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IMPLEMENTATION OF CHATBOTS IN HEALTHCARE ORGANIZATIONS FOR PROCESS AUTOMATION

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Abstract. This article examines the implementation of chatbots in healthcare as a means to automate the patient flow management. The authors analyze the current state of this process, identify operational bottlenecks, and propose chatbot-based solutions for automation of patient registration, document processing, and room allocation. The research method rests on modelling using chatbot technologies and evaluating their overall impact on healthcare efficiency and service delivery. According to the results, the introduction of chatbots reduces administrative workload, facilitates paperwork, and significantly improves service quality. Specific attention is paid to the risks associated with chatbot implementation, such as privacy concerns, and strategies for their mitigation. As a result, the introduction of chatbots proved to have a significant positive impact on operational efficiency, resource optimization, and patient satisfaction in healthcare.

Keywords: chatbots, process automation, patient flow management, medical documentation, healthcare efficiency, healthcare information systems

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ВНЕДРЕНИЕ ЧАТ-БОТОВ В МЕДИЦИНСКИЕ ОРГАНИЗАЦИИ ДЛЯ АВТОМАТИЗАЦИИ ПРОЦЕССОВ

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Аннотация. Данная статья посвящена исследованию внедрения чат-ботов в медицинские учреждения для автоматизации процесса управления потоками пациентов. В статье описан анализ текущего состояния данного процесса, выявлены несовершенства и предложены решения, основанные на использовании чат-ботов для автоматизации различных этапов. Методология исследования включает моделирование процессов с использованием технологий чат-ботов и оценку их воздействия на эффективность работы медучреждений. Результаты показывают, что внедрение чат-ботов способствует снижению административной нагрузки на персонал, сокращению времени обработки документации и улучшению качества обслуживания пациентов. В статье также рассмотрены риски внедрения таких технологий и предложены стратегии их минимизации. В заключение, внедрение чат-ботов оказывает значительное положительное влияние на улучшение операционной эффективности и удовлетворенность пациентов в медицинских организациях.

Ключевые слова: чат-боты, автоматизация процессов, управление потоками пациентов, медицинская документация, эффективность медицинских учреждений, информационные системы здравоохранения

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Introduction

Integration of artificial intelligence and automated communication systems, such as chatbots, opens new horizons for better quality of medical care. Chatbots based on machine learning algorithms and natural language processing provide opportunities to optimize multiple processes in healthcare facilities, from patient admission to post-discharge support.

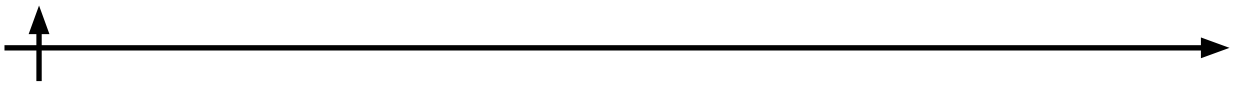
This research aims to comprehensively analyze and evaluate the impact of chatbots on the structure of a medical organization. Special attention is paid to the assessment of the effects produced on performance of medical staff and patient satisfaction, as well as the economic aspects of medical institutions.

Within the framework of this research:

1. healthcare specifics were defined;
2. chatbot solutions were reviewed;
3. potential risks and prospects were assessed.

Materials and Methods

This research invites the following methods: collection and analysis of information, description, comparison, and synthesis. Analytics involves gathering information on data technologies, and assessing information on the structure of medical organizations.



Various articles, journals, and training manuals have been analyzed as a theoretical basis of the research. They include the works by:

– Altayeva A.U., Kaipova A.Sh., Mukhamedjanova A.U., and Ospanova G.K. consider the prospects of using chatbots in medicine, emphasizing their potential to automate processes and increase efficiency. The study focuses on positive aspects of technology implementation in medicine (Altayeva, Kaipova, Mukhamedjanova, Ospanova, 2023).

– Janarsanam S. in his book "Developing Chatbots and Conversational Interfaces" describes the technical aspects of chatbot performance. This source is used to understand the architecture and technical capabilities of the given solution (Janarsanam, 2022).

– Khairullin A.M. and Zaripova R.S. explore the implementation of chatbots and online counselling in medicine. Special attention is paid to improving the interaction between patients and medical staff, as well as the impact of technology on the accessibility of medical services (Khairullin, 2020).

– Potapov D.A. in his paper "Overview of chatbot creation technologies" reviews the evolution of chatbots, thus helping to assess their applicability in medicine (Potapov, 2017).

– Epanchintsev M.Y., Starichenko B.E., and Shakirova A.A. study the use of chatbots in education at medical colleges, showing their significance in learning and interaction with students (Epanchintsev, 2022).

Results and Discussion

One of the key aspects of health care facilities is patient flow management – a complex system that includes organizing, planning, and controlling the movement of patients in a health care facility at all stages of medical care. This process is aimed at maximizing the quality and efficiency of services provided, as well as meeting the needs of patients and reducing the burden on medical staff.

The following facets of the medical care process deserve special attention:

1. Admission of patients – initial examination of patients with due respect to original complaints;

2. Optimization of the staff's schedule – efficient scheduling that takes into account both patient needs and staff capacity, minimizing wait lists and overload;

3. Optimization of waiting lists –reduction of waiting through improved scheduling and better coordination between departments;

4. Improved access to medical equipment and resources – efficient utilization of medical facilities to ensure that necessary procedures and tests are performed in time;

5. Implementation of technologies – utilization of information systems to track patient status, manage data, and communicate within the facility;

6. Training and protocols – development of clear protocols for handling patient flow and training staff;

7. Continuous analysis and improvement – regular update of patient flow management processes and implementation of improvements based on data and feedback from staff and patients.

Patient flow management is a key to maintaining high quality care and ensuring patient safety. It not only helps improve patient experience, but also contributes to overall efficiency and cost reduction in healthcare.

In order to carry out a comprehensive overview of this process it is necessary to examine the major stages involved. During the admission stage, the patient is admitted to the healthcare facility. Primary diagnosis of the patient is established via the examination and referral to specialists. After admission to the inpatient unit, the necessary pre-operation treatment is prescribed, followed by the surgery. Then comes the final stage – preparation for discharge,

recovery planning and the discharge itself.

Effective patient flow management requires transparent organization, advanced technology, and aligned communication between all participants of the medical process, which directly affects the success of treatment and patient satisfaction.

This research primarily focuses on optimizing staff performance, and opportunities to improve patient experience. Based on the above presented description of all stages involved, the "AS IS" model was developed for the "Patient Flow Management" process. Figures 1-3 provide a full-scale structure of this model.

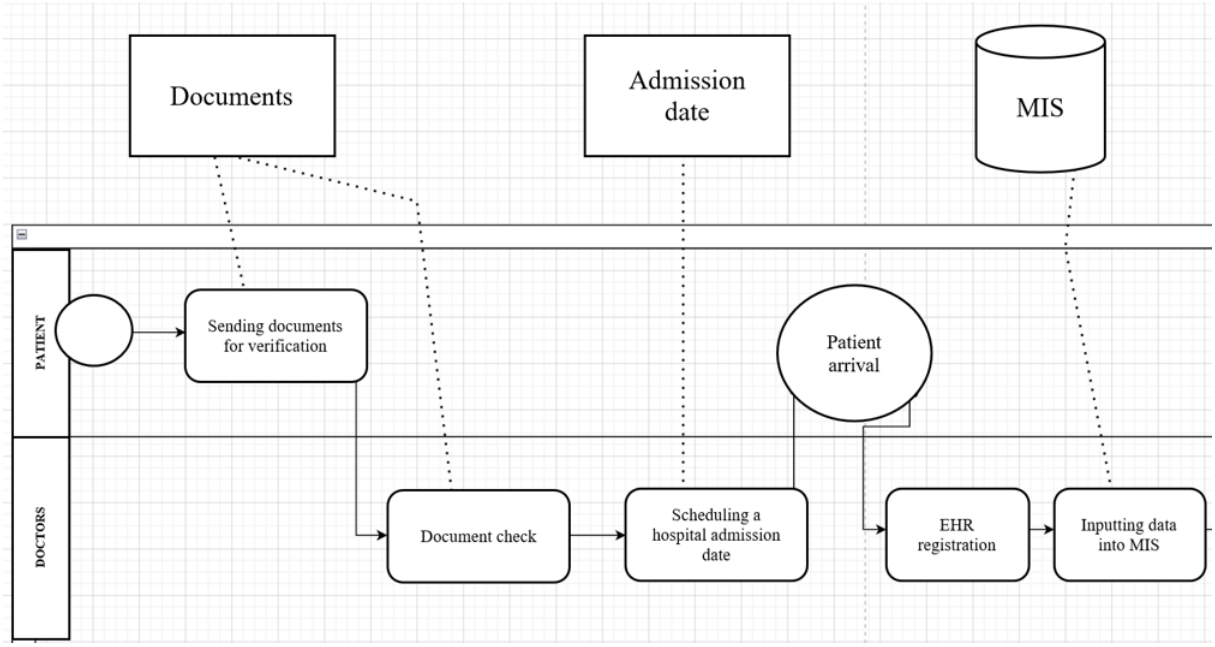


Fig. 1. "Patient Flow Management": "AS IS" process model (Part 1).

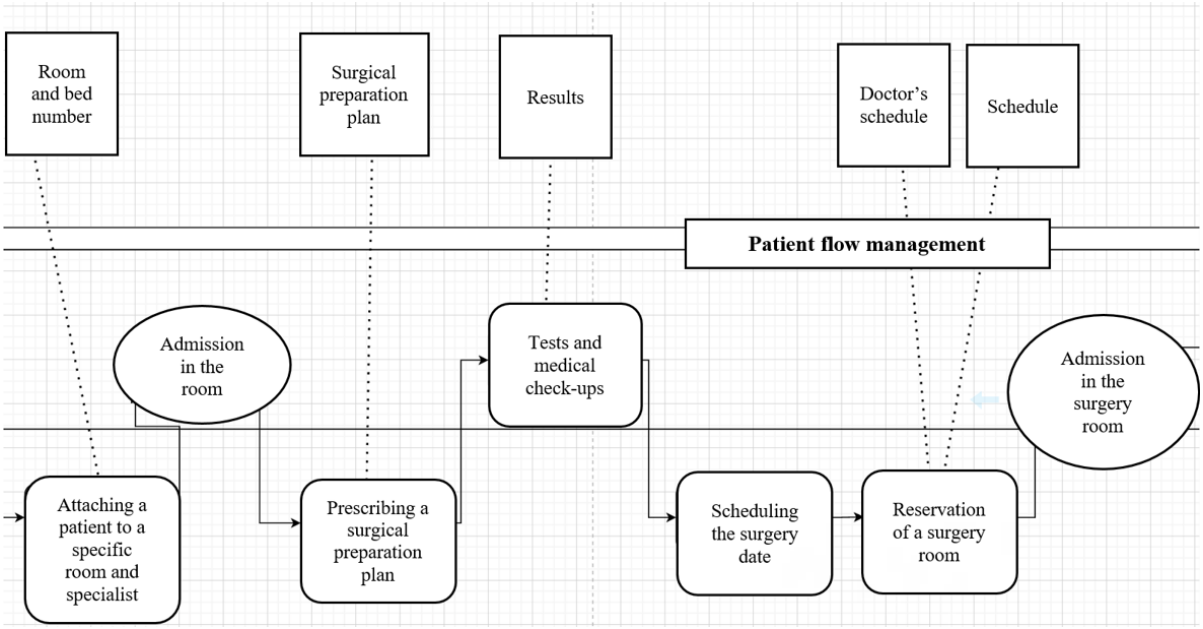


Fig. 2. "Patient Flow Management": "AS IS" process model (Part 2).

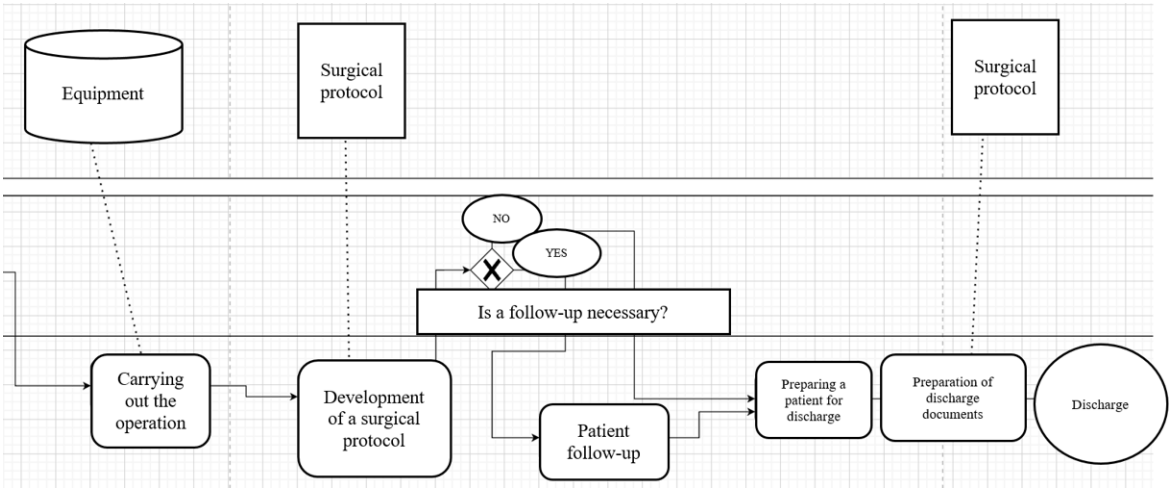


Fig. 3. "Patient Flow Management": "AS IS" process model (Part 3).

Having studied the process of patient flow management, it is possible to detect a wide range of challenges which require additional support based on a chatbot (neuro-employee). In modern medical practice, paperwork takes up a significant share of physicians' time. Normally it includes completing, verifying, and archiving various forms and reports such as medical record, prescriptions, discharge summaries, etc. Often, physicians have to enter data into electronic medical systems manually, which is a time-consuming and error-prone process.

The excessive staff workload is primarily represented by such tasks as document verification, selection of a roon in the inpatient unit, preparation of treatment plan, prescription of tests and check-ups, operating room reservation, drawing up an operation protocol, etc. All these stages require a whole-scale automation in order to improve the patient flow management.

One of the most promisint solutions is chatbots that can carry on conversations with humans or other computer programs using natural language. They are typically used to automate communication with users via text messages but can also support voice interaction. Simple chatbots can perform a limited set of tasks, such as providing information about a company's schedule or answering FAQs. More sophisticated chatbots use artificial intelligence to interpret user queries, analyze context, and provide more complex services such as consulting, ordering products, or booking services.

Chatbots can be integrated into various platforms and applications such as (Dubgorn, Esser, 2022; Lepekhin et al, 2022):

– websites;
– messengers (e.g., Facebook Messenger, WhatsApp);
– mobile apps;
– voice assistants (e.g., Siri, Google Assistant).

Chatbots are widely used in a variety of areas, including business, education, healthcare, customer service, etc. In medicine, chatbots improve access to healthcare services, optimize workflows, and enhance the quality of patient care. They provide continuous access to medical information and support, automate administrative tasks, and contribute to cost reduction.

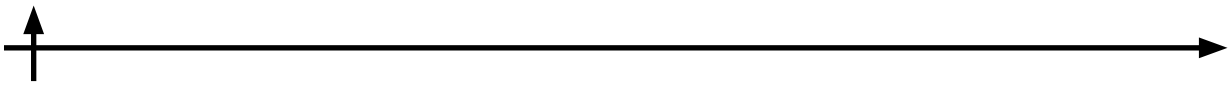
In the following section of the article the authors discuss the prospects of chatbot implementation in healthcare in terms of the major challenges of the industry.

Stages: "Document verification", "Preparation for discharge"

Problem: heavy workload associated with paperwork.

Solutions:

1. Integration with the hospital information system. The chatbot is integrated with the hos-



pital database and electronic medical documentation system.

2. Patient identification. At check-in, the patient provides their ID and insurance, which are scanned via a mobile app or the admissions department.

3. Automated verification. The chatbot automatically checks the information provided against insurance policies and all required medical records. The bot can also request additional data or clarifications from the patient through an interactive interface.

4. Notification to medical staff. Once all documents are verified, the chatbot sends a notification to the responsible medical staff that the patient is ready for further care.

5. Collecting data for discharge. The chatbot automatically collects all necessary medical data from the electronic records system, including the results of recent tests and procedures.

6. Document generation. Based on the collected data, the chatbot generates preliminary versions of discharge documents, including recommendations and prescriptions.

7. Verification by the doctor. The doctor receives the generated documents through the MIS system, checks them and introduces corrections, if necessary.

8. Discharge. The chatbot sends the final versions of the documents to the patient via email or the hospital app, notifying the patient of the discharge date and time.

Stage: "Selection of a room in the inpatient unit"

Problem: lack of automation in selecting rooms/beds in the inpatient unit.

Solutions:

1. Integration with the hospital management system. The chatbot is integrated with the central medical information system that tracks the status of all rooms/beds in real time.

2. Automatic data query. When a patient is admitted to the hospital, the chatbot automatically requests information on the patient's status and medical needs (e.g., special medical equipment, etc.).

3. Matching algorithms. The chatbot uses algorithms to assess available rooms/beds, taking into account the patient's medical needs, current unit occupancy, and logistical factors (e.g., proximity to the needed department or specialists).

4. Placement optimization. The chatbot identifies the optimal room/bed to meet the patient's medical and logistical requirements, and reserves them automatically.

5. Notification of staff and patient. The chatbot sends notifications to the appropriate medical staff and patient on their placement.

Stages: "Drawing a preparation plan for surgery," "Tests and check-ups"

Problem: complexity of coordination between different departments and specialists, including anesthesiologists, surgeons, nurses, and dietitians; the patient's medical and personal needs.

Solutions:

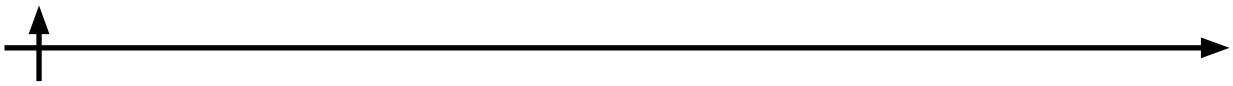
1. Gathering patient data. When a patient or healthcare provider first seeks care, they enter basic data into the chatbot interface. The data includes medical record, current medical problems, allergies, and previous surgeries.

2. Automatically generated checklist. Based on the information entered, the chatbot uses built-in algorithms to generate a personalized pre-operation checklist that can include lab tests, procedures, medication instructions, dietary restrictions, and pre-surgery lifestyle recommendations.

3. Coordination with medical departments. The chatbot automatically sends notifications to the appropriate departments and specialists about upcoming procedures and tests that need their input. This solutions eliminates scheduling conflicts.

4. Patient reminders. The chatbot is configured to send regular reminders to the patient about upcoming tests, procedures, and changes via SMS or a mobile app.

5. Feedback and plan adjustments. The patient can report task completion or problems via



a chatbot interface, which can automatically adjust the plan and inform medical staff when needed (Dillon, 2020; Caroline, 2019).

Stage: "Reserving an operating room"

Problem: coordinating room availability, surgeon schedules, inefficient equipment and associated delays.

Solutions:

1. Data entry of upcoming surgery. The medical staff or surgeon enters information about the planned surgery into the chatbot, specifying the date, expected duration, type of surgery and equipment requirements.

2. Automatic reservation of an operating room. The chatbot scans the available operating rooms, checks compatibility with all the requirements and automatically books the most suitable room.

3. Notification and confirmation. The chatbot sends notifications to the surgeon, medical staff and operating room management department.

4. Dynamic rescheduling. In case of schedule shifts or emergencies, the chatbot can automatically reschedule reservations and notify all participants.

5. Interactive reservation management. Staff can interact with the chatbot via text commands or GUI to modify reservations or request additional information.

Stage: "Surgical protocol"

Problem: labour intensive and error-prone nature of manual drafting (Batson, 1984).

Solutions:

1. Baseline data collection. The chatbot requests the surgical staff to provide the baseline data on the type of surgery, basic medical instructions, list of equipment, names of participating specialists, and anesthesia preferences.

2. Automated protocol generation. The chatbot automatically generates a surgical protocol and organizes all information in an appropriate format.

3. Revision and approval. The generated document is sent to the surgeon and anesthesiologist for revision and approval. The chatbot can include change tracking and comments to simplify editing.

4. Distribution and archiving. Once approved, the protocol is distributed to all medical staff involved in the surgery. A copy of the protocol is also archived in the electronic medical system (Tairov, 2023; Medvedeva, 2023).

Having observed the "AS IS" model for the "Patient Flow Management" process, a "TO BE" model can be shaped (Figures 4-8).

Despite the fact that the overall process has expanded, the introduction of chatbots will remove excessive workload and increase staff efficiency. However, the implementation of chatbots is associated with a wide range of risks. In order to exclude or minimize them it is necessary to develop a matrix of risk response (Zaripova, Kudryakov, 2023; Parate, 2024).

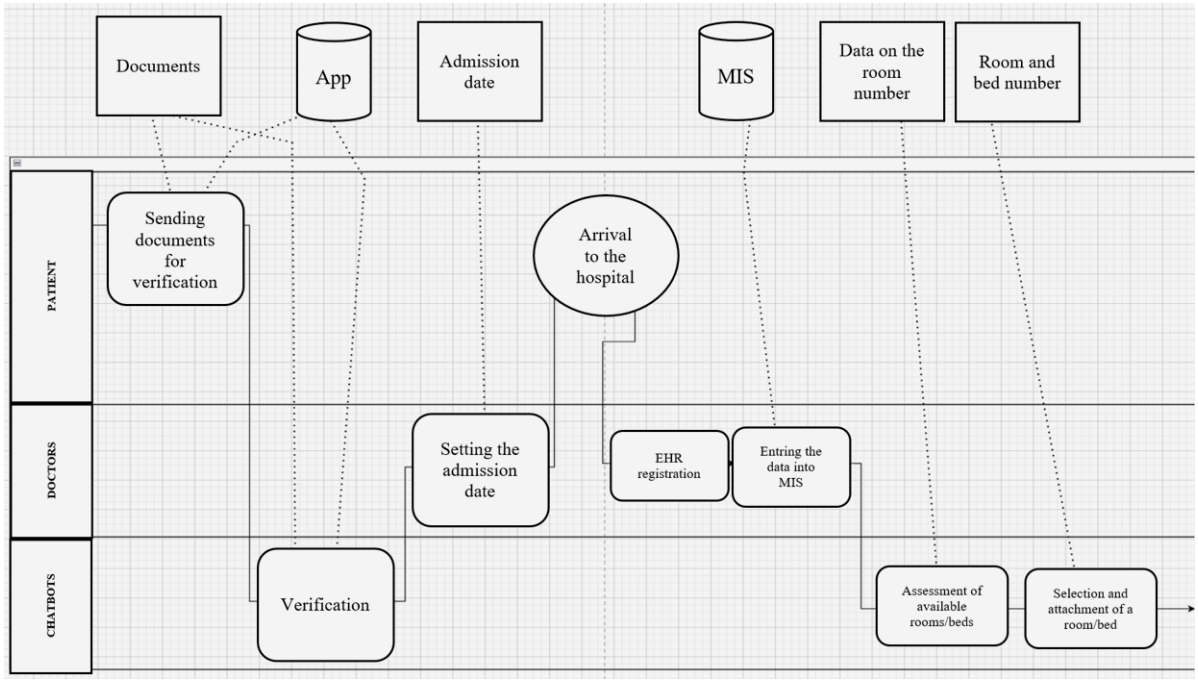


Fig. 4. “Patient Flow Management”: “TO BE” process model (Part 1).

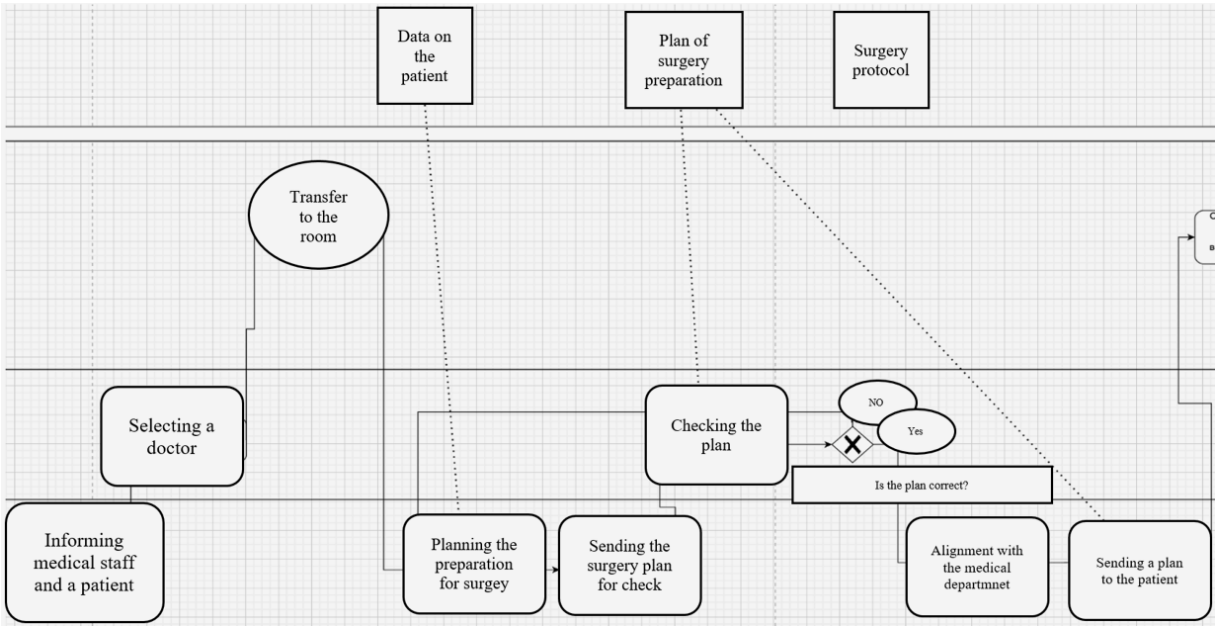


Fig. 5. “Patient Flow Management”: “TO BE” process model (Part 2).

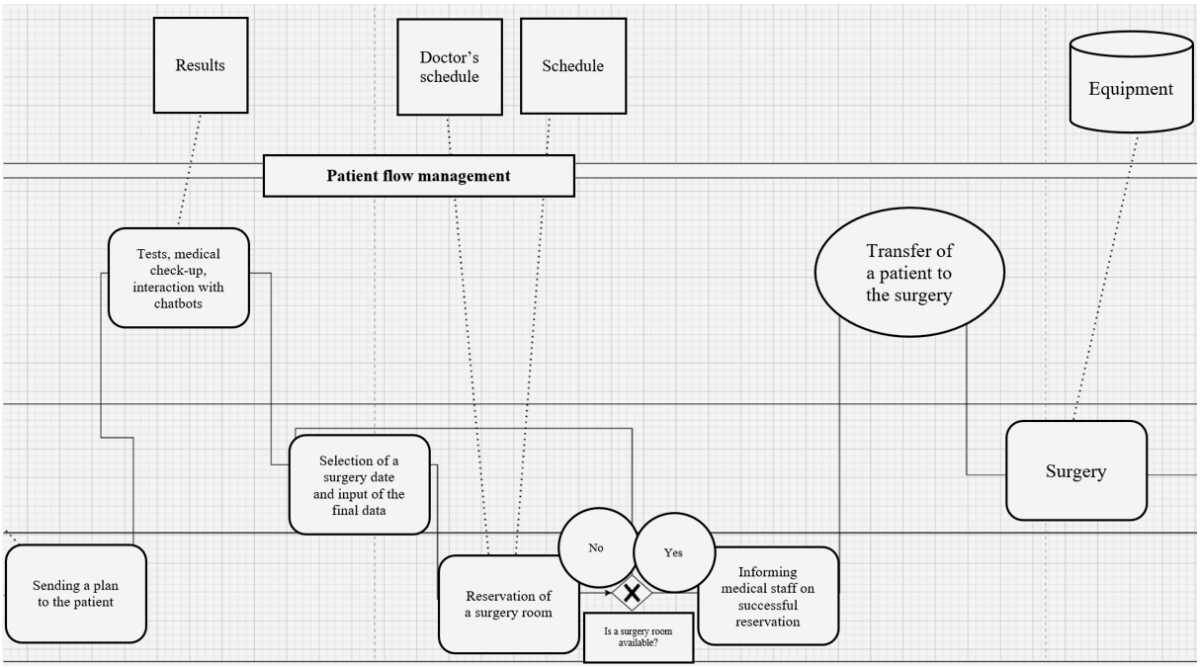


Fig. 6. "Patient Flow Management": "TO BE" process model (Part 3).

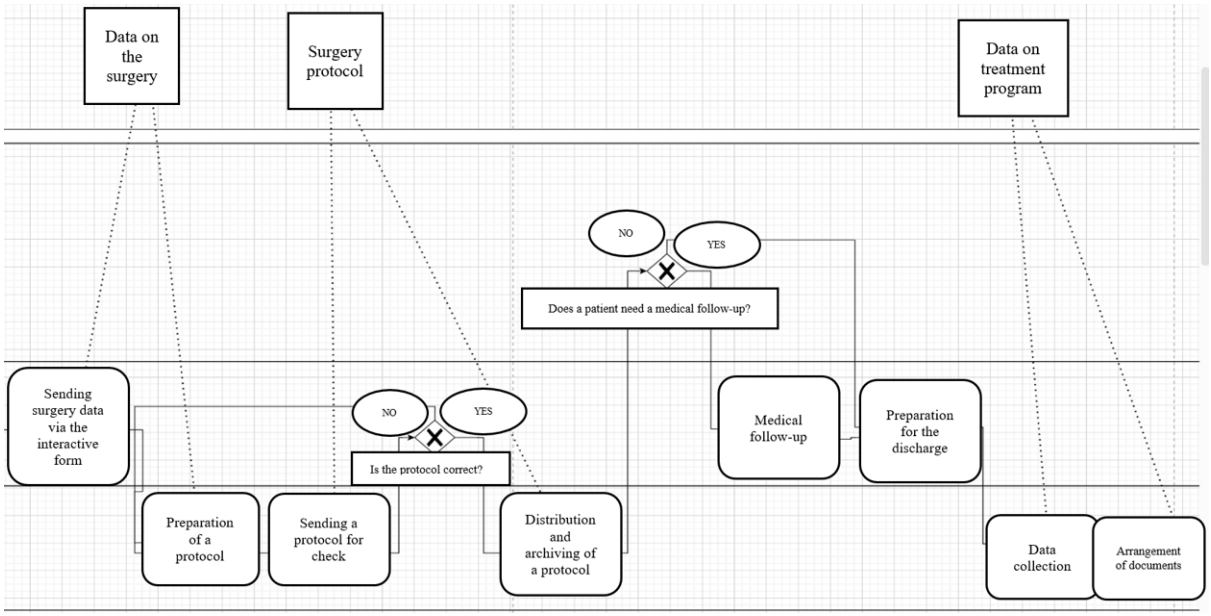


Fig. 7. "Patient Flow Management": "TO BE" process model (Part 4).

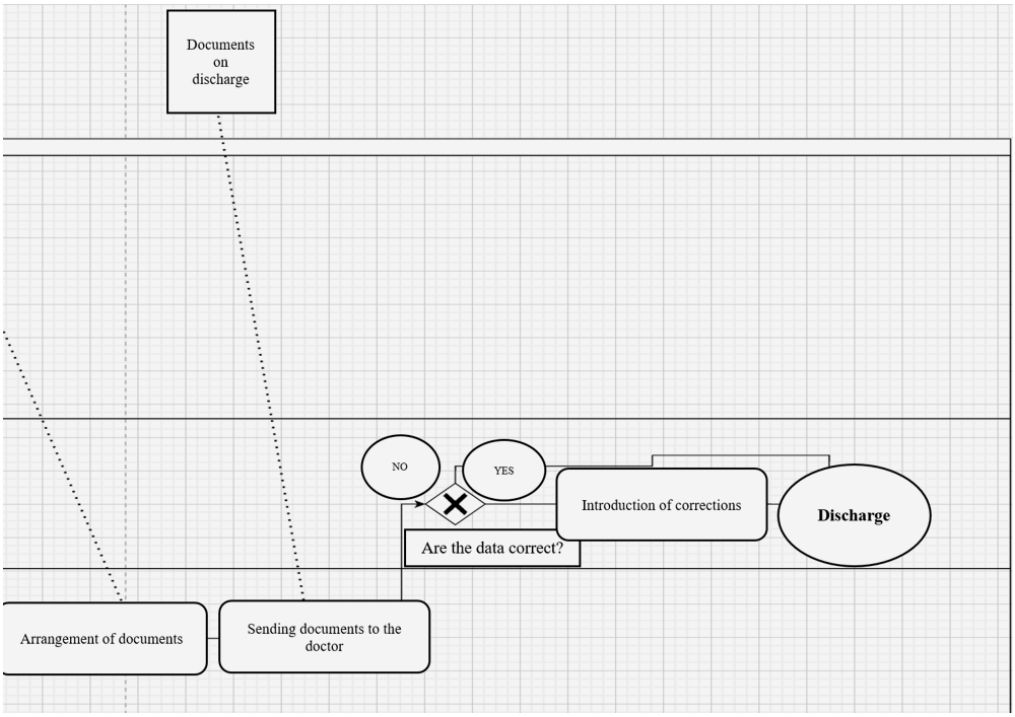


Fig. 8. "Patient Flow Management": "TO BE" process model (Part 5).

Table 1. Risk response matrix

Risk	Probability	Impact	Response strategy
Insufficient data accuracy	High	High	Thorough data verification, validation with medical professionals
Violation of privacy	Medium	High	Implementation of advanced security measures, regular security audits
Staff resistance	Medium	Medium	Training and informing staff on the benefits of the system
Technical failures	Low	High	Developing an emergency recovery plan, regular maintenance
Systems integration problems	Medium	High	Utilizing interoperability standards, pre-integration testing
Legal issues	Low	Medium	Consultations with health care attorneys to ensure compliance with legislation
Incorrect use	Medium	Medium	Creating detailed user manuals, staff trainings

This matrix will help project managers and stakeholders to be prepared for possible problems and respond quicker.

Conclusion

Overall, as a result of chatbot implementation the following effects will take place:

1. Increased efficiency. Reduction of the time needed to process documents allows doctors to focus on patient care.

2. Reduced number of errors. Automation reduces the likelihood of human error in data entry, thus increasing the accuracy of medical records.

3. Improved patient satisfaction. Fast and efficient document processing improves patients'

impression of hospital services.

4. Resource savings. Reducing the cost of administrative processes allows resources to be reallocated to other important needs of the healthcare facility.

5. Better data security. Chatbots that comply with data protection standards ensure that medical information is stored and processed securely (Rikhi, 2023).

6. Accelerated placement.

7. Facilitated preparation. Automating data collection and notifications significantly reduces the time needed to prepare for surgery.

8. Improved staff communication.

9. Improved operational efficiency. Automation allows minimizing downtime, optimizes schedules, and boosts the capacity of the medical facility.

10. Reduced administrative burden. The volume of manual work associated with scheduling and coordination decreases.

11. Higher scheduling accuracy. Automatic reservation eliminates errors associated with double booking or misallocation of resources.

12. Increased staff satisfaction. Smoother and more predictable schedule improves overall interaction within the health system.

13. Quick adaptation to change. Chatbots can be easily updated to accommodate new requirements or schedule changes, providing management flexibility (Huo, 2023; Gцndцcs, 2024).

14. Better coordination.

15. Easy access to medical records. Improved archiving provides all stakeholders with the opportunity to access documents at any time. What is more, automating the surgical records with chatbots ensures standardization.

As seen from a large list of prospective benefits, the introduction of chatbots in medical institutions proves to be an absolute win-win that improves the efficiency of medical processes and boosts patient satisfaction.

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