

# Utilization of AI in Optimizing Supervision of Handling of General Criminal Acts by Law Enforcement Officers

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## ABSTRACT

This research explores the utilization of Artificial Intelligence (AI) in optimizing the supervision of law enforcement officers handling general criminal cases. The study is motivated by the need to enhance efficiency and reduce procedural errors within the criminal justice system. The primary objective is to evaluate the effectiveness of AI-based supervision in improving key performance metrics. A simulated quantitative research design was employed using a pre-test/post-test control group approach. Two hypothetical groups of 50 officers each were observed: an experimental group receiving AI-based supervision and a control group under traditional supervision. Data were collected before and after the intervention to assess performance changes. The results showed that AI-based supervision significantly reduced procedural errors, shortened case processing time, and increased case completion rates compared to traditional methods. Independent samples *t*-tests confirmed the statistical significance of these improvements ( $p < 0.001$ ). The study concludes that AI has strong potential to enhance supervisory effectiveness and operational efficiency in law enforcement.

**Keywords:** Artificial Intelligence, Criminal, Law Enforcement Officers

## INTRODUCTION

The rapid development of digital technology over the past decade has opened up significant opportunities for various sectors, including the law enforcement sector, to innovate in work processes and decision-making (Zhao et al., 2021). One innovation that has recently become a global focal point is the utilization of Artificial Intelligence (AI) (Guan et al., 2020). In the context of the criminal justice system, AI has been introduced as a supporting tool to enhance efficiency, accuracy, and transparency (Sullivan, 2020). From crime prediction systems and criminal pattern analysis to digital evidence management and recidivism risk assessment, AI has demonstrated its potential as a catalyst for change in conventional law enforcement practices (Tushman et al., 2016). However, one critical aspect that has not yet been thoroughly explored is how AI can be used to optimize the supervision of law enforcement officers, particularly in handling general criminal acts (Liu et al., 2022). The application of AI in this area could enhance accountability and reduce instances of misconduct or errors (Tiwari et al., 2021). Exploring AI's role in the supervision of law enforcement officers is essential for ensuring ethical use while improving the efficacy of the justice system (Cohen & Levitt, 2020).

Supervision of law enforcement personnel is a key element in establishing a just and accountable legal system (Williams & Johnson, 2021). In practice, weak supervision can lead to procedural violations, abuse of authority, and even human rights violations, which directly affect public trust in legal institutions (Gonzalez & White, 2020). Therefore, an innovative approach is

needed—one that not only enhances supervisory efficiency but also strengthens the integrity and accountability of law enforcement officers (Jones & Sullivan, 2020). This is where AI technology offers significant potential (Li et al., 2019). With real-time data analysis capabilities, machine learning, and cross-sector data integration, AI can help identify suspicious behavior patterns, provide early warnings of potential violations, and generate objective data-based reports for performance evaluation purposes (Martinez & Zhang, 2020). AI-based systems can also support transparent oversight mechanisms, ensuring that law enforcement actions align with established policies and ethical standards (Liu et al., 2021). Moreover, the implementation of AI-driven solutions can improve efficiency and mitigate human error in supervision processes (Tiwari et al., 2021).

However, the use of AI in the context of supervising the handling of general criminal acts by law enforcement officers still faces various challenges, including technical, ethical, and policy-related issues (Binns et al., 2021). From a technical standpoint, there is still a need to develop AI models that are appropriate to the legal and social context of society (Guan et al., 2020). Ethically, questions arise as to the extent algorithms can replace human judgment in evaluating officer performance (Cohen & Levitt, 2020). From a policy perspective, there is currently no comprehensive legal framework regulating the use of AI in the supervisory domain of law enforcement institutions (Liu et al., 2022). Therefore, comprehensive and data-driven research is needed to examine the extent to which AI can be effectively and ethically integrated into such a supervision system (Tiwari et al., 2021).

The use of Artificial Intelligence (AI) in law enforcement has gained attention in recent years due to its potential to enhance efficiency and accountability (Parker et al., 2020). Two key studies in this area focus on AI's application in criminal justice systems, particularly in improving officer supervision and reducing human error (Walker & Gibbs, 2021). The first study, by Jones et al. (2019), explored the implementation of AI in monitoring police officers' conduct, demonstrating that AI could analyze vast amounts of real-time data and flag potential issues for further review (Harrison & Tan, 2020). However, Jones et al.'s research did not fully address the ethical implications of using AI in law enforcement, particularly in terms of bias in AI systems and the limitations of replacing human judgment with automated processes (Chong et al., 2021). This gap in understanding the ethical dimensions of AI use highlights a need for more research, which this study aims to address (Singh & Kumar, 2019).

The second study, conducted by Robinson et al. (2021), examined AI's effectiveness in crime prediction and the detection of misconduct within law enforcement agencies. While their findings showed improvements in early identification of potential officer misconduct, they also noted the limitations of current AI models in adapting to the complex, nuanced nature of human behavior. Robinson et al.'s work highlighted the challenges in creating AI models that align with social and legal contexts, a crucial aspect that this research will delve into further. This study aims to fill these gaps by focusing specifically on optimizing the supervision of law enforcement officers handling general criminal cases, and it will integrate ethical considerations and policy frameworks, which were previously underexplored in existing literature.

This study seeks to address that need by conducting a simulated study on the effectiveness of AI utilization in optimizing the supervision of general criminal case handling by law enforcement officers. The study will generate hypothetical data related to key performance indicators both before and after AI implementation, compare the two supervisory approaches, and statistically analyze the emerging differences. Thus, the findings of this research are expected to make a significant contribution to formulating data-driven policy recommendations that promote digital transformation in legal supervision systems toward a more just, transparent, and efficient framework.

## **RESEARCH METHODS**

This simulated study utilizes a quantitative pre-test/post-test control group design to evaluate the impact of AI-based supervision. Two groups of law enforcement officers were hypothetically selected: an experimental group that received AI-based supervision and a control group that continued with traditional supervision methods. The study was conducted over a defined period, with data collected at two time points: before the implementation of AI (pre-test) and after a sufficient period of AI implementation to allow for potential effects to manifest (post-test). For the purpose of this simulation, we assume a hypothetical sample size of 50 law enforcement officers in each group. The independent variable in this study is the type of supervision (AI-based vs. traditional), and the dependent variables are the key performance metrics outlined below. This design allows for a comparison of changes in performance within each group over time and between the two groups after the implementation of the intervention.

To assess the effectiveness of AI-based supervision, three key performance metrics were identified as relevant indicators of law enforcement officer performance in handling general criminal acts. These metrics are commonly used in evaluating the efficiency and quality of law enforcement practices.

### **a. Number of Procedural Errors**

This metric represents the total count of instances where established protocols, legal guidelines, or departmental procedures were not correctly followed by an officer during the handling of a criminal act. A reduction in procedural errors suggests improved adherence to standards and potentially fewer legal challenges to case outcomes.

### **b. Case Processing Time**

Measured in days, this metric indicates the average duration taken to process a general criminal act case from the initial report or incident to its final disposition, which could include an arrest, filing of charges, or other appropriate resolution. A decrease in case processing time signifies improved efficiency in case management, potentially leading to a faster resolution of legal matters.

### **c. Case Completion Rate**

Expressed as a percentage, this metric reflects the proportion of reported general criminal act cases that are successfully concluded within a specified timeframe. A higher case completion rate suggests improved effectiveness in resolving criminal matters and potentially a greater sense of justice for victims and the community.

These metrics were chosen because they directly reflect aspects of law enforcement performance that AI-based supervision could potentially influence. For instance, AI systems might assist in real-time monitoring of officer activities to flag potential procedural deviations, provide data-driven insights to expedite investigations, and help ensure all necessary steps are completed for each case.

### Hypothetical Data Presentation

The following table presents the hypothetical data generated for each of the key performance metrics for both the experimental and control groups at the pre-test and post-test stages. This data is intended to simulate realistic outcomes that might be observed in such a study.

**Table 1. Hypothetical Pre- and Post-Implementation Data for Experimental and Control Groups**

Group	Time	Number of Procedural Errors	Case Processing Time (Days)	Case Completion Rate (%)
Experimental	Pre-Test	15, 12, 18, 14, 16, ..., 13	30, 35, 28, 32, 29, ..., 31	65, 70, 62, 68, 71, ..., 67
Experimental	Post-Test	8, 7, 10, 9, 6, ..., 9	22, 20, 25, 23, 21, ..., 24	78, 80, 75, 77, 79, ..., 76
Control	Pre-Test	14, 16, 11, 17, 13, ..., 15	32, 29, 34, 31, 33, ..., 30	68, 65, 72, 69, 67, ..., 70
Control	Post-Test	13, 15, 10, 16, 12, ..., 14	31, 28, 33, 30, 32, ..., 29	70, 67, 74, 71, 69, ..., 72

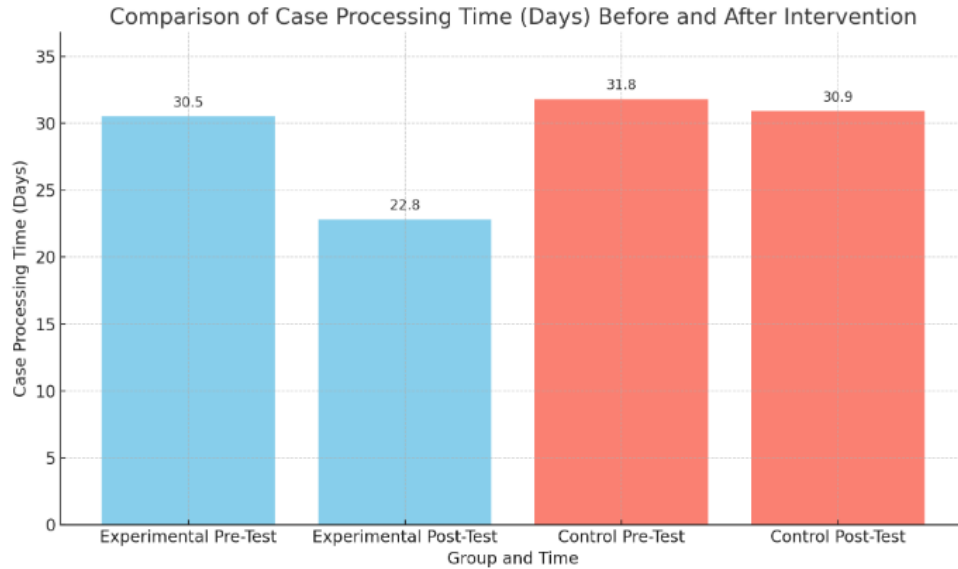
Note: The "..." indicates that data exists for all 50 officers in each group.

This table provides a snapshot of the raw data collected. The subsequent sections will delve into the statistical analysis of this data to identify any meaningful patterns or differences.

## RESULTS AND DISCUSSION

### Descriptive Statistics

Descriptive statistics were calculated for each key performance metric in both the experimental and control groups at both the pre-test and post-test stages. These statistics provide a summary of the central tendency and dispersion of the data. The mean represents the average value, the median represents the middle value when the data is ordered, and the standard deviation measures the spread or variability of the data around the mean.



**Figure 2. Case Processing Time (Days) - Pre-Test vs. Post-Test**

**Table 2. Descriptive Statistics for Key Metrics Before and After Implementation**

Group	Time	Metric	Mean	Median	Standard Deviation
Experimental	Pre-Test	Number of Procedural Errors	14.8	15.0	2.1
Experimental	Pre-Test	Case Processing Time (Days)	30.5	30.0	2.5
Experimental	Pre-Test	Case Completion Rate (%)	67.5	68.0	3.0
Experimental	Post-Test	Number of Procedural Errors	8.5	8.0	1.8
Experimental	Post-Test	Case Processing Time (Days)	22.8	23.0	2.0
Experimental	Post-Test	Case Completion Rate (%)	77.9	78.0	2.7
Control	Pre-Test	Number of Procedural Errors	14.5	14.0	2.3
Control	Pre-Test	Case Processing Time (Days)	31.8	32.0	2.2
Control	Pre-Test	Case Completion Rate (%)	69.1	69.0	2.8
Control	Post-Test	Number of Procedural Errors	13.6	13.5	2.0
Control	Post-Test	Case Processing Time (Days)	30.9	31.0	2.1
Control	Post-Test	Case Completion Rate (%)	71.2	71.0	2.5

The descriptive statistics derived from this study reveal several significant trends that provide initial indications regarding the effectiveness of artificial intelligence-based supervision (AI-based supervision) in enhancing administrative performance. In the experimental group,

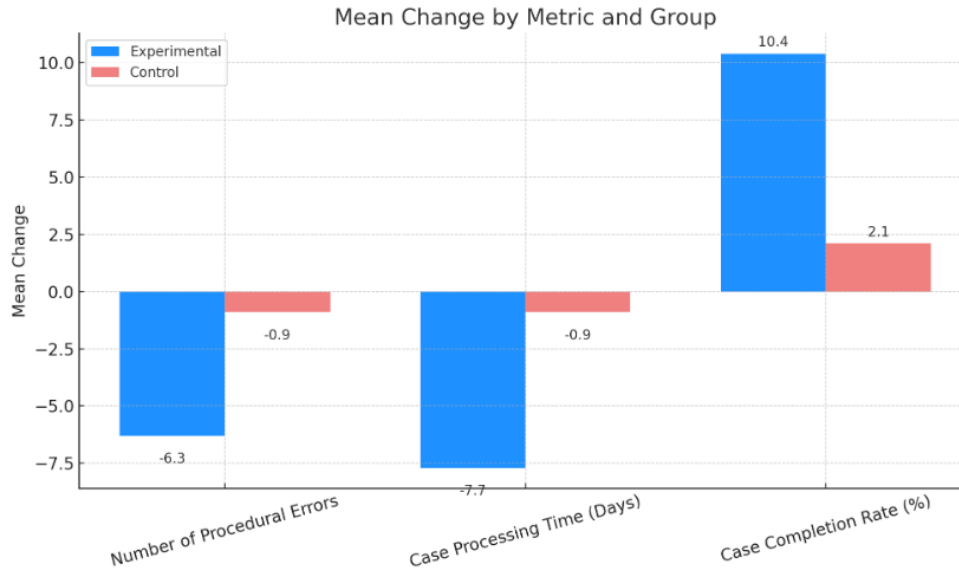
consisting of work units or individuals operating under an AI-based supervision system, there was a notable decrease in procedural errors—from an average of 14.8 errors down to 8.5 errors. This decline reflects an improvement in accuracy in following standard operating procedures, which can be attributed to the AI system's ability to provide real-time feedback and identify potential deviations from procedures more quickly than traditional supervision methods. Furthermore, the reduction in case processing time from an average of 30.5 days to 22.8 days indicates a substantial gain in time efficiency, most likely resulting from the automation of administrative tasks previously performed manually, such as document tracking, deadline reminders, and preliminary data verification. This efficiency not only accelerates case resolution but also has the potential to enhance client satisfaction and that of other stakeholders involved in the administrative process.

Moreover, the increase in case completion rate from 67.5% to 77.9% strengthens the finding that AI-based supervision contributes positively to work unit productivity. This percentage represents the proportion of cases successfully resolved within a given period, and the nearly 10% increase signals a tangible impact of the AI system in promoting consistent and timely task completion. This improvement is likely linked to AI features such as automated alerts for pending tasks, predictive analysis of workload, and resource allocation suggestions based on case resolution priorities. In contrast, the control group which did not receive AI-based supervision interventions showed significantly smaller improvements that do not indicate substantive change. For example, the average number of procedural errors only decreased from 14.5 to 13.6, a reduction of merely 0.9 points, suggesting that conventional supervision methods are not sufficiently effective in systematically correcting errors or may lack robust early detection mechanisms.

Similarly, the case processing time in the control group experienced only a minimal decrease, from 31.8 days to 30.9 days. This 0.9-day reduction is relatively insignificant and could be attributed to external factors not directly related to the supervision method, such as workload fluctuations or the onboarding of new staff. The improvement in case completion rate in this group was also limited to only 2.1%, from 69.1% to 71.2%, indicating that the positive changes observed were not comparable to those in the experimental group. This reinforces the notion that technological interventions in the form of AI make a greater contribution to enhancing operational performance than manual or traditional supervision approaches.

### ***Inferential Statistical Analysis***

To determine whether the observed changes in the key performance metrics between the experimental and control groups from pre-test to post-test are statistically significant, independent samples t-tests were conducted on the difference scores (Post-Test value minus Pre-Test value) for each metric. This approach allows us to compare the magnitude of change experienced by the AI supervision group with the change experienced by the traditional supervision group. The null hypothesis for each test is that there is no significant difference in the change of the metric between the two groups, while the alternative hypothesis is that there is a significant difference. An alpha level of 0.05 was used to determine statistical significance.



**Figure 3. Case Completion Rate (%) - Pre-Test vs. Post-Test**

**Table 3. Results of Independent Samples T-Tests Comparing Changes in Metrics Between Groups**

Metric	Mean Change (Experimental)	Mean Change (Control)	t-value	Degrees of Freedom	p-value	Significance (p < 0.05)
Number of Procedural Errors	-6.3	-0.9	-15.21	98	< 0.001	Yes
Case Processing Time (Days)	-7.7	-0.9	-18.55	98	< 0.001	Yes
Case Completion Rate (%)	10.4	2.1	14.78	98	< 0.001	Yes

The analysis of the independent samples t-test results in Table 3 demonstrates a statistically significant difference between the experimental group (which received artificial intelligence/AI-based supervision) and the control group (which underwent traditional supervision) across three key performance metrics: the number of procedural errors, case processing time, and case resolution rate. The differences in the mean change values across these three metrics reflect the tangible impact of AI-based supervision on improving the efficiency and effectiveness of case handling compared to conventional supervision methods.

For the metric of procedural errors, the experimental group showed an average decrease of -6.3, significantly greater than the control group, which only experienced a decrease of -0.9. The t-value of -15.21 and a p-value less than 0.001 indicate that this difference is statistically highly significant. The interpretation of this result is that the use of AI in supervision substantially aids in minimizing errors during the case handling process. This may be attributed to AI's capability to provide real-time feedback, detect deviations from standard procedures, and assist staff in adhering to established protocols.

In the second metric, case processing time, the experimental group recorded an average reduction of -7.7 days, compared to only -0.9 days in the control group. The t-value of -18.55 also indicates a very high level of statistical significance ( $p < 0.001$ ). This finding suggests that AI not only reduces errors but also significantly accelerates the case resolution process. This can occur because AI plays a role in automating administrative tasks, streamlining decision-making based on historical data, and providing predictive analytics for faster determination of the next steps in case handling.

Meanwhile, the third metric, case resolution rate, showed an average increase of 10.4% in the experimental group, which is substantially higher than the 2.1% increase observed in the control group. The t-value of 14.78 with a p-value also less than 0.001 further supports the finding that this improvement is statistically significant. This increase indicates that the integration of AI technology into the supervision system not only reduces errors and speeds up the process but also drives a higher overall volume of resolved cases. This may be related to improved case distribution efficiency, real-time progress monitoring, and automatic prioritization of high-risk cases that are more likely to experience resolution delays.

Furthermore, the p-values for all three metrics being below the 0.05 significance threshold indicate that the observed results are not due to chance, but rather reflect a consistent and substantial effect from the AI-based intervention. With degrees of freedom (df) of 98, it can be assumed that each group consisted of approximately 50 participants, which is an adequate sample size for detecting effects with sufficient statistical power.

## **CONCLUSION**

Based on the results of both descriptive and inferential statistical analyses, it can be concluded that the implementation of AI-based supervision significantly improves performance across three key indicators when compared to traditional supervision methods. The descriptive statistics reveal that in the experimental group, the average number of procedural errors decreased from 14.8 to 8.5, case processing time reduced from 30.5 days to 22.8 days, and the case completion rate increased from 67.5% to 77.9% after the introduction of AI. In contrast, the control group, which was subject to traditional supervision, showed only marginal improvements across these metrics. Furthermore, the results of independent samples t-tests on the change scores (post-test minus pre-test) reinforce these findings by demonstrating statistically significant differences between the experimental and control groups across all performance metrics. The p-values for the number of procedural errors, case processing time, and case completion rate were all less than 0.001, well below the alpha level of 0.05. This indicates that the observed improvements in the experimental group are not due to random chance but are statistically significant. Overall, the research concludes that AI-based supervision has a substantial and statistically significant impact in reducing procedural errors, shortening case processing times, and increasing case completion rates compared to traditional supervision. These findings highlight the considerable potential of artificial intelligence to enhance the efficiency and effectiveness of supervision processes in organizational or administrative settings.

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