

Innovative digital platforms in the human resources management of medical institutions

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Abstract. The study aimed to analyse the effectiveness of integrating digital technologies into the human resources management of medical institutions under conditions of dynamic workload. The methodology included a three-institution quasi-experiment with the implementation of iStaff Scheduler, ShiftMaster Pro, Systems, Applications, and Products in Data Processing SuccessFactors, MedLearn App, and Feedback360 platforms during 2024. Artificial intelligence algorithms, Student's t-test, analysis of variance (ANOVA), logistic regression, and weekly digital surveys based on the Likert scale were used. The results showed a 26% increase in the accuracy of shift distribution, a 43.3% reduction in the time required to manually correct schedules, and a 47.2% reduction in the number of conflicts in schedules. The study also recorded a 31.5% reduction in overtime workload, a 42.1% reduction in downtime due to staff shortages, and a 36.2% reduction in the adaptation period for new employees. The number of calls to the human resources department decreased by 27.8%, which demonstrates the effectiveness of decentralised digital services. According to the results of digital surveys, the level of professional engagement increased by 22.3%, readiness for change by 24.6%, and independence by 27.8%, and the emotional burnout index decreased by 19.1%. The study found that employees who actively used mobile applications, in particular MedLearn App, had higher satisfaction with working conditions ($OR = 2.31, p < 0.01$), emotional stability and positive expectations for career development. Thus, digital tools have demonstrated significant potential to improve staff efficiency and psychological resilience. The practical significance of the study is determined by the possibility of using its results for strategic workforce planning and digital transformation of human resources management in the healthcare sector

Keywords: emotional resilience of staff; algorithmic planning; digital learning; managerial innovation; employee adaptation; organisational digitalisation

Introduction

The urgency of implementing digital technologies in the systematic management of healthcare staff is driven by the increase in clinical activity, when even minor delays or errors in shift distribution can lead to excessive workload, staff burnout, and disruptions in care. Increased schedule dynamics, regulatory changes, staff turnover, and the need to respond quickly to emergencies all increase the demands on the accuracy and flexibility of workforce planning. Platforms such as iStaff Scheduler, ShiftMaster Pro, SAP SuccessFactors, MedLearn App, and Feedback360 can significantly contribute to optimising shift distribution, reducing the number of manual corrections, and enhancing staff

morale. Their use within medical institutions warranted a separate assessment of each tool's contribution and a systematic evaluation of the effectiveness of their integration. This, in turn, underscored the need for a scientific justification of the selected technologies and approaches.

Difficulties in balancing workload and staff availability remain a relevant issue, especially in the context of seasonal workload spikes. V. Shostak (2024) applied traditional methods of manual schedule correction and constraint programming but did not address the impact of real-time machine learning algorithms. This resulted in limited adaptability of the system to unpredictable changes and main-

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tained a high level of human time spent on making corrections. Another problem is the insufficient consideration of the psychological state of medical staff during staffing planning. K.S. Malakhov (2023) implemented digital surveys through platforms but did not combine the results with analytics to automatically adjust changes. Due to the lack of integration of survey data with planning systems, a significant reduction in the level of professional burnout was not achieved, and the full adaptation of staff remained insufficiently studied. The problem of the lack of a predictive function in staffing planning deserves detailed attention. N. Veresniuk *et al.* (2021) used historical analytical models and regression methods, but their solution did not consider the variable interaction between the number of staff and the pain burden of patients. As a result, the predictive models could not adapt to the distribution of changes in real time, which limited their practical value. The problem of inconsistency between technical tools and staff training is a key issue in practice. B. Liu *et al.* (2024) analysed the technical settings of demo versions of digital platforms but did not consider the human factor of adaptation. This led to a low level of user readiness and, as a result, to a decrease in the effectiveness of even well-configured systems.

Another pressing issue is the lack of a unified feedback system for human resources (HR) analytics and management in the format of online platforms. A. Malik *et al.* (2024) implemented Feedback360 as a standalone tool, but without linking it to HR planning, this resulted in insufficient analytical integration and limited ability to draw operational conclusions from mixed data. A common problem is the lack of validation of interfaces in the clinical environment. D. Aggarwal *et al.* (2024) compared commercial solutions without considering the specifics of mixed variables in the clinical environment and emergencies. Due to insufficient testing under real-world conditions, they found that interfaces such as the MedLearn App were of low practical use. Another problem is the focus on short-term performance metrics, without assessing long-term changes in staff behaviour. S. Kraus *et al.* (2021) conducted a quasi-experiment that captured changes over a single quarter, but the lack of follow-up made the conclusions incomplete in terms of the sustainability of effects and staff retention. Another problematic area is the lack of statistical validity in studies on the digital engagement of staff. A. Vallée (2023) used regression analysis, but ignored controlling for multiple confounders, which reduced the reliability of the coefficients of the platforms' impact on workplace satisfaction and stress resilience. Such identified gaps in the justification of the use of digital technologies require a systematic study using modern analytical methods. Thus, the study aimed to assess the effectiveness of integrating digital technologies into the HR management of medical institutions under dynamic workload. The objectives of the study included: analysing the impact of artificial intelligence (AI) algorithms on the accuracy of shift distribution; determining the effect of platforms on reducing manual correction of schedules; assessing the impact of digital tools on staff

psychological indicators; developing recommendations for strategic planning; and verifying the link between digital activity and satisfaction with working conditions.

Materials and Methods

The study was conducted in Ukraine in January–December 2024 at three state-owned medical institutions in Kyiv, Lviv, and Kharkiv. The temperature and climatic conditions of the study area varied from 5°C to +30°C, which was addressed during analysis of seasonal fluctuations in patient flow, increased staff workload, and the dynamics of scheduling during periods of increased risk. All interventions were conducted following ethical requirements, with written consent from staff (Declaration of Helsinki, 2013; European Commission, 2021). Personal data was anonymised and stored in an encrypted database, access to which was regulated by the internal cybersecurity policies of each institution. To evaluate the effectiveness of digital tools in scheduling shifts and allocating resource load, the iStaff Scheduler (USA) and ShiftMaster Pro (Canada) platforms were implemented and integrated with local HR systems of medical institutions. Artificial intelligence algorithms were adapted to the clinical context, considering historical data on patient flow, duty schedules and staff qualifications. To identify changes after the implementation of the systems, key indicators were compared, including the accuracy of shift distribution, the time required to adjust schedules, and the frequency of conflicts between schedules. In addition, the potential impact of AI algorithms on the speed of change approval, the speed of filling vacancies, and the level of managerial satisfaction was analysed. The results were processed using quantitative statistical analysis methods, including Student's t-test and ANOVA, which identified statistically significant changes in the dynamics of processes.

The MedLearn App (USA) and Feedback360 (Germany) mobile applications were implemented for continuous training, staff assessment and feedback collection. "Continuous learning" meant regular access to interactive educational content, including clinical simulations, micro-modules on updated treatment protocols, video instructions, test tasks and personalised educational trajectories according to specialisation. The MedLearn App recorded the user's progress and generated individual recommendations based on test results and viewing history. To assess the psycho-emotional state of the staff, weekly digital surveys were conducted through the Feedback360 platform using a 5-point scale R. Likert (1932), which covered such variables as professional engagement, emotional burnout, readiness for change, and decision-making independence. Employees were asked to answer the following questions: "I feel involved in the processes taking place in my unit", "I have the energy to perform my daily professional duties", "I am open to new work formats or changes in the schedule", "I can make decisions independently in difficult work situations", etc. The data obtained was used to form an integrated profile of each employee, identify group trends and promptly adjust management decisions following the current

psychological climate in the teams. The sample consisted of 420 healthcare workers aged 25 to 60 who had continuous access to mobile devices. The study involved 138 employees from a hospital in Kyiv, 127 from a hospital in Lviv, and 155 from a hospital in Kharkiv. In terms of professional structure, 42% were doctors, 52% nursing staff, and 6% technical staff. Employees with technical limitations in using the apps (lack of a smartphone or low level of digital literacy recorded in the previous survey) were not included.

To assess interregional differences in the impact of digital tools on staff efficiency and psychological engagement, a comparative analysis was conducted between three medical institutions. The study used ANOVA to identify statistically significant between-group differences in variables such as shift distribution accuracy, overtime workload, staff adaptability, emotional burnout, and decision-making autonomy. The HRM system SAP SuccessFactors (Germany), linked to the Microsoft SQL Server platform (USA), was used to optimise personnel records and workload. The system provided automatic scheduling, time tracking, personal files and professional development history. The comparative analysis was conducted by the following variables: average number of hours of overtime, average downtime due to staff shortages, speed of adaptation of new employees, and average number of requests to the HR department. Statistical analyses included Student's t-test for linked samples to compare mean values before and after the introduction of digital tools (e.g., average time to review changes, number of errors in schedules), Fisher's test to determine

the relationship between the use of mobile platforms and the level of staff engagement, and ANOVA to identify intergroup differences in the level of adaptability. Logistic regression was used to assess the relationship between digital engagement and satisfaction with working conditions. All statistical tests were conducted at the set significance level of $\alpha = 0.05$. Data were processed in R Studio (version 4.2.1) using the tidyverse, car, and psych packages and visualised in Tableau Desktop 2023.1. To test the internal consistency of the questionnaires, the Cronbach's α coefficient was used, with a value of 0.87. The reliability of the regression models was tested by the Wald test.

Results

After the implementation of the digital scheduling systems iStaff Scheduler and ShiftMaster Pro, a significant improvement in the functioning of personnel processes was identified. According to the results of the comparison between before and after implementation, the accuracy of shift distribution increased by an average of 26%, the time for adjusting schedules decreased by 43%, and the number of conflicts between shifts was almost halved. The biggest improvement was recorded at the Kharkiv hospital, due to a more complex shift structure and a higher initial error rate. The data demonstrates the adaptability of AI algorithms to high dynamics and mixed staffing. The systems proved to be most effective when working with a variable schedule and many departments, which optimised the working time of middle managers (Table 1).

Table 1. Performance indicators of digital timetable management systems before and after implementation

Metric	Before implementation	After implementation	Δ , %
Accuracy of change distribution (%)	71.2	89.6	+26
Average schedule correction time (min)	42.5	24.1	-43.3
Number of conflicts between schedules/month	17.8	9.4	-47.2

Source: compiled by the author

The integration of iStaff Scheduler and ShiftMaster Pro digital technologies into the HR processes of three state medical institutions in Ukraine has demonstrated a high level of efficiency, particularly in shift scheduling optimisation. AI algorithms adapted to the clinical environment, considering the history of patient flow, previous duty schedules and staff qualifications, have led to a significant increase in the accuracy of automatic shift allocation. Before the implementation, the average accuracy level was only 71.2%, which indicated frequent cases of staff being placed in inappropriate time slots or repeated errors in the workload of departments. After the integration of AI systems, the accuracy rate increased to 89.6%, which corresponds to a 26% increase. This indicates that digital tools have significantly reduced the probability of administrative failures caused by human error. A reduction in the average time required for manual correction of schedules from 42.5 to 24.1 minutes (-43.3%) confirmed the effectiveness of the algorithms in detecting anomalies and automatically recalculating shift distribution options. In situations where

changes were caused by urgent requests or unplanned events, the systems demonstrated the ability to quickly generate new schedules, considering the requirements for rest time, individual workload, and interprofessional balance. This reduced the number of cases of incomplete staffing, especially in the context of a heavy workload in intensive care and emergency departments.

An even more noticeable result was a reduction in the number of conflicts between schedules from 17.8 to 9.4 cases per month (-47.2%). Conflicts that used to arise due to overlapping shifts, double scheduling, or violations of working time standards have been significantly reduced by automatic preventive algorithms. These mechanisms proved to be particularly useful when creating schedules for night and holiday shifts, which are traditionally the most conflict-ridden. A more even workload and algorithmic rotation not only reduced the administrative burden but also helped stabilise the emotional climate in the teams. The regional analysis showed the most pronounced positive effects in the Kharkiv hospital. Digital tools were

used in the context of high staff turnover, frequent changes in the composition of teams, and the need to respond to emergencies instantly. This experience proved that AI models with high data variability work more efficiently than in environments with stable structures. In Lviv and Kyiv, the implementation was also successful, but the initial indicators were much higher, which reduced the amplitude of improvement.

In addition, there has been a positive effect on operational communication between departments: due to the visualisation of schedules in a mobile format and instant notifications of changes, the time for coordinating changes between managers has been reduced. This reduced the overall management burden by 17-22% (according to surveys of shift coordinators), shifting priority to strategic rather than routine management tasks. As a result, digital solutions have demonstrated the ability not only to automate processes but also to transform the logic of HR

management in the healthcare sector. They have ensured greater transparency, predictability and adaptability of the change system, creating the basis for its further digitalisation. The use of the SAP SuccessFactors HRM system integrated with Microsoft SQL Server has made it possible to centralise the accounting of personnel indicators and significantly reduce administrative costs associated with maintaining documentation, scheduling and onboarding new employees. According to the results of a comparative analysis, the average number of overtime hours per employee decreased by 31.5%, the average downtime due to staff shortages by 42.1%, and the speed of onboarding new employees increased by 36.2%. There was also a reduction in administrative burden: the number of requests to the HR department decreased by 27.8%. These results demonstrate the effectiveness of digital management in both preventing excessive workload and optimising human resources using real-time analytics (Table 2).

Table 2. Changes in key staffing indicators after the implementation of the HRM system

Metric	Before implementation	After implementation	Δ , %
Average number of overtime hours per person	13.7	9.4	-31.5
Average downtime due to staff shortages (hours/month)	8.1	4.7	-42.1
Average onboarding time for new employees (days)	19.9	12.7	-36.2
Number of requests to the HR department/month	158	114	-27.8

Source: compiled by the author

The implementation of the SAP SuccessFactors HRM system integrated with Microsoft SQL Server was a key factor in the transformation of HR management in the three healthcare institutions studied. The analysis of the pre- and post-implementation indicators shows a comprehensive improvement in several critical areas that have a direct impact on the efficiency of staff allocation, the quality of internal services, and the stability of the organisational structure. One of the most significant results is the reduction in the average number of overtime hours per employee from 13.7 to 9.4 hours per month (-31.5%). This indicator is critical in the clinical context, where excessive workload can lead to increased errors, emotional burnout, and staff turnover. The study determined that the digital system can predict peak workloads based on historical data on patient flow and automatically reallocate resources. The system also covered the standard working hours, qualification restrictions and the availability of permits, which minimised the number of violations of labour law.

The significant reduction in average downtime due to staff shortages (from 8.1 to 4.7 hours per month, i.e., 42.1%) demonstrated that the system provided a timely response to resource shortages. Due to the integrated alert mechanisms, branch managers received warnings of staff shortages before the situation became critical. Based on risk assessment algorithms, SAP SuccessFactors offered scenarios ranging from mobilising related staff to initiating a search for a reserve or postponing less critical procedures. This approach reduced unproductive time, ensured

the continuity of medical services and increased the overall logistical resilience of the institutions.

The third key area is improving the onboarding process for new employees. The average onboarding time was reduced from 19.9 to 12.7 days, a 36.2% reduction. This was made possible due to the system's functionalities, which included individual digital onboarding trajectories, automated issuance of instructions, monitoring of training modules and progress analytics. New employees quickly navigated the institution's structure and had access to integrated reference books, treatment standards and administrative procedures, which reduced the time to full productivity. In addition, the system was used to track the stages of adaptation and respond to identified difficulties promptly. A separate managerial benefit was a 27.8% reduction in the number of requests to the HR department (from 158 to 114 requests per month). This is a testament to the decentralisation of HR information, which is available directly through employees' digital accounts. All standard actions, such as checking leave balances, submitting applications for schedule changes, and clarifying documents, were transferred to electronic format, which reduced the need for personal visits and communications with administrators. This, in turn, reallocated the HR department resources to analytical and strategic activities.

In addition, the analysis of time dynamics showed that the effect of the HRM system implementation was cumulative. During the first three months, the changes were moderate, but from the fourth month onwards, the system

reached the optimal level of integration into operational processes. The highest improvement dynamics were observed in Kharkiv, where staff turnover was higher. This accelerated learning from a large amount of data, creating more accurate predictive models. In Kyiv and Lviv, the effects were smoother but more stable, which is consistent with a less dynamic environment. Thus, SAP SuccessFactors has proved to be an effective strategic HR management tool that can be used to optimise not only current but also forecasted processes of labour allocation, forming the basis for a digitally oriented HR policy.

The MedLearn App and Feedback360 mobile applications, implemented in all three healthcare facilities, provided a platform for continuous learning, staff performance assessment and feedback collection. The study participants were surveyed weekly using a 5-point Likert scale

that assessed the level of emotional burnout, professional engagement, readiness for change, and decision-making independence. As a result of the introduction of digital platforms, the level of engagement increased by 22.3%, the emotional burnout index decreased by 19.1%, and the readiness for change and autonomy increased by 24.6% and 27.8%, respectively. The emotional burnout index was based on the average scores of responses to five Likert scale items covering fatigue, decreased professional motivation, emotional distance, irritation, and subjective feeling of exhaustion. All the items were adapted from a modified version of the Maslach Burnout Inventory, which addressed the specifics of the medical environment. The data obtained indicate a positive impact of digital technologies not only on administrative processes, but also on the psychological readiness of staff for innovation (Table 3).

Table 3. Psycho-organisational changes based on the results of weekly digital surveys (Likert scale, 1-5)

Metric	Before implementation	After implementation	Δ , %
Level of professional engagement	3.31	4.05	22.3
Emotional burnout index	3.41	2.76	-19.1
Readiness for changes	2.93	3.65	24.6
Independence in decision-making	3.18	4.07	27.8

Source: compiled by the author

The integration of the mobile digital applications MedLearn App and Feedback360 into the daily practice of three medical institutions has become a determining factor in changes in staff behaviour. These tools provided constant availability of learning content, functionality for self-assessment, feedback and micro-analysis of emotional state, which created a new format of interaction between the employee and the organisation. According to the results of weekly Likert scale surveys covering four variables: professional engagement, emotional burnout, readiness for change, and decision-making autonomy, there was a statistically significant improvement in all parameters. The most pronounced growth was shown by the sense of autonomy in decision-making, which increased from 3.18 to 4.07 points (+27.8%). This is an indicator of the development of internal leadership, increased confidence in personal decisions and the ability to act autonomously in the face of uncertainty. Healthcare workers who had access to simulated clinical scenarios, reaction scores, colleagues' decision history, and AI-based system recommendations showed less dependence on administrative instructions. This reduced the workload of middle managers while increasing the speed of clinical response in a dynamic environment.

At the same time, the readiness for change grew: the average score increased from 2.93 to 3.65 (+24.6%). This indicator is critical in the context of the digital transformation of healthcare facilities. The growth reflects a decrease in institutional resistance and the formation of a more open environment ready for technological innovation. In the process of adapting mobile platforms, staff often reported increased awareness of the goals of change,

transparency of processes, the ability to discuss innovations, and participation in feedback. This created an atmosphere of involvement and shared responsibility for the results. The professional engagement scores also improved significantly, rising from 3.31 to 4.05 points (+22.3%). Engagement is a critical predictor of team stability, productivity and reduced staff turnover. The survey results showed that the availability of individualised development trajectories, visualisation of personal achievements and regular digital feedback had a positive impact on employee motivation. The "mini recognition" mechanism was more effective: automatic notifications about achievements, completion of modules, and contribution to team goals, which formed a positive affective connection with the institution.

Another key result is a decrease in the level of emotional burnout from 3.41 to 2.76 points (-19.1%). In the context of medicine, this indicator is critical for maintaining the long-term functionality of the healthcare system. The self-diagnostic and anonymous reporting mechanisms available in the Feedback360 app helped to identify early signs of destabilisation. Users were able to analyse their emotional state, receive personalised advice, and in difficult cases, forward the data to psychological support specialists. This helped to create a culture of prevention of psycho-emotional burnout. The time analysis showed that the most active dynamics of changes occurred in the first 6-8 weeks after the start of using the apps. After that, most of the indicators reached a plateau, indicating that the new behavioural model had stabilised. At the same time, the Kharkiv hospital recorded a repeated increase in readiness for change after 12 weeks, which is associated with the launch of the module for

self-development of the curriculum, which gave staff more control over their professional development. In summary, mobile platforms have acted not only as tools for technical optimisation, but also as catalysts for transformations in organisational behaviour. They activated internal staff resources, supported stress resistance, and increased the subjective sense of value and participation in a collective goal. The result was an adaptive, digitally competent environment capable of self-regulation and innovation.

To determine the relationship between employees' digital engagement and satisfaction with working conditions, a logistic regression was conducted, where digital engagement was determined by the number of logins to

the HRM system, use of mobile applications, and participation in digital surveys. The level of satisfaction was assessed by an integral indicator based on the Likert scale for emotional state, workload balance, management support, and access to development. The model results indicate a strong positive correlation between the intensity of digital activity and the probability of high satisfaction. Regular use of the MedLearn App ($OR = 2.31$, $p < 0.01$) and integration into digital change planning ($OR = 1.87$, $p < 0.05$) had the highest weight, which confirms the importance of personal involvement in digital processes for the formation of subjective comfort in the professional environment (Table 4).

Table 4. Logistic regression: the impact of digital activity on the level of satisfaction with working conditions

Predictor variable	Odds Ratio (OR)	p-value	Interpretation
Frequency of use of the MedLearn App	2.31	<0.01	High impact
Regular participation in Feedback360 surveys	1.59	<0.05	Moderate impact
Frequency of logins to SAP SuccessFactors	1.42	<0.05	Sustained positive impact
Interaction with digital shift schedules	1.87	<0.05	Significant impact
Use of more than 2 digital channels daily	2.08	<0.01	Independent predictor of high satisfaction

Source: compiled by the author

The results of a logistic regression analysis of the relationship between the level of digital activity of medical staff and subjective assessment of working conditions revealed several key digital predictors that were statistically significantly associated with increased satisfaction. Digital activity included the frequency of logins to the SAP SuccessFactors HRM platform, the number of interactions with the MedLearn App and Feedback360, activity in digital change planning, and the integrated use of multiple digital channels daily. The integral satisfaction index was formed based on respondents' assessments of emotional comfort, fairness of workload distribution, management transparency, and access to development.

The highest regression coefficient was observed for the variable "frequency of use of MedLearn App" ($OR = 2.31$; $p < 0.01$), which indicates a significant impact of continuous access to individualised training on the formation of a positive attitude towards the work environment. Employees who regularly completed the modules reported greater confidence in their professional skills, a sense of personal development, and increased control over their career trajectory. The study participants reported a high value of the embedded clinical cases, error analysis and automated feedback, which not only taught but also reduced anxiety about the assessment. Interaction with digital shift schedules was an equally significant factor ($OR = 1.87$; $p < 0.05$). Employees who were able to adjust their schedules, participate in internal planning, coordinate shifts, or exchange shifts with colleagues through SAP SuccessFactors demonstrated a higher level of emotional stability and a sense of fairness. It also reduced the number of conflicts related to uneven workloads and promoted a responsible approach to shift distribution.

The frequency of logins to the HRM platform ($OR = 1.42$; $p < 0.05$) is an independent predictor of satisfaction, which demonstrates the role of information transparency in reducing organisational tension. Access to data on personal files, qualification status, leave balances, calendar of events, and incentive history contributed to increased trust in the management system. Employees who had a complete picture of their professional position in the system reported less uncertainty, faster decision-making and a higher level of result orientation. Regular participation in Feedback360 surveys ($OR = 1.59$; $p < 0.05$) was also positively correlated with satisfaction. This result demonstrates the importance of emotional engagement, feedback, and a sense of employee voice in the organisation. In the focus groups, respondents emphasised that through Feedback360, they began to perceive management as an open-to-dialogue party that responds to employees' requests and emotional state. The anonymity of the surveys reduced the fear of negative consequences for critical remarks, which encouraged honesty in responses and improved the quality of data for management decisions.

The variable "using more than two digital channels daily" ($OR = 2.08$; $p < 0.01$) deserves special attention, as it had a significant integration effect. Employees who were involved in several digital platforms daily were more likely to have a positive assessment of their working conditions. This multi-channel approach created a sense of a digital support environment where information, training, scheduling and emotional state were integrated into a single system. Such employees were the most active in internal communication, self-organised and prone to innovative practices. In summary, the results of the regression analysis confirm that digital activity is not only a behavioural marker

of a modern employee, but also a key factor in building satisfaction with working conditions. The high values of regression coefficients indicate the effectiveness of digital platforms as a means of creating a transparent, adaptive and psychologically safe organisational environment in the healthcare sector.

Discussion

This study showed a 26% increase in the accuracy of shift distribution, which demonstrates the effectiveness of integrating iStaff Scheduler and ShiftMaster Pro into the HR management process. Artificial intelligence algorithms have provided a more accurate consideration of the factors of department workload, qualifications, and historical data. M. Ghonim *et al.* (2024) reported a 15% improvement in accuracy in lower-dynamic environments, while M. Gonzalez-Moreno *et al.* (2023) recorded an increase of over 30% in environments with high staff turnover. The comparison confirms that the effectiveness of AI solutions is directly proportional to the complexity of the management environment; thus, adaptability is a key advantage of the implemented systems.

A 43.3% reduction in the time required for manual correction of schedules demonstrated the efficiency gains achieved through automated anomaly detection and prompt recalculation of shifts. The study particularly emphasised the role of adaptive algorithms that can consider not only standard constraints but also non-standard situations, such as sudden vacations, shift changes, or employee illness. W. Wang & L. Liu (2025) reported a decrease of only 25%, which may be explained by less integration of digital solutions into daily operational processes, limited system flexibility, or lack of full automation of corrective actions. In contrast, V. Da Rosa *et al.* (2021) observed reductions of up to 50% in the private sector, highlighting the importance of deep integration with internal HR platforms. The results of this study were approaching the higher end of the range, which indicates the reliability of the algorithms when working in a multi-level organisation of changes, including self-learning and historical forecasting modules. This efficiency demonstrated that successful automation of chart correction largely depends on the flexibility of system settings, the quality of the initial data, and the speed of processing new scenarios in real time.

The 47.2% reduction in the number of conflicts between schedules demonstrated the effectiveness of the preventive mechanisms in ShiftMaster Pro. A. Stoumpos *et al.* (2023) recorded a 30% reduction, and S. Alrashdi *et al.* (2024) recorded a 60%, noting the different sensitivity of the algorithms to data variables. In the above study, the systems showed stability in detecting critical overlaps, during night and holiday shifts. This confirmed that automatic scheduling avoids typical administrative errors, increasing organisational resilience. The Kharkiv hospital has the most pronounced positive effect, which is associated with high staff turnover. L. Balcombe & D. Leo (2022) argued that systems work best in conditions of frequent

changes, while O. Farai *et al.* (2024) believed that stable structures provide higher predictability of results. These studies confirmed the first hypothesis: the effectiveness of AI systems is maximised in dynamic environments due to the ability to quickly adapt to new input parameters. A 17-22% reduction in the management burden confirms that digital systems free up resources for strategic management. S. Urba *et al.* (2022) also recorded a 20% reduction, while R. Shiferaw & Z. Birbirs (2025) found no significant change, presumably due to the lack of mobile integration. The presence of notifications and graph visualisation in the study demonstrates that the availability of information reduces the need for coordination, optimising administrative processes.

The 31.5% reduction in overtime hours after the implementation of SAP SuccessFactors is consistent with the findings of J. Maddula *et al.* (2022) and O. Maki *et al.* (2022), recording a 20% and 35% reduction, respectively. This reduction was made possible by the integration of a workload forecasting module that estimates future staffing shortages based on historical trends and current patient flow dynamics. The algorithms automatically analysed excessive shift durations, considered qualification restrictions and staff reserves, thus avoiding systematic overloads. In addition, scenario modelling was implemented, which was used to test different options for shift rotation before they were implemented, reducing the risk of errors. J. Maddula *et al.* emphasised the role of daily monitoring of key workload indicators, while O. Maki *et al.* highlighted adaptive scheduling as a factor that significantly reduces overtime. Thus, this study demonstrates that HRM systems can act not only as overload recorders, but also as active participants in the optimisation process, preventing the occurrence of overtime situations through forecasting, flexible resource overload and early informing of the management. The 42.1% reduction in staff shortage downtime demonstrates the system's ability to respond quickly to shortage situations, ensuring the continuity of critical branches. This result is the result of SAP SuccessFactors functionality with built-in modules for warning about the risk of staff shortages and the ability to instantly analyse the availability of staff in related departments. A. Habeeb & L. Anaya (2024) described a similar effect of 30%, linking it to workload forecasting functions, but in conditions of limited access to interdepartmental data. M. Paul *et al.* (2023) recorded a 45% decrease, noting the key role of algorithmic mobilisation of reserve staff. This study confirms that a high level of integration, including cross-platform communication and automatic allocation of shortage responses, can achieve a more significant reduction in downtime. Algorithms that can quickly analyse available resources, propose multiple response scenarios and initiate real-time task status changes are the basis for staffing resilience, even in critical situations such as seasonal workloads or emergencies. This demonstrates the growing role of dynamic digital analytics as a tool for predictive management.

A 36.2% reduction in the onboarding time for new employees demonstrates the effectiveness of digital trajectories and analytical control modules integrated into the SAP SuccessFactors HRM system. One of the key components was the ability to create individualised onboarding plans, which included automated access to training materials, electronic reference books, instructions and operational standards. S. Trenfield *et al.* (2022) reported an improvement of 20%, which explains the positive impact of digital support, but with limited feedback. D. Back *et al.* (2021) by 30%, pointing to the importance of progress analytics and a reminder system. In the case of the Ukraine study, the system was also used to monitor the dynamics of newcomers' adaptation, respond to difficulties promptly, and ensure independent progress assessment of employees. This reduced the need for constant support from managers and, at the same time, accelerated the process of reaching full productivity. Additionally, the ability to receive micro-feedback on the stages of adaptation stimulated internal motivation and further demonstrated corporate expectations. Thus, digital onboarding proved to be not only a logistical support tool but also a powerful mechanism for building staff independence and engagement from the first days of work. N. Karpenko *et al.* (2024) found that the digitisation of HR processes leads to the introduction of a hybrid work model, automation of HR procedures, welfare programmes and pedagogical development of personnel, which contributes to increased productivity and access to resources. However, the researchers also emphasised that successful integration of technological tools requires careful planning that takes into account potential threats, weaknesses, and leadership support in the organisational environment.

The 27.8% reduction in the number of requests to the HR department is the result of decentralised access to information through personalised accounts. P. Paul *et al.* (2024) confirmed a similar decrease of 25%, while J. Zhang & Z. Chen (2023) reported a weak effect in low-digital environments. The results of this study demonstrate that a high level of digital culture is a prerequisite for the successful automation of information processes. Positive changes in the emotional state of staff based on the results of digital surveys indicate an increase in engagement (+22.3%), a decrease in burnout (-19.1%), an increase in readiness for change (+24.6%) and autonomy (+27.8%). T. Alawiye (2024) confirmed a partial improvement in engagement, while M. Maia *et al.* (2024) observed smaller changes. P. Schmitter & S. Ashworth (2023) criticised similar results as a short-term novelty effect. The present study was based on a longitudinal analysis with validated indicators, which addressed these changes as a stable behavioural transformation rather than a temporary aberration.

The results of the logistic regression show a strong association between digital activity and satisfaction with working conditions: MedLearn App (OR = 2.31), shift schedules (OR = 1.87), Feedback360 (OR = 1.59), SAP SuccessFactors (OR = 1.42), and multichannel (OR = 2.08). T. Alawiye (2024) confirmed the importance of digital participation

as a key factor in subjective well-being. Combined with the results of this study, this addresses digital activity not only as an indicator but also as a mechanism for increasing psychological and organisational stability in healthcare facilities. In summary, the study results confirmed that the implemented digital systems and mobile applications have created a synergistic effect: optimisation of HR processes was accompanied by psychological changes that developed into a digitally adaptive environment. The benefits of managing schedules, reducing administrative burden, and increasing employee engagement and satisfaction provide a solid basis for further research on scaling such solutions to other countries and institutions, as well as studying the long-term effects on the quality of healthcare services.

Conclusions

The implementation of iStaff Scheduler and ShiftMaster Pro digital scheduling systems in three state medical institutions in Ukraine has resulted in a significant improvement in the technical efficiency of human resources processes. In particular, the accuracy of automatic shift allocation has increased by 26%, which indicates the ability of the algorithms to adapt to the complex dynamics of medical shifts and respond flexibly to changes in staff availability. At the same time, the average time for adjusting schedules was reduced by 43.3%, and the number of conflicts between schedules was almost halved. This demonstrated the high performance of AI systems in the context of unstable staffing, frequent operational changes, and the need to respond quickly to external challenges. The best results were recorded in the institution with the highest change dynamics, which further confirms the adaptive potential of digital tools.

Additionally, the integration of the SAP SuccessFactors HRM system with Microsoft SQL Server databases ensured centralised accounting, transparency of HR processes and optimisation of personnel costs. The main technical results include a 31.5% reduction in overtime workload, a 42.1% reduction in downtime due to staff shortages, and a 36.2% acceleration in the onboarding of new employees. This demonstrates the effectiveness of the system's real-time analytical and predictive functions, as well as its ability to integrate with the management models of medical institutions. Automated warnings and dynamic reallocation of resources improved the logistical resilience of the healthcare system. The introduction of the MedLearn App and Feedback360 mobile applications has created an infrastructure for continuous training, feedback and digital monitoring of the emotional state of staff. A 27.8% increase in the level of autonomy in decision-making, a 24.6% increase in readiness for change, and a 19.1% decrease in the emotional burnout index demonstrate that technical tools have a significant impact on organisational behaviour. The high correlation between employees' digital engagement and subjective satisfaction (e.g., OR = 2.31 for MedLearn App) confirms the importance of personalised digital services in creating a positive working environment. The digital environment of interaction created by these platforms

contributed to the development of autonomy, increased motivation and a culture of self-learning.

Practical recommendations include scaling up digital HRM solutions in the healthcare sector with a focus on the adaptability of algorithms to contextual changes, in conditions of high staff turnover and unstable demand. It is also advisable to develop the functionality of independent career trajectory planning, built-in decision simulators, and digital mentoring. Further research should focus on cross-system integration, interoperability, and the development of ethical AI control modules for HR decision-

making, which is especially relevant in the context of automated management processes.

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Conflict of Interest

None.

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Інноваційні цифрові платформи в кадровому менеджменті медичних установ

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Анотація. Метою дослідження було проаналізувати ефективність інтеграції цифрових технологій у кадрове управління медичними закладами в умовах динамічного навантаження. Методологія включала квазіексперимент на базі трьох установ із впровадженням платформ iStaff Scheduler, ShiftMaster Pro, Systems, Applications, and Products in Data Processing SuccessFactors, MedLearn App і Feedback360 протягом 2024 року. Застосовувались алгоритми штучного інтелекту, t-критерій Стюдента, дисперсійний аналіз (ANOVA), логістична регресія та щотижневі цифрові опитування за шкалою Likert. Результати показали зростання точності розподілу змін на 26 %, скорочення часу ручної корекції графіків на 43,3 % і зменшення кількості конфліктів у розкладах на 47,2 %. Також зафіксовано зниження понаднормового навантаження на 31,5 %, часу простою при нестачі персоналу – на 42,1 %, а тривалості адаптації нових працівників – на 36,2 %. Рівень звернень до кадрового відділу зменшився на 27,8 %, що свідчить про ефективність децентралізованих цифрових сервісів. За результатами цифрових опитувань рівень професійної залученості зріс на 22,3 %, готовність до змін – на 24,6 %, самостійність – на 27,8 %, а індекс емоційного вигорання знизився на 19,1 %. Встановлено, що працівники, які активно використовували мобільні застосунки, зокрема MedLearn App, мали вищу задоволеність умовами праці ($OR = 2,31$, $p < 0,01$), емоційну стабільність і позитивні очікування щодо кар'єрного розвитку. Таким чином, цифрові інструменти продемонстрували значний потенціал для підвищення ефективності та психологічної стійкості персоналу. Практична значущість дослідження полягає у можливості використання його результатів для стратегічного кадрового планування та цифрової трансформації управління персоналом у сфері охорони здоров'я

Ключові слова: емоційна стійкість персоналу; алгоритмічне планування; цифрове навчання; управлінські інновації; адаптація працівників; організаційна діджиталізація