

The role of the pharmacy navigator in hematopoietic stem cell transplantation

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Section editor: Fernando Barroso Duarte 

Received: Aug. 28, 2025 • Accepted: Sept. 29, 2025

ABSTRACT

Hematopoietic stem cell transplantation (HSCT) is a complex procedure that requires rigorous pharmacotherapeutic management. This study aimed to describe the role of the pharmacy navigator in HSCT at the Hospital das Clínicas of the Medical School of the Universidade de São Paulo. For the assessment of pharmacist activities in HSCT, a literature review was conducted, alongside direct observation of pharmaceutical activities in different HSCT phases at the service: pre-transplant, hospitalization, discharge, and outpatient follow-up. It was observed that the pharmacy navigator plays a crucial role, including medication reconciliation, dose adjustments, monitoring drug interactions and toxicities, and providing health education to patients and the multidisciplinary team. Pharmacotherapeutic follow-up contributed to reducing medication errors, improving treatment adherence, and ensuring safer administration of immunosuppressants and antimicrobials. In conclusion, the presence of a pharmacy navigator in HSCT is essential to optimize treatment, prevent complications, and enhance patients' quality of life, consolidating this professional as a key member of the multidisciplinary healthcare team.

Keywords: Patient Navigator. Hematopoietic Stem Cell Transplantation. Pharmaceutical Services.

INTRODUCTION

Patients undergoing hematopoietic stem cell transplantation (HSCT) go through multiple phases, each one associated with specific risks, primarily due to immunological impairment, which significantly increases the morbidity and mortality of the procedure. At every stage of HSCT, pharmacotherapeutic management is crucial, from antineoplastic therapy to the patient's bone marrow recovery. This process is characterized by polypharmacy, driven by the high risk of infectious complications and the incidence of graft-versus-host disease (GVHD) in allogeneic transplants. The use of immunosuppressants, antimicrobials, and prophylactic therapies requires frequent dose adjustments and medication modifications, underscoring the critical role of a pharmacist in optimizing pharmacotherapeutic management¹⁻³.

Recognizing the complexity of oncological treatments, Harold Freeman, an oncologic surgeon, introduced the concept of "patient navigators," professionals who provide personalized support to patients, families, and caregivers throughout the treatment process, helping them overcome challenges encountered along their journey. The activities performed by healthcare navigators include health education, assistance with appointment scheduling, language interpretation, and pharmacotherapy follow-up, with a patient-centered approach aimed at fostering autonomy^{4,5}.

Although navigators are most commonly nurses or social workers, and given the lack of data in the literature, this study aimed to identify and describe the activities performed by pharmacists in the context of HSCT. Specifically, it sought to outline the role of a pharmacist navigator in the HSCT service at the Hospital das Clínicas of the Medical School at the Universidade de São Paulo (HCFMUSP), a leading university hospital in Brazil, emphasizing patient-centered care throughout the pharmacotherapeutic process involved in HSCT⁶.

METHODS

Observational and single-center study

To identify the activities performed by pharmacists in HSCT, a bibliographic search was conducted using the PubMed, Virtual Health Library (Biblioteca Virtual da Saúde—BVS), Web of Science, and Scopus databases. The search employed Descritores em Ciências da Saúde (DeCS)/Medical Subject Headings (MeSH) descriptors in Portuguese, English, and Spanish, including: “pharmacist” and its variations; “pharmaceutical service” and its variations; “bone marrow transplantation” and its variations; and “pharmacy navigator.”

The search was limited to studies published between 2014 and 2024 in English, Portuguese, and Spanish. Original articles, review articles, and clinical guidelines available in full text were selected for review. Articles were screened based on abstracts describing pharmacist navigator activities in oncology, pharmacist roles in HSCT, or pharmacist involvement in long-term outpatient follow-up. After the search, duplicate articles were removed using the EndNote platform.

To describe the activities performed by the pharmacist navigator in HSCT at HCFMUSP, a one-year observational study was conducted, documenting pharmaceutical activities across different phases of treatment and follow-up for patients undergoing autologous and allogeneic HSCT. These phases included “pre-hematopoietic stem cell transplantation,” “hospitalization,” “hospital discharge,” and “post-transplant outpatient pharmacotherapeutic follow-up.”

RESULTS

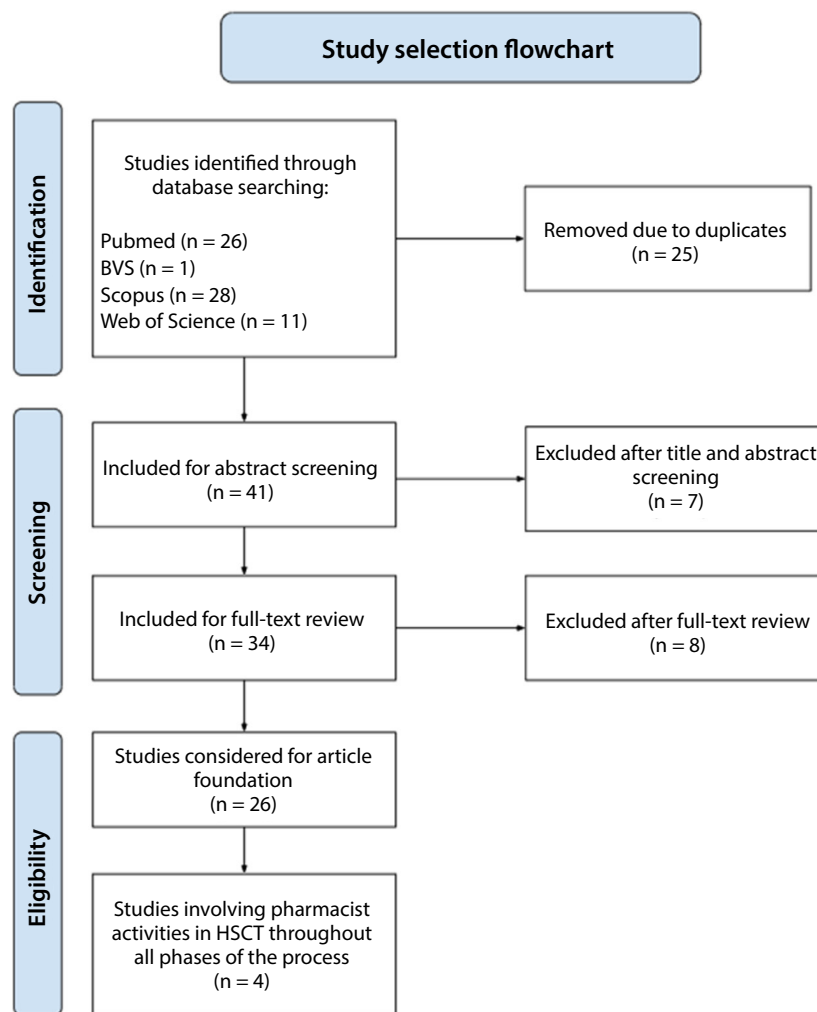
Identification of activities performed by pharmacists in hematopoietic stem cell transplantation

For the bibliographic survey of pharmacist-related activities in the context of HSCT, a screening process was conducted among the studies found (Fig. 1). Subsequently, four primary literature sources were selected, which encompassed the patient journey across all transplantation phases. These sources are presented in Fig. 2 and were considered for outlining the activities performed by the pharmacist navigator in HSCT at HCFMUSP^{8–11}.

Description of activities performed by the pharmacy navigator in hematopoietic stem cell transplantation at HCFMUSP

Role of the pharmacy navigator in the pre-hematopoietic stem cell transplantation phase

In the period leading up to HSCT, the patient undergoes various assessments with a multidisciplinary team, with the pharmaceutical assessment being one of them. During the pharmaceutical consultation, aspects are questioned and evaluated to ensure a deeper understanding of the patient involved. The information collected during the pre-HSCT consultation includes educational level, understanding of the diagnosis, and the type of transplant to be performed, social and family support, current medications, supplements, use of herbal medicines, homeopathy, organization regarding pharmacotherapy, comorbidities, drug interactions, and drug allergies. Additionally, it is also possible to identify the individual responsible for accompanying the patient during the HSCT process, allowing for an evaluation of their level of understanding and the support to be provided to the patient during the proposed treatment.



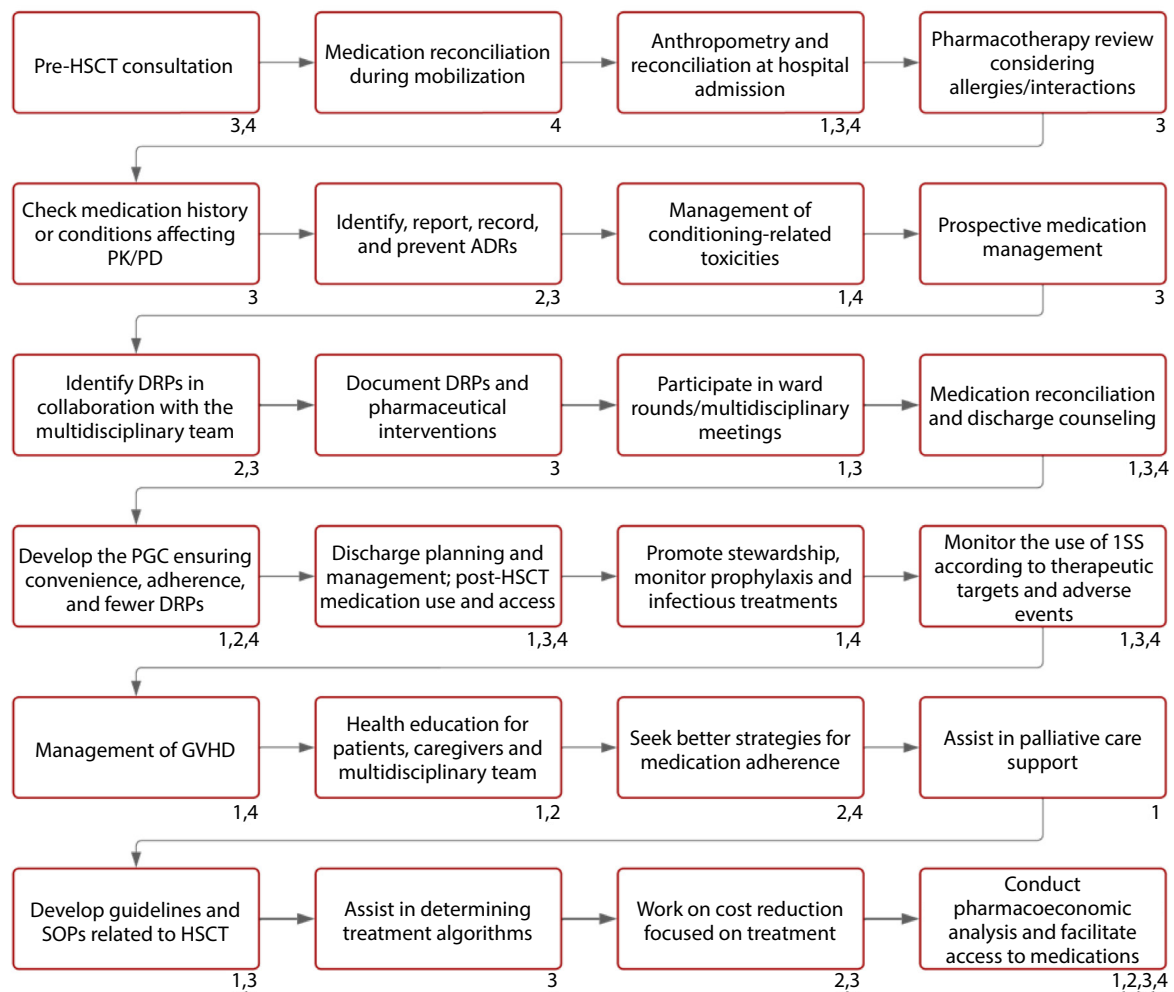
Source: BVS-Virtual Health Library (Biblioteca Virtual da Saúde).

Figure 1. Study selection process.

The pre-HSCT pharmaceutical assessment enables the therapeutic plan and communication with the patient and their caregiver to be tailored to the patient's level of education and clinical condition. It may also lead to the identification of potential medication errors occurring during this phase of the onco-hematological treatment.

Prior to the transplant, both the autologous transplant patient and the allogeneic transplant donor undergo a process known as hematopoietic cell mobilization. This involves the administration of a granulocyte-stimulating factor to collect cells for transplantation. At this stage, the pharmacist navigator conducts medication reconciliation for mobilization and discusses the case with the medical team to ensure that the patient is not using medications that could interfere with cell production or collection, such as α -blockers, β -blockers, vasodilators, and immunomodulators. The pharmacist also critically analyzes the prescription for the granulocyte-stimulating factor, ensuring the patient receives the appropriate dose for mobilization in accordance with institutional protocols.

After the cell collection, the patient is hospitalized for conditioning regimen and HSCT. Again, the pharmacist navigator performs medication reconciliation, in collaboration with the medical team, to ensure continuity of treatments, the registration of allergies in the computerized system, and any necessary adjustments in pharmacotherapy before the administration of chemotherapy conditioning and HSCT.



Caption: ① ASBMT⁷ ② Kelly, R⁸ ③ EBMT⁹ ④ SOBRAFO^{1,10}

Source: Elaborated by the authors. PK/PD: pharmacokinetic-pharmacodynamic; ADR: adverse drug reaction; DRP: drug-related problems; PGC: pharmaceutical guidance chart; ISS: immunosuppressants; GVHD: graft-versus-host disease; SOP: standard operating procedures.

Figure 2. Activities developed by the pharmacy navigator in hematopoietic stem cell transplantation (HSCT) at Hospital das Clínicas of the Medical School at the Universidade de São Paulo (HCFMUSP) in comparison with the literature data.

Along with medication reconciliation, the pharmacist navigator executes the anthropometry protocol, which is double-checked with the nursing team. This protocol involves obtaining the patient's weight and height parameters and registering them in the computerized system. This allows for the calculation of the doses used for conditioning, as well as their prescription and its analysis.

The pre-HSCT pharmaceutical consultation and the anthropometry protocol are recorded through progress notes in the MV PeP system, which can be accessed by the entire multidisciplinary team involved in patient care.

Role of the pharmacy navigator in hospitalization phase

In the context of hospitalization for conditioning and HSCT, the pharmacist navigator collaborates with the clinical pharmacist to provide support to these patients.

All medical prescriptions during hospitalization are reassessed by the pharmacist, considering drug interactions, scheduling times, drug allergies—when applicable—, as well as the patient's diagnostic, laboratory, and medication history, to determine if there are any dysfunctions that may alter the therapeutic

efficacy of the prescribed medications. This assessment may lead to dose adjustments or even the suspension of prescribed medications.

At the time of conditioning regimen for HSCT, the prescription is evaluated to ensure it meets the dose and therapeutic indications specified by institutional protocol, considering the anthropometry protocol performed by the pharmacist and nurse on the day of the patient's admission. The pharmacist ensures that the chemotherapy prescription adheres to all institutional requirements for generating the order for antineoplastic therapy (AT). If discrepancies are found in the AT prescription, the pharmacist contacts the prescribing team to discuss the case and make the necessary adjustments.

The entire conditioning process requires a double-check by a second pharmacist to ensure medication safety parameters and traceability. This double-check is carried out during the conditioning protocol analysis, dose verifications, label checks, production orders, compounded medications, and AT dispensing.

After conditioning, the patient receives hematopoietic stem cells, and it is common for patients to experience toxicities related to the medications used. In this scenario, the pharmacist navigator assists in several aspects, including adjusting available medication formulations for patients suffering from mucositis or those with impaired oral intake; the escalation and de-escalation of antimicrobials; reviewing the prescription of infectious prophylaxis in neutropenia; and analyzing laboratory parameters that may require adjustments in prescriptions, such as renal and hepatic function, electrolyte levels, and hematimetric parameters. The pharmacist also monitors the efficacy, indication, and availability of medications prescribed to HSCT patients.

All medication-related issues encountered during the HSCT patient's hospitalization are discussed with the multidisciplinary team through pharmaceutical interventions, ensuring the best possible therapeutic efficacy and patient comfort. It is essential that all pharmaceutical interventions are properly documented in the medical records, facilitating pharmacotherapeutic follow-up and enhancing understanding among the multidisciplinary team involved in patient care.

In the case of potential adverse drug reactions and medication errors, the incident is reported to the responsible institutional service and, when relevant, to the national regulatory agency through the pharmacovigilance service.

For the entire pharmaceutical navigation and care process to be integrated with the team, it is essential that the pharmacist navigator actively participates in multidisciplinary rounds and ward visits. This integrated process ensures that the pharmacist can develop a therapeutic plan during hospitalization and allows for the organization of a post-discharge care plan tailored to the patient's profile and the complexity of their condition following hospitalization.

Role of the pharmacy navigator in the hospital discharge after hematopoietic stem cell transplantation

At the time of hospital discharge, guidance from the pharmacy navigator is crucial. This professional accompany the patient throughout their post-HSCT recovery journey, which involves lifestyle changes and, most importantly, managing the polypharmacy commonly encountered by these patients.

In the HSCT service at HCFMUSP, the pharmacist performs medication reconciliation upon hospital discharge, in accordance with the medical prescription. This ensures that the patient continues their treatment for non-hematologic comorbidities such as diabetes, hypertension, dyslipidemia, asthma, among others. Additionally, prescription errors are prevented, such as missing medications during care transition and non-compliance with institutional protocols. Drug interactions are also assessed, and appropriate management strategies are implemented.

If discrepancies are identified in the discharge prescription, the pharmacy navigator contacts the prescribing team to discuss the case and make any necessary adjustments.

Based on the discharge prescription, the pharmacy navigator prepares a pharmaceutical guidance chart tailored to the patient's level of understanding. The purpose of this chart is to assist the patient in adapting to their new polypharmacy routine. The chart is designed to optimize medication scheduling in the patient's context, aiming to reduce drug interactions and adverse effects, enhance drug absorption in relation to food intake, ensure medication adherence, and minimize medication errors.

Discharge guidance at HCFMUSP is provided to both the patient and their caregiver, given the high complexity and infectious risk associated with the patient's condition. During discharge counseling, the pharmacy navigator also dispenses the prescribed medications for outpatient use.

The caregiver receives the medical prescription, medications, and the pharmaceutical guidance chart. The pharmacist provides health education and instructions regarding the purpose, administration methods, importance of adherence, the need to follow the prescribed schedule, and potential adverse effects of the medications. Additionally, guidance is given on the pharmaceutical follow-up process in the outpatient follow-up.

Both the hospital discharge pharmaceutical counseling and the pharmaceutical guidance chart are documented in the MV PeP system, allowing access to the entire multidisciplinary team involved in patient care.

Outpatient pharmaceutical follow-up after hematopoietic stem cell transplantation

Pharmaceutical follow-up for autologous transplant patients

Patients undergoing autologous HSCT typically require a significantly lower number of outpatient medications, primarily consisting of prophylactic antiviral and antibacterial therapies, which are generally prescribed for a period of up to 180 days post-transplant. The pharmacy navigator monitors medication use and ensures access to the necessary drugs for infectious prophylaxis.

For these patients, due to the lower associated risks, the pharmacy navigator focuses on health education for both patients and their families. This includes guidance on medication use, potential risks during recovery, the need to adhere to the vaccination schedule, and other relevant instructions based on individual cases.

In the HSCT service at the HCFMUSP, autologous transplant patients undergo short-term follow-up. Once they have no HSCT-related complications, infectious complications, and present a bone marrow aspirate according to normal parameters, they are transitioned to long-term follow-up at their local healthcare service, at which point they are discharged from the outpatient clinic of the institution.

Pharmaceutical follow-up for allogeneic transplant patients

Allogeneic transplant patients are considered more complex cases compared to autologous transplant recipients. This is primarily due to the need for pharmacological immunosuppression, increased vulnerability to infectious complications, and the potential development of GVHD.

To prevent complications during recovery and mitigate the risk of an iatrogenic cascade, these patients require a significantly higher number of medications. Consequently, pharmacotherapeutic monitoring is more intensive, making the role of the pharmacy navigator even more critical.

In addition to prophylactic antiviral and antibacterial therapies, allogeneic transplant patients must also receive prophylaxis for invasive fungal infections, veno-occlusive disease, and GVHD. To support early detection, diagnosis, and treatment of these complications, routine surveillance tests are conducted, including viral serologies, antigenemia, polymerase chain reaction, blood cultures, among others.

Post-allogeneic HSCT pharmacotherapy often includes high-cost medications. The pharmacist ensures patient

access to these treatments through optimal patient assistance programs, such as specialized component pharmacies or special authorizations when necessary. Furthermore, compassionate or expanded access programs for new therapeutic technologies may be considered, taking into account pharmacoeconomic aspects and potential medication substitutions.

The pharmacy navigator plays a fundamental role in monitoring patient adherence to immunosuppressive therapy. Assessing whether the prescribed dosage aligns with the actual medication intake is crucial to maintaining accurate serum levels of immunosuppressants. This is essential to prevent both underdosing, which may lead to graft loss or therapeutic failure, and overdosing, which can result in severe adverse effects.

The pharmacist also evaluates the need for electrolyte replacement, as immunosuppressive therapy frequently depletes electrolytes, and monitors laboratory parameters indicative of adverse effects, particularly renal and hepatic dysfunction.

If clinical or laboratory discrepancies are identified, the pharmacy navigator recommends dose adjustments in accordance with established protocols and the patient's clinical status and discusses the case with the medical team. Subsequently, the patient is informed about the changes, and a new therapeutic plan is developed, which may include dose modifications, initiation or discontinuation of medications, and a focus on symptom management, along with the new medication dispensing. Communication regarding immunosuppressant dose adjustments is conducted via telepharmacy, in compliance with Resolution No. 727/2022 of the Brazilian Federal Pharmacy Council, thereby minimizing the time immunosuppressed patients spend in hospital settings and, consequently, reducing the risk of opportunistic infections⁷.

In cases in which GVHD symptoms arise, institutional management typically involves high-dose corticosteroids. The pharmacy navigator assists in selecting the most appropriate pharmacotherapy based on the affected system, monitors treatment efficacy, and ensures proper corticosteroid tapering to minimize patient complications.

If the patient fails to respond to first-line treatment, the pharmacy navigator evaluates alternative therapeutic options available at the institution, considering patient eligibility, scientific evidence of efficacy, pharmacoeconomic factors, and medication accessibility.

To optimize medication adherence, the pharmacy navigator conducts weekly pharmaceutical consultations following outpatient medical appointments and interdisciplinary case discussions. This ongoing assessment helps determine the patient's current phase in the therapeutic plan, updating the pharmaceutical guidance chart with each new prescription, dispensing necessary medications, and adjusting the treatment plan according to clinical evolution. The pharmacist also educates the patient about any modifications and monitors potential adverse effects, advising on appropriate management strategies.

For patients receiving palliative care, the pharmacy navigator supports maintenance therapy adjustments, modifications to drug formulations, deprescribing—respecting patient preferences—pain management, and control of other uncontrolled symptoms. Additionally, they provide guidance and health education to both patients and caregivers.

Thus, the pharmacy navigator becomes a key professional in patient care and an essential link within the multidisciplinary team, helping to prevent drug-related problems (DRPs) and ensuring the patient's recovery with minimal complications.

Patients remain in long-term outpatient follow-up and continue to be monitored by the pharmaceutical team throughout their lifetime if GVHD or any other HSCT-related adverse event persists. Outpatient pharmacotherapeutic follow-up is documented in the MV PeP system, making the information accessible to the entire multidisciplinary team involved in patient care.

DISCUSSION

This article describes the significance and activities performed by a pharmacy navigator in HSCT, a growing field in oncology, in the face of complex treatments. The pharmacy navigator plays a crucial role in promoting health education, improving medication adherence, identifying adverse drug reactions, selecting cost-effective pharmacotherapy, and facilitating access to necessary medications^{12–15}.

Regarding patient follow-up in the pre-HSCT phase, our study corroborates the findings of Bauters et al.¹⁶, who emphasize the need for a pharmacist at this stage to collect medication history, allergies, toxicities, pharmaceutical presentation preferences, and financial concerns.

According to the cited study, in addition to the pre-HSCT consultation, the pharmacist also participates in the conditioning regimen for handling AT and dose adjustments based on pharmacokinetic/pharmacodynamic parameters, activities carried out by the pharmacy navigator in HSCT at HCFMUSP. The collection of anthropometric data by the pharmacy navigator is essential for determining and adjusting dosages in treatment and conditioning regimens. Vogl et al.¹⁷ examined 73% of a population of 1,087 multiple myeloma patients who were overweight or obese and required optimization of chemotherapy in terms of safety, efficacy, and toxicity management during conditioning. Studies also emphasize that chemotherapy dose rounding can be performed within 5 to 10% without compromising treatment response, allowing for pharmacoeconomic benefits through significant cost reductions^{16–19}.

At HCFMUSP, the pharmacy navigator collaborates with the clinical pharmacist during the inpatient period following HSCT. The activities carried out in our center align with the findings of Bauters et al.¹⁶ regarding monitoring drug interactions, identifying DRPs, participating in ward rounds, and discussing treatment algorithms to optimize patient recovery.

Regarding DRP identification, a study by Taylor et al.²⁰ followed 31 patients, identifying approximately 165 drug-related problems over 12 weeks, 91% of which were associated with HSCT patients. This finding reinforces the necessity of pharmacotherapeutic follow-up for these patients. In the consensus published by the European Group for Blood and Marrow Transplantation (EBMT), the authors also emphasize the importance of reporting such DRPs to the pharmacovigilance sector, a practice implemented through the notification workflow at HCFMUSP^{10,20}.

At hospital discharge, a critical role of the pharmacy navigator is medication reconciliation. Zheng et al.²¹ demonstrate that this activity significantly reduces medication errors, prevents avoidable adverse events, and lowers hospital readmission rates within 30 days, leading to considerable cost savings. Another perspective is provided by Marques and Romano-Lieber²², who highlight that one of the main reasons for poor medication adherence is insufficient knowledge about health conditions and pharmacotherapy. Based on our findings and the aforementioned impacts, the pharmacist's role in patient and caregiver health education is justified. Lima et al.²³ conducted a hospital discharge counseling project for transplant patients, emphasizing the necessity of educational tools tailored to the literacy level and limitations of patients and their caregivers. In light of this, we developed a pharmaceutical guidance table and structured a hospital discharge clinical evolution document, outlining a therapeutic plan to guide outpatient and day-hospital follow-up for these patients^{21–23}.

Alongside discharge counseling, in our study, the pharmacy navigator facilitates medication dispensing and access for outpatient treatment. Several studies identify this activity as an opportunity for pharmacoeconomic intervention, reducing oncology treatment costs through reimbursement strategies or government medication access programs. As our service is part of the Brazilian Unified Health System, which provides free healthcare, the pharmacy navigator contributes to pharmacoeconomics by promoting rational drug use, stewardship programs, and dispensing specialized pharmaceutical assistance medications. This approach enables budgetary savings for the institution, including expanded and compassionate access to new technologies^{1,8–11,16}.

In long-term follow-up, Chieng et al.¹⁵ discuss the implementation of outpatient pharmacotherapeutic monitoring post-HSCT, consisting of 20-minute pharmacy consultations before patients' medical appointments. Evaluating patients before medical consultations facilitated proactive communication and more effective correction of medication errors. These consultations included medication reconciliation, assessment of regimen changes, adverse drug events, prevention and management of treatment complications, and medication adherence. To identify necessary adjustments, laboratory tests such as serum drug levels, electrolytes, and renal and hepatic function were monitored. Pharmacist prescription analysis resulted in 161 pharmaceutical interventions over 12 months, monitoring 22 patients. Pharmacotherapy adjustments were discussed directly with the medical and nursing teams, either in person or via telephone, ensuring immediate intervention when necessary. In contrast to the study by Chieng et al.¹⁵, which focused on adverse drug reactions, at our center, the pharmaceutical consultation is conducted both before and after the medical appointment. This approach enables assessment of medication adherence and immediate interventions. Furthermore, the post-medical pharmaceutical consultation ensures complete access to pharmacotherapy and medication education, demonstrating the critical importance of having a pharmacist dedicated to this care pathway.

Chieng et al.¹⁵ and Corrêa et al.³ highlight the pharmacist's role in monitoring serum immunosuppressant levels. In the study by Chieng et al.¹⁵, compliance with administered immunosuppressant doses was assessed to verify medication adherence. Corrêa et al.³, in turn, underscored the importance of immunosuppressant collection and adjustment due to their narrow therapeutic index. In their study, 82% of collected samples from patients monitored by pharmacists fell within the therapeutic range, compared to only 65% in the control group, demonstrating the critical role of the pharmacy navigator in this aspect of treatment. Our study's findings strongly align with the literature on the impact of adherence and serum immunosuppressant monitoring in achieving better long-term prognoses in HSCT^{3,15}.

In another way, Alexander et al.²⁴ evaluated pharmacist activities in HSCT from the perspectives of physicians and patients, considering the pharmacist as a key professional for health education, medication guidance, and addressing patient and team inquiries about pharmacotherapy. In a survey conducted by the researchers, the pharmaceutical service received an approval rating exceeding 80% from both the medical team and patients.

As a limitation of the present study, it should be noticed that, although enteral and parenteral nutritional support is a recognized activity performed by pharmacists according to the EBMT¹⁰, it is not currently part of the routine responsibilities of the pharmacy navigator at HCFMUSP. However, in accordance with Resolution No. 292/2013²⁵, regarding parenteral nutrition, the pharmacist is an integral member of the healthcare team, holding responsibility for therapeutic monitoring, patient and multidisciplinary team counseling, as well as reviewing pharmacotherapy and monitoring potential interactions and adverse effects. It is the exclusive responsibility of the pharmacist to evaluate the components of the parenteral nutrition prescription, prepare the formulation, ensure traceability, shelf life, quality, and documentation; in addition to participating in the selection, standardization, and acquisition processes, and in the institution's nutritional support committee. At our institution, this practice is carried out by a separate team of pharmacists, functioning in an integrated manner with the HSCT pharmacy navigator service.

A future perspective for the pharmacy navigator in HSCT involves post-transplant vaccine management, identified as a pharmaceutical responsibility by the American Society for Blood and Marrow Transplantation. Considering the practice setting at HCFMUSP, the pharmacist could collaborate with the medical team to oversee and monitor vaccination adherence. Our institution has a Special Immunobiological Reference Center, where patients undergo immunization according to their bone marrow recovery progress⁸.

Based on the available literature, the HSCT pharmacy navigator service at HCFMUSP provides comprehensive and high-quality care. Structured to support patients at all stages of treatment, this service offers dedicated care, enabling prevention, management, and recovery of patients' health.

In conclusion, the pharmacist monitors both the patient and their caregiver from the moment of arrival at the transplant service until hospital discharge and transfer to the referring medical service, providing guidance and serving as a liaison with the multidisciplinary team regarding pharmacotherapy. The pharmacy navigator becomes a key point of reference and a reliable source of treatment-related information, acting as a facilitator of care for both patients and the healthcare team. Given the high complexity of the treatment, its financial impact, and the significant incidence of factors that may increase morbidity and mortality—particularly among allogeneic transplant patients—the pharmacy navigator in HSCT emerges as a critical healthcare professional. Their role contributes to improved patient recovery, greater autonomy, and cost savings for the healthcare system^{26–28}.

CONFLICT OF INTEREST

Nothing to declare.

DATA AVAILABILITY STATEMENT

All data are presented/generated in the article.

AUTHORS' CONTRIBUTIONS

Substantive scientific and intellectual contributions to the study: Santos GFL, Santos CF and Diniz AP. **Conception and design:** Santos GFL. **Analysis and interpretation of data:** Santos GFL, Santos CF and Diniz AP. **Technical procedures:** Santos GFL, Sforsin ACP. **Statistics analysis:** Otuyama LJ. **Manuscript writing:** Santos GFL. **Final approval:** Pinto VB.

FUNDING

Not applicable.

ACKNOWLEDGMENTS

We would like to express our sincere gratitude to the Hospital das Clínicas of the Medical School at the Universidade de São Paulo for providing the setting for this research.

We are also deeply grateful to the pharmacists Andrea Cassia Pereira Sforsin and Frank Ferreira Pinto for their invaluable contributions as members of the evaluation committee. Their insightful feedback and thoughtful guidance played a crucial role in refining this work. We truly appreciate their dedication and commitment to advancing pharmaceutical knowledge.

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