Jornal de Assistência Farmacêutica e Farmacoeconomia
v.10, n.3, 2025.
Review Article

Use of Dashboards in Pharmaceutical Services: an integrative review

Uso de dashboards em serviços farmacêuticos: uma revisão integrativa

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Received in: 11/07/2024

Accepted for publication on: 07/29/2025

Abstract

Introduction: A large volume of data generated in pharmaceutical services can make it difficult to visualize, interpret results, and decision-making. Dashboards are a useful tool in this process. **Objective:** To synthesize primary studies that described the use of dashboards in pharmaceutical services. **Methodos:** An integrative review was conducted through a literature search up to May 2024 in the Medline, Lilacs, Scopus databases, and the Google Scholar search engine (the first 60 records). The search strategy combined keywords in English and/or Portuguese, including the following terms: 'dashboards', 'pharmacist', 'pharmaceutical services', and 'pharmacy'. **Results:** The results were presented in a narrative and tabular format. Nine studies were included in this review. Most of the studies were conducted in the United States, in the hospital pharmacy context and for logistic services. The studies demonstrated positive results from the use of dashboards for improving both the services provided to patients and the performance of pharmacists, although challenges have been identified, such as lack of data, insufficient professional training, and resistance to use. **Conclusions:** Therefore, although there are barriers to its implementation, the results indicate that the use of the tool should be encouraged to support continuous improvement in the quality of pharmaceutical services.
Keywords: Dashboard; Pharmaceutical services; Data analysis; Quality of health care.

Resumo

Introdução: O grande volume de dados gerados em serviços farmacêuticos pode dificultar a visualização, interpretação dos resultados e tomada de decisão, sendo o *dashboard* uma ferramenta útil neste processo. **Objetivo:** Sintetizar estudos primários que descreveram o uso de *dashboards* em serviços farmacêuticos. **Métodos:** Foi realizada uma revisão integrativa por meio de busca na literatura até maio de 2024, nas bases de dados PubMed, Lilacs, Scopus e motor de busca Google Scholar (os 60 primeiros registros). A pesquisa utilizou palavras-chave ou combinações dos termos em inglês e/ou português: "*dashboards*", "farmacêutico", "serviços farmacêuticos", "farmácia". **Resultados:** Os resultados foram apresentados de forma narrativa e tabular. Nove estudos foram incluídos na revisão. A maioria dos estudos foram conduzidos nos Estados Unidos da América, no contexto de farmácia hospitalar e para serviços técnico-gerenciais. Os estudos demonstraram resultados positivos do uso de *dashboards* para a melhoria tanto dos serviços prestados aos pacientes quanto para otimização do trabalho dos farmacêuticos, embora desafios tenham sido apontados como falta de dados, capacitação dos profissionais e resistência ao uso. **Conclusões:** Portanto, embora existam barreiras para sua implementação, os resultados indicam que a utilização da ferramenta deve ser estimulada para contribuir com a melhoria contínua da qualidade dos serviços farmacêuticos.
Palavras-chave: Dashboard; Serviços farmacêuticos; Análise de dados; Qualidade da assistência à saúde.

Introduction

According to Ordinance No. 2,510 of the Ministry of Health of december 19, 2005, health technologies are considered to be medicines, materials, equipment and procedures, organizational, educational, information and support systems, programs and care protocols used in the provision of health care to the population.[1] Thus, it is important to seek innovations to promote an increasingly high-quality health service for the population.

However, obtaining the best technologies is not enough to advance the quality of care, since without monitoring and evaluation there is no guarantee that its use is efficient. It can be said that monitoring and evaluation are complementary aspects of the same process. Monitoring follows the development of certain activities over time and formulates hypotheses about it. Evaluation, in turn, deepens the understanding of this development, investigating the hypotheses generated by monitoring through value judgment.[2] Al-Assaf et al.[3] state that access to quality information allows health systems to prioritize patients effectively by stratifying them based on risk factors. This approach enhances trend assessment, ultimately improving healthcare delivery and patient outcomes. In addition, it makes it possible to adjust resources and services, allowing the reduction of waiting times and increasing their efficiency by aligning available resources with needs.

One way to monitor and evaluate the quality of health services is by using digital tools such as the *dashboard*, which is a visual presentation of the most important information in real time about a service, allowing the process quickly and facilitating decision-making.[4] In this context, the tool can be used to monitor and evaluate the effectiveness of treatments offered, patient safety, treatment cost forecasting, drug supply, among other established parameters.[5]

Pharmaceutical services are part of health services, which comprise activities aimed at preventing diseases, promoting, protecting and recovering health, and improving the quality of life of individuals.[6] The use of structured tools for monitoring and evaluating these services can increase productivity and optimize patient care. However, the adoption of *dashboards* in pharmaceutical services still faces challenges for their implementation in practice. Therefore, the present study aims to identify studies that describe the use of *dashboards* in pharmaceutical services, pointing out the benefits and limitations of their use.

Methods

It is an integrative literature review, a research method that allows gathering and synthesizing the results of published studies, collaborating to deepen the understanding of a given topic. The main steps described by Souza et al.[7] were followed: elaboration of the guiding question, search criteria in the literature, data collection, discussion and presentation of the results obtained.

To guide the study, the research question was formulated: "What is the scientific evidence on the use of *dashboards* in pharmaceutical services?".

Medline (via PubMed), Lilacs Scopus and Google Scholar search engine (the first 60 records) were used to search for studies up to May 2024. The search was carried out using the controlled vocabularies MeSH and DeCS, keywords or combinations of terms in English and/or Portuguese: "*dashboards*", "pharmacist", "pharmaceutical services", "pharmacy" and the Boolean operators AND and OR. There was no restriction of year and language. Studies relevant to the topic were selected to be part of the body of the review.

Primary studies published in scientific journals that address the use of *dashboards* in pharmaceutical services were included. A dashboard is a tool that allows the visualization and monitoring of a more or less complex set of data or indicators in a simple way.[3] On the other hand, studies that addressed the use of the tool in other health services, review studies, non-peer-reviewed studies, articles not available on websites, congress abstracts, theses and dissertations, and books/book chapters were excluded.

The articles obtained from the databases were imported into the Mendeley reference management software for deletion of duplicate files. The selection of studies was carried out, at first, through the title and abstract, excluding those that were not related to the theme. Subsequently, the texts were analyzed in full in order to select the studies according

to the eligibility criterion. The selection of articles was made by a researcher (C.B.A.) and reviewed by another researcher (T.M.L.). The articles were obtained via Capes Journals (https://www.periodicos.capes.gov.br) and, when not available in it, were requested through the ResearchGate platform (https://www.researchgate.net/) or by e-mail to the corresponding author.

In order to store and organize the collected data, Google Drive cloud storage was used, where the files were separated by folders. The results were synthesized in a narrative and tabular way. The data extracted from the studies were: author, year of publication, type of publication, country, context (hospital, outpatient or community pharmacy), services (technical-managerial or clinical), objectives, tool/software used, main results and limitations of the studies. The concepts and ideas of the authors of the studies were respected.

The evaluation of the methodological quality of the included articles was not carried out, as the integrative reviews aim to gather and synthesize the available scientific evidence and highlight its main characteristics, regardless of the quality of the evidence.

Results

Database search

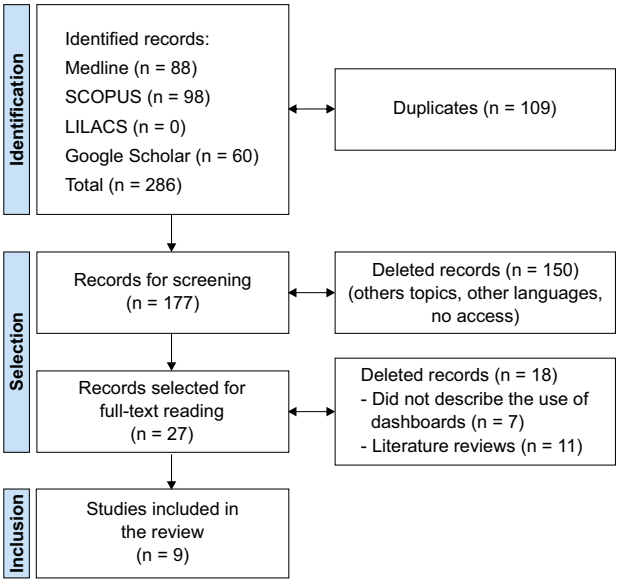
The search in databases and the search engine identified 286 potentially relevant records. After the duplicates were excluded and the titles and abstracts were screened, 27 of them were selected for full reading. Of these, nine studies[8-16] met the inclusion criteria. The flowchart of the research results of the included studies is presented in Figure 1.

Main characteristics of the included studies

The studies were published between the years 2007 and 2023 and all were written in English. Most of the type of publication of the included studies was original articles.[8,10-16] Most studies were conducted in the United States of America,[9-11,14-16] in the context of hospital pharmacy[9-13,15,16] and for technical-managerial services.[8-12,15] Different software was used to construct the *dashboard* and only two studies did not describe its limitations.[8,12] The characteristics of the included studies are shown in Chart 1.

The benefits and challenges discussed by the authors were summarized and presented in Chart 2. A comprehensive overview of the main advantages and limitations in the use of *dashboards* for pharmaceutical services addressed by the included studies is presented below.

Figure 1. Flowchart of the selection of studies included in the literature review



Source: Prepared by the authors

Main benefits highlighted by studies

Al-Jazairi et al. (2021)[8] demonstrated how the use of a near-real-time dashboard contributed to avoiding prescription backlogs during the COVID-19 pandemic, allowing for rapid adjustments in human resource allocation and preventing treatment interruptions. Likewise, Wai and collaborators. (2023)[15] showed that the integration of *dashboards* into automated dispensing booths resulted in significant reductions in average inventory costs and alerts of missing doses, reflecting greater logistical efficiency. Mahmoodabadi et al.[12] emphasized that the use of a *dashboard* proved to be essential to monitor performance indicators in real time, facilitating the interpretation of data and directly contributing to a more effective management of pharmaceutical services.

Table 1. Characteristics of the included studies.

Author, year	Country	Context	Service	Objectives	Software	Main results	Limitations
Al-Jazairi *et al*., 20218	Saudi Arabia	Outpatient Pharmacy	Technical-managerial	Describe the usefulness of an innovative, near-real-time dashboard in managing workload during the COVID-19 pandemic	ScriptPro	Prevention of prescription backlog, which can contribute to reducing therapy interruption, improving patient compliance, and improving care.	NR
Bahl *et al*., 20079	USA	Hospital Pharmacy	Technical-managerial	Identify trends in medication use and normalize data regarding patient volume	Siebel Analysis	The cost reports that have been developed have allowed for a better understanding of drug use.	Difficulty in evaluating the effect of the use of the *dashboard* in hospitalized patients and limitation in the central data processing system regarding the distribution of information and presentation of data.
Kinney *et al*., 201710	USA	Hospital Pharmacy	Technical-managerial	Describe a comprehensive, real-time dashboard and evaluate its use in an Inpatient Care Intravenous Mixing Center pharmacy.	Lean	Several areas for improvement were identified. The display of trends has become clearer, making it easier to visualize results and reorganize workflow	The lack of data for on-time production was due to the absence of registration in each delivery, which may have contributed to the uncertainty in the information collected.
Lux *et al*., 202211	USA	Hospital and Outpatient Pharmacy	Technical-managerial	Track drug shortages and identify their causes and trends during the COVID-19 pandemic.	NR	High rates of hospital beds occupied with the increase in the shortage of medicines were identified.	Response rate was lower than expected. The available data were duly de-identified, which made it impossible to verify possible repeated responses by the same hospitals throughout the study. It was not possible to determine whether the shortage of medicines observed was restricted to a specific region. In addition, there was no record of the manufacturers or distributors associated with each institution.
Mahmoodabadi *et al*., 202012	Iran	Hospital Pharmacy	Technical-managerial	Determine KPIs necessary for the efficient operation of hospital pharmacies and design a *dashboard* based on the detailed specification of technical and operational requirements.	Qlik-View12	The development of efficient dashboards should be based on the use of a small number of KPIs, ensuring clarity and focus on essential metrics	NR

Author, year	Country	Context	Service	Objectives	Software	Main results	Limitations
Sajogo *et al*., 202313	Australia	Hospital Pharmacy	Clinical	Describe the process of developing a robust, efficient, and adaptable tool for structured documentation and critical analysis of clinical interventions.	Microsoft Excel®	It demonstrated the feasibility of developing a low-cost and low-resource clinical intervention documentation tool, capable of providing essential data for quality improvement.	It did not consider the analysis of the variation in the number of clinical interventions per pharmacist, which limits the understanding of the distribution and the identification of possible outliers associated with the individual performance of each professional.
Umbreit *et al*., 201614	USA	Outpatient Pharmacy	Clinical	Describe a method for internal benchmarking of GTM's pharmaceutical activities	PhARMS	The use of the tool facilitated the evaluation of productivity goals and monitoring of patient care in a GTM program.	The data does not provide any information about patient outcomes, healthcare costs, or reimbursements for GTM services
Wai *et al*., 202315	USA	Hospital Pharmacy	Technical-managerial	Determine the impact of a *dashboard* to optimize automated dispensing booths	Qlik Sense®	Optimizing automated dispensing booths had a positive impact on almost all KPIs measured during the study.	Implemented in a single large hospital and must be externally validated in different hospitals to verify the level of effectiveness of optimization methodologies.
Waitman *et al*., 201116	USA	Hospital Pharmacy	Clinical	Implement a real-time surveillance application to enable pharmaceutical review of requests for high vigilance medicines, complementing the entry automated ordering from suppliers and systems integrated clinical decision support systems in a tertiary hospital.	Python	Even in environments that use advanced computerized systems, surveillance systems have been shown to be essential for the detection of medication errors and optimization of drug therapy	The daily use of the tool required significant adjustments to the staffing and workflow of clinical pharmacists.

Abbreviations: USA (United States of America), GTM (drug therapy management), KPI (performance indicators), NR (not reported).
Source: Prepared by the authors (2025).

Bahl et al. (2007)[9] reported that *dashboards* can help in the analysis of trends in drug consumption by therapeutic class, hospital service and type of patient, promoting savings by identifying opportunities to rationalize expenses. Kinney et al. (2017)[10] reinforced this idea by showing how the use of a Lean methodology combined with *dashboards* increased productivity and reduced operational costs, including the elimination of outsourced processes and cost savings.

The study by Lux et al. (2022)[11] demonstrated how the tool can be used to monitor medicine shortages during health crises, ensuring that health facilities maintain adequate levels of supply.

Sajogo et al. (2023)[13] explored the use of *dashboards* to document clinical interventions performed by pharmacists, recording thousands of annual actions and highlighting the relevance of the tool for the standardization and critical analysis of these activities. Umbreit et al. (2016),[14] in turn, highlighted how dashboards facilitated the monitoring of time dedicated to clinical activities and the direct impact on patient care, justifying the need to increase the number of full-time pharmacists. In addition, Waitman et al. (2011)[16] highlighted the importance of *dashboards* in the real-time surveillance of high-surveillance medications, contributing to the prevention of medication errors and adverse events.

Main challenges highlighted by the studies

Bahl et al. (2007)[9] observed difficulties in evaluating the impact of the *dashboard* on hospitalized patients due to the lack of an updated and integrated central data processing system.

Mahmoodabadi et al. (2020)[12] emphasized that the use of *dashboards* requires technical training on the part of the professionals involved and that the inappropriate choice of metrics can compromise the clarity and usefulness of the tool.

Kinney et al. (2017)[10] pointed out that the absence of detailed records in each delivery hindered the collection of accurate information, generating uncertainties in the results. Similarly, Lux et al. (2022)[11] highlighted the difficulty in verifying possible repeated responses from hospitals due to the lack of data identification, in addition to the impossibility of determining whether the shortage of medicines was regionalized.

Sajogo et al. (2023)[13] reported resistance from professionals to adopt new technologies, especially when there is a lack of knowledge about how to interpret the data or when *dashboards* are seen as another administrative task. Waitman et al. (2011)[16] highlighted that the daily use of the *dashboard* required significant adjustments in the workflow and personnel allocation, which can lead to initial resistance.

Table 2. Benefits and challenges of using *dashboards* in pharmaceutical services.

Benefits	Challenges
Workflow management	Need for efficient operating systems
Cost management	Staff training
Service Quality Assurance	Lack of data or incorrect data
Improved adherence and safety of treatment	Professionals' adherence to the tool

Source: Prepared by the authors (2025).

Discussion

The use of *dashboards* in pharmaceutical services, as evidenced by the studies included in this review, proved to be a promising tool both for improving the services provided to patients and for optimizing the work process of pharmacists. These monitoring dashboards allow for simplified visualization of complex data in real-time, aiding in informed decision-making and efficient management of human and material resources. However, despite the benefits identified, its implementation faces practical and technical barriers, such as training and adherence by professionals and integrated systems, which need to be overcome to ensure its effective use.

Previous reviews have addressed the use of dashboards to support patient-centered clinical decision-making[17] and in hospital emergency departments,[18] highlighting the improvement in processes, communication, and situational awareness. Other studies also show positive results from the use of *dashboards* in the surveillance of epidemiological data on malaria[19] and health information of patients

with hypercholesterolemia.[20] These findings reveal the tool's potential for use in various areas, including pharmaceutical services.

In cases that are not normal, such as the COVID-19 pandemic, which brought shortages of medicines and increased pharmacists' workload,[21] the use of this tool proved to be effective for management and decision-making, as addressed in two studies. Al-Jazairi et al.[8] indicated how *dashboards* can be used to manage the high demand for these professionals, while Lux et al.[11] used the tool to predict and manage drug shortages. Another issue observed was cost management, an activity closely linked to the performance of the pharmacist.[22] Two studies[9,10] have reinforced the importance of these tools in the analysis of trends in drug consumption and in the identification of opportunities to rationalize expenses, resulting in direct savings and increased productivity. In addition, studies have also highlighted the role of *dashboards* in the real-time surveillance of high-vigilance medications[16] and in the standardized record of clinical interventions,[13] directly contributing to patient safety and quality of care.

The use of *dashboards* can increase patient safety by aiding decision-making regarding drug therapy. The study by Waitman et al.[16] indicated a decrease in the occurrence of adverse effects associated with high-surveillance drugs when using the tool to monitor prescriptions and patients using them.

The use of tools that improve pharmaceutical services, promoting both positive health outcomes for patients and optimizing the work of professionals, should be widely encouraged and disseminated.[23] When used properly, *dashboards* represent an excellent alternative. However, like other management tools, they have limitations that must be considered according to the context in which they are applied.

Despite technological advances, many information systems are still not prepared to support *dashboards* effectively, as highlighted by Bahl et al. (2007).[9] Another challenge is the lack of data or incorrect data, cited by Lux et al. (2022),[11] highlighting that the absence of detailed records in each evaluation hindered the collection of accurate information, generating uncertainties in the results. In addition, the training of human resources and the resistance of professionals to adopt new technologies are important limitations described by the studies.[12,13,16] Pharmacists should understand the importance of systematic data collection in clinical practice. To overcome this obstacle, it is necessary to involve professionals in the process of developing and customizing the tool, ensuring that it meets their daily practice needs. Success in the implementation of *dashboards* also depends on the quality of the information added by the professionals themselves, which does not always occur adequately, compromising the effectiveness of the data generated. The careful choice of indicators is essential to ensure that the visualization offered by the dashboard is clear, accurate, and useful for decision-making. In addition, maintaining the tool requires specialized technical knowledge and the use of efficient operating systems.[24.25]

Most of the studies included in this review were conducted in hospital settings, suggesting the need to investigate the use of this tool in other contexts, such as community pharmacies and outpatient clinics, where management challenges and resource availability may be different. In addition, only three studies were conducted in clinical services, emphasizing the need for future studies on the use of dashboards to assist in improving the clinical practice of pharmacists.

It is worth noting that most of the studies were conducted in the United States of America. This indicates a significant evidence gap in countries with less centralized health systems and more limited technological infrastructure, such as those in Latin America and Africa. In these countries, many healthcare institutions lack access to specialized *software*, stable internet connectivity, and adequate devices to run advanced digital tools. In addition, even when there is interest in adopting *dashboards*, the lack of investment in basic infrastructure can make it impossible to collect, store, and analyze data in real time.[26,27] Another challenge in health systems around the world, particularly in countries with fragmented systems such as Brazil, is interoperability between different health management platforms. The integration of data from different systems (such as electronic medical records, medication dispensation, and medical prescription) is essential for

dashboards to present complete and useful information.[28] In view of these facts, it is important for institutions to develop contextualized solutions, adopting strategies focused on the technical training of professionals, simplicity of interface and ease of use, integration with existing systems, manual or semi-automatic data collection in environments with little technological infrastructure, and government and institutional support for the modernization of information systems.

This study has limitations. It is possible that some studies were not retrieved because they were not indexed in the databases used. Finally, there was no evaluation of the quality of the studies taking into account the inherent characteristics of an integrative literature review.

Conclusion

The use of *dashboards* for pharmaceutical services is still little addressed. The studies included in this review show that its implementation is promising both for optimizing the work of professionals and for improving patient health outcomes. Its use corroborates improvements in adherence to drug therapy, patient safety, and therapy optimization. From the professional's point of view, it was observed that the tool brings better working conditions, optimizing the workload and facilitating the monitoring of patients and services provided. However, the need for efficient operating systems, trained human resources, and the correct adherence of professionals are barriers to its use.

There is a need to expand research on the use of *dashboards* in contexts other than the United States and outside the hospital setting, especially in developing countries and in community or outpatient pharmaceutical services. It is also important to evaluate the acceptance and usability of the tools by professionals, ensuring that they are practical and useful in everyday life. In addition, the real impact of *dashboards* on patients' clinical outcomes should be investigated. Finally, there is promising potential to apply advanced technologies, such as artificial intelligence, to improve the accuracy and personalization of these tools, making them more effective in supporting decision making in the pharmaceutical context.

Ethical and legal aspects
The authors declare that they do not require ethical approval from a Research Ethics Committee.

Declaration of authorship and authors' contributions
CBA: Data curation, formal analysis, research, writing, review, and editing. TML: Conceptualization, data curation, formal analysis, research, methodology, administration and planning, supervision, validation, review, and editing.

Conflict of interest
All authors declare no conflicts of interest.

Source of funding
No financing to declare.

Data Declaration and Availability
The contents underlying the research text are contained in the manuscript.

Responsible editor
Pablo de Moura Santos

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