Original article

Optimization of the diagnostic examination process: identification of a methodology based on Lean Healthcare

Otimização do processo de realização de exames diagnósticos: identificação de metodologia baseada em *Lean Healthcare*

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ABSTRACT | OBJECTIVES: To identify gaps in the process of performing diagnostic tests in a healthcare unit (primary) and propose an appropriate methodology to improve this process (secondary). **METHOD:** A descriptive and qualitative study was carried out in a university hospital in Salvador, Bahia. After applying an anonymous online instrument to healthcare managers involved in performing diagnostic tests, the data were correlated with current information on the Lean Healthcare methodology to define and propose the tool. **RESULTS:** Six healthcare managers participated. Two thematic substages were defined: "Managers' view of the process for performing diagnostic tests" and "Association between information collected from managers and current data in the literature". After evaluating the Lean Healthcare tools and the association with the categories listed from the managers' responses, the one that best correlated with the challenge of organizing the process for performing diagnostic tests was "*Kamishibai*". **FINAL CONSIDERATIONS:** The identification of *Kamishibai* as a methodology to improve the execution of diagnostic exams was based on the literature review and the gaps in the current process (communication failures; inadequate application of the exam request flow; quantity and actual indication of exams; inadequate physical structure and reduced support staff).

KEYWORDS: Health Management. Diagnostic Tests. Patient Safety.

RESUMO | OBJETIVOS: Identificar as lacunas no processo de realização de exames diagnósticos em unidade assistencial (primário) e propor metodologia apropriada para aprimorar este processo (secundário). **MÉTODO:** Estudo descritivo e qualitativo realizado em um hospital universitário de Salvador/Bahia. Após aplicação de instrumento online anônimo com gestores de saúde envolvidos na realização de exames diagnósticos, os dados foram correlacionados às informações vigentes sobre a metodologia *Lean Healthcare* para definição e proposta da ferramenta. **RESULTADOS:** Participaram 6 gestores de saúde. Foram definidas duas subetapas temáticas: "Visão dos gestores acerca do processo para realização dos exames diagnósticos" e "Associação entre as informações coletadas com os gestores e os dados vigentes na literatura". Após avaliação das ferramentas do *Lean Healthcare* e a associação com a categorias elencadas a partir das respostas dos gestores, a que melhor correlacionou com o desafio de organização do processo para realização dos exames diagnósticos foi o "*Kamishibai*". **CONSIDERAÇÕES FINAIS:** A identificação do *Kamishibai* como metodologia para aprimorar a execução de exames diagnósticos baseou-se na revisão de literatura e nas lacunas existentes no processo atual (falhas na comunicação; aplicação inadequada do fluxo de solicitação de exames; quantidade e real indicação dos exames; estrutura física inadequada e pessoal de apoio reduzido).

PALAVRAS-CHAVE: Gestão em Saúde. Exames Diagnósticos. Segurança do Paciente.

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1. Introduction

Insufficient improvement in the flows for carrying out diagnostic exams in the *Sistema Único de Saúde* (SUS) generates significant impacts on the quality and efficiency of services, resulting in waiting lists, delays in treatment, and system overload. This inefficiency affects both patient experience and the system's ability to adequately meet demands, bringing about negative consequences for public health[1]. Optimization of these flows in the SUS is a complex challenge, demanding joint efforts of managers, health professionals and users of the system.

Given this situation in Brazil, organizations face increasing pressure to improve process management at a fast pace, which requires the implementation of new strategies and, accordingly, a constant search for innovation and quality[2]. Process management plays a crucial role in improvement programs, as several studies identify good practices and critical success factors for this strategy. Its objective is to analyze, define, organize, monitor and control the company's operations in a qualified and assertive manner[3]. The decision of which methodology should be implemented depends on the defined strategic objectives.

Organizational processes play a key role in multiprofessional interaction within an institution, creating methods that assist in the flow of activities between teams and promoting effective communication among different sectors. This assisted communication contributes to the identification of existing flaws in the process and optimizes the performance of diagnostic exams[3].

When considering healthcare processes within the hospital unit, patients commonly need to undergo low, medium and/or high complexity exams to guide the treatment. Many laboratory and/or imaging diagnostic exams need specific preparation and care to be taken to ensure safe and quality performance. In university hospitals, with a high turnover of health professionals in the process of training, there may be a substantial number of errors in patient identification, labeling, technique, collection time, contact with the responsible sector and reappointment of exams. These factors can directly interfere with the quality of care and consequently delay the performance of the exam and increase the length of stay of the individual in the hospital[1,4].

Interdisciplinary communication failures are frequently observed and identified as risk factors for the patient, which may lead to adverse events, inappropriate conduct, procedure errors and reappointment of exams, bringing about irritability and impairing the bond with the patient[5]. In this manner, it is understood that the risk could be diminished if there is a method of transferring information supported by records and standards that format a reliable communication system.

Considering that failures in processes within hospital environments can result in reappointment of exams that alter the flow of care, causing major impacts on the health and well-being of the assisted individual[6], it is worthwhile to propose an appropriate methodology for the process execution that can be applied to improve the performance of these exams; organizing interdisciplinary work and, consequently, promoting patient safety.

A recognized management system is known as Lean Healthcare. It is based on the theory of efficiency in production, prioritizing the elimination of waste and maximizing value delivered to the client, who in this context is the healthcare user[7]. Its purpose is to improve the quality of the work environment, promoting effective communication among professionals and increasing productivity in patient care, providing services of greater value and quality based on humanistic principles. Such values are crucial to ensure the safety of the users[7,8].

According to Lean Healthcare, there are methods based on agile thinking, aimed at improving the execution of the services, with constant deliveries and systematic problem solving[7]. For hospital organizations, the implementation of methods to improve care processes and favor more coherent and assertive decision-making is pertinent, because depending on the methodological strategy applied, and even with a small-scale investment, efficiency is observed in the process for improvement[8].

Lean Healthcare is a set of methods and tools that aim to improve the quality of attention to patients and efficiency of healthcare institutions. It is inspired by the Lean philosophy and, accordingly, focused on eliminating waste, providing agility, quality and humanization in healthcare spaces. The main benefits include reducing waiting time for diagnostic exams

and procedures, optimizing the flow of information to patients, reducing errors that could place patients at risk, increasing the satisfaction of patients, family members and the healthcare staff, and reducing operational costs[8]. Lean Healthcare has various methodologies/strategies for application that can be implemented in accordance with the profile of each institution, such as: Value Stream Mapping (VSM); Visual Management (*Kamishibai*); 5S; Flowracks; Kanban; *Poka-yoke*; and Spaghetti Diagram[8].

Given the relevance and complexity involved in the performance of diagnostic exams, and in order to minimize the number of reappointments of exams in the inpatient units of a university hospital in Salvador, Bahia, the primary objective of this study was to identify gaps in the process of performing diagnostic exams in a healthcare unit and the secondary objective was to propose an appropriate methodology to improve this process.

2. Method

A descriptive study, with a qualitative approach, carried out in a university hospital in the city of Salvador, Bahia. This hospital is a public and general institution belonging to a complex of the *Universidade Federal da Bahia*. The Federal university hospitals are important training centers for human resources in the health area and offer support in education, research and extension programs for higher education federal institutions to which they are associated with.

Data collection, in the first stage, occurred between September and October 2024 through an online questionnaire, of an anonymous and individual nature, prepared on the REDCap (Research Electronic Data Capture) platform, the link of which was sent to managers via institutional emails. Exclusion criteria were: managers of the university hospital, directly involved in the process of performing diagnostic exams, but who were on vacation and/or leave of absence during the data collection period.

Subjective aspects of the subjects (health managers directly involved in the process of performing diagnostic exams in a medical clinic care ward) were explored in the first stage, and in the second stage, information collected was correlated with current data in the literature related to the Lean Healthcare methodology, in order to identify the appropriate and effective methodology for the process of performing diagnostic exams.

The instrument comprised of open and closed questions, divided into 6 parts, seeking information on the profile of the professional (age, sector, length of time working in the sector related to the process of performing diagnostic exams); flow of care and constraints in the unit (how do you consider the flow for the performance of the exams? What are the obstacles in the process of performing the diagnostic exams in this institution? Any suggestions for improving the flow of patient care?); intersectoral communication and professional training (how do you consider the effectiveness of the current communication among clinical sectors and diagnostic sectors in this institution?); Is there any training on processes for performing diagnostic exams in this institution?); satisfaction and complaints regarding the service (do patients and healthcare staff complain about the process for performing diagnostic exams?); safety practices and service efficiency (what are the patient safety practices implemented in the unit during exams? Do the patients receive clear and sufficient information about the exams they need to perform?); and regarding delays occurred and feedback (how often do delays occur in the performance of diagnostic exams in this institution? Are there mechanisms in the institution to collect feedback from patients about diagnostic exams?).

All references to the statements of the interviewed parties were made from the coding of the letter "P", followed by numerical digits according to the sequence of the interviews, therefore it is understood as P1, Professional 01. It is important to note that all the participants signed the Informed Consent Form.

After data collection, the information was transferred to the Word program and compiled according to Bardin's core content meaning for data analysis. Bardin's content consists in recognizing the core meanings structuring the speech of the subject and operationalized in three stages: pre-analysis; exploration of the material and treatment of the results obtained interpretation[9].

The study complied strictly with Resolution 466/2012 of the National Health Council (CNS)[10], Data Protection Law 13.709/2018 and Circular Letter 2/2021/CONEP, which guides research projects involving the virtual environment, approved under report 7.047.832.

3. Results

There was a total of six healthcare managers with direct involvement in the process of performing diagnostic exams in the care ward participating in the research: Technical Reference Nurse of the wards, Head of the Nursing Division, Head of the Nursing Management Support Unit, Head of the Quality Management and Patient Safety Unit, Head of the Clinical Analysis Laboratory Unit and Head of the Bioimaging Unit. There was a representative of all the technical areas involved in the process of performing diagnostic exams and this being a qualitative study, it was possible to carry out a detailed analysis with significant results.

The age group of the responding professionals varied between 35 and 51 years of age, with time working in the diagnostic sector of between 1 and 9 years.

The result of the analysis evidenced three thematic categories: "Aspects related to communication on the performance of diagnostic exams", "Aspects related to the flow of requests for diagnostic exams" and "Aspects related to structural and technological issues". These categories were key points to start planning the identification of the appropriate methodology to optimize the process of conducting exams at the institution.

3.1 Category 1: aspects related to the flow of requests for diagnostic exams

- Communication failures

Participants, when questioned about the effectiveness of the flow of exams, highlighted that communication failures among the clinical and diagnostic sectors pervade throughout the whole process of performing the exams, often impacting the frequency of delays in conducting the exams.

As described below, P3 mentions that communication failures begin from the interactions of the multiprofessional team, from the change of shifts among professionals up until the request, appointment, and prescription of the preparation of the patient, influencing the effectiveness and quality of the diagnostic process. Participant P2 mentions failure in the communication channel within the multiprofessional team, specifically pointing out that the nursing team faces difficulties because it does not receive the absolute message transmitted. This could result in barriers that compromise the effectiveness of interaction between team members.

Communication failure from the request, by the medical team, to the appointment and preparation of patients... information that is lost as shift changes occur by professionals...making it impossible for professionals to take ownership of the care plan of the patient and actively participate in the guidance, preparation and transfer of the patient. (P3)

Only the patient is aware of the exam, and nursing staff is the last to know. (P2)

- Inadequate application of the flow of requests for exams

Associated with the communication process there is a management approach in order to systematize the request for exams. Participant P5 highlighted the communication failure between sectors and departments associated to the incorrect use of the *Aplicativo para Gestão de Hospitais Universitários* ("AGHU") tool, mentioning the need for improvement in this approach to enable communication between departments. P3's comments indirectly portray this systematic process when it addresses issues about the request, appointment, preparation and transfer of patients.

To parameterize the AGHU in order that all the requested exams are consistent with those performed and, finally, billed the AGHU tool needs to be improved a lot there are still some limitations in the executing unit. (P5)

Communication failure from the request, by the medical team, to the appointment and preparation of patients. Information is lost during changes of shifts by professionals. (P3)

Participants P1 and P6 also emphasized the lack of formal requests for exams by part of the team, and the non-computerized appointment of exams, generating duplication of exams. These communication failures, apart from delays in the flow, decrease patient safety, exposing them to invasive procedures, irritability and a series of iatrogenic behaviors.

There is also the duplicity in exams, generating confusion in the team. (P1)

Some with non-computerized appointment... lack of formal request. (P6)

- Communication and safety of the patient

However, regarding the association between patient safety and effective communication, P1 highlights a positive contribution to the guidance of procedures involving the patient, especially in relation to diagnostic exams, permitting active involvement and valuing their autonomy in the care process.

Detailed guidance to the patient regarding the exam to be performed. (P1)

In this respect, the effectiveness of the correct identification process of the patient is inserted, commented by participants P3, P4, P5 and P6, demonstrating that there is clear communication at the time of the patient's entry to the healthcare network.

The correct identification of the patient who will be performing the exam is important. (P3)

The use of labels with two identifiers is essential. (P4)

Verification of the identification of the patient on the wristband generates safety and minimizes failures. (P5)

Identification wristband conference. (P6)

Furthermore, one participant highlights the application of questionnaires to the patients as a strategy that strengthens the dissemination of knowledge regarding the process, promoting a deeper understanding and ensuring that the patient is fully informed about all the stages of the treatment. These aspects evidence the importance of communicative practices that favor safety, autonomy and active participation of patients in their own healthcare journey.

Application of questionnaires. (P5)

3.2 Category 2: aspects related to the flow of requests for diagnostic exams

- Quantity of diagnostic exams requested

P5 highlighted the importance of reducing requests for diagnostic exams for hospitalized patients, emphasizing that this measure could contribute towards improvement in the organizational structure. According to him, a reduction in the number of requests, mainly high-complexity ones, would enable a more efficient and fair flow in the request process, optimizing the use of resources available at the hospital. This, in turn, would benefit both outpatients and the clinical research area, promoting more universal, guided, and effective care.

Reducing requests for exams for hospitalized patients, mainly high-complexity patients (CT and MRI), to favor the possibility of generating new vacancies for outpatients and for clinical research. (P5)

Thus, according to the interviewee, a strategy could be implemented with the potential for optimizing hospital management in relation to the flow of requests for diagnostic exams within the sectors, guaranteeing that there would not be an excessive quantity of exams requested.

Associated with the number of exams requested, P1 also stressed the need to prepare a plan of priorities regarding requests made by resident doctors and/or preceptors, thus, the citation further supports P5's allusion to the creation of strategies that systemize the management of these services.

There needs to be more planning of the priorities to be carried out when requesting exams in the wards. (P1)

- Indications of diagnostic exams

Interviewees (P3, P5 e P6), emphasized the lack of training of health professionals for the indication of exams, either laboratorial and/or imaging exams. They also suggested that there should be justifications for the exams in order to effectively direct the requests.

Few discussions on exams to be carried out by patients to insert the entire team in the process, understanding the importance of performing each exam at the expected time. (P3)

Carry out educational work with the healthcare teams (doctors and residents) about the real need that justifies requests for exams, especially those of high complexity. (P5)

Flow little known, lack of training, requesting team not well oriented. (P6)

Inadequate medical requests. (P4)

3.3 Category 3: aspects related to structural and technological issues

- Use of available software for requesting diagnostic exams

Regarding obstacles during the performance of exams, participants had similar responses, evidencing the absence of a technological structure that includes them. With reference to hospital software, for example, P5 reports problems related to the limited use of the AGHU tool and the lack of available licensed software for the radiology team.

Offer better working conditions (licensed software) for the radiology team... parameterize the AGHU so that all the requested exams are consistent with those performed. (P5)

- Physical structure and support personnel

P1, P4 and P5 also pointed out that another significant obstacle is the lack of hospital structure in relation to the lack of materials, physical structure and issues related to the diagnostic exam equipment. One of the participants highlighted that investments in structural improvement of the sector is essential.

Suspension due to mechanical issues of the sector where exam would be carried out. (P1)

Lack of material. (P4)

Issues related to the devices (preventive and corrective maintenance) improve the physical structure of bioimaging, in order to offer improvement for the work of the teams, investing in renovations and adaptions of the internal physical space of bioimaging. (P5)

Regarding the reason for the delay, participant P5 highlights an important factor of the diagnostic exam sector, which is a shortage in staff scheduling.

Undermanned in the radiologist roster (vacation, medical leave, allowances, compensation of hours worked, etc.). (P5)

In line with what was exposed above, delay in requests associated with difficulties in transporting patients and low vacancies for the quantity of patients in the care unit stand out.

Delays are usually due to the exam sector and transport of the patient. (P1)

After an in-depth analysis and categorization of the responses of the managers, an association was made between the methodologies/strategies provided by Lean Healthcare, carefully correlating objectives with the needs of the healthcare system in this study.

It was taken into consideration that the selected tool required to meet the following criteria: analyze all of the stages for performing the diagnostic exams; minimize bottlenecks, waste and ensure optimization of the processes; eliminate or adapt unnecessary procedures or those causing delays; adjust organizational culture; and create a mindset of constant learning and improvement.

The table below points out seven Lean Healthcare tools with the respective objectives and relationship with the categorization of the managers' responses:

Table 1. Lean Healthcare tools x categorization of managers of the diagnostic exam processes at a University Hospital. Salvador, BA. 2025

Lean Healthcare Tools	Objectives of the tool	Categorization by managers	Related quantity
Value Stream Mapping (VSM)	- Verify which activities generate value to the patient and which do not. - Promote optimization of such activities to increase patient satisfaction.	a) Aspects related to communication. * Diagnostic tool and focused on the patient.	01
Visual Management *(Kamishibai)*	- Enable un understanding of the current scenario of the institution - Favor the proposal of solutions and decision-making.	a) Aspects related to communication; b) Aspects related to the flow of requests for diagnostic exams; c) Aspects related to structural and technological issues.	03
5S	- Insert 5 phases to aggregate value to the product or service; - Organize, standardize, use, *Lean* materials adequately and guarantee commitment of the team.	Ø * Greater relationship with the product and not with the processes.	Ø
Flowracks	- Organize materials according to the flow of use (example medicines in the pharmacy).	Ø * Greater relationship with the product and not with the processes.	Ø
Kanban	- Visually organize planned, running and completed activities.	a) Aspects related to communication; b) Aspects related to the flow of requests for diagnostic exams.	02
Poka-yoke	- Prevent errors by eliminating the causes.	a) Aspects related to communication.	01
Spaghetti diagram	- Study movements or distances covered by materials, information and team.	a) Aspects related to communication; b) Aspects related to the flow of requests for diagnostic exams; * Merely diagnostic tool.	02

Source: the authors (2025)

After assessment of the tools and their association with the categories raised from the responses of the managers, the best fit to deal with the challenge for organization of the process for performing diagnostic exams was Visual Management (*Kamishibai*).

3.4 Design for implementation of the *Kamishibai*

To optimize and standardize the flows, *Kamishibai* should be used on a daily basis, according to the demand for exams, in order to analyze and reestablish communication between the diagnostic exam sectors, carrying out a visual and objective audit of the operation of the hospital unit.

Materials used for preparation of the *Kamishibai* are: a white board (size M); cards (made of cardboard and plasticized); Removable green, yellow and red labels.

The audit cards shall be divided into areas in which the responsible professional should perform a pre-established checklist with “yes” and “no” spaces, which will be the pillars for assessment. If the answers have successful answers, the professional will place a GREEN label, meaning that it was carried out successfully. If there is any pending matter, a YELLOW label will be placed and when it is not correctly executed, a RED label will be placed.

Card checklist:

As detailed in Table 2 below, the following actions will be assessed on the card checklists: 1 – Assess exam request; 2 – Assess appointments; 3 – Assess guidance to the patient; 4 – Assess if adequate preparation was made for the exams; 5 – Assess the performance of the exams; 6 – Assess infrastructure and resources; 7 – Assess effectiveness of communication among sectors.

Table 2. Safety checklist for diagnostic exams – *Kamishibai*. Salvador, BA. 2025

Demands	Assessor	Parameters	Status
1. Exam requests	Name/sector of the professional	*A. Type of exam? Repetition or new?* *B. Medical request – Will the exam be performed internally or externally?* *C. SUS authorization?* *D. Priority attention?*	**Green - Compliant** **Red – Non-compliant** **Yellow - Pending**
2. Appointment	Name/sector of the professional	*A. Availability of date and time at the location;* *B. Remittance of appointment confirmation via available system (AGHU and/or telephone when urgent).*	**Green – appointment confirmed** **Red – critical issue that prevents realization.** **Yellow – Pending (what ?)**
3. Patient guidance	Name/sector of the professional	*A. Explain the type of exam and type of preparation;* *B. Duration and expected sensations;* *C. Post-exam atte*	**Green – Successfully performed** **Red – Not performed (report reason)** **Yellow – Pending**
4. Patient preparation	Name/sector of the professional	*A. Assess adequate fasting period;* *B. Assess suspension of medication (if recommended);* *C. Assess special needs (allergy/locomotion);* *D. Assess patient clothing.*	**Green – Successfully performed** **Red – Not performed (report reason)** **Yellow – Pending**
5. Performance of exams	Name/sector of the professional	*A. Eams performed at the appointed time: YES/NO;* *B. Cancelation due to lack of personnel/material: YES/NO;* *C. Exams performed according to prior medical request or adjustment required?*	**Green - Successfully performed** **Red – Not performed (report reason)** **Yellow – Pending**
6. Infrastructure and resources	Name/sector of the professional	*A. Adequate physical structure: YES/NO;* *B. Necessary material for exams available: YES/NO.*	**Green - Compliant** **Red - Non-compliant** **Yellow – Pending**
7.Communication effectiveness	Name/sector of the professional	*A. Communication regarding change in exam appointments and procedures informed at least 8 hours in advance: YES/NO;* *B. Use of communication systems in a standardized manner (AGHU system, telephone): YES/NO;* *Adequate response time for urgent and non-urgent demands: slow, moderate or fast.*	**Green - Compliant** **Red - Non-compliant** **Yellow – Pending**

Source: the authors (2025)

The *Kamishibai* board should be widely used to guide and improve the execution of the exam requests based on visualization and on the action plan determined from the results obtained, in order to guide the processes that break the flow. The action plan should align all of the linkages to improve efficiency.

4. Discussion

It is understood that the flow for the performance of diagnostic exams is complex, involving various sectors, workers, managers and technologies with the aim of promoting quality, safety and meeting the high hospital demand. Identifying gaps is the first step towards verifying opportunities for improvement and, consequently, optimizing the flows, making them more effective and efficient[2].

Throughout this study, it was observed that one of the main obstacles in the process for requesting and performing exams was communication failure among the clinical and diagnostic sectors, exacerbated by inadequate use of the available technological tools[5]. The results of the research evidenced that these communication failures permeate through the whole process, compromising fluidity in the work of the multiprofessional team and directly impacting the safety of the care provided to the patient. Among the problems most reported by the participants were inadequate transmission of information during change of shifts, lack of effective communication between the multiprofessional and sectorial teams, and the lack of a structured flow for request and appointment of exams.

Consistent with the above, the interviewed professionals also highlighted the inappropriate use of the exam management software (AGHU), which compromises the flow between the sectors, resulting in non-computerized requests and duplicity of exams. The errors communicated do not affect only the patients, but also generate operating obstacles, loss of information and impact on the quality of care. For this reason, failures occur in different forms, including divergent information about the results of critical exams, unnecessary fasting, difficulties in understanding data during shift changeovers, as well as omission or erroneous transmission of information[5].

Accordingly, it was perceived that communication gaps not only compromise the efficiency of the diagnostic processes, but also generate practical problems that directly impact the quality of care and safety of the patient. As pointed out by some of the interviewed parties, the team frequently receives late or insufficient information, hindering the preparation and adequate referral of the patients for exams. Fragmented communication among professionals, aggravated by inadequate management of the processes and by the underuse of technological tools, such as the AGHU, evidences the need for strategies that promote the integration and systematization of communication among hospital units.

In healthcare management, the application of the Lean methodology stands out in the elimination of delays, errors and inappropriate procedures, promoting a more agile, safe and efficient care. This approach is directly related to its core competencies, such as reducing process time, improving quality, increasing reliability of systems and reducing costs. In addition, by minimizing failures and optimizing workflows, Lean Healthcare, which is a management philosophy, contributes to more satisfied professionals and to the delivery of services more aligned to the needs of patients, guaranteeing more effective care[8].

Diagnostic exams cause challenges for healthcare management once they are complex, technological and involve various sectors, making it necessary to invest in training flows for team development, since obtaining the diagnostic is essential in patient care[11].

Based on the challenges identified throughout this study, it is observed that communication and operating failures directly impact all phases of the exam process. These failures not only delay the delivery of diagnoses, but also increase the need for new collection of samples and/or repeated imaging, extending the time necessary for defining the clinical condition of the patient. Consequently, there is the risk of worsening the condition while waiting for the results, as well as the significant financial impact, once the repetition of exams overloads the public healthcare system and compromises the efficiency of the services provided[12]. Given this scenario, the application of methodologies such as Lean Healthcare, allied to tools such as the *Kamishibai*, emerges as a strategy based on evidence, necessary to minimize errors, optimize processes and guarantee a safer and more efficient care, benefiting both professionals and patients.

Kamishibai is a Lean methodology tool, designed to support process management. It is used as a process audit by means of the visualization of a whiteboard with tasks to be performed, working as a checklist and organizing institutional processes. It assists management, determining priorities and establishing effective communication through visual management, evidencing conformities and non-conformities of the established flow, permitting real-time corrective actions[13].

The *Kamishibai* board can promote a visual control of the tasks to be performed, being a detailed structure to assess the efficiency and safety of the flow of requests, appointments, patient preparation, execution of diagnostic exams, infrastructure and resources of the unit and communication effectiveness in the hospital environment. It permits a standardized visual monitoring, enabling the identification of problems and implementation of continued improvement. In a clear and intuitive manner, this approach permits all of the participants of the process to easily understand pending matters and next steps necessary for the conclusion of each stage[12].

When correctly applied, the *Kamishibai* audits are planned within staggered periods, on a weekly, biweekly or even quarterly basis in order to meet the needs of the unit in which it was implemented[13]. In order for them to be carried out in an efficient manner, it is necessary that both managers and directors participate. Accordingly, one of the requirements for its operation is effective communication, engaging the team in solving problems and enabling their due roles, promoting interaction between leaders and their teams[11].

This tool allows for the structuring of monitoring and control activities in a systematic manner, contributing towards increasing efficiency of the institutional processes, such as the performance of diagnostic exams[13,14]. It has been widely used in the health area, obtaining success in the organization of flows in public and private hospital units. Because it is an agile tool, capable of identifying and eliminating waste, avoiding delays and cancellations of diagnostic exams, with high adaptability and low cost, it is advantageous and indicated to be used in public hospitals[13].

The fact that the study was conducted in a single center could be considered a limitation, and, in addition, it is necessary to consider selection bias, once the research addressed only managers because they were considered to have a wider and strategic perspective of the process for performing diagnostic exams.

5. Final considerations

Identifying the *Kamishibai* as an appropriate methodology to improve the process of performing diagnostic exams in a healthcare unit was based on the association between data collected through a literature review on the subject and the main gaps pointed out by managers involved in this hospital dynamic, such as: communication failures that directly imply patient safety; inappropriate application of the diagnostic exam request flow; quantity and actual indication of diagnostic exams requested; inadequate physical structure in some spaces and reduced support staff.

The study could contribute towards healthcare management, optimizing the whole process for performing exams, improve flows and improve quality in the care provided to the user. It can also ensure that adjustments to the current scenario can favor communication, minimize waste and delays, and guarantee positive changes in the organizational culture, enhancing tasks among multiprofessional teams and sectors with the purpose of promoting solutions of excellence for the care of all of the patients in the unit, strengthening patient safety.

Even with the use of a standard tool, it is more important that the professionals involved understand and are aware of the importance of constant review, fostering a mindset of continuous learning and improvement of the team as a whole.

Authors' contributions

The authors declare that they made substantial contribution in terms of conception or design of the research, acquisition, analysis or interpretation of data and the writing or critical review of the relevant intellectual content. All of the authors approved the final version to be published and agreed to take public responsibility for all aspects of the study.

Competing interests

No financial, legal or political conflict involving third parties (government, companies and private foundations, etc.) were declared for any aspect of the study submitted (including, but not limited to grants and funding, advisory board membership, design of the study, preparation of manuscripts, statistical analysis, etc.).

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References

1. Mendes EV. Desafios do SUS [Internet]. Brasília: Conselho Nacional de Secretários de Saúde – CONASS; 2019 [cited 2025 Jun.15th]. Available from: https://www.conass.org.br/biblioteca/desafios-do-sus

2. Costa JMH. Method for diagnosis and identification of new Product Development Process improvement opportunities using a pattern of recurrent undesirable effects [tese] [Internet]. São Carlos: Escola de Engenharia de São Carlos; 2011. https://doi.org/10.11606/T.18.2011.tde-25042011-112003

3. Freitas CC, Pires EEM, Emerick JA, Fraga BO. Process management in the hospital area: a comparative literature review [Internet]. Minas Gerais: Faculdade do Futuro; 2023 [cited 2024 Jun. 6th]. Available from: https://faculdadedofuturo.com.br/wp-content/uploads/2023/05/TCC-GestOo-de-Processos-na-rea-Hospitalar-RevisOo-Comparativa-de-Literatura-2.pdf

4. Mrazek C, Lippi G, Keppel MH, Felder TK, Oberkofler H, Haschke-Becher E, et al. Errors within the total laboratory examing process, from exam selection to medical decision-making - A review of causes, consequences, surveillance and solutions. Biochem Med (Zagreb). 2020;30:020502. https://doi.org/10.11613/BM.2020.020502

5. Barra DCC, Alvarez AG, Knihs NS. Comunicação efetiva [Internet]. Florianópolis: UFSC; 2022 [cited 2024 Jun. 6th]. Available from: https://repositorio.ufsc.br/handle/123456789/240250

6. Oliveira RGAM, Silva GAF. The main errors of the pre-analytical phase of laboratory exams. RBAC. 2022;54(1):16-25. https://doi.org/10.21877/2448-3877.202202089

7. Castello RV. Lean healthcare: um caminho para melhorias de gestão e serviços de saúde [dissertação] [Internet]. Uberlândia: Universidade Federal de Uberlândia; 2022. Available from: https://repositorio.ufu.br/handle/123456789/35436

8. Limonta GF. Conceitos Lean em sistemas de saúde: eficácia da utilização de ferramentas para gestão de estoques de medicamentos e correlatos [dissertação] [Internet]. Campinas: Universidade São Francisco; 2014. Available from: https://lyceumonline.usf.edu.br/salavirtual/documentos/2609.pdf

9. Sousa JR, Santos SCM. Content analysis in qualitative research. PDE. 2020;10(2):1396-1416. https://doi.org/10.34019/2237-9444.2020.v10.31559

10. Resolução nº 466, de 12 de dezembro de 2012 (Brazil). Aprova as seguintes diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. [Internet]. Diário Oficial da União. Available from: https://www.gov.br/conselho-nacional-de-saude/pt-br/acesso-a-informacao/atos-normativos/resolucoes/2012/resolucao-no-466.pdf

11. Srougé MPP, Cardoso LF, Nakano LCU. O impacto da otimização dos processos de alta hospitalar na economia em saúde. Int J Health Manag Rev. 2024;10(1):e355. https://doi.org/10.47172/ijhmreview.v10i1.355

12. Silva ÉA, Ribeiro LCF, Souza LT, Vitorino MGC, Valadares ACF. Assertiveness in laboratory exams - the importance of pre and post- analytical phases focusing on the final diagnosis. Revista ReCiFaQui. 2022;2(12):163-178. Available from: https://recifaqui.faqui.edu.br/index.php/recifaqui/article/view/204

13. Labone Consultoria [Internet]. Kamishibai: uma ferramenta para a gestão de processos. [cited 2020 Jun. 6th]. Available from: https://www.laboneconsultoria.com.br/kamishibai/

14. Shea G, Smith W, Koffarnus K, Knobloch MJ, Safdar N. Kamishibai cards to sustain evidence-based practices to reduce healthcare-associated infections. am J Infect Control. 2019;47(4):358-365. https://doi.org/10.1016/j.ajic.2018.10.004