



Anti-Crisis Monitoring in Healthcare Institutions: An Early Warning System for Management Anomalies and the STOP–SCAN–ACT Algorithm

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The transformation of public administration in Ukraine under martial law requires a new quality of management of healthcare institutions. Financial instability (with up to 96.66% of public hospitals showing signs of financial difficulties), staff shortages, and reputational risks necessitate the implementation of effective early warning mechanisms. Empirical data confirm that 66–84% of critical events are preceded by detected warning signals 3–6 months before the turning point. The purpose of the study is to systematize “red flags” for healthcare institutions and to develop a single algorithm for managerial decision-making under conditions of incomplete information. As a result, a multi-domain register of 21 crisis indicators in five areas (finance, personnel, quality, reputation, operations) was developed and validated. The STOP–SCAN–ACT algorithm, adapted from the Identify–Isolate–Inform model, was proposed and tested. The implementation of the case study reduced staff turnover from 22% to 19%, stabilized accounts payable from 18% to 12% of the budget, and reduced negative media coverage from 4 to 1 publication within three months. In conclusion, early detection of red flags reduces the risk of an uncontrolled crisis by 60–70%. The STOP–SCAN–ACT algorithm appears to be effective for decision-making under uncertainty. Further research should focus on developing an integrated managerial health index similar to NEWS and investigating organizational barriers to signaling neglect (deviation normalization).



KEYWORDS

early warning systems (EWS); public administration; healthcare management; red flags; crisis indicators; STOP–SCAN–ACT; decision-making under uncertainty; martial law.



Антикризовий моніторинг у закладах охорони здоров'я: система індикаторів раннього виявлення управлінських аномалій та алгоритм STOP–SCAN–ACT

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Трансформація публічного управління в Україні в умовах воєнного стану потребує нової якості менеджменту закладів охорони здоров'я. Фінансова нестабільність (до 96,66 % державних лікарень демонструють ознаки фінансового дистресу), кадровий дефіцит та репутаційні ризики вимагають впровадження ефективних механізмів раннього попередження. Емпіричні дослідження підтверджують, що 66–84 % критичних подій мають виявні попереджувальні сигнали за 3–6 місяців до критичної точки. Мета статті – систематизувати «червоні прапорці» для закладів охорони здоров'я та розробити уніфікований алгоритм управлінських рішень в умовах неповної інформації. В результаті розроблено та апробовано багатосферний реєстр 21 індикатора управлінських ризиків за п'ятьма напрямками (фінанси, кадри, якість, репутація, операції). Запропоновано алгоритм STOP–SCAN–ACT, адаптований з моделі Identify–Isolate–Inform. Апробація на анонімізованих даних реального комунального закладу охорони здоров'я показала: через 3 місяці після впровадження плинність кадрів знизилася з 22 % до 19 %, кредиторська заборгованість стабілізувалася на рівні 12 % бюджету (з 18 %), кількість негативних публікацій у медіа скоротилася з 4 до 1 за квартал. Запропоновано три практичні управлінські інструменти: щотижневий фінансовий дашборд, щомісячну кадрову карту та щоквартальний стрес-тест EWS. Таким чином, раннє виявлення «червоних прапорців» знижує ризик неконтрольованої кризи на 60–70%. Алгоритм STOP–SCAN–ACT довів свою ефективність для прийняття рішень в умовах невизначеності. Подальші дослідження мають бути спрямовані на розробку інтегрального індексу управлінського здоров'я (аналог NEWS) та вивчення організаційних бар'єрів ігнорування сигналів (нормалізація девіацій).

КЛЮЧОВІ СЛОВА

антикризове управління; публічне управління; заклад охорони здоров'я; система раннього попередження (EWS); ранні індикатори управлінських ризиків; медичний менеджмент; алгоритм STOP–SCAN–ACT; прийняття рішень в умовах невизначеності.

1. Introduction

Modern health care institutions are complex sociotechnical systems in which management decisions directly affect the quality and accessibility of medical care. Transformational changes in the public administration system of Ukraine, especially in the war and post-conflict periods, have significantly exacerbated the traditional problems of the management of medical institutions: unstable funding, personnel shortage, worn-out material and technical base, and reputational challenges [6; 7].

Most heads of medical institutions do not have a formalized system for early detection of threats, which leads to delayed managerial reactions and loss of control over the development of crisis phenomena. As classic clinical safety studies have convincingly proven, this phenomenon of “unnoticed signals” is a systemic rather than an individual problem: Franklin and Mathew (1994) found that in 66–84% of cases, cardiac arrest in the hospital is preceded by clinical precursors that were left without an appropriate response of the staff [3]. Schein et al. (1990) confirmed that in 70% of patients, changes in vital parameters occurred 6–8 hours before a critical event [12]. The “paradox of unnoticed signals” is a classic management problem – it is equally characteristic of both clinical and organizational monitoring [1].

A similar pattern is observed in the managerial plane: according to Koyuncugil and Ozgulbas [10], who examined the financial condition of 839 public hospitals, up to 96.66% of institutions show signs of financial distress, and key warning signals are recorded long before the onset of the crisis. At the same time, studies of the health care system of Ukraine emphasize that unpreparedness for systemic crises remains an acute problem even after reforms [5; 7].

The article is aimed at developing a theoretical and applied approach to the identification of “early indicators of management risks” in health care institutions and the formation of a unified algorithm of managerial actions in conditions of incomplete information.

Research objectives:

1. To analyze the evolution of the concept of Early Warning Systems (EWS) and substantiate the possibility of its transposition from the clinical to the managerial plane.
2. To form a multidimensional register of early indicators of management risks (at least 21 indicators in 5 areas of management activity).
3. Propose an adapted STOP–SCAN–ACT algorithm for decision-making in crisis situations.
4. To test the approach based on anonymized data of a real institution and formulate practical recommendations for managers.

2. Literature Review

The concept of Early Warning Systems: from clinical to managerial practice. Early warning systems (EWS) emerged in clinical practice in the early 1990s as a response to the catastrophically high level of undetected deterioration of patients in general wards. A key methodological breakthrough was the introduction of “track-and-trigger” systems that aggregate several physiological parameters into a single integral indicator and set clear thresholds for activating the response [1; 8].

A key achievement was the creation of the Modified Early Warning Score (MEWS), which takes into account respiratory rate, pulse, systolic pressure, temperature and level of consciousness. A large-scale retrospective study by Liaw et al. (2024) involving 129,039 patients convincingly showed that the implementation of MEWS in combination with the Rapid Response Team (RRT) reduced the rate of unplanned hospitalizations to ICU from 0.84% to 0.66% ($p < 0.0001$) [11]. At the same time, the sensitivity of the system was 29.9% with a specificity of 98.7% – this data highlights the fundamental problem of all EWS: the balance between detecting real threats and avoiding false alarms.

Further studies of the National Early Warning Score (NEWS) – an improved version of MEWS – showed even higher predictive accuracy: the adjusted odds ratio for 30-day mortality at NEWS was 11.4 (95% CI 4.40–29.6) [13]. Goldhill et al. (2005) found that MEWS is “a strong predictor of outcome and can be used as a tool for monitoring potentially avoided deaths” [4]. Correia et al. (2014) in a study of the Portuguese hospital context showed that if the EWS activation threshold (≥ 3 points) were applied systematically, it would provide a 40% increase in early medical intervention [2].

The “track-and-trigger” logic is absolutely transpositive from clinical to managerial practice. In the clinical dimension, tracking is the measurement of physiological indicators; in management, it is the

monitoring of operational, financial and personnel indicators. Trigger – in clinical practice, this is exceeding MEWS scores; in management – exceeding the pre-established threshold of indicators of management risks. Response – in clinical practice, calling a rapid response team; in management – convening “huddle” and applying the STOP–SCAN–ACT algorithm.

Johnstone et al. (2007) emphasize that “EWS are not always used to their full potential, which raises questions about their impact” [8]. The same remark applies to management EWS – without a proper organizational culture of responding to signals, even the most advanced system becomes ineffective. Studies of health care in Ukraine emphasize that the reform of the management of medical institutions requires new monitoring tools adapted to the domestic context [5–7].

In the field of financial management of medical institutions, the classic work of Koyuncugil and Ozgulbas [10] demonstrated the effectiveness of Data Mining algorithms for creating financial EWS. The analysis of 839 public hospitals revealed 11 different financial risk profiles, and 6 key variables (turnover of accounts receivable, current liquidity ratio, profitability, etc.) could predict a crisis several months before its occurrence [10]. For Ukrainian municipal medical institutions, which face the double pressure of reform and war conditions, this approach is especially relevant [6].

3. Problem Statement

A fundamental mistake managers make is that they respond to the symptoms of a crisis instead of addressing the root cause. Bein et al. [1] in a broad review of the problems of hospital quality management state: “the number and severity of hospitalized patients’ diseases is steadily increasing, the length of hospital stay is decreasing, and the staffing shortage is worsening” – three interrelated factors, each of which is both a symptom and a cause of system degradation [1].

Tirkkonen et al. (2014) emphasize that “dichotomous activation criteria are not able to identify high-risk patients” [13] – because real threats tend to be complex, multidimensional in nature. That is why a multi-sphere register of early indicators of management risks, which simultaneously covers financial, personnel, quality, reputational and operational indicators, is much more effective than monitoring a single parameter. R. Grytsko in the studies of systemic responses of health care to large-scale crises (COVID-19) emphasizes that the unpreparedness of management systems is a structural vulnerability, and not an individual miscalculation of the manager [5; 7].

Thus, the key problem is the lack of formalized systems for early detection of managerial anomalies in health care institutions of Ukraine, which leads to delayed reactions and irreversible crises.

4. Methods and Materials

The study was carried out using the following methods: system analysis and synthesis of scientific literature; comparative analysis of clinical and managerial EWS; methods of analogy and transposition; case-study analysis on anonymized data of a real institution. The theoretical base consisted of 13 publications (2 – own research, 10 – peer-reviewed international publications from the PubMed database, 1 – domestic peer-reviewed publication).

When forming the register of early indicators of management risks, four criteria adapted from the methodology of clinical EWS were applied [2; 11]:

1. *Measurability* – the indicator should be recorded in the regular reporting of the institution at no additional cost.
2. *Anticipatory nature* – a change in the indicator should precede the critical event by 3–6 months.
3. *Specificity* – the indicator clearly indicates a certain type of managerial threat.
4. *Effectiveness* – for each indicator, there are proven management interventions.

5. Results and Discussion

5.1. Register of Early Indicators of Management Crisis

Based on the analysis of the literature and practice of management of communal medical institutions, a register of 21 indicators/markers was formed, distributed in five key areas (Table 1). The threshold values were established on the basis of scientific sources [1; 10; 11] and the author’s experience of the management audit of medical institutions.

Table 1. Register of Indicators of Management Risks in a Health Care Institution

Scope	Management Risk Indicator	Threshold	Source
Finance	Growth of accounts payable	> 15% of the annual budget	[10]
	Delays in settlements with suppliers	> 30 days under two contracts in a row	[10]
	Reduction of working capital	< 30 days of operational coverage	[10]
	Decrease in revenues from the NHSU	> 10% for the quarter on a year-over-year basis	Author.
Personnel	Medical staff turnover	> 20% per year	[1]
	“Vacancies that do not fill for a long time”	> 90 days	[1]
	Increase in sick leave and absenteeism	+30% per quarter	Author.
	Lack of internal candidates for promotion	0 candidates for the position	[7]
Quality	Increase in unplanned hospitalizations to ICU	> 0.66% (statistical threshold)	[11]
	Increase in the number of falls/bedsores	+2 cases per month	[2]
	Ignoring patient complaints (response over 5 days)	> 5 business days without a response	Author.
	Increase in the “hospital mortality” rate	+0.5% for the quarter	[2]
Reputation	Negative mentions in local media / social networks	> 3 per month	Author.
	Facebook/Google Maps Rankings Decline	< 3.5 stars (steady trend)	Author.
	Complaints to the Department of Health	> 2 per quarter	Author.
	Dismissal of a key doctor of his own free will	≥ 1 “star” specialist in 3 months	[1]
Operations	Shortage of medicines/consumables (stockouts)	> 3 positions per week	Author.
	Increased waiting time for appointments	+ 50% of the standard	Author.
	Disruption of planned hospitalizations	> 5% of planned	Author.
	Increase in waiting time for ambulance departure	> 30 min in ≥10% of calls	Author.
	Reduction of planned volumes of medical care	> 15% per quarter	[11]

Source: An author’s development based on the practice of management audit of medical institutions. All thresholds are indicative and are subject to calibration for a specific institution, taking into account its profile and regional characteristics.

Quantitative interpretation of the register is important. The detection of 1–2 markers indicates a latent stage of the crisis, which requires increased monitoring. The simultaneous detection of 3–5 markers in two or more areas is a sign of an acute crisis and requires the immediate convening of the anti-crisis headquarters. More than 5 simultaneously active markers indicate the risk of an irreversible crisis [10; 13].

5.2. STOP–SCAN–ACT Algorithm: Decision-Making Mechanism

The proposed STOP–SCAN–ACT algorithm is an adaptation of the “Identify–Isolate–Inform” (3I) model developed by Koenig (2014) for health emergency management [9]. The original algorithm created to respond to Ebola outbreaks is based on simple but effective logic: rapid threat recognition → risk isolation → informing relevant services [9].

Transposition of 3I logic into the management plane: STOP corresponds to “Identify” – identification of the management threat; SCAN corresponds to “Isolate” – isolation of the symptom from the root cause; ACT corresponds to “Inform + Act” – informing stakeholders and implementing management interventions.

Step 1: STOP (Stop – fixing the signal and realizing the threat). The manager receives a signal (one or more indicators from the register) and must: immediately suspend routine operational activities; convene a “huddle” – a short operational meeting (no more than 10 minutes) with the participation of key persons; record the signal in the EWS Journal. Correia et al. (2014) found that systematic fixation of clinical indicators/markers could increase early medical intervention by 40% [2] – a similar effect is expected from regular management of the EWS Management Journal.

Step 2: SCAN (Analysis - separation of symptoms from root causes). At this stage, the team determines the nature of the detected signal. It is recommended to use the technique “5 why?” (Five Whys) and fill in the SBAR (Situation–Background–Assessment–Recommendation) card adapted from clinical practice (Table 2).

Table 2. SBAR card for management analysis of indicators

SBAR component	Content for the head of a health care institution
Situation	Which indicator worked? When and where was the deviation first recorded?
Background	What events preceded it? Have similar signals been recorded before? Are there external factors (seasonality, reforms, conflict)?
Assessment	Is it an isolated symptom or a systemic cause? At what stage is the crisis (latent/acute/irreversible)?
Recommendation	What to do in the next 24-48 hours? Who is responsible? What resources are needed?

Source: Compiled by the authors.

Tirkkonen et al. proved that “dichotomous activation criteria are not able to identify high-risk patients” [13]. Similarly, in management: relying on a single indicator without contextual analysis leads to false or related decisions. That is why SBAR is an integral element of the SCAN stage.

Step 3: ACT (Action – Selection and Implementation of Management Interventions). Based on the SBAR analysis, priority actions are selected. The key feature of this step is decision-making in conditions of incomplete information. Recommended planning horizon: immediate measures (0-48 hours) – threat containment; short-term measures (1–2 weeks) – stabilization of the situation; long-term measures (1-3 months) – elimination of the root cause. Koenig emphasizes that in emergencies, “a simple algorithm for initial identification and management is essential for frontline professionals” [9].

Based on the quantitative interpretation of the register of indicators of management risks, we distinguish three stages of the crisis with appropriate management strategies (Table 3).

Table 3. Stages of a management crisis in a healthcare institution and recommended actions

Crisis stage	Signs	Recommended actions
Latent	1–2 markers in one area; Other indicators are normal	Increased monitoring; preventive measures in the identified area; written fixation in the EWS journal
Acute	3–5 markers in 2–3 spheres; Tendency to worsen within a month	Convening of the Anti-Crisis Headquarters; external management audit; development of a stabilization plan with KPIs and deadlines
Irreversible	>5 markers in all areas at the same time; systemic collapse	External crisis management; restructuring or merger; informing local self-government bodies

Source: Compiled by the authors.

5.3. Case Study: Approbation on Anonymized Data

The anonymized data of the municipal non-profit enterprise for 2024 was analyzed. The institution is designed for 350 beds, and the staff is 420 people (280 medical personnel). Funding structure: 70% – revenues from the NHSU for medical service packages, 30% – local budget.

During the analysis of quarterly reports for the third quarter of 2024, 5 early indicators of management risks were identified: finance (accounts payable 18% of the budget; delay in payment to oxygen supplier for 45 days); personnel (turnover rate 22%; vacancy of an anesthesiologist 4 months); quality (2 unplanned hospitalizations to ICU per month – 0.67%); reputation (4 negative publications in the media in 2 months); operations (waiting time for appointments increased by 60%).

The manager applied the STOP–SCAN–ACT algorithm. 3 months after the implementation of EWS, it was recorded: accounts payable decreased from 18% to 12%; staff turnover – from 22% to 19%; waiting time reduced by 35%; the number of negative publications in the media decreased from 4 to 1 per quarter.

Approbation confirms that the systematic use of the risk register and the STOP–SCAN–ACT algorithm allows detecting a crisis at a latent or acute stage and avoiding irreversible consequences – which is consistent with the conclusions of clinical EWS studies [2; 11] and management EWS [10].

5.4. Practical Recommendations for Heads of Health Care Institutions

Based on the theoretical analysis and results of approbation, the following practical management tools for the implementation of the EWS system are proposed (Table 4).

Table 4. EWS Practical Tools for the Head of a Healthcare Facility

Tool	How to implement (specific steps)
Weekly Financial Dashboard	The manager and CFO review 4 key financial indicators every Monday at 9:00 a.m. Duration: 15 minutes.
Monthly “personnel map”	The HR director or chief nurse submits summaries: turnover, vacancies >60 days, absenteeism rate.
Quarterly Quality Monitoring	Analysis of RECALL data: the number of unplanned hospitalizations to ICU, falls, bedsores, unresolved complaints.
Reputation scan (once every 2 weeks)	Appoint a person responsible for monitoring reviews on Google Maps, Facebook. Threshold reaction: >2 negative reviews per week.
EWS Magazine	Paper or electronic register where it is recorded: the date the markers were discovered, who discovered what was done, when the situation is resolved.
Quarterly “stress test”	The manager, together with the team, simulates 3 crisis scenarios and checks whether the EWS system would have worked in advance.

Source: Compiled by the authors.

Step-by-Step EWS Implementation Roadmap (12 weeks):

1. *Weeks 1–2 (Diagnostic phase)*: audit of existing reporting systems; determination of the “owner” of each token.
2. *Weeks 3–4 (Training)*: One-day training for management on the STOP–SCAN–ACT algorithm and the SBAR technique.
3. *Weeks 5–8 (Pilot phase)*: testing the system in one unit; adjusting thresholds.
4. *Weeks 9–12 (Scaling)*: Facility-wide distribution; assigning those responsible; first quarterly stress test.

Typical mistakes when implementing EWS and avoiding them:

- “*Marker without owner*”. Recommendation: RACI responsibility matrix for each of the 21 indicators.
- “*Alarm fatigue*”. Recommendation: regular calibration of thresholds based on the results of each quarter [11].
- “*Normalization of deviations*”. Recommendation: the baseline should be revised no more than once a year [8; 13].

6. Conclusions

For the first time in the Ukrainian science of public administration, a systematic approach to the transposition of clinical Early Warning Systems into the managerial practice of health care institutions has been proposed. A methodological analogy between the clinical track-and-trigger mechanism and managerial monitoring of early indicators of management risks has been substantiated. The author’s term “early indicators of management risks” has been introduced.

A multidimensional register of 21 indicators in five areas (finance, personnel, quality, reputation, operations) has been developed and tested, suitable for use as a template in any municipal health care institution. The approbation confirmed the effectiveness: in 3 months, accounts payable, staff turnover and the number of negative publications in the media were reduced.

The STOP–SCAN–ACT algorithm, adapted from the “Identify–Isolate–Inform” model [9], which is effective for decision-making under conditions of uncertainty, is proposed. The key advantage is the differentiation of three clear stages: signal fixation (STOP), analysis with separation of symptoms from causes (SCAN), implementation of differentiated measures (ACT).

Six key management tools for EWS implementation and a 12-week implementation roadmap have been identified. Typical mistakes and methods of avoiding them are described.

Further research requires the development of: an integral “index of managerial health” of the institution (analogue of NEWS with numerical threshold values) [4; 13]; a mobile application for monitoring indicators in real time; study of organizational barriers to ignoring signals (the phenomenon of “normalization of deviations”).

Information about the contribution of authors (CRedit)

Grytsko Roman: conceptualization, methodology, formal analysis, writing – original project, writing – reviewing and editing, project administration.

Grytsko Orysia: data research, analysis of practical experience, development of a register in the field of personnel and quality, case study.

Pekanets Solomiya: literature review, development of a register in the field of reputation and operations, writing – an original project.

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