, that address was used as the victim residence anchor point for these calculations. So, the distances used represent actual distances from an identified anchor point to the body D for most of the cases. In the case of the offenders, the one extreme trip (3411 miles) was an individual who traveled to Los Angeles, remained in a transient status for several days, and then fled back to San Juan, Puerto Rico following his offense. This offender, despite having been identified, remains at large. The short, nonzero distance trips typically represent incidents involving neighbors.

Perhaps more relevant from a preventive perspective is an analysis of the journey-to-crime information about the victim and offender travel patterns to the E. As Rossmo has noted (14), the more geographically complex the murder event the less likely the case is to be cleared by arrest. The E is the first critical location in a chain of events and locations that culminates in the sexual assault, murder and disposal of the victim's body. The E is that location where the offender's activity space intersects with the victim's activity space and the victim is "selected." In fact, Rossmo reports that two-thirds of the time the offender is at this location because they belong there, or their routine activities frequently place them there.

It was determined that 78.2% of the trips from the offender residence to the E (n = 101) were five miles or less and 46.5% were trips of less than half a mile. For the victim trips (n = 133) to the E an even higher proportion were close to home with 85% being five miles or less and 66.9% being under a half mile. Table 12 shows the descriptive statistics for the nonzero distance journey to E trips.

In these data, the median is once again the best measure of the typical case and we see the substantial distortion of the distribution caused by the extreme distance trips. Of the offender journeys to E only 12 total trips (11.9%) were 10 miles or more, and of like victim trips only 11 (8.3%) exceeded 10 miles of travel.

Unfortunately, there were not enough cases for which a separate A and M could be clearly identified to allow for any meaningful analysis. However, 59 cases were available for the analysis of the trip from the E to the body D. Although still a skewed distribution (see Fig. 4) these cases are much less distorted by extreme distance trips. The mean distance from E to body D was 6.9 miles and the median distance was 2.6 miles. The minimum distance was 33 feet and the maximum was 42.5 miles.

There were some other differences noted in the E to body D trips as well. The majority of trips were still five miles or less (62.7%), but there were a substantial number (n = 10) of middle-distance trips from 5 to 10 miles (16.9%). There were a total of 12 trips of 10 miles or more which constituted 20.4% of the cases.

Perhaps of most investigative relevance are the data about the postoffense travel behavior of the offenders. There has been very little research on journey-after-crime (27) and most of what is available has focused on property crime. In this dataset we have good locations for 98 postoffense trips which allowed for some analysis of the journey-after-crime behavior of these offenders. These are trips from the body D to an anchor point for the offender. As would be expected, not all of these trips were direct, many having intermediate stops before arriving at a destination point. In
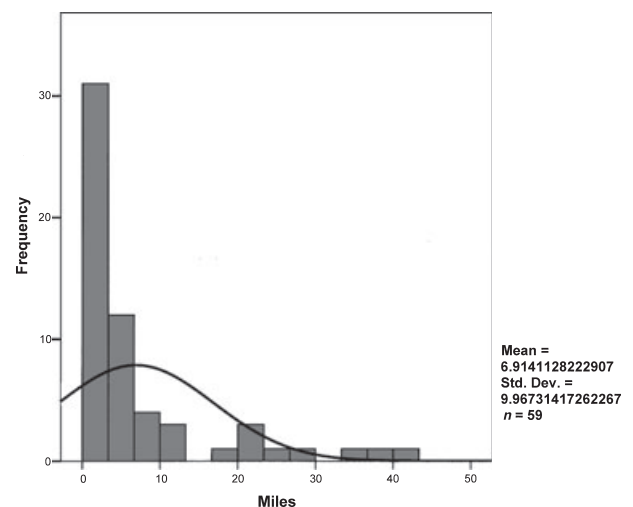

Mean = 6.9141128222907
Std. Dev. = 9.96731417262267
n = 59

FIG. 4—*Distribution of encounter-site-to-disposal-site trips.*

TABLE 13—*Journey-after-crime.*

	Body-Dump to Postoffense Site	Nonzero Body-Dump to Postoffense
Zero-distance trips	11	0
Number of trips	98	87
Mean	68.68	77.36
Median	1.86	2.16
Range	0–3410.87 miles	153 ft–3410.87 miles

this case, the destination point is defined as the location to which the offender traveled and once there, ceased contiguous travel.

As with the earlier trip data, Table 13 shows that this is a heavily skewed distribution affected by a few extreme distance outliers. There were 10 zero-distance trips in the set of 98 where the offender's postoffense behavior left them at the body dump site. In 10 of those cases, the body-dump site and the offender's home address were the same. In one case, the offender remained and was arrested at the victim's address, also the incident address, following the offense.

When considering these postoffense trips according to distance, there is a slightly different distribution when compared with earlier offender travel behavior. A sizable portion of the trips ($n = 37$, 37.8%) were neighborhood trips of less than a half-mile distance. Another third of the trips ($n = 29$, 29.6%) were between a half-mile and five miles in length. These short distance trips cumulatively account for slightly more than two thirds of all postoffense movement ($n = 66$, 67.3%). Middle distance trips, between 5 and 15 miles, accounted for the smallest proportion overall ($n = 15$, 15.3%). Surprisingly, 17.3% ($n = 17$) of the trips were more than 15 miles long and nine of these trips were more than 25 miles in length.

Like most localities, Los Angeles County has its own unique geography. The county looks somewhat like an inverted triangle with an almost 70-mile border with Kern County to the north and tapering down to about a third of that with Orange County to the south. It covers *c.* 4087 square miles and ranges from isolated mountain wilderness to urban dense-pack. The forested mountains to the north, the Pacific Ocean to the southwest, and the high desert to the east serve as natural geographic boundaries which affect offender travel behavior. Los Angeles County also includes one of the Channel Islands (Santa Catalina) to the south, although none of the offenses occurred there (Fig. 5).

To more fully understand the movement behavior of the offenders, the compass direction for the various trips was also analyzed. Because of the unique topography of Los Angeles County and the geospatial dependence of offender movement patterns, this analysis may not apply to any other locality. To accomplish this, actual trip compass directions were classified into 30°-arc groupings (e.g. −0° to 30°, 30° to 60°, and so forth). These directional classes were then plotted as a radar graph to allow a visual analysis of the directional movement. The first set of trips analyzed were the movement to the E by both victim and offender (Figs. 6 and 7).

The predominant direction of travel for victims to the E is to the West Northwest (300°) with a secondary lobe to the East and Southeast. This directional axis loosely parallels the coast and, with an origin site in the more populated area of the county, would keep the victim mostly in the major urban areas (see Fig. 5). Offender travel to the E exhibits a different pattern with bimodal lobes to the East Northeast (60°) and the South. The majority of trips are to the Northeast quadrant (0° to 90°) although a substantial number are to the South.

After the intersection of victim and offender activity spaces at the E, the next important trip is from the E to the incident location
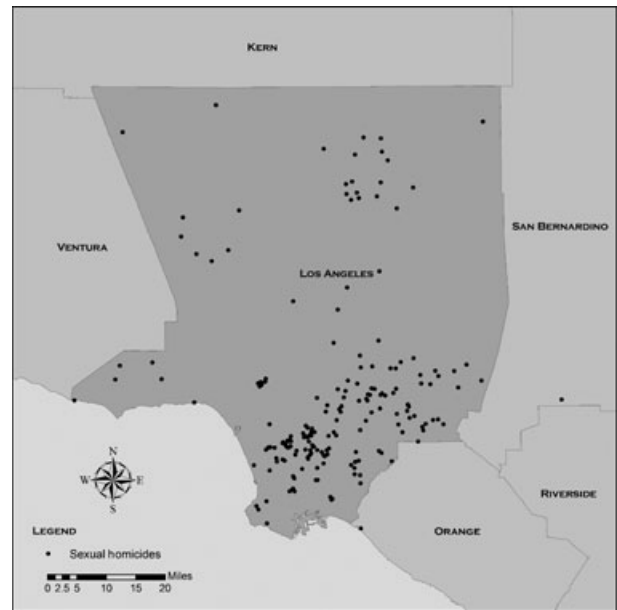
FIG. 5—*Los Angeles County sexual homicides.*
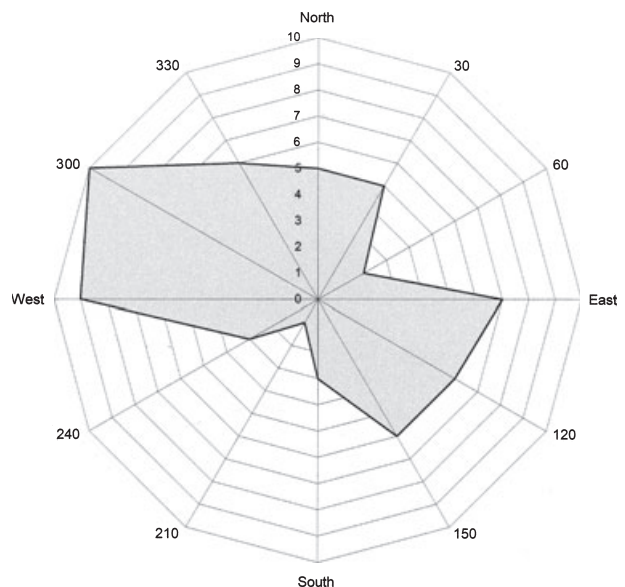
FIG. 6—*Victim-residence-to-encounter-site trip direction.*

(body D). The predominant direction of travel is to the West. The arc between 240° and 300° accounts for 32.2% of all E to body D trips (see Fig. 8).

The last trip of interest is the direction of movement used by the offender after leaving the body dump site. As can be seen in Fig. 9, the most frequent direction of travel was to the North Northwest (330°). Fifteen (17.24%) of the postoffense trips were in this direction. The next most frequently used direction of travel was to the East with 12.64% of the trips in this direction ($n = 11$).

Sexual Homicide Geometry

We decided to evaluate the impact of homicide geometry as described by McEwen and Groff (12) on case clearance rates. The fundamental hypothesis is that the more complex the homicide
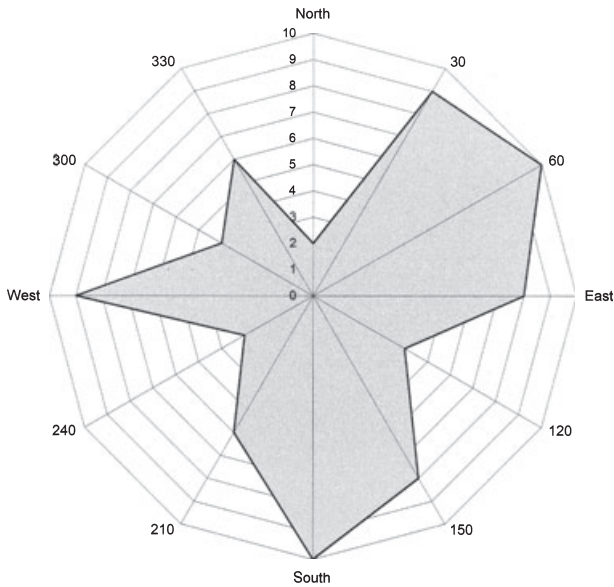
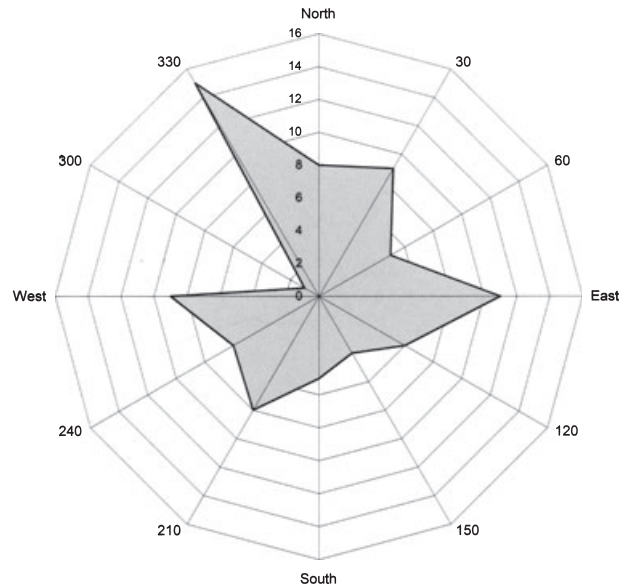FIG. 7—*Offender-residence-to-encounter-site trip direction.*
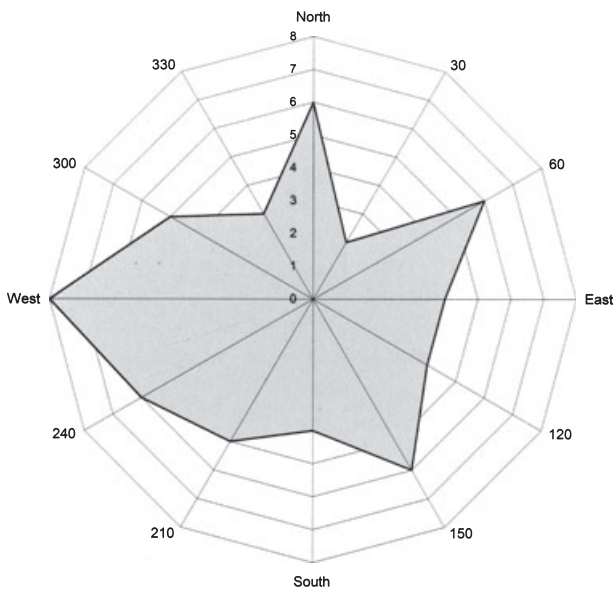

FIG. 9—*Postoffense travel direction.*

FIG. 8—*Encounter-site-to-disposal-site trip direction.*

TABLE 14—*Regression coefficients—homicide geometry.*

	B	Wald	d.f.	p	Odds Ratio
Dots	1.692	10.58	1	0.001	5.429
Lines	1.818	16.08	1	<0.001	6.162
Triangles[*]					
Intercept	−1.7430	18.098	1	<0.001	

*This parameter is set to zero because it is redundant.

geometry the more difficult the case will be to clear (14). A logistic regression was conducted on this data to determine the extent to which homicide geometry might predict the likelihood of a case being cleared. The regression results indicate this model with three indicators (Dots, Lines and Triangles) was statistically reliable in distinguishing between sexual homicides that were cleared and those which were not (−2 Log Likelihood = 12.865, χ^2 = 20.798, d.f. = 2, $p < 0.001$). The model correctly classified 60.2% of the cases. The regression coefficients can be found in Table 14. The Wald statistics indicates that both Dots and Lines correctly predict case clearance. The odds ratio indicates that if a case has a Dot geometry it is more than five times more likely that the case will be cleared by arrest or exception. If the case has a Line geometry it is more than six times more likely to be closed.

While both the simpler geometries exhibit the hypothesized relationship with case clearances, it was unexpected that a Line-type

case would actually be the stronger predictor of the two. However, both of the simple geometries were significantly better predictors of case closure than was the most complex geometry of the Triangle.

Discussion

In this study of sexual homicides we confirmed the findings of previous research (5,6) with respect to the base rates for sexual homicide. It is, indeed, a low base rate phenomenon (about 4.3% for LA County) which makes these cases harder to solve and difficult to study. Even though this estimate of the mean base rate is about four times that found in the national data by Meloy (6), in any given year it may range from a high of more than 9% to under 1% (see Fig. 3). Low base rate phenomena make it difficult to accumulate any body of expertise for the investigators, criminalists and medico-legal death investigators. That may be reflected in the slightly lower clearance rates for sexual homicides compared with national averages for homicide in general.

Sexual homicide is a heavily gendered crime with the vast majority of victims being female (and most offenders being male) and this bias is even more pronounced in the vulnerable populations of the young and old. Safarik, Jarvis and Nussbaum (28) identified both the special vulnerability of the elderly female population and the difficulty with amassing any investigative expertise in these sexual homicides. In the Los Angeles data there is a clear targeting of females for sexual homicide. This is even more pronounced at the end of the age spectrum, with elderly women being targeted in sexual homicides at a higher rate than would be expected.

Despite being a strongly gendered crime, one of five victims was a male. A small subset of these sexual homicides involved identifiably gay men. While many of these homicides clearly met the definition of a sexual homicide, at least two of the 28 were more in the nature of a domestic homicide than a sexual killing. This data is still being examined and will be reported on in the future. While the racial distribution for male victims was similar to the larger victim pool, Hispanic males were victimized at a slightly higher rate (26% of the male victims to 22% of all victims who were Hispanic). As a group, male victims were older with nearly half over 30 years of age and the largest single group of male victims being middle aged males (35–59 years old).

When we examine the racial and ethnic characteristics of the victims we see that Asians and Hispanics are under-represented in the victim pool when compared with population demographics (29). On the other hand, whites and blacks are both over-represented with blacks being victimized at a rate almost three times that of the population base (27.1% of the victims, 9.8% of the population). Whites are victimized at about one-and-a-half times the rate of the population base (47.2% of the victims, 29.9% of the population).

Not surprisingly, offenders were predominantly male (99%) with only two female primary offenders identified. Of the two female offenders, one would clearly not be a sexual homicide perpetrator. In this case, the offender was a street-working prostitute during a period when a serial killer targeting prostitutes was working in the area of her stroll. Being somewhat on guard, she reacted quickly when this John began to attack her. She managed to stab him several times, piercing his liver, and then fled from the vehicle. The mortally wounded John drove about a 100 yards down the street, collapsed, and died. This woman was eventually exonerated on a self-defense claim when the deceased john's DNA came back as a match for the samples obtained from his other serial killing victims.

White males were the single largest offender group (40%), followed by Hispanic males (31%) and then black males (29%). Interestingly, there were no Asian or native American offenders in this group of known offenders. Like most other crime, these sexual homicides were predominantly intra-racial. The only ethnic group that really crossed that line were the Hispanic offenders who perpetrated equally between Hispanic and white victims. As Safarik et al. (28) noted in their analysis, this may be more a function of the larger neighborhood demographics wherein persons of Hispanic origin make up 47% of the population base. In addition, a large portion of service-based work in Los Angeles is performed by Hispanics which, consistent with routine activities theory (8), puts them through out the Los Angeles area in the normal course of the day.

These victims tended to be older with the single largest group in their middle years (35–59 years of age). By comparison, again similar to other crime, the offenders were younger with the single largest group in early adulthood (18–25 years). There was a small group of minor offenders ($n = 10$) and in six of these offenses the targeted victims were over the age of 35. Young adults (18–25 years) primarily targeted young adults. However, both adults (26–34 years) and mid-age adults (35–59 years) tended to target younger victims. For adult age offenders, 44% of their victims were younger compared with 24% being in the same age range. For middle age offenders, two-thirds of their victims were younger with one quarter being close to the same age. This suggested that as offenders age they tend to target younger victims, while young adult offenders tend to target age mates, consistent with the self perception variable in assessing offender age in criminal investigative

analysis. Forty percent of the elderly victims were targeted by offenders in the young adult age range, with 27% of the elderly targeted by middle age adults. The minor offenders showed a distinct preference for victims who were much older than they were.

Consistent with the findings of other authors (21), in sexual homicides the cause of death is much more likely to be through the result of close contact. Close contact involves any cause of death in which the perpetrator must come into direct personal contact with the victim and whose primary weapons are hands and feet or an implement requiring direct application of force by the offender. Therefore we also consider edged weapons to be a close contact cause of death. By this definition more than 60% of these deaths were by close contact whereas gunshot wounds are generally predominant in homicides in the United States. This may well reflect the distorted intimacy associated with the deaths in sexual homicides.

The evaluation of blunt force trauma as a cause of death raises some interesting issues. Meloy (6), using something of an object relations perspective, discusses the catathymic motivation in sexual homicide as a form of symbolic matricide brought about by sexualized disillusionment in the maternal object. In these cases the crime scene often exhibits considerable violence and is frequently disorganized in nature with the victim succumbing to this excess of violence. In this sample, it was interesting to discover that when blunt force trauma was the cause of death and the offenders were aged 25 and younger, 64% of the victims were over 35 years of age. This would be consistent with Meloy's proposal of the matricidal dynamic. In the two cases where blunt force trauma was the cause of death and the perpetrator was a minor (under the age of 18), the victims were older female relatives (one an aunt, the other a grandmother). In all blunt force cases, 70% of the victims were over 35 years of age when the perpetrators were under the age of 35.

These cases all list blunt force trauma as the singular or primary cause of death. In a pragmatic sense, the medical examiner may identify multiple causes of death, only one of which is blunt force trauma, so the actual number of cases exhibiting this expressive release of violence is actually higher. In reviewing the cases it was noted anecdotally that a substantial number of cases listing ligature or manual strangulation as the cause of death also identified extensive injures caused by blunt force trauma. While these injuries were not always sufficient to cause death, they are clear behavioral evidence of the expressive use of violence to discharge anger. A detailed examination of cases where the violence has a more expressive quality is underway.

A total of 38 of these homicides were prostitute murders. Brewer et al. (22) estimates the rate of prostitute homicides to be around 2.7% of all female homicides. However, they convincingly argue that this is a low-side estimate based on their own data and the review of nine other homicide datasets. While it follows logically that there will be a higher percentage of prostitute murders in a sample of sexual homicides (19.1%), it is somewhat surprising that proportionally there were seven times as many. This would tend to support the argument made by Brewer et al. that these murders are under-counted among femicides.

These authors (22) also argued that prostitute murders were more difficult to solve and they offered two reasons: they are often committed by strangers and the victims are transported farther distances to the body D. Although we did not assess the stranger-acquaintance relationship in this dataset, we did examine the spatial parameters of these prostitute murders. First, we concur with Brewer et al. and found that prostitute murders are almost six times more

likely to remain unsolved than other sexual homicides. The clearance rate for these murders was only 23.7% compared with 64.6% for nonprostitute sexual homicides. We also found a significant difference in the distance traveled from the E to the D when comparing prostitute murders to nonprostitute murders ($F_{1,135} = 10.234$, d.f. = 1, $p = 0.002$), although the effect size was quite small ($\eta = 0.071$). The mean distance traveled from E to disposal was 8.2 miles for prostitute murders and 2.3 miles for nonprostitute murders. This was perhaps due to the fact that only 17 of the 38 prostitute murders were available for this test. Only four of the prostitute murders were zero-distance trips, but with the zero-distance trips removed from the computations the difference fades ($F_{1,59} = 2.53$, d.f. = 1, $p = 0.117$, $\eta = 0.043$). Still, the mean nonzero E to D distance for prostitute murders was 10.7 miles compared with 5.8 miles for all nonzero trips for the other sexual homicides. It will take a larger sample size of prostitute murders to really determine if this relationship holds. However, right now it is generally consistent with the findings of Brewer et al. (22).

We also examined case clearance by victim and offender age. Although some interesting trends were identified, there were no significant relationships in these trends. Child homicide victims present a daunting challenge to the investigative team (30) and sexual homicides doubly so. The clearance rate for minor victims of sexual homicide was 69.7% compared with a low of 39.6% cleared for 26- to 34-year-old adults. While it would be nice to think that this is the result of a greater effort by investigators, it may be due to other case-related factors. One characteristic of younger people is that they generally have a smaller activity space. Considering the journey to E for both the youngest and oldest victims gives some insight into the differences in clearance rates.

In evaluating the distance from victim residence to encounter, we see that 71% of the minors who traveled some distance, traveled less than a half-mile and none traveled more than 10 miles. With elderly persons, two-thirds had an encounter at their residence (zero-distance trip) and of the remaining 15 (nonzero distance trip) all but one traveled less than a half-mile. Both the very young and the very old tend to travel lesser distances to the E which restricts their activity space and reduces the pool of likely offenders with whom they will intersect. This also tends to support the general supposition that the smaller the activity space the greater the likelihood the case will be cleared. Adults, 26–34 years, who had the lowest clearance rate (39.6%) had the highest proportion of trips to the E of 10 miles or more (24%).

We also examined 30-day unsolved and 180-day unsolved cases to see how this affected clearance rates. The LASD Homicide Bureau has an operational policy of not relegating unsolved cases to an inactive or suspended status and does this only in the rarest of circumstances. Of the 199 victims of these sexual homicides, only two cases had been placed in an inactive status. In both these cases an identified suspect had died and their remains were unavailable for DNA comparisons. The true definition of a cold case is one in which every workable lead has been exhausted and for which there is no new physical evidence pending. However, in the world of death investigation there are more colloquial definitions generally dependent on how long the case has been open. We evaluated case clearance against the amount of time a case had been under active investigation and set two markers for considering a case "cold;" 30 days and 6months. In modeling these two different definitions of "cold" case as predictors of case clearance we found that being 30-days unsolved was not a significant predictor but that being 180-days unsolved the case was 36 times more likely to go uncleared at the end of the study period. This would suggest that caution is advisable for administrators who want to inactivate a case after it has been open for just a month. However, clearly when a case has been open for 6 months the nut is going to be tougher to crack. Of the 110 cases eventually cleared, 91 had been closed by the 180-day mark. That left 20% of the cases open at the 6-month point that were subsequently cleared.

The spatial analyses of both victim and offender journey-to-crime trips were quite revealing. First of all, the vast majority of these crime trips involved neighborhood trips of less than a half-mile. For victims, 35% of the trips were "zero-distance" which means they were murdered in their home. Of the trips that involved at least some travel away from home, 67% involved a half-mile or less and 85% less than five miles of travel. For offender travel to the E, only 11% of these were "zero-distance" trips. Put another way, 89% of the offenders engaged in a predatory behavior to locate their victims which required some travel from their residence. Of those offenders who left home to hunt, 46% engaged in a marauder-style hunting pattern within a half-mile radius of their residence (31). Another 32% ranged out to a five mile radius which is more of an emerging commuter pattern (this covers c. 79 square miles of potential activity space). The remaining 22% engaged in a clear commuter-style hunt traveling well beyond their home neighborhood to the E.

Offender movement patterns from the E, where the victim is first targeted, to the D site, where the body is left, shows that most offenders travel between a half-mile and five miles. This analysis includes only those sexual homicides that have some travel between the E and D sites. In many cases, this travel behavior represents a relatively high-risk behavior for the offender because they have already committed a crime of abduction, sexual assault, or murder and possibly all three. In any case, should they be stopped by the police the presence of the victim's remains represents a distinct threat to their liberty. As a consequence we see generally foreshortened travel behavior ranging from under 50 feet to a maximum of 43 miles. Half of all these trips were <2.64 miles and the average trip were just slightly less than seven miles. There were nine trips of more than 15 miles, and these all involved the disposal of a body in a remote area, either the desert or the Angeles National Forest.

There is very little information on offender journey-after-crime and what there is consists primarily of the study of auto-theft (27). We were able to analyze the postoffense travel behavior in 98 cases. Of those cases, 11 had zero-distance trips following the crime, indicating they remained at the D. This was most often the offender's residence. For those offenders who traveled some distance, 30% traveled a half-mile or less and another 33% traveled between a half-mile and five miles. However, almost 20% of these offenders traveled more than 15 miles from the D to their next anchor point. The most frequent postoffense anchor point was the offender's home residence, so most of these offense-related trips were out-and-back. This is somewhat confirmed by the analysis of the direction of movement, where we see that the primary journey-to-crime direction was to the southeast and the primary journey-after-crime direction was to the northwest.

In considering offender travel behaviors and case clearance, it is not surprising that we found that of the 22 offenders whose E was their residence there was an 86.4% clearance rate. This is compared with a more evenly split clearance rate for nonzero trips from offender residence to encounter which had a closure rate of 53.1% (with 46.9% still open/active). The relationship between victim travel to E and case clearance is less dramatic, but in the expected direction. Sixty-three percent of the victim zero-distance trips were cleared when compared with 54% of the trips for which there was some travel involved.

Homicide geometry provides a systematic method for analyzing the relationship between critical locations and the homicide event. The simplest geometry occurs when the incident location is co-existent with both the victim's residence and the offender's residence (Dots). When any one of the points is separate from the other two co-located points this results in a Line geometry. A Triangle geometry occurs when all three points are separate from one another. Rossmo (14) notes that the more complicated the event geometry the more difficult the case is to clear. We found that both Dot and Line geometries were more likely to result in a cleared case than a Triangle geometry. These geometric classes do not carry specific distance information. They just indicate that the points are either together or separated in space. However, when considered in conjunction with the information about journey-to-crime we can see that the spatially more complex cases are generally more difficult to close.

Conclusions

Critical choices made by offenders in incidents of sexual murder generate specific spatial behaviors in time and distances between event locations. We see a gage for the likelihood of case solvability in the geometric patterns produced. Our research tends to corroborate the findings by Keppel et al. (32–34) on the importance of spatial and temporal factors in homicide solvability. This, combined with other solvability factors we have outlined, should suggest modifications in the investigative approach that may increase the chances of successful case resolution.

Case specifics must be considered in determining how to modify the investigative approach to best increase the chances of success. These include spatial geometry along with considerations of mode of travel, victimology, with particular emphasis on routine travel patterns and circumstances that might result in changes in those patterns, and manner of death, which may provide insight into the offender's motivation, level of organization and degree of criminal sophistication.

As soon as it is determined the victim was not murdered in her or the likely offender's residence, concerted efforts should be made to identify likely encounter, assault and M. In instances of exterior D, for example, the discovery that the victim is found within a mile of her residence or the last known location visited, a ground search of the area beginning within a quarter mile radius of the residence or last known location might reveal potential encounter, assault or M. Identifying these sites can result in a wealth of physical evidence. These can be expanded as necessary. Likewise, extensive canvassing of citizens within these areas about possible victim destinations may be required to establish where the victim was last seen and to generate potential leads. These could be augmented with an aggressive media strategy.

Finally, the longer such cases remain unsolved, the more likely they will remain so. Therefore, the closer a case comes to the 180 day mark without the development of substantial leads, the greater the need for expansion of investigative resources. Given the volume of cases typically handled by most modern forensic laboratories and the priority given to solved cases pending trial, it may be necessary to obtain administrative authorization for priority to be given to the forensic processing of evidence to breathe new life into a faltering endeavor.

From the case management perspective, a multidisciplinary review and consultation not later than 60 days from case inception may prove invaluable. Investigators, supervisors and forensic experts including pathologists and criminalists may aid in developing investigative suggestions and identifying other avenues for expert consultation. Based on findings from this study, we believe the sooner such measures are taken, the greater their potential in overcoming the daunting obstacles posed in such investigations.

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