University of Milan

LM-18 - Computer science

Workflow of Patients in a Clinical Setting
Business Process Engineer Project

Project Supervisor: Prof. Gianini Gabriele
Student: Aislu Naran

Academic year 2022-2023

Content

1. Introduction

1.1 Workflow of Patients in a Clinical Setting

A hospital is a complex organism covering simultaneously multiple interactions and operations, also different actors perform different activities and tasks that require a level of organization. For this reason, the whole situation in the hospital is represented by what call the Workflow of Patients in a Clinical Setting.

Humanity has experienced a number of remarkable innovations that have transformed the face of the world, mainly in the field of healthcare. Prominent among these innovations is health information technology, which is considered a key enabler for improving the quality and safety of health care. Telemedicine and asynchronous consultations are becoming as effective as traditional doctor visits. Electronic consultations, for example, can significantly reduce the time patients wait before visiting a specialist, as well as improve the decision-making process.

A key aspect of the success of any medical treatment is time management, especially in the field of oncology. Early detection of cancer increases the likelihood of a successful diagnosis and can save the patient's life. Amid the COVID-19 pandemic, holding virtual meetings such as conferences has become an essential necessity to address the healthcare service lockdown and severe delays faced by cancer patients. However, complexity arises in organizing the clinical workflow for patients.

The patient's clinical workflow is basically the interaction between participants in hospitals on various tasks performed in the respective services, flows of medical information related to the clinical workflow, which must be presented very carefully taking into account the detailed specification of the institution, any errors occurring in the clinical patient process. The workflow will impact the data recorded in the electronic health record (EHR), and therefore the entire hospital information system (HIS).
The goal is to capture the remaining services exposed through BPMN and explain them through sequential functional analysis, while preserving old results.

1.2 Process of working

Clinical workflow refers to the sequence of tasks performed by patients, professionals, and administrators within and across hospital environments. Sequentially or simultaneously, the work process occurs at different levels:

• Clinical workflow: between people or between patients' EHRs and their clinical and healthcare processes.
• Inter-organizational workflow: between services, eg hospitalization service and pharmacy service.
• Visit Workflow: Workflow occurred for this service in accordance with institutional protocols and policies.
• Cognitive Workflow: The mental workflow that occurs during decision making or order processing.

Typically, clinical workflow is a process that occurs at various levels within a healthcare facility. In information technology, workflow and processes are often represented using business process modeling languages. The most popular among them are BPMN.

Clinical processes in a multidisciplinary hospital are inherently complex, leading researchers to introduce specific healthcare modeling requirements that will then be supported by BPMN to capture the processes:
• There are many roles involved in one process.
• Several specialists work together on a common task.
• A task can be performed alternately by different roles.
• A task may optionally include additional roles.

BPMN is known for its core modeling elements. Pools and lanes are used to structure the process diagram and separate organizational units and organizations, respectively.

1.3 Advantage and disadvantage of the workflow of patients in a clinical setting

- Advantages of Patient Workflow in a Clinical Setting:
Efficiency: Streamlined workflows enhance the overall efficiency of clinical operations, allowing healthcare professionals to provide timely and effective care to patients.
Accuracy: Well-designed patient workflows reduce the likelihood of errors in documentation, treatment, and communication, contributing to more accurate healthcare delivery.
Patient Satisfaction: Smooth workflows can positively impact the patient experience by minimizing wait times, improving communication, and ensuring a more cohesive and patient-centered care process.
Data Accessibility: Digitalized workflows enable quick access to patient information, fostering better coordination among healthcare providers and facilitating informed decision-making.

Resource Optimization: Effective workflows help in optimizing the use of resources, such as staff, equipment, and facilities, leading to cost savings and improved resource allocation.

- Disadvantages of Patient Workflow in a Clinical Setting:

Complexity: Overly complex workflows can lead to confusion among healthcare professionals, potentially causing delays and compromising the quality of patient care.

Technology Challenges: Dependence on technology for workflow management introduces the risk of technical glitches, system failures, or cybersecurity issues that can disrupt patient care processes.

Resistance to Change: Implementing new workflows may face resistance from healthcare staff accustomed to traditional methods, leading to challenges in adoption and potential disruptions in the transitional phase.

Communication Breakdowns: Poorly designed workflows or inadequate communication channels may result in information gaps, hindering effective collaboration among healthcare team members.

Patient Privacy Concerns: Digital workflows may raise concerns regarding patient data privacy and security, necessitating robust measures to safeguard sensitive health information.

2. Process

The main components of the business process are:
• Oncology patient clinical workflow specifications.
• Analysis of existing clinical workflow.
• Analysis of the existing situation in the clinical workflow.
• Consistency, versatility and compatibility of any proposed business process with the hospital information systems specifications.

Through observation and qualitative research, including taking into account all the characteristics of the various services provided by RHCs, were included in the business process to clarify and reduce the steps taken by patients during their visits or stay, and most importantly, obtaining the basic medical information included into the work process and necessary during other procedures carried out in the RSC, for example, discussions at a meeting of a multidisciplinary group.

These noted services include:
• Consulting service.
• Anatomical pathology service.
• Biological analysis service.
• Radiation therapy service.
• Chemotherapy service.
• Pharmacy services.
• Hospital care service.

Using BPMN, it is possible to provide a patient workflow that contains various activities in oncology services, performed in both an administrative and operational manner, these activities are controlled by several events linked through multiple associations and communicated through messages or documents.
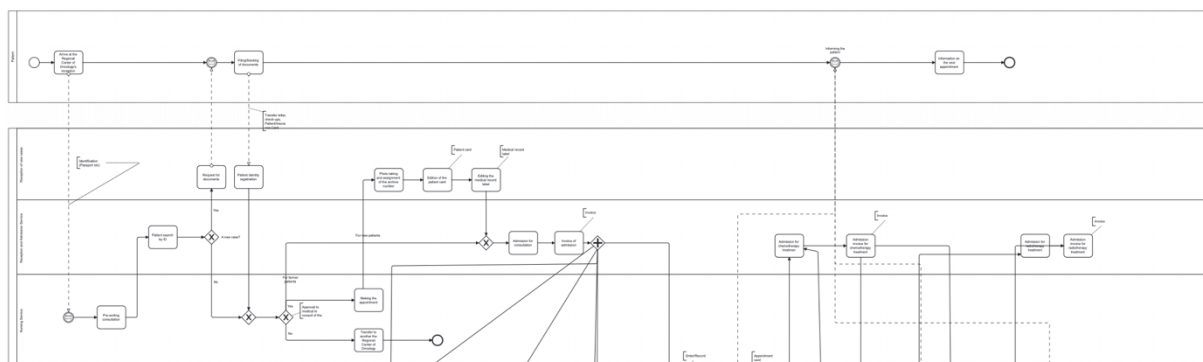
Reception and Admission Service Patient's Clinical Workflow
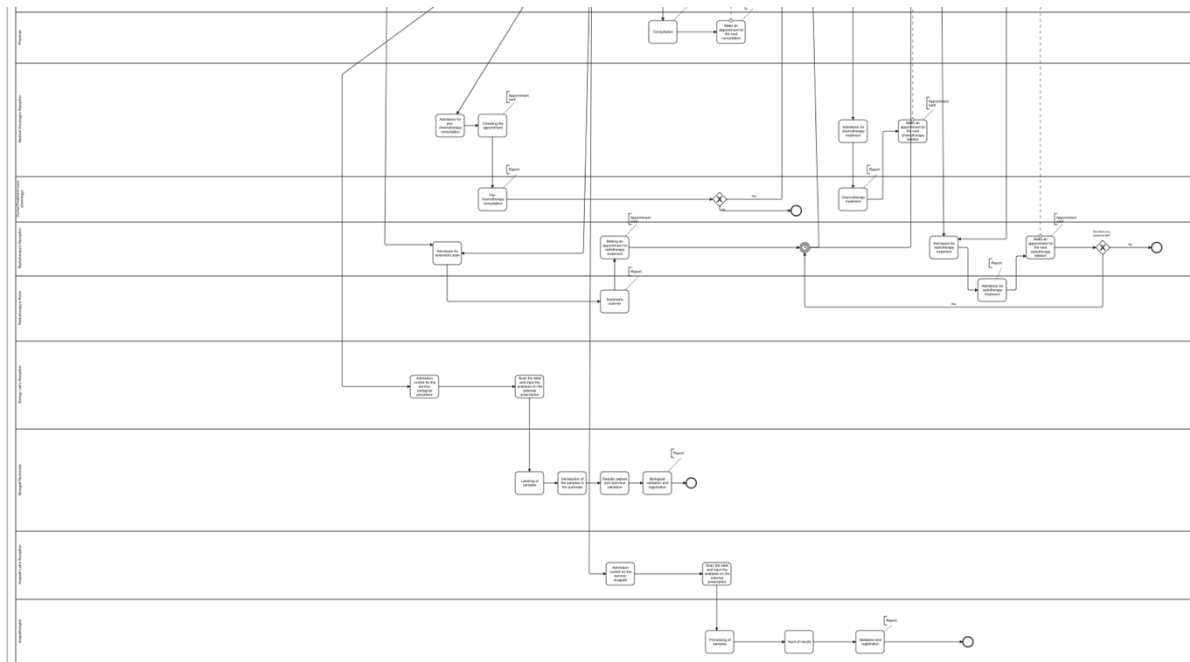
Medical Oncology, Biology, Anatomopathology, and Radiotherapy Service Patient's Clinical Workflow

This reviews the sequence of tasks performed by patients and professionals within various services in oncology department, which are represented in our business process model:

Actor - Activity/Task

Patient - The patient is oriented by the RAS to be received by other services and either give him an appointment or a consultation, every service given to the patient is invoiced and must be recorded.

Nursing Service - Conducts a preliminary sorting of patients then orients them.

Reception and Admission Service Reception of New Cases - Orients new cases and checks patients admission, manages the cash register.

Physicians/Specialists (Medical Oncology, Radiotherapy, etc.) - Registers new patients, edition of patients' cards and EHR labels.

Receptions (Medical Oncology, Radiotherapy, etc.) Treatment Rooms (Medical Oncology, Radiotherapy, etc.) - Inform and refer patients during their visit to a service, or refer them to a related service if necessary.

Treatment Rooms (Medical Oncology, Radiotherapy, etc.) - Where patients are treated based on the service.

3. Business Process Flow

3.1 BPMN

BPMN stands for Business Process Model and Notation. It is a standardized graphical notation that provides a widely accepted way to represent and communicate business processes. BPMN is used to create visual models of business processes in a clear and consistent manner, making it easier for both business and technical stakeholders to understand and analyze complex processes. Key features of BPMN include:

Graphical Elements: BPMN uses a set of standardized symbols and notations to represent various elements of a business process, such as tasks, events, gateways, and flows. These graphical elements make it easy to create visual models of processes.

Process Flow: BPMN diagrams visually depict the flow of activities, decisions, and interactions between different participants in a business process. The flow is represented by connecting arrows and lines.

Standardization: BPMN is an industry standard maintained by the Object Management Group (OMG), providing a common language and notation for business process modeling. This standardization ensures consistency and facilitates communication between different stakeholders.

Ease of Understanding: BPMN is designed to be easily understood by both technical and non-technical users. The visual nature of BPMN diagrams allows for a clear representation of complex processes.

Analysis and Optimization: BPMN diagrams facilitate the analysis of business processes, helping organizations identify inefficiencies, bottlenecks, and opportunities for improvement. This makes BPMN a valuable tool for business process optimization.

Overall, BPMN serves as a powerful tool for organizations to document, analyze, and communicate their business processes. It is widely used in various industries to improve process efficiency, enhance communication, and support business process management initiatives.

3.2 Structure of BPMN

The structure of a BPMN diagram consists of various graphical elements that represent different aspects of a business process. These elements are organized

in a way that visually depicts the flow of activities, decisions, and interactions within the process.

- Start Event: Represents the beginning of a process. Typically depicted as a circle or oval shape.
- End Event: Represents the conclusion or end of a process. Usually depicted as a circle with a bold border.
- Activities: Tasks or work to be performed within the process. Represented by rounded rectangles.
- Gateways: Decision points in the process flow. Determine which path the process will follow based on certain conditions.
- Sequence Flow: Arrows that connect activities, events, and gateways, indicating the order in which they occur. Represents the flow of the process.
- Message Flow: Arrows connecting pools or lanes to show the flow of messages between participants.
- Sub-Processes: Represent a subprocess or a grouping of activities within the main process.
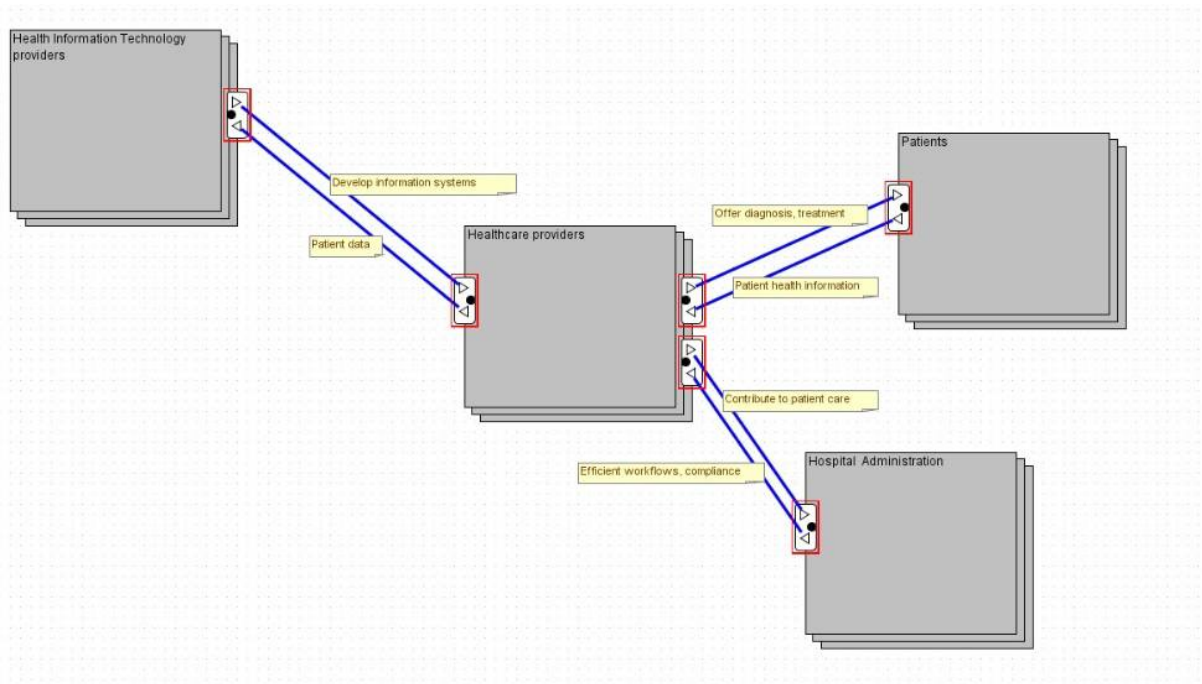
3.3 Full BPMN
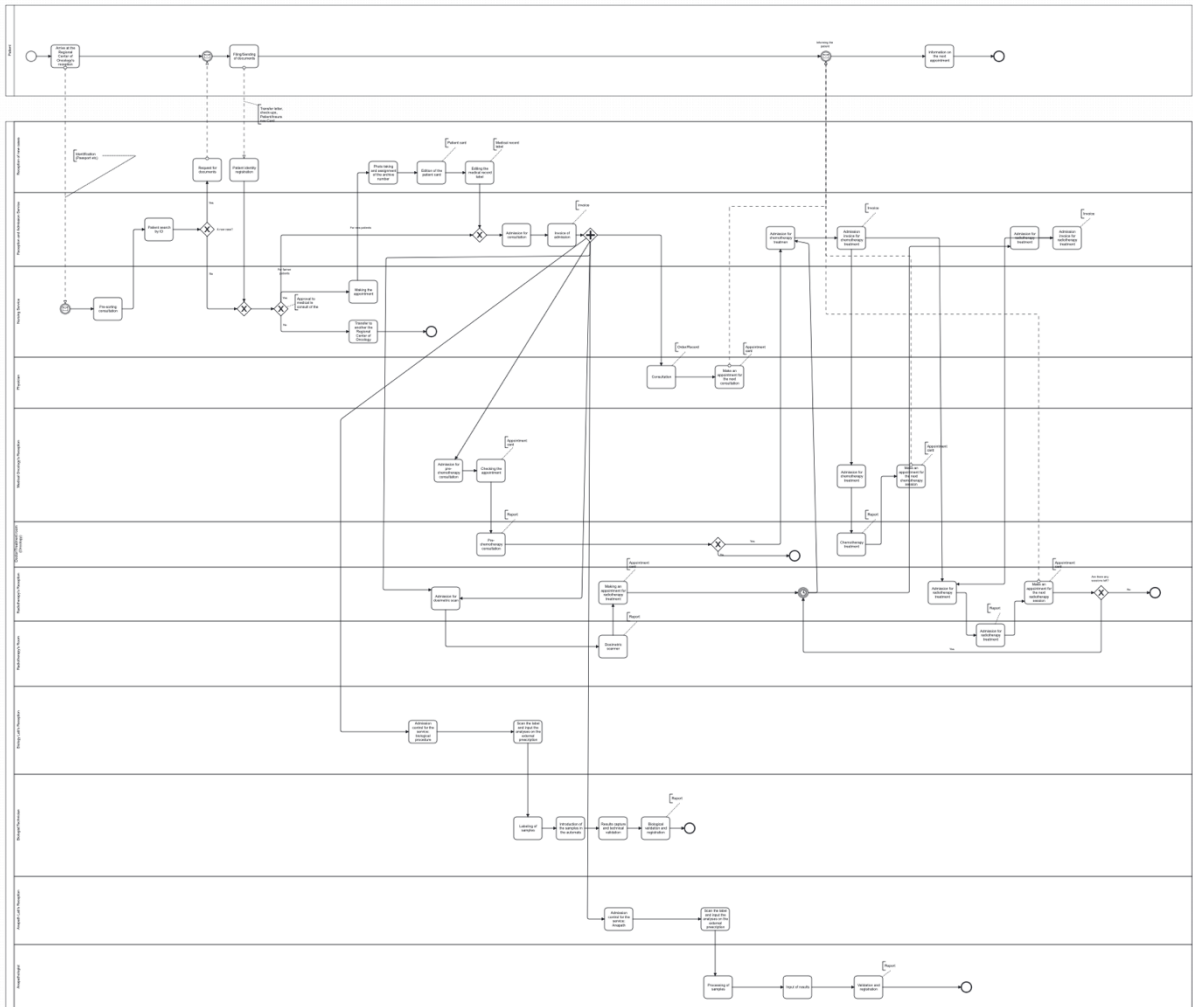
4. Value model

4.1 E3 value model

A value model is a conceptual representation that articulates the components and relationships involved in the creation, delivery, and consumption of value within a specific context. It helps organizations understand how value is generated and exchanged among different entities in a system, whether it be a business, a product, or a service. Value models are used in various fields, including business, economics, and systems engineering.

The purpose of a value model is to provide a clear and structured representation of how an entity creates, delivers, and captures value. It aids in strategic decision-making, process optimization, and understanding the dynamics of value creation within a specific context. Value models are often used in conjunction with other business analysis tools and methodologies to enhance overall business understanding and performance.

4.2 Structure of E3 value model

- Actors: Actors are entities or participants within the business ecosystem who engage in economic transactions.
- Interactions: Interactions represent the exchanges or transactions that occur between actors.
- Types: Different types of interactions may include transactions, negotiations, collaborations, or any other form of value exchange.
- Value Objects: Value objects represent the goods, services, or information that are exchanged between actors in an interaction.
- Value Models: Value models provide a detailed representation of a specific interaction between actors, including the value objects exchanged.
- Value Flows: Value flows describe the sequence and direction of value exchanges within an interaction or a value constellation.

Health Information Technology providers

Patients

Develop information systems

Patient data

Healthcare providers

Offer diagnosis, treatment

Patient health information

Contribute to patient care

Efficient workflows, compliance

Hospital Administration

5. Business evaluation

5.1 Critical success factors

Creating Critical Success Factors (CSFs) for the Workflow of Patients in a Clinical Setting involves identifying key elements that contribute to the effectiveness, efficiency, and positive outcomes of the patient care process.

Here are some critical success factors for the Workflow of Patients in a Clinical Setting:

- Timely Access to Information:

Ensure quick and easy access to patient information for healthcare providers to facilitate timely decision-making and treatment.

- Health Information Technology Integration:

Integrate health information technology seamlessly into the clinical workflow to enhance communication, reduce errors, and improve overall healthcare quality.

- Telemedicine and Asynchronous Consultations:

Promote the use of telemedicine and asynchronous consultations to provide effective healthcare services, especially during emergencies or situations like the COVID-19 pandemic.

- Efficient Time Management:

Prioritize efficient time management to reduce waiting times for patients, enhance scheduling processes, and improve overall workflow productivity.

- Early Detection and Diagnosis in Oncology:

Emphasize the importance of early detection in oncology by streamlining processes that lead to quicker diagnoses and treatments.

- Virtual Conferencing and Communication:

Facilitate virtual conferences and communication channels to overcome challenges, such as service lockdowns, and ensure continuous collaboration among healthcare professionals.

- Detailed Specification of Clinical Workflow:

Clearly define and communicate the detailed specifications of the clinical workflow to ensure consistency and accuracy in the execution of tasks and activities.

- Error Management and Resolution:

Implement robust mechanisms for identifying and resolving errors in the clinical workflow promptly to minimize potential risks to patient safety and data integrity.

- Impact on Electronic Health Records (EHR):

Understand and manage the impact of the clinical workflow on the Electronic Health Record (EHR) system, ensuring accurate and comprehensive recording of patient data.

- Preservation of Historical Data:

Establish protocols for preserving historical data while implementing changes to the workflow, ensuring continuity and the ability to analyze past results.

By focusing on these critical success factors, healthcare organizations can enhance the effectiveness of the Workflow of Patients in a Clinical Setting, leading to improved patient care, better outcomes, and a more streamlined healthcare delivery process.

5.2 Key Goal Indicators

Key Goal Indicators (KGIs) are measurable parameters that reflect the achievement of critical goals within a specific timeframe. For the Workflow of Patients in a Clinical Setting, these indicators can help monitor and assess the success of the implemented strategies and ensure that the critical success factors are being met. Here are some Key Goal Indicators for the Workflow of Patients:

- Average Patient Waiting Time:

KGI: Achieve and maintain a target average waiting time for patients before consultations, tests, or procedures.

- Percentage of On-Time Appointments:

KGI: Ensure a high percentage of patient appointments start on time, reducing delays and optimizing resource utilization.

- Utilization of Telemedicine Services:

KGI: Increase the percentage of patients utilizing telemedicine services, reflecting the successful integration of virtual healthcare options.

- Timeliness of Oncology Diagnoses:

KGI: Improve the timeliness of oncology diagnoses by tracking and achieving specific time intervals for screening, testing, and reporting.

- Rate of Clinical Workflow Errors:

KGI: Decrease the rate of errors within the clinical workflow, measured through incidents and near misses, to enhance patient safety.

- Adoption of Health Information Technology:

KGI: Monitor the adoption rate of health information technology tools within the clinical workflow to enhance communication and data accuracy.

- Patient Satisfaction Scores:

KGI: Regularly assess and improve patient satisfaction scores, capturing feedback on the overall experience with the clinical workflow.

- Percentage of Completed Virtual Conferences:

KGI: Achieve a high percentage of successfully completed virtual conferences, ensuring effective communication among healthcare professionals.

- Accuracy of Electronic Health Records (EHR):

KGI: Maintain a high level of accuracy in electronic health records, minimizing discrepancies and ensuring reliable patient data.

- Compliance with Workflow Specifications:

KGI: Ensure high compliance with the detailed specifications of the clinical workflow, measured through audits and assessments.

- Reduction in Service Lockdown Impact:

KGI: Monitor and reduce the impact of service lockdowns, assessing the ability to maintain healthcare services during challenging situations.

- Historical Data Preservation Rate:

KGI: Monitor the rate of successful preservation of historical data during workflow changes, ensuring data continuity and analysis capabilities.

These Key Goal Indicators provide a quantitative and qualitative way to evaluate the success and effectiveness of the Workflow of Patients in a Clinical Setting, allowing healthcare organizations to make informed decisions for continuous improvement.

6. Conclusion

In modern conditions of active development of information technologies, they become the basis for improving the healthcare system and providing medical care in hospitals. In large complexes such as hospitals, the implementation of information technology requires careful study and modeling, resulting in the formation of a Hospital Information System (HIS). Within this system, information flows along a defined patient's clinical pathway (according to the organizational structure) using electronic medical records. Patient data is recorded in electronic health records and can be retrieved as needed.

However, based on a literature review and field studies conducted at the Regional Oncology Center in Tangier, special attention is given to accurately representing the patient's clinical workflow. This is necessary to ensure an effective information system with a minimum number of errors. This study developed a business process model and notation that allows for a robust representation of the clinical patient workflow in oncology. This was achieved by analyzing the experience of national and international oncology institutions, which filled organizational gaps in the representation of the clinical workflow of the patient as a whole and ensured the unification of this representation at the national level.

The integration of Business Process Model and Notation and the E3 value model offers significant advantages to the processes within a Workflow of Patients in a Clinical Setting.

BPMN provides a standardized and visual representation of the hospital department's business processes. By mapping out workflows, decision points, and interactions, BPMN facilitates a clear understanding of the end-to-end processes involved in patient care, from admission to discharge. This visual clarity enables stakeholders, including healthcare professionals and administrators, to identify bottlenecks, streamline processes, and optimize resource utilization. Additionally, BPMN supports effective communication across different departments, fostering a more collaborative and integrated approach to healthcare delivery.

On the other hand, the E3 value model focuses on value creation and exchange within the hospital's broader ecosystem. It helps the hospital department identify key stakeholders, such as patients, healthcare providers, suppliers, and payers, and understand how value flows between them. By modeling economic transactions and relationships, the E3 value model assists in optimizing resource allocation, improving collaboration among stakeholders, and ultimately enhancing the overall value proposition of the hospital department.

In conclusion, the integration of BPMN and the E3 value model equips hospital departments with powerful tools to not only optimize their internal processes but also strategically position themselves within the broader healthcare ecosystem. This approach enhances the department's ability to deliver high-quality, patient-centered care while ensuring operational excellence and economic sustainability.