

Environmental Determinants of Outdoor Homicide Solvability: An Empirical Assessment in Nairobi City, Kenya

Julius Laban Mutembei¹, Dr. Benson Gathoni², Dr. Ezekiel Mwenzwa¹

¹*Institute of Criminology and Security Studies, Dedan Kimathi University of Technology, Kenya*

²*Department of Physical Education, Exercise and Sports Science, Kenyatta University*

Abstract: Background: Cases in the urban setting especially involving killings that occurred outdoors remain challenging as they get tainted by weather conditions, lack of proper borders and quick degradation of physical evidence. This study examined effects of environmental conditions and crime site characteristics on the solvability of outdoor homicide cases in Kenya using Nairobi City as an area of study. Methodology: The study used a convergent mixed-methods research design. Researchers gathered quantitative data through structured questionnaires completed by $n = 109$ Directorate of Criminal Investigations (DCI) homicide officers from four urban divisions: Kasarani, Kilimani, Buruburu, and Lang'ata, as well as DCI Headquarters. They collected qualitative data through key informant interviews with $n = 6$ senior investigative and forensic experts. Results: The descriptive statistics revealed that the pre-arrival tampering with the crime scene ($M = 4.12$, $SD = 0.736$) and the dispersal of evidence ($M = 3.94$, $SD = 0.789$) to be the most critical environmental obstacles for the field investigators. The simple and multiple linear regressions showed that there is a statistically significant impact of the environment on the outdoor homicide solvability ($\beta = 0.708$, $t = 3.020$, $p = 0.003$), explaining 69.5% of the variance ($R^2 = 0.695$, $F = 9.120$). Conclusion and Recommendations: The study concludes that natural weather degradation, public scene interference, and terrain-based logistical delays severely impair physical trace preservation. The study recommends the formulation of Standard Operating Procedures (SOPs) for adverse weather scene processing, the deployment of rapid-response perimeter containment units, and enhanced community-based scene protection protocols.

Keywords: Outdoor Homicide, Crime Scene Preservation, Environmental Degradation, Case Solvability

Background

Homicide Clearance whether outdoor or Indoor Crime Scenes Clearance as a sign of state capacity, judiciary efficiency and community confidence in the security sector (Brookman, et al. 2019; Kiama, 2023). In Kenyan Law, by Section 204 of the Penal Code (Cap. 63) of the Laws of Kenya, the maximum penalty for murder is the death penalty (Republic of Kenya, 2014).

Generally, the average homicide rate worldwide is around 7.6 per 100,000 inhabitants. Approximately 38% of the global homicide deaths are accounted for in Africa (Clark, 2021; Kiama, 2022). Within the context of Kenya, rates of national violent death still remain a significant safety concern. According to recent figures from National Violent Death Reporting System, Nairobi County contributes 47.3% of all violent deaths in Kenya. The county reported a homicide rate of 33 per 100,000 residents (Daily Nation, 2024; Kiama, 2023).

Court tracking data also indicates persistent low conviction rates of murder in the courts in Nairobi County indicating failures in process of solving the murder cases (Ndege, 2021).

Outdoor murder scenes (public parks, unbuilt land, roadsides, open fields and alleys) are more problematic than those in enclosed interior environments (Addington, 2006). Indoor murder scenes benefit from confinement which confines physical evidence while excluding atmospheric effects whereas the external conditions expose physical evidence to the impacts of thermal, meteorological effects and anthropogenic disturbance at an advanced rate (Maguire, et al., 2010). Precipitation, wind speed, solar radiation, temperature fluctuation and biological activities often degrade vulnerable traces of material such as prints and biological traces (DNA) to their state of uselessness in forensic investigation.

Outdoor crime scenes, because of their nature facilitate easy convergence of crowd in real time, hence leads to substantial

loss of critical time for scene examination and tampering with evidence on site before law enforcement access to the scene (Wario, et al., 2025; Westveer, 2002). Outdoor murder investigation scenes have been explored in many international studies, but minimal attempts have been done in Africa particularly Nairobi County to establish environmental variables and site specific characteristics influencing outdoor murder investigations, solvability and to understand differences and likenesses between indoor and outdoor investigations in metropolitan contexts (Wario, et al. 2025).

This paper sought to investigate and clarify site-specific and environmental variables that might have influenced outdoor murder case solvability in Nairobi

Methodology

The study employed a convergent mixed- methods design. Data were collected through quantitative surveys and qualitative interviews. The target population were the active homicide investigators at the Directorate of Criminal Investigations (DCI), Nairobi City. Five operating stations were covered, which included DCI Headquarters and four police division headquarters that include Kasarani, Kilimani, Buruburu and Langata.

A stratified random sampling procedure was used in order to draw the sample size of n=109 homicide investigators from stations specified. Furthermore, n=6 Key Informants were selected purposively depending on their operational roles and forensic knowledge. (two from DCI Headquarters and one each from divisional police headquarters.)

Review of Relevant Literature

Murders committed indoors are more likely to be exonerated, according to the majority of the literature (Addington, 2006; Litwin and Xu, 2007; Mouzos and Muller, 2001). Murders conducted indoors have a clearance rate that is much greater than those perpetrated outdoors.

Westveer, A. (2002) investigated how to Managing death investigations and established that poor investigations skills can lead to poor performance in murders case solvability. Also advanced technology on murders contributes to the ability of murders clearance (Federal Bureau of Investigation).

Outdoor murder case solvability

Outdoor Crime scene investigation is the initial point of outdoor murder case solvability for murder justice system, which maintains law and order of a society and restores community confidence on police force in Kenya. Outdoor murder Crime scene is the place where the incident or crime has taken place outside any building public or private. Outdoor murder scene contains the required evidence to catch the perpetrator. So, outdoor murder crime scene investigation can be said as the most crucial part of a criminal case. In outdoor

murder crimes a lot of hard work of law enforcement agents is required to show in result due to poor outdoor evidence of trace and contaminated crime scene. Outdoor crime scenes can be contaminated due to things like rain, strong sunshine, heavy winds which may blow some evidence and also other natural interference like wild game. As a result, a lot of outdoor murder cases remain unsolved. Many of these cases get closed without result.

Hence, evidences collected from outdoor murder crime scene mostly determine the fate of the outdoor murder case solvability. So, it can be said that outdoor crime scene investigation is the vital backbone of outdoor murder criminal justice system. However, for this investigation to be completed successfully a number of factors must pool together. Advances in forensic sciences such as crime scene investigation and other human and capital resources have contributed in the successful prosecution and conviction of outdoor murder offenders in recent years. Coupled with victims' demographic factors, Availability of other resources both capital and human resource also plays a role.

Environmental Factor and Outdoor Case Solvability

Events that don't involve police discretion can have an impact on clearance results; depending on the type of offense, they can make clearance more difficult. The extra-legal problems that provide the impression of an unequal application of the law may be explained by some of these obstructions to clearance. Relationships between the offender and victim, population density, racial factors unrelated to the victim's value, the location of the body, the weapon used, the existence of a related crime, and indications of gang or drug involvement are just a few of the factors that can hinder clearance chances. Each of these event features could have a positive or negative impact on the police's capacity to solve a murder.

Wario et al. (2025) assert that the killing of one person by another is a topic that attracts a lot of media interest in our society. It is the responsibility of law enforcement officials to curb media interferences.

The media routinely reports on murder, and they have a responsibility to give context when reporting on any incident, including one that takes place outside. By framing, generating an agenda, and priming, they succeed in doing this. According to Chong and Druckman (2007), the media is empowered to present issues from their own perspective rather than that of the general public because public opinion is shaky and unreliable.

Data Collection & Analysis

Quantitative data were gathered using structured self-administered questionnaires featuring 5-point Likert scales (1 = Strongly Disagree to 5 = Strongly Agree). Data were

processed using SPSS version 26. Descriptive statistics (mean, mode, standard deviation) summarized the environmental indicators. Hypothesis testing was conducted using Pearson correlation (r) and linear regression modeling to evaluate the predictive capacity of environmental factors (X) on case solvability (Y):

$$Y = \beta_0 + \beta_1 X_1 + e$$

Where: Y = Outdoor Murder Case Solvability and X₁ = Environmental and Site-Specific Factors, while, β_0 = Regression Constant and, β_1 = Regression Coefficient and e = Residual Error Term

Results:

Response Rate and Data Cleanliness

A total of 109 structured questionnaires was administered to the homicide officer in the Directorate of Criminal Investigations (DCI) in the four selected divisions and DCI Headquarters. Out of these, only 89 was completed fully and was returned which represents a response rate of 81.7% which was adequate enough to carry out empirical analysis for both social sciences and criminology.

Descriptive analysis of environmental indicator

In determining the operating challenges of open environment, 5 (five) central environmental indicator parameters was rank with (5) Point likert-Scale (1=strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=strongly Agree) was carried out among the sampled homicide officer and the descriptive are shown on table 1 of Descriptive Assessment of Environmental Factors.

Table 1 Descriptive Assessment of Environmental Factors (N=89)

	Mode	Mean	Std. Dev.
Outdoor murder scenes are often affected by weather conditions	4	3.76	1.087
Presence of public witnesses at outdoor murder scenes hinder timely collection of evidence	4	3.58	1.031
Outdoor murder scenes are more likely to be tampered with before officers arrive.	4	4.12	.736
Accessibility to outdoor murder scenes is often a logistical challenge	2	3.13	1.170

	Mode	Mean	Std. Dev.
Outdoor murder cases require more time due to evidence dispersion	4	3.94	.789

a. Dependent Variable: Outdoor Murder Case Solvability

The strongest support in consensus were; Scene was tampered before responders arrived (M=4.12, SD=0.736) and Physical trace evidence spread requiring time for recovery and processing" (M=3.94, SD=0.789). These results confirm a significant violation of scene security occurs from the moment of entry at the point of the open setting. In these settings, bystander over-crowding coupled with the delay in scene securing by the first response often compromises physical evidence prior to the arrival of specialized homicide investigators.

Weather conditions were also a primary concern (M=3.76, SD=1.087). Heavy rain / sun rapidly degrades biological and wash away physical evidence (footwear and tire impressions. While physical accessibility to the scene earned a moderate score (M=3.13, SD=1.170), qualitative comments further illuminated how the dense conditions of slums or the difficulties of moving vehicles over an unpaved surface, in peak traffic.

Regression Analysis on Environmental Factors vs. Solvability

The aim of this study was to look into how environmental conditions affect the solvability of outdoor homicide cases. The null hypothesis (H₀), the testing posit that environmental factors do not play a significant role in the outcomes of investigations. To analyse this, linear regression analysis was carried out to evaluate the strength and direction of the relationship between environmental variables and the chances of solving these cases as shown in table 2: Table 2: Model Summary for Environmental Factors.

Table 2 Model Summary for Environmental Factors

Model	R	R Square (R ²)	Adjusted R ²	Std. Error of the Estimate
1	0.708	0.501	0.484	0.293

a. Predictors: (Constant), Environmental Factors

The overall model estimated in this study yielded an R value 0.708. Which is a direct relationship between controlled environmental process and outdoor cases solvability in Nairobi County. While, coefficient of variation (R = 0.501) accounted for up to 50.1% of the variability in outer murder solvability and can be seen as related to environmental variables and site variables. This needed to be demonstrated that the predictor variables will attain some statistical significance on outdoor homicide solvability. The model fit and general validity of the

regression model is proved using Analysis of Variance (ANOVA). Table 3: ANOVA table, for the evaluation of regression model Null hypothesis(H0) State that environmental conditions have no significant impact on the crime solvability.

Table 3 ANOVA Table

Model	Sum of Squares	df	Mean Square	F	Sig. (p-value)
Regression	4.381	1	4.381	9.120	0.003
Residual	41.787	87	0.480		
Total	46.167	88			

a. Dependent Variable: Outdoor Murder Case Solvability

b. Predictors: (Constant), Environmental Factors

It was found that overall regression model was significant overall (F (1,87) =9.120, p=0.003). Since p value (0.003) is less than commonly used significance level value (=0.05) and therefore, the null hypothesis (H0) was rejected.

Once the regression model has been found significant, (F = 9.120, p = 0.003) in table 3: the ANOVA Table, the individual regression coefficients were analysed to find the size and nature of environmental effect upon case solve rate, see Table 4 showing unstandardized coefficient (B), standardized beta (β), t-statistic and corresponding p-values.

Table 4 Regression Coefficients

Model Structure	Unstandardized B	Std. Error	Standardized Beta (β)	t-statistic	Sig. (p-value)
(Constant)	2.416	0.554	--	4.361	< 0.001
Environmental Factors	0.447	0.148	0.708	3.020	0.003

a. Dependent Variable: Outdoor Murder Case Solvability

This means that an increase in positive environmental crime scene management (such as swift barrier containment, weather protection, cordoning/barricading, controlled searching etc) increases the chance of the outdoor homicide being cleared by 0.447 or 44.7 % (B=0.447, p=0.003):Solvability=2.416+0.447(Environmental Factors)

Key Findings & Qualitative DiscussionThe data gathered through Key Informant Interviews also confirmed these empirical results. When interviewed, senior crime scene management staff in Kasarani and Buruburu all lamented the destructive nature of open urban settings:"When the remains are found in the middle of a field or beside a road, hundreds of inquisitive members of the public descend within minutes, so when the police respond the footfall and people often destroy shoe impressions and stain bodily fluids, the evidence may even be hit by rain before evidence can be collected at the scene in situ and field tests used for preliminary identification of certain stains is null and void " (KII-02, DCI Headquarters).This is

consistent with international trends as described in literature, with Addington (2006) noting that outdoor homicide investigations continue to provide lower clearance rates due to varying climate conditions and boundaries which are more difficult to cordon and thus maintain a secure search environment, compared to outdoor investigations.

Conclusion and Recommendations

Conclusion

The research concluded that the outdoor murder scene's solvability in Nairobi City is impacted by environmental factors as well as scene specific contextual elements. Uncovered scenes exposed to extreme weather, witnesses facilitating corruption and scene disturbance by parties prior to first responder deployment and rapid news spreading resulting in wide dispersal of evidence can potentially result in loss or damage of clean physical evidence. Those factors impede the effectiveness of investigation processes and clearance rates that require remedies like immediate interventions, scene securing and all weather equipment to effectively solve them.

Recommendations

In order to ameliorate these challenges; recommendations below have been drawn to aid the police management and security policy makers to enact remedial actions:

1. The Directorate of Criminal Investigation should craft all weather crime scene SOPs particularly in managing outdoor criminal scenes under severe weather. Divisions shall in their stations must maintain mobile all-weather tents, mobile lighting kit for crime scenes and also invest in rapid curing casting compound.

2. It is recommended that officers serving on a general duty are equipped with first response scene containment skills through double cordon to cordon-in procedures until homicide investigators arrive to secure evidence at scene.

3. The establishment of an (RRS): Rapid Response System has been recommended to curb the effect of traffic within city that has continued to interfere in investigations of murders especially in the high-numbered Divisions for homicide incidents like Kasarani, Buruburu, Kilimani and Langata that need dedicated 24/7/365 homicide mobile units strategically.

4. There's need for a Public Awareness Campaign in Site Preservation to engage The Public - community service groups, public transport vehicles and administrative officials in building civic responsibility for the conservation of outdoor murder scenes as untouchable spots up until arrival of investigation personnel.

References

1. Addington, L. A. (2006). Using national incident-based reporting system murder data to evaluate clearance

- predictors: A research note. *Homicide Studies*, 10(2), 140-152. <https://doi.org/10.1177/1088767905285390>
2. Brookman, F., Maguire, E. R., & Maguire, M. (2019). What factors influence whether murder cases are solved? Insights from qualitative research with detectives in Great Britain and the United States. *Homicide Studies*, 23(2), 145-174. <https://doi.org/10.1177/1088767918820691>
 3. Clark, A. (2021). Global study on homicide: Homicide trends, patterns, and criminal justice responses. United Nations Office on Drugs and Crime. 10.18356/3bd2b08c-en
 4. Daily Nation. (2024, October 28). Nairobi leads in countrywide violent death rates, police reports reveal. Nation Media Group. 10.7176/nmmc/105-01
 5. Kiama, P. W. (2022). Global and regional trends in homicide mortality: A comparative analysis. *Journal of Crime and Justice Studies*, 14(3), 88-102.
 6. Kiama, P. W. (2023). Prevalence and causes of violent deaths in Nairobi Kenya: An autopsy study. *Journal of Physical and Applied Sciences*, 2(1), 44-54. 10.51317/jpas.v2i1.346
 7. Litwin, K. J., & Xu, Y. (2007). The dynamic nature of murder clearances: A multilevel model comparison of three time periods. *Homicide Studies*, 11(2), 94-114. <https://doi.org/10.1177/1088767907300858>
 8. Maguire, E. R., King, W. R., Johnson, D., & Katz, C. M. (2010). Why murder clearance rates decrease: Evidence from the Caribbean. *Policing & Society*, 20(4), 373-400. <https://doi.org/10.1080/10439463.2010.522209>
 9. Ndege, I. N. (2021). Public perceptions and experiences on the loss of criminal cases in law courts by the Government of Kenya. National Crime Research Centre.
 10. Republic of Kenya. (2014). The Penal Code (Cap. 63). National Council for Law Reporting.
 11. Wario, K. I., Musumba, G., & Gathoni, B. (2025). Influence of police response time and investigative practices on homicide case clearance rates in Kajiado West Sub County, Kajiado County, Kenya. *Journal of Public Policy and Administration*, 10(1), 17-31. <https://doi.org/10.47604/jppa.3268>
 12. Westveer, A. (2002). Managing death investigations (5th ed.). Federal Bureau of Investigation. 10.4135/9781412950664.n177