UDC 351.74:005.334
DOI: 10.63341/naia-herald/2.2026.37

ISSN 2410-3594
E-ISSN 2786-7382

# A model for determining normal and critical risk levels in the activities of the national police of Ukraine based on the mean and standard deviation

**Ihor Blyzniuk***
PhD in Law
National Academy of Internal Affairs
03035, 1 Solomianska Sq., Kyiv, Ukraine
https://orcid.org/0000-0003-3882-741X

**Olena Sakharova**
PhD in Law
National Academy of Internal Affairs
03035, 1 Solomianska Sq., Kyiv, Ukraine
https://orcid.org/0000-0002-9759-5324

■ **Abstract.** The research relevance is determined by the need to enhance the analytical rigour, objectivity and consistency of security environment assessments in the activities of the National Police of Ukraine, given the dynamic changes in the crime situation. Approaches to determining threshold values for risk indicators, in particular those based on the use of the median, did not adequately account for the variability of statistical data, which limited their sensitivity to changes in time series and reduced the effectiveness of management decisions. The study aimed to develop a methodological model for determining normal and critical risk levels in the activities of the National Police of Ukraine based on the use of the arithmetic mean and standard deviation. Within the scope of the study, a risk assessment model was proposed, which involved determining the normal statistical range of indicator values and establishing threshold values for identifying risk levels. On this basis, an approach to classifying risk levels (stable, elevated, extreme) was formulated, which was based on the interpretation of deviations of indicators from the mean value and was used for the formalisation of the boundaries of the transition from a normal to a crisis state in the security environment. As a result of applying the model, the quantitative limits of the normal functioning of indicators and the threshold values for elevated and extreme risk levels were determined, enabling an objective comparison of their dynamics over time. Testing of the model using the indicator of serious bodily injury resulting in death confirmed its sensitivity to changes in statistical series and its suitability for the early detection of negative trends. The proposed approach was characterised by the reproducibility of results and reduced the dependence of assessments on subjective expert judgements, thereby enhancing the soundness of management decisions in the field of public safety. The results obtained can be used in the information and analytical support system for the activities of the National Police of Ukraine to monitor risks, respond promptly to their increase and optimise the allocation of resources

■ **Keywords**: risk assessment; risk indicators; risk-based approach; standard operating procedures; safety environment

■ **Suggested Citation:**
Blyzniuk, I., & Sakharova, O. (2026). A model for determining normal and critical risk levels in the activities of the national police of Ukraine based on the mean and standard deviation. *Scientific Journal of the National Academy of Internal Affairs,* 31(2), 37-46. doi: 10.63341/naia-herald/2.2026.37.

■ *Corresponding author (*blz122@ukr.net*)

■ Received: 12.01.2026; Revised: 09.04.2026; Accepted: 26.05.2026; Published: 01.06.2026

## Introduction

In the current climate, characterised by an increasingly complex security environment, the proliferation of hybrid threats, transnational and organised crime, and the digitalisation of criminal activity, risk assessment in law enforcement has become of paramount importance at both national and international levels. In European Union countries and states with developed security systems, risk management in policing has been based on a risk-oriented approach, involving a systematic analysis of threats, vulnerabilities and potential consequences, followed by evidence-based management decision-making. The international risk management standards ISO 31000:2018[1] and ISO 31010:2019[2], as well as the concept of Intelligence-Led Policing (ILP), involved the use of analytically processed information to set priorities, forecast threats and the rational allocation of police resources (Ratcliffe, 2016), and were widely applied in the practice of law enforcement agencies in EU member states as a methodological basis for risk assessment, criminal analysis and ILP. These approaches focus on the use of quantitative and qualitative risk indicators, statistical methods of analysis, forecasting and resource prioritisation with the aim of enhancing the effectiveness of crime prevention and ensuring public safety.

International studies highlighted the diversity of methodological approaches to risk assessment in policing. Alongside general models of risk assessment in policing, contemporary scholarship has increasingly focused on specialised areas of risk analysis. J. Phoenix & B.J. Francis (2022) analysed risk assessment practices in missing persons cases and established their impact on the outcomes of police investigations, highlighting the importance of a systematic approach to risk analysis in operational decision-making. E. Halford (2024) applied a multidimensional scaling method to analyse the classifications used by the police when assessing missing person cases, which revealed the structure and logic of police decision-making within the context of risk assessment. S. Brayne (2020) analysed the use of data and predictive models in police work, justifying the possibility of applying formalised approaches to risk assessment based on empirical information. Thus, studies reflected the gradual development of approaches to risk assessment in policing – from the analysis of decision-making practices to the use of formalised statistical models of risk analysis. A separate area of research concerned the implementation of algorithmic and AI solutions in policing. D. Marciniak (2023) analysed data on how individual risk assessments were generated using algorithms, and how these technologies were perceived by police officers themselves in the decision-making process. Researchers Y. Ezzeddine *et al.* (2023) investigated public attitudes towards the use of artificial intelligence in policing, highlighting the need to strike a balance between enhancing security and protecting privacy. These findings demonstrated that the effectiveness of risk assessment models depends not only on their statistical accuracy, but also on the level of public trust in them and the acceptability of their use by law enforcement agencies. The interdisciplinary nature of contemporary approaches to risk assessment is reflected in the study by I.M. Sunde (2025), which examines the police risk assessment system in domestic violence cases in Norway and its connection to the state's international legal obligations regarding security. The authors A. Lyall *et al.* (2023) studied the use of a pre-release risk assessment tool, demonstrating its potential for practical application in police work. T. Cranshaw *et al.* (2025) assessed the sensitivity of a specialised health screening tool for detainees, emphasising the significance of empirically validated assessment procedures in specific areas of police work. C. Logan (2022) highlighted the conceptual distinction between threat assessment and risk assessment in law enforcement, thereby clarifying the analytical foundations of modern security governance.

In Ukraine, in the context of Russian full-scale military aggression, the escalation of crime-related risks, the evolution of organised crime, and the increasing strain on the law enforcement system, the issue of introducing scientifically sound risk assessment methodologies into the operations of the National Police of Ukraine has become a matter of great importance. In their day-to-day activities, National Police units conducted continuous risk assessments of various types of crime, in particular organised crime and serious offences (Serious and Organised Crime Threat Assessment (SOCTA)[3]), identified trends in security processes and ensured an effective response to threats, covering available resources and using analytical, statistical and predictive tools. However, risk-oriented models in policing were increasingly applied not only to forecast crime-related processes, but also to assess the legitimacy, accountability and quality of policing. In particular, this concerned the assessment of harm caused by police misconduct, the use of force and the implementation of law enforcement accountability policies. Thus, an analysis of contemporary academic sources has demonstrated

[1] ISO 31000:2018. (2018). *Risk management – guidelines*. Retrieved from https://www.iso.org/standard/65694.html.
[2] ISO 31010:2019. (2019). *Risk management – risk assessment techniques*. Retrieved from https://www.iso.org/standard/72140.html.
[3] Europol. (2021). *European Union serious and organised crime threat assessment (SOCTA) 2021*. Luxembourg: Publications Office of the European Union.

the expansion of the scope of risk analysis in policing – from the assessment of crime-related processes to ensuring the accountability, legitimacy and effectiveness of law enforcement agencies. The study aimed to justify and develop a methodology for assessing risks based on statistical indicators of risk in the activities of the National Police of Ukraine, with the identification of normal and critical risk levels in police operations based on an analysis of time series data for 2021-2025, mean values and standard deviations. To achieve this aim, the article addressed the following tasks:

1) to determine the role of statistical indicators in the risk-based management system for police operations;

2) to propose an approach to classifying risk levels (stable, elevated, high) based on quantitative indicators;

3) to demonstrate the potential for the practical application of the developed methodology in supporting management decisions within the National Police of Ukraine.

The scientific novelty of the study is determined by the development of a comprehensive approach to risk assessment within the Ukrainian National Police, based on statistical data from risk indicators. This can be used for a quantitative assessment of the security environment, identifies trends in risk changes over time, and enhances the effectiveness of risk-based management in the fields of public safety and crime prevention.

## Materials and Methods

The methodological framework of the study was based on the principles of risk-based management and risk assessment methods noted in ISO 31000:2018[1] and ISO 31010:2019[2], which have been widely applied in European law enforcement practice. In international policing practice, the use of formalised risk assessment tools covered both general criminal analysis and highly specialised areas related to the assessment of vulnerability, harm, violence, missing persons, the health of detainees and interagency response. This confirmed the advisability of developing unified and transparent statistical procedures for risk assessment in the activities of the National Police of Ukraine. The assessment of the security environment in Ukraine within the Ministry of Internal Affairs was conducted following the Methodological Recommendations on the Determination (Assessment) of the Security Environment in Ukraine, approved on 26 December 2023 (internal document, not published). This approach was based on determining the upper limit of the normal range for each security environment indicator using the statistical median as the central tendency, which minimised the impact of extreme values in the time series and ensured the robustness of the assessment against outliers. This approach proved appropriate in cases of high data variability or the presence of isolated anomalous spikes in indicators.

The methodology proposed in the study for assessing risks based on statistical indicators of risk in the activities of the National Police of Ukraine was based on standard statistical procedures and official data, ensuring that it was fully reproducible. Provided that similar indicators and time series are used, it can be applied to assess risks at the regional level or adapted to the activities of other law enforcement agencies. Furthermore, the study proposed an alternative approach to risk assessment in the activities of the National Police of Ukraine, which was based on the use of the arithmetic mean and standard deviation (σ) to determine the normal statistical range of risk indicators. The mean (μ) was calculated using the formula:

$$\mu = \frac{\sum xi}{n}, \quad (1)$$

where $x_i$ – risk indicator values by year; $n$ – number of years analysed; μ – arithmetic mean. Standard deviation (σ) was calculated using the following formula:

$$\sigma = \frac{\sqrt{\sum(xi-\mu)2}}{n}, \quad (2)$$

where $x_i$ – risk indicator values by year; μ – arithmetic mean; n – number of years analysed; σ – standard deviation. The "normal" range (the limits of the normal level) was determined using the following formula:

$$d = \mu \pm \sigma, \quad (3)$$

where d – normal range; μ – arithmetic mean; σ – standard deviation. Thus, applying this formula made it possible to obtain the lower limit of the risk indicator (μ - σ) and the upper limit of this indicator (μ + σ). The threshold for the risk indicator's emergency level was calculated using the following formula:

$$p = \mu + 2\sigma, \quad (4)$$

where p – emergency threshold of the risk indicator; μ – arithmetic mean; σ – standard deviation. The empirical basis of the study was provided by official statistics on the activities of the National Police of Ukraine (Prosecutor General's Office, n.d.)[3], which reflected the state of the crime and security situation.

[1] ISO 31000:2018. (2018). *Risk management – guidelines*. Retrieved from https://www.iso.org/standard/65694.html.
[2] ISO 31010:2019. (2019). *Risk management – risk assessment techniques*. Retrieved from https://www.iso.org/standard/72140.html.
[3] Prosecutor of General's Office. (n.d.). *About registered criminal offenses and the results of their pretrial investigation*. Retrieved from https://gp.gov.ua/ua/posts/pro-zareyestrovani-kriminalni-pravoporushennya-ta-rezultati-yih-dosudovogo-rozsliduvannya-2.

For each risk indicator, time series were compiled covering a period of at least five consecutive years, ensuring comparability over time and enabling the identification of sustained trends. This sampling time horizon was consistent with approaches in statistical risk analysis and prevented distortions associated with short-term fluctuations or isolated crisis events. The time series took the form: $x_1, x_2, x_3, \ldots, x_i$, where $x_i$ – value of the corresponding risk indicator for the *i*-th year of observation, and $n \geq 5$. Time series were characterised by temporal ordering of values; homogeneity of indicators (a single indicator within a single series); the ability to identify trends (increase, decrease or stabilisation); and suitability for further statistical analysis (calculation of the mean, standard deviation and determination of risk thresholds). The use of time series of this structure ensured the comparability of indicators over time, reduced the impact of random fluctuations in individual years, and provided a well-founded determination of the limits of normal functioning of risk indicators. In the proposed methodology for assessing risks based on statistical indicators of risk in the activities of the National Police of Ukraine, the normal statistical range for each risk indicator was defined as an interval:

$$\mu \pm 1\sigma, \quad (5)$$

where $\mu$ – arithmetic mean of the indicator for the period under review, $\sigma$ – standard deviation. This approach made it possible to define the limits of typical fluctuations in the indicator in the absence of significant deviations. According to the laws of the normal distribution (Gaussian or Gauss-Laplace), approximately 68% of observations[1] decreased within one standard deviation of the mean, making this method suitable for monitoring the stability of the security environment and the early detection of risky changes. In cases where it was necessary to determine the central tendency (mean) without the influence of outliers from individual years, it was appropriate to use the statistical median. Conversely, for assessing the controllability and variability (stability) of the security situation, the use of the mean in combination with the standard deviation proved more informative. Based on the calculated statistical limits, risk indicators were classified according to the proposed methodology for assessing risks using statistical indicators of risk in the activities of the National Police of Ukraine into three levels of the security environment: stable level (low risk) – the indicator value falls within the range of $\mu \pm 1\sigma$; crisis level (elevated risk) – the value exceeds the upper limit of the normal range; emergency level (high risk) – a sustained or sharp deviation of the indicator beyond the established statistical thresholds.

The assessment of risks based on statistical indicators of risk in the activities of the National Police of Ukraine was founded on the following principles: 1) systematic approach – risk analysis was conducted separately for each indicator, with the results subsequently integrated; 2) objectivity – use of exclusively formalised statistical methods (mean ($\mu$) and standard deviation ($\sigma$)), which minimised the subjective influence of expert assessments; 3) comparability over time – the use of time series data covering a period of at least five years; 4) ease of interpretation – the results obtained can be directly used in management decisions and analytical reports. At the same time, the use of the median did not provide the degree of variability of the indicators and the intensity of their fluctuations over time to be considered. The approach proposed in the study, based on the arithmetic mean and standard deviation ($\mu \pm \sigma$), was used to assess not only of the central tendency but also of the dispersion of the indicator's values, which made it possible to formalise the limits of the system's "normal" functioning and to determine the threshold values for the transition to elevated and extreme risk levels. Thus, the median approach proved more robust to outliers and suitable for initial aggregate analysis, whilst the $\mu \pm \sigma$ approach was more informative for analytical monitoring, trend identification and early warning of changes in the security environment.

## Results and Discussion

Risk assessment within the Ukrainian National Police required not only the collection of statistical data, but also the application of formalised methodological approaches to its interpretation. In the current context, the effectiveness of risk-based management depended to a large extent on the ability of law enforcement agencies to use reproducible and statistically sound mechanisms for assessing the security environment. In this context, the integration of international risk management standards and quantitative analysis methods into the practice of the police's information and analytical activities took on particular significance. The risk-oriented approach in the activities of the National Police of Ukraine involved structuring the analysis of information on threats, vulnerabilities and the potential consequences of their materialisation in the sphere of national, economic and public (civil) security and order, as well as in the fight against crime. The application of this approach was aimed at improving

[1] OpenStax. (n.d.). *6.1 The Standard Normal Distribution*. Retrieved from https://openstax.org/books/introductory-statistics-2e/pages/6-1-the-standard-normal-distribution.

the soundness of management decisions, optimising the allocation of resources, and identifying priority areas of police activity. The ultimate objective of applying the risk-based approach within the units of the National Police of Ukraine was to identify risks in the system through which these units ensure public safety and order, combat crime, determine the elements of risk management, assess these risks, and contribute to the development of a strategy for the security system. The risk analysis toolkit used by officers of the National Police of Ukraine was based on the processing of large volumes of data using general and specialised methods, standards, standard operating procedures based on a risk-oriented approach, methodologies for risk analysis and assessment, information and analytical activities, strategic management and forecasting. This also involved the use of relevant international standards on the risk-based approach and foresight capabilities as part of the decision-making policy within the bodies (agencies, institutions) of the National Police of Ukraine. The information and analytical units of the National Police of Ukraine were central in implementing the risk-based approach; their activities involve processing large datasets, using statistical and forecasting methods, criminal analysis, geoinformation systems, predictive analytics, analytical monitoring and specialised threat assessment tools, in particular SOCTA.[1], IOCTA[2] and EOCTA[3].

The systematisation of statistical indicators of the security environment and their analysis over time have laid the groundwork for a formalised assessment of risks in the activities of law enforcement agencies. The application of quantitative methods ensured transition from a descriptive analysis of indicators to their interpretation through the definition of objective boundaries for normal and abnormal system functioning. In this context, the development of a reproducible model became significant, as it identified changes in the security environment based on statistically sound criteria. On this basis, a methodology for assessing risks using statistical indicators in the activities of the National Police of Ukraine was developed and tested, which made it possible to determine the quantitative boundaries of stable, heightened and emergency states of the security environment based on mathematical analysis of dynamic data series. The methodology was designed to determine whether the crime and security situation was in a stable, heightened or emergency state through a formalised analysis of long-term statistical time series. The assessment was conducted using a system of statistical indicators reflecting the state of the crime and security situation within the remit of the National Police of Ukraine, based on data covering a long period (at least five years). As part of the methodology developed, key statistical parameters – the arithmetic mean (μ) and standard deviation (σ) – were determined for each risk indicator, enabling the establishment of a normal statistical range for the indicator's performance and critical threshold values. This approach was consistent with the general principles of risk management stipulated in ISO 31000:2018[4], according to which risk assessment should be based on systematic, reproducible and objective data analysis. At the same time, the use of statistical parameters such as the mean and standard deviation is consistent with the logic of ISO 31010:2019[5], which provided for the application of quantitative risk assessment methods to support decision-making under conditions of uncertainty.

Based on these parameters, quantitative criteria for differentiating risk levels were proposed, according to which: 1) stable state (low risk level) – the indicator value does not exceed the upper limit of the normal statistical range (μ + σ); 2) elevated risk level – the value exceeds the upper limit of the normal range but does not reach the critical threshold (μ + 2σ); 3) extreme risk level – the value equals or exceeds the critical threshold (μ + 2σ), indicating a deterioration in the security situation. To determine the comparative values of indicators for identifying a stable, crisis and emergency state of the security environment, as maintained by the National Police units, it is necessary to establish the upper limit of the normal level for each indicator, which serves as a baseline for determining what falls within the scope of a stable, crisis and emergency state of the security environment. The determination of the upper limit of the normal range for each indicator was based on a time series and the calculation of the mean (μ) and standard deviation (σ). Consequently, data series for the years 2021-2025 were compiled for each risk indicator. Based on this data, the following were calculated: the mean (μ); the standard deviation (σ); the upper limit of the normal range (μ + σ); the lower limit of the normal range (μ - σ); and the threshold for the emergency level (μ + 2σ). The corresponding criteria for classifying risk levels are summarised in Table 1.

[1] Europol. (2021). *European Union serious and organised crime threat assessment (SOCTA) 2021*. Luxembourg: Publications Office of the European Union.
[2] Europol. (2025). *Internet organised crime threat assessment (IOCTA) 2024*. Luxembourg: Publications Office of the European Union.
[3] Europol. (2024). *Internet organised crime threat assessment (IOCTA) 2023*. Luxembourg: Publications Office of the European Union.
[4] ISO 31000:2018. (2018). *Risk management – guidelines*. Retrieved from https://www.iso.org/standard/65694.html.
[5] ISO 31010:2019. (2019). *Risk management – risk assessment techniques*. Retrieved from https://www.iso.org/standard/72140.html.

**Table 1.** Criteria for determining the security environment in the sphere of activity of the National Police of Ukraine

| Risk level | Interpretation | Criteria |
|---|---|---|
| Stable | Figures within the normal range of statistical variation | Value ≤ μ + σ |
| Elevated | Reading is above the normal range, but does not exceed the critical threshold | μ + σ < Value < μ + 2σ |
| Extraordinary | Figures demonstrate a critical deterioration in the security situation | Value ≥ μ + 2σ |

**Source:** compiled by the authors

The practical application of the risk assessment methodology based on statistical indicators of risk in the activities of the National Police of Ukraine is illustrated by the example of the risk indicator "number of cases of grievous bodily harm resulting in death detected by the National Police". For this indicator, a time series of values was compiled for the years 2021–2025: 2021 – 480, 2022 – 410, 2023 – 379, 2024 – 353, 2025 – 337[1]. On this basis, the upper limit of the normal (standard/stable) level and the critical threshold for this risk indicator were determined. Thus, the arithmetic mean for the risk indicator "number of cases of grievous bodily harm resulting in death detected by the National Police" was:

$$391.8 = \frac{(480 + 410 + 379 + 353 + 337)}{5}.$$

The standard deviation (σ) was calculated as the square root of the mean of the squares of the deviations of the actual values from the arithmetic mean, using the formula:

$$\sigma = \frac{\sqrt{\sum(480-391.8)2+(410-391.8)2+(379-391.8)2+ + (353-391.8)2+(337-391.8)2}}{5} \approx 50.6.$$

The calculation resulted in a standard deviation of approximately 50.6 cases. The standard deviation determined the typical level of variation in the risk indicator "number of cases of grievous bodily harm resulting in death detected by the National Police" and the boundaries of the "normal" range. The lower limit of the risk indicator was ≈ 341 (391.8 - 50.6), and the upper limit was ≈ 442 (391.8 + 50.6). The threshold for the extreme level of the risk indicator "number of cases of grievous bodily harm resulting in death detected by the National Police" was:

$$p = 391.8 + 2 \times 50.6 = 493.$$

Thus, the results of the statistical analysis of this risk indicator showed that the mean value of the indicator for the period under review was μ = 391.8, and the standard deviation was σ = 50.6. Accordingly, the upper limit of the normal level of the indicator was set at ≈442 cases per year, whilst the critical threshold for the emergency level was ≈493 cases per year. If the figure exceeded 442, the security situation could be assessed as deteriorated. If the excess is significant (over 493 cases), this constitutes an emergency risk level. The state of the security environment within the remit of the National Police of Ukraine for 2025, as measured by the indicator "number of cases of grievous bodily harm resulting in death detected by the National Police", was 337. Thus, a comparison of this indicator value with the upper limit and the threshold for the extreme risk level concluded that the value of the risk indicator "number of cases of grievous bodily harm resulting in death detected by the National Police" in 2025 did not exceed the upper limit of the normal range (337 < 442) and did not reach the critical threshold (337 < 493). At the same time, the value of this indicator in 2025 was below the lower limit of the normal range (337 < 341), which may indicate a structural decline in the indicator or a change in crime trends. Consequently, the status of the indicator "number of cases of grievous bodily harm resulting in death detected by the National Police" in 2025 is stable. The figures established quantitative thresholds for risk levels for the indicator under study (Table 2).

**Table 2.** Risk levels for the indicator "number of cases of grievous bodily harm resulting in death detected by the National Police"

| Level | Formula | Range of values | Interpretation |
|---|---|---|---|
| Stable (normal) | μ ± 1σ | up to 442 | Controlled situation Stable security environment |
| Advanced (difficult) | from μ + 1σ to μ + 2σ | 442-493 | Increased risk |
| Extraordinary | >μ + 2σ | more than 493 | Crisis (uncontrolled) situation in the security environment |

**Source:** compiled by the authors

[1] Prosecutor of General's Office. (n.d.). *About registered criminal offenses and the results of their pretrial investigation*. Retrieved from https://gp.gov.ua/ua/posts/pro-zareyestrovani-kriminalni-pravoporushennya-ta-rezultati-yih-dosudovogo-rozsliduvannya-2.

An interpretation of the results of the risk assessment for serious bodily harm resulting in death for the year 2025 showed that the actual value of the indicator (337 cases) was below the upper limit of the normal statistical range and did not reach the critical threshold for an extreme level of risk. The analysis confirmed that the methodology proposed in the study can be used for a quantitative assessment of the security environment by comparing the actual values of the indicators with statistically determined threshold levels. The use of the arithmetic mean and standard deviation made it possible to formalise the risk assessment procedure, ensure the reproducibility of results, and interpret changes in the security environment based on objective statistical criteria. The proposed approach made it possible to identify in a timely manner transitions from a stable security environment to an elevated or extreme level of risk without the use of subjective expert scales.

J. Chen *et al.* (2024) argued for the need for an integrated assessment of security risks that considers the spatial distribution of crime, socio-economic indicators and police resource allocation, emphasising that most existing studies have focused solely on specific types of crime, overlooking the complex nature of security risks. A systematic review by H. Ryland *et al.* (2025) demonstrated the variability of risk assessment tools used in police practice, as well as the inconsistency in their predictive accuracy, highlighting the need for standardised, statistically sound methodological approaches. The role of data in modern police analytics was further explored in the work of M. Afzal & P. Panagiotopoulos (2025), who classified police information resources into targeted, automated and crowdsourced data, emphasising their importance in forming the evidence base for risk assessment. Similar conclusions regarding the significance of information technology, algorithmic analytics and digital tools in decision-making within policing were reflected by T. Bäckman *et al.* (2025), who analysed technological (digital and algorithmic) alert systems designed to support law enforcement responses in situations related to mental health crises. The study demonstrated that such systems can improve inter-agency information sharing and facilitate the rapid coordination of decisions, whilst raising questions regarding data quality, compliance with the principle of proportionality, and the need for appropriate ethical safeguards when using algorithmically generated risk information. Research into predictive policing, notably the study by I. Mugari & E.E. Obioha (2021), has demonstrated the potential of algorithmic crime prediction, whilst also highlighting the ethical and methodological limitations inherent in such models.

A separate area of contemporary research focuses on the practical validity and applicability of risk assessment tools in policing. J. Richardson & K. Norris (2021) analysed the effectiveness of risk-screening tools in policing, highlighting their evidence base, limitations in predictive accuracy, and the need for proper training of police officers to use them effectively, whilst A.S. Almasoud & J.A. Idowu (2025) investigated the issue of algorithmic fairness in predictive police analytics systems, highlighting the risks of structural bias, lack of algorithmic transparency, and the need to ensure legal and ethical safeguards when using crime prediction models. The issue of interpreting statistical data and developing professional competence in the field of risk management was examined by C. Zimmermann (2025), who emphasised the importance of statistical literacy for the effective management of security processes. The study by L.M. Dario *et al.* (2024) demonstrated the potential for quantitatively assessing the harm caused by unlawful police actions, thereby expanding the scope of risk analysis. S. Skinner (2024) emphasised the global mechanisms of law enforcement accountability, particularly in the context of the use of lethal force. H. Zare *et al.* (2025) examined the prevalence of accountability policies across different jurisdictions, highlighting the role of risk-based approaches in ensuring oversight of police activities.

The approach to risk assessment proposed in the study, based on the arithmetic mean and standard deviation, had a range of significant advantages. First and foremost, it ensured the formalisation and reproducibility of results, as it was based on standard statistical procedures that minimised the subjective influence of expert assessments. Furthermore, this method addressed not only the central tendency but also the variability of indicators over time, which increased sensitivity to changes in the security environment. Its simplicity of interpretation and the possibility of practical application within the constraints of the limited analytical resources of the National Police of Ukraine's units were also significant advantages. At the same time, the proposed approach had certain limitations. In particular, the use of the interval $\mu \pm \sigma$ was most appropriate when the distribution of indicators approximated a normal distribution, whereas in real-world conditions, statistical series of crime-related indicators may be asymmetric or contain outliers. In such cases, the boundaries of the "normal" range may be distorted. Furthermore, the methodology did not account for structural changes in the environment (for example, the influence of military factors or reforms), nor did it address the ethical and legal issues that arose in more complex systems of algorithmic risk assessment (Wachter *et al.*, 2021), which might have required further adjustment of the models. It is therefore advisable to combine further development of risk assessment methodologies based on statistical indicators of risk in the activities of the National Police of Ukraine with the integration of multidimensional analysis.

## ■ Conclusions

The methodology for assessing risks in the activities of the National Police of Ukraine, which was developed and methodologically substantiated, was based on the use of the arithmetic mean and standard deviation as tools for determining the boundaries of the normal statistical range of risk indicators. The approach proposed in the study provided a shift from a fragmented description of individual statistical indicators to a systematic quantitative interpretation of risk levels in the field of policing and provided the means for a unified assessment of the security environment based on mathematically defined criteria. The calculations revealed that the application of the interval $\mu \pm \sigma$ ensured an objective determination of typical fluctuations in the values of risk indicators and provided a basis for identifying statistically significant deviations, which may indicate a deterioration in the crime situation or destabilisation of the security environment. Using the indicator "number of cases of grievous bodily harm resulting in death detected by the National Police" for the period 2021-2025, the arithmetic mean was determined to be $\mu = 391.8$ and the standard deviation $\sigma = 50.6$. The study established that the upper limit of the normal statistical range was approximately 442 cases per year, whilst the critical threshold for an extreme level of risk was around 493 cases. The value of the indicator for 2025 (337 cases) did not exceed the specified thresholds, which classified the indicator as stable. The actual value of the indicator in 2025 was below the lower limit of the normal statistical range ($\approx 341$), indicating structural changes in the dynamics of this type of criminal offence. The study demonstrated that the use of statistical series spanning at least five years ensured the comparability of results over time and minimised the impact of random fluctuations in individual periods. In contrast to approaches based exclusively on median values, the proposed methodology addressed not only of the central tendency but also of the degree of variability in the indicators across time series. Prospects for further research include the study of statistically oriented models for analysing the security environment in the activities of Ukraine's law enforcement agencies and the establishment of unified risk thresholds for different categories of indicators.

## ■ Acknowledgements

None.

## ■ Funding

None.

## ■ Conflict of Interest

None.

## ■ References

[1] Afzal, M., & Panagiotopoulos, P. (2025). Data in policing: An integrative review. *International Journal of Public Administration*, 48(7), 411-430. doi: 10.1080/01900692.2024.2360586.

[2] Almasoud, A.S., & Idowu, J.A. (2025). Algorithmic fairness in predictive policing. *AI and Ethics*, 5, 2323-2337. doi: 10.1007/s43681-024-00541-3.

[3] Bäckman, T., Sandegård, E., & Thodelius, C. (2025). The role of digital and algorithm-based alert systems in policing mental health crises: A scoping review. *Health & Justice*, 13, article number 75. doi: 10.1186/s40352-025-00385-x.

[4] Brayne, S. (2020). *Predict and surveil: Data, discretion, and the future of policing*. Oxford: Oxford University Press.

[5] Chen, J., Li, W., Li, Y., & Chen, Y. (2024). Integrated assessment of security risk considering police resources. *ISPRS International Journal of Geo-Information*, 13(11), article number 415. doi: 10.3390/ijgi13110415.

[6] Cranshaw, T., Austin, H., Moore, J., Evans, E., Rauf, S., Groom, F., Mannix, E., Whitehouse, E., & McKinnon, I. (2025). Evaluation of the sensitivity of the health screening of people in police custody (HELP-PC) tool in Northumbria Police, UK. *International Journal of Law and Psychiatry*, 102, article number 102101. doi: 10.1016/j.ijlp.2025.102101.

[7] Dario, L.M., Cesar, G.T., Jalbert, K., & de la Torre, F. (2024). Quantifying the impact: From prevalence to harm in evaluating police misconduct. *Journal of Criminal Justice*, 93, article number 102229. doi: 10.1016/j.jcrimjus.2024.102229.

[8] Ezzeddine, Y., Bayerl, P.S., & Gibson, H. (2023). Safety, privacy, or both: Evaluating citizens' perspectives around artificial intelligence use by police forces. *Policing and Society*, 33(7), 861-876. doi: 10.1080/10439463.2023.2211813.

[9] Halford, E. (2024). Classifying missing persons cases: An analysis of police risk assessments using multidimensional scaling. *Police Practice and Research*, 25(5), 612-639. doi: 10.1080/15614263.2024.2330623.

[10] Logan, C. (2022). Threat assessment in law enforcement: Advances in the appraisal and management of violence risk by police. In D. Canter (Ed.), *Police psychology: New trends in forensic psychological science* (pp. 313-335). London: Academic Press. doi: 10.1016/B978-0-12-816544-7.00015-2.

[11] Lyall, A., Austin, H., Alder, R., Wild, G., Reid, K., & McKinnon, I. (2023). Pre-release risk assessments: Pilot study of a novel tool in one police station in the North East of England. *Policing: A Journal of Policy and Practice*, 17. doi: 10.1093/police/paac082.
[12] Marciniak, D. (2023). Algorithmic policing: An exploratory study of the algorithmically mediated construction of individual risk in a UK police force. *Policing and Society*, 33(4), 449-463. doi: 10.1080/10439463.2022.2144305.
[13] Mugari, I., & Obioha, E.E. (2021). Predictive policing and crime control in The United States of America and Europe: Trends in a decade of research and the future of predictive policing. *Social Sciences*, 10(6), article number 234. doi: 10.3390/socsci10060234.
[14] Phoenix, J., & Francis, B.J. (2022). Police risk assessment and case outcomes in missing person investigations. *The Police Journal: Theory, Practice and Principles*, 96(3), 390-410. doi: 10.1177/0032258X221087829.
[15] Ratcliffe, J.H. (2016). *Intelligence-led policing* (3rd ed.). London: Routledge.
[16] Richardson, J., & Norris, K. (2021). Evaluating the risk assessment tools used by Australian police officers responding to domestic violence incidents: A narrative review. *Psychiatry, Psychology and Law*, 28(6), 785-801. doi: 10.1080/13218719.2020.1739576.
[17] Ryland, H., Burghart, M., Zhong, S., Fazel, S., & Yu, R. (2025). Risk assessment tools used at the policing stage for health and crime outcomes: A systematic review and meta-analysis. *Social Science & Medicine*, 383, article number 118457. doi: 10.1016/j.socscimed.2025.118457.
[18] Skinner, S. (2024). Enhancing accountability for police use of lethal force: Global monitoring and comparative benchmarking. *Policing: A Journal of Policy and Practice*, 18, article number paad100. doi: 10.1093/police/paad100.
[19] Sunde, I.M. (2025). Turning legal obligations into safety: Norway's police risk assessment system for IPV under Article 51 IC. *Nordic Journal of Studies in Policing*, 12(2), 1-19. doi: 10.18261/njsp.12.2.3.
[20] Wachter, S., Mittelstadt, B., & Russell, C. (2021). Why fairness cannot be automated: Bridging the gap between EU non-discrimination law and AI. *Computer Law & Security Review*, 41, article number 105567. doi: 10.1016/j.clsr.2021.105567.
[21] Zare, H., Gilmore, D.R., Balsara, K., Pargas, C.R., Valek, R., Ponce, A.N., Masoudi, N., Spencer, M., Warren, T.Y., & Crifasi, C. (2025). State-by-state review: The spread of law enforcement accountability policies. *Social Sciences*, 14(8), article number 483. doi: 10.3390/socsci14080483.
[22] Zimmermann, C. (2025). Statistical literacy in the police: Handling statistical information and using it for risk assessments. *Journal of Police and Criminal Psychology*, 40, 442-450. doi: 10.1007/s11896-024-09689-4.

# Модель визначення нормальних і критичних рівнів ризику в діяльності Національної поліції України на основі середнього значення та стандартного відхилення

**Ігор Близнюк**
Кандидат юридичних наук
Національна академія внутрішніх справ
03035, пл. Солом'янська, 1, м. Київ, Україна
https://orcid.org/0000-0003-3882-741X

**Олена Сахарова**
Кандидат юридичних наук
Національна академія внутрішніх справ
03035, пл. Солом'янська, 1, м. Київ, Україна
https://orcid.org/0000-0002-9759-5324

■ **Анотація.** Актуальність дослідження зумовлена необхідністю підвищення аналітичної обґрунтованості, об'єктивності та послідовності оцінювання безпекового середовища в діяльності Національної поліції України в умовах динамічних змін криміногенної ситуації. Підходи до визначення порогових значень індикаторів ризику, зокрема ґрунтовані на використанні медіани, не забезпечували належного врахування варіативності статистичних даних, що обмежувало їх чутливість до змін у часових рядах і знижувало ефективність управлінських рішень. Метою статті стало розроблення методологічної моделі визначення нормальних і критичних рівнів ризику в діяльності Національної поліції України на основі використання середнього арифметичного значення та стандартного відхилення. У межах дослідження запропоновано модель оцінювання ризиків, що передбачало визначення нормального статистичного діапазону значень індикаторів і встановлення порогових значень для ідентифікації рівнів ризику. На цій підставі сформовано підхід до класифікації рівнів ризику (стабільний, підвищений, надзвичайний), який ґрунтувався на інтерпретації відхилень показників від середнього значення і дав змогу формалізувати межі переходу від нормального до кризового стану безпекового середовища. Унаслідок застосування моделі було визначено кількісні межі нормального функціонування індикаторів і порогові значення підвищеного та надзвичайного рівнів ризику, що забезпечувало можливість об'єктивного порівняння їх динаміки в часі. Апробація моделі на прикладі індикатора тяжких тілесних ушкоджень зі смертельними наслідками засвідчила її чутливість до змін статистичних рядів і придатність для раннього виявлення негативних тенденцій. Запропонований підхід характеризувався відтворюваністю результатів і знижував залежність оцінювання від суб'єктивних експертних суджень, що підвищувало обґрунтованість управлінських рішень у сфері публічної безпеки. Отримані результати може бути використано в системі інформаційно-аналітичного забезпечення діяльності Національної поліції України для моніторингу ризиків, своєчасного реагування на їх підвищення та оптимізації розподілу ресурсів

■ **Ключові слова:** оцінювання ризиків; індикатори ризику; ризик-орієнтований підхід; стандартні операційні процедури; безпекове середовище