

RESEARCH ARTICLE

# Clinical impact of pharmacotherapeutic follow-up and pharmacist interventions in a reference hospital in Mexico City

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## Abstract

**Background:** Pharmacotherapeutic monitoring is a professional practice focused on identifying, preventing, and resolving drug-related problems (DRPs). **Objective:** To assess the clinical impact of pharmacotherapeutic follow-up (PFU) and pharmacist interventions in hospitalised patients at the Instituto Nacional de Cardiología Ignacio Chávez. **Methods:** A retrospective, observational, descriptive study based on the information from two databases between July 2021 and June 2022 was conducted to calculate the risk reduction associated with pharmacist interventions on medical prescriptions. **Results:** The study involved 3015 patients who received care during the specified timeframe. The pharmacists provided 10130 attentions, including 5593 medication reconciliations, 16027 pharmacotherapeutic profiles, and 18542 assessments of prescription suitability. The pharmacists carried out 3628 interventions, of which 2282 were targeted at medical prescriptions. The results indicated an increase in risk reduction for accepted interventions, achieving a rate of 40.23%. **Conclusion:** Pharmacist interventions improved prescriptions, identified and prevented DRPs and medication errors, and enhanced medication safety by facilitating informed therapeutic decisions.

## Introduction

Among the activities of clinical pharmacists stands out pharmacotherapeutic follow-up (PFU), which focuses on identifying, preventing, and resolving drug-related problems (DRPs) and the underlying causes of errors that give rise to these problems in patients. It aims to increase the quality of care and ensure clinical safety (Martí Gil, Sanz Ferrando & Aznar Prats, 2011).

Clinical pharmacists aim to improve patient health by making the best use of drugs through PFU, which can be performed using different ways and methods. In Mexico, PFU guidelines are outlined in the "Suplemento para Establecimientos dedicados a la Venta y Suministro de Medicamentos y demás insumos para la salud de la Farmacopea de los Estados Unidos Mexicanos" sixth edition, which specifies that medication reconciliation, pharmacotherapeutic

profile, and drug prescription suitability must be carried out by a pharmacist (Ministry of Health, 2018). At the Instituto Nacional de Cardiología Ignacio Chávez, these activities are done by the newly formed Pharmacotherapeutic Follow-up Unit (PFUU) at the Clinical Pharmacology Department.

Medication reconciliation is a formal process that consists of identifying the medications used before patient hospitalisation and comparing them with those prescribed after a transfer of care or a transfer within the care level itself, intending to analyse and give therapeutic continuity during the hospital stay (Ministry of Health, 2009). Care transfers include hospital admission, transfers of service within the hospital, changes of attending doctor and hospital discharge. The "Guía para la Implantación de Programas de Conciliación de la Medicación en Centros Sanitarios" considers any discrepancy detected

between the medications patients take chronically and those prescribed at the hospital (Societat Catalana de Farmàcia Clínica, 2009).

The pharmacotherapeutic profile is a documented analysis of the physiological and pathophysiological characteristics of the patient. It includes anthropometric data, pathological and non-pathological history, surgical procedures, laboratory results, and antibiograms. This profile accounts for factors that may influence the pharmacokinetics or pharmacodynamics of the pharmacological treatment, such as side effects, contraindications, interactions, adverse drug reactions, therapeutic failures, and treatment duplications (Ministry of Health, 2018).

Drug prescription suitability consists of relying on the pharmacotherapeutic profile to analyse and evaluate the appropriateness of indications before administering medications to patients during their hospital stay. Clinical pharmacists perform this analysis to ensure that the prescription is appropriate, considering the pharmacological and physiological factors of the patient (Ministry of Health, 2018).

At the Instituto Nacional de Cardiología Ignacio Chávez, pharmacist interventions involve identifying and classifying a DRP, suggesting changes, and documenting the process in the corresponding format. Clinical pharmacists then discuss their findings with the responsible health professional. If the proposed changes are implemented, the intervention is classified as accepted; otherwise, it is classified as considered. This is part of the Instituto Nacional de Cardiología Ignacio Chavez procedures in the Clinical Department.

### **Aim**

This study aimed to assess the clinical impact of pharmacotherapeutic follow-up and pharmacist interventions in hospitalised patients at the Instituto Nacional de Cardiología Ignacio Chávez.

### **Methods**

A retrospective, observational, descriptive study of PFU was carried out by the PFUU of the Instituto Nacional de Cardiología Ignacio Chávez in hospitalized patients from July 2021 to June 2022.

PFU activities are recorded on a specific form developed by the PFUU. Clinical pharmacists document evaluations, including medication reconciliation, pharmacotherapeutic profiles, drug prescription suitability analysis, and pharmacist interventions. The information collected in this form is entered weekly

into two separate databases; the first compiles information on PFU evaluations, such as medication reconciliation, pharmacotherapeutic profiles, and drug prescription suitability analysis, and the second database focuses on pharmacist interventions. Both databases enable the analysis of findings and interventions weekly, monthly, and annually. They allow for an understanding of the trends and patterns in the data.

The impact of pharmacist interventions was evaluated monthly and annually using the Risk Reduction associated with Pharmacist Interventions to Medical Prescriptions (RRPI) calculation developed by the PFUU. RRPI is calculated by dividing the Risk of Identified Medication Errors in Medical Prescriptions (RIME) by the Risk Reduction to Identified Medication Errors in medical prescriptions from the Accepted Pharmacist Interventions (RRIMEAPI) and then multiplying the result by 100, as shown below:

$$RRPI = \frac{RIME}{RRIMEAPI} * 100$$

$$RIME = \frac{\text{Total pharmacist interventions performed in medical prescriptions}}{\text{Total number of patients attended}}$$

$$RRIMEAPI = \frac{\text{Total pharmacist interventions to the medical prescriptions accepted}}{\text{Total number of patients attended}}$$

RIME is calculated by dividing the total pharmacist interventions to the medical prescriptions accepted by the number of patients attended by the PFUU monthly.

RRIMEAPI is calculated by dividing the total pharmaceutical interventions to accepted medical prescriptions by the number of patients attended by the PFUU.

RRPI, RIME, and RRIMEAPI are proof-of-concept calculations developed at the PFUU as a first evaluation phase that allows using the data recollected to evaluate and quantify the impact of pharmaceutical intervention in a feasible way.

### **Results**

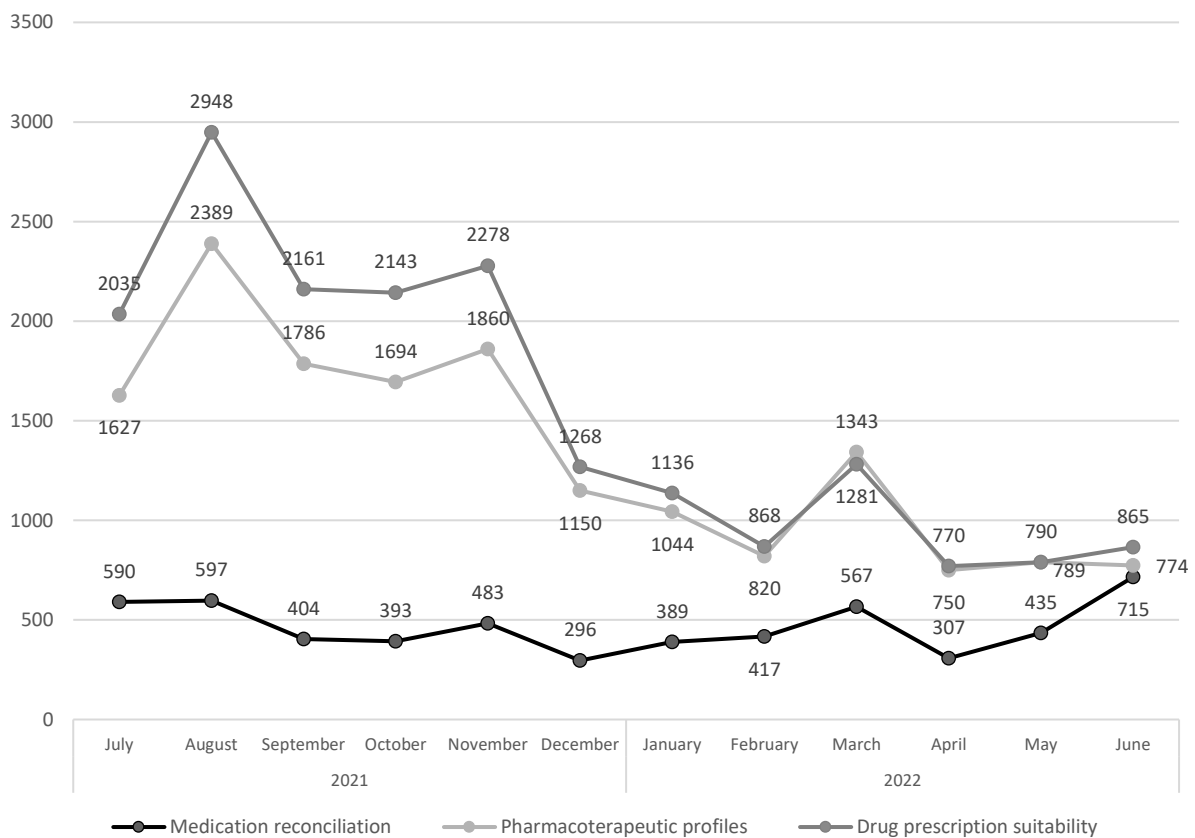
During the designated study period, the PFUU provided care to 3,015 patients, delivering 10,130 pharmacist attention. As patients underwent various care

transitions, medication reconciliations were performed 5,593 times to ensure the continuity of their pharmacological treatment. Table I illustrates the distribution of medication reconciliations across different care transitions. Medication discrepancies were identified through this process, enabling pharmacists to implement 25 interventions to enhance patient care and ensure treatment continuity.

**Table I: Reconciliations across different transitions of care**

Transition of care	Number
Hospital admission	2905
Transfer of service within the hospital	913
Changes of attending doctor	32
Hospital discharge	1743

The pharmacotherapeutic profile allows clinical pharmacists to understand patients' characteristics and their relationship with prescribed medication, identifying any pharmacokinetic or pharmacodynamic alterations. Clinical pharmacists assessed 16,027 pharmacotherapeutic profiles throughout the study period. The number of evaluations was higher in the initial months compared to subsequent months, likely due to the presence of pharmacist students conducting their professional practices in the department. A similar pattern was observed in the drug prescription suitability analysis, which was carried out 18,542 times (Figure 1). Of note, the number of drug prescription suitability evaluations is expected to exceed that of pharmacotherapeutic profiles since each modification in drug indication requires a corresponding evaluation.



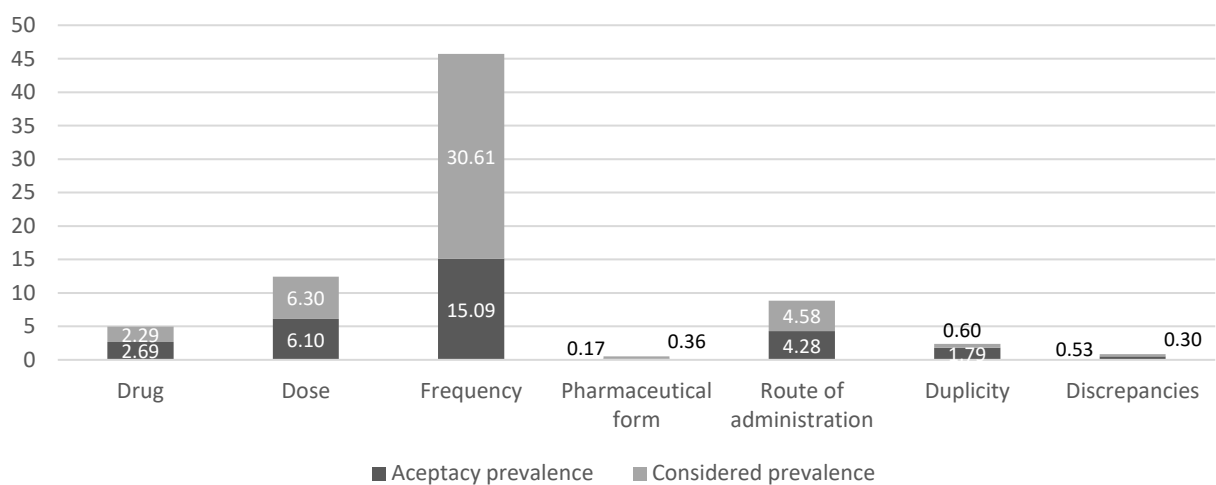
**Figure 1: Activities done from July 2021 to June 2022**

Through drug prescription suitability assessments, clinical pharmacists identified the main cause of medication errors (ME) in medical prescriptions, observing a greater prevalence of frequency ME (45.70) per 100 patients, followed by dose ME (12.40), route of

administration ME (8.86), and drug ME (4.98), as shown in Table II. The impact of pharmacist interventions can be observed in Figure 2, which highlights the differences between accepted and considered interventions.

**Table II: Distribution of pharmacist interventions to medication prescriptions stratified by type of ME**

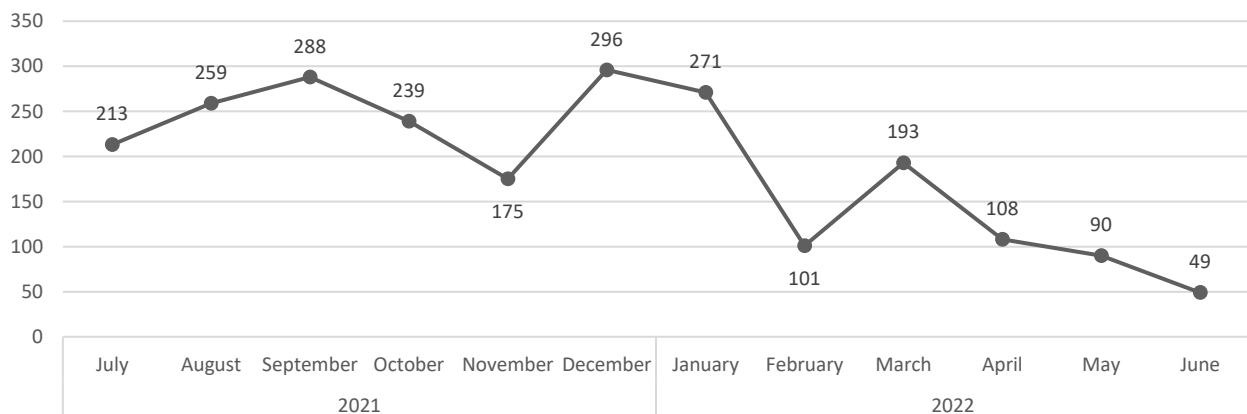
Type of ME	Pharmacist interventions			Total prevalence per-100 patients
	Accepted	Considered	Total	
Drug	81	69	150	4.98
Dose	184	190	374	12.40
Frequency	455	923	1378	45.70
Pharmaceutical form	5	11	16	0.53
Route of administration	129	138	267	8.86
Duplicity	54	18	72	2.39
Discrepancies	16	9	25	0.83



**Figure 2: Prevalence of medication errors by intervention type**

More important than knowing the prevalence of ME, is that the timely identification of ME in the medical prescription allowed assertive interventions, and in a collaborative manner with doctors, ensure adjustments to the prescriptions which makes them more suitable for patients and by that making medication safer.

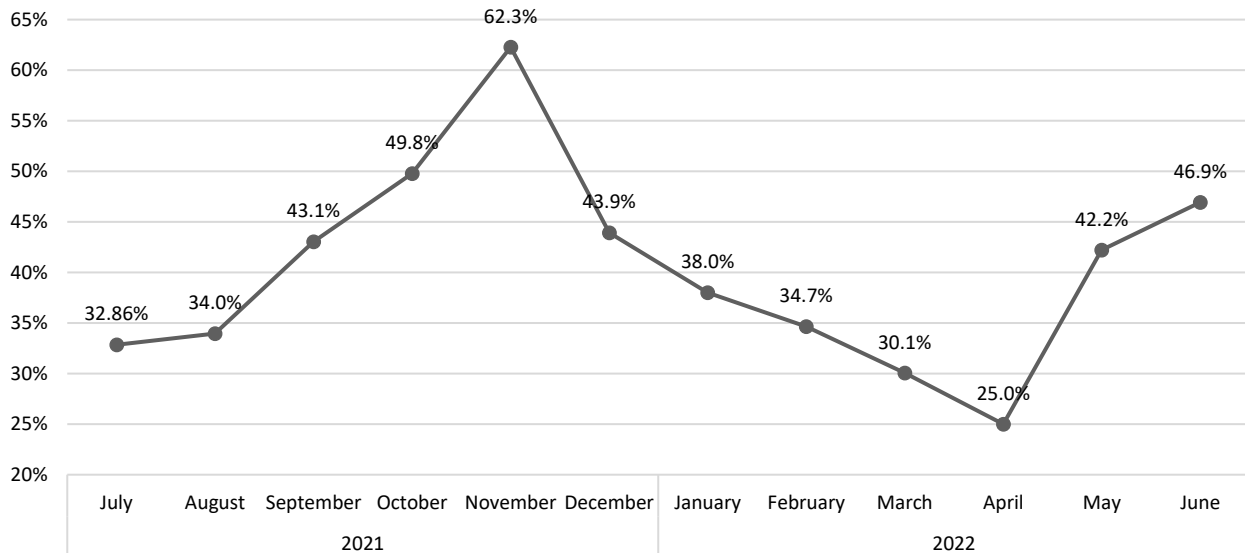
Through the evaluations the clinical pharmacists made a total of 3,628 interventions, from which 2,282 interventions were to medical prescriptions during the period studied, observing the greatest number of interventions in December 2021 (296), as shown in Figure 3.



**Figure 3: Pharmaceutical interventions done from July 2021 to June 2022**

As explained in the method section, RRPI was calculated monthly, and the highest risk reduction was achieved in November 2021, reaching 62.3%, with an average of 40.23% over the study period (Figure 4).

These results show that these interventions were relevant, as they led to modifications in prescriptions by the doctors, thereby reducing the likelihood of DRPs.



**Figure 4: Risk reduced by accepted pharmaceutical interventions from July 2021 to June 2022**

## Discussion

Figure 1 illustrates the fluctuation in the number of medication reconciliations, ranging from 296 to 715, with an average of 466 per month. The pattern of medication reconciliations followed an expected trend, with a higher number occurring during hospital admission, followed by hospital discharge and service transfers within the hospital. Of the total of 5593 medication reconciliations evaluated, clinical pharmacists identified only 25 discrepancies. In 2020, a study assessing medication reconciliation in 100 patients showed a discrepancy rate of 71% (Cascone, Seguro & Olivera, 2020). This finding suggests that the PFUU can enhance their medication reconciliation process to be more comprehensive and resourceful in identifying discrepancies.

It is essential to improve the number of medications reconciliations to achieve the required 100% coverage, aligning with medication safety practices like the Joint Commission International guidelines. This study demonstrated that the PFUU covered 96% of the medication reconciliation evaluations during hospital admission and 58% at hospital discharge.

The time to complete the medication reconciliation evaluation following a transition of care was not assessed in this study, considering that some guidelines

recommend completing it in the first 12 to 72 hours (Hung *et al.*, 2019), but stricter guidelines require finalising it before administering the first prescription to the patient. The High 5s Project emphasises that medication reconciliation must be performed during the first 24 hours of hospitalisation (Cascone, Seguro & Olivera, 2020; Guido, 2015). Measuring the time to complete medication reconciliation can be considered a supplementary evaluation.

Both the pharmacotherapeutic profile and prescription suitability evaluation had a similar pattern, with a decrease in the number of evaluations observed. This decline could be attributed to the presence of pharmacy students in the department and the implementation process of these evaluations, which required adjustments. As expected, prescription suitability outnumbered pharmacotherapeutic profile evaluations. This trend was observed throughout the study period, except from January to June 2022. This deviation could be due to the lack of clinical pharmacists in the second afternoon shift, highlighting the need for clinical pharmacists across all shifts.

The most prevalent medication errors were related to frequency, suggesting a lack of standardisation in clinical guidelines for patient treatment. A comprehensive strategy is needed to address this issue. It should involve reviewing and updating the guidelines

and implementing modifications that have a clinical impact.

Figure 3 illustrates the trend of pharmacist interventions and the relationship between clinical pharmacists and the multidisciplinary healthcare team. It shows a decrease in RRPI from November 2021 to April 2022, which could be attributed to the incorporation of new pharmacy students who began their training in the department in January 2022; additionally, the decrease in RRPI observed in April 2022 corresponds to the incorporation of new medical residents in March 2022. This pattern can be explained by the adjustment between the new medical residents and pharmacy students during their professional practices. It is expected to observe this behaviour every year, reflecting the learning process of both healthcare professionals.

Several studies have reported varying acceptance rates of pharmacist interventions, ranging from 71% (Gleason *et al.*, 2004) to 81% (López *et al.*, 2014) and reaching as high as 88% (Moriel *et al.*, 2008). This results of this study revealed an acceptance rate of 40.49% and an RRPI average of 40.23%. Despite being relatively modest, this acceptance rate is a promising starting point towards the established goals of enhancing medication safety. The PFUU comprises three trained clinical pharmacists and pharmacy student trainees. An improvement in the RRPI is expected with the incorporation of additional trained clinical pharmacists and the implementation of this process on a broader scale.

### Limitations

The proposed methodology for the initial evaluation phase enabled the assessment of the clinical impact of pharmacist intervention. However, it is crucial to conduct a more in-depth study to measure the impact of pharmaceutical interventions across various dimensions, such as clinical, economic, and organizational aspects.

A two dimension-study also can be carried out to assess clinical and economic features (Lin *et al.*, 2020); however, measuring three dimensions is better, as shown with the CLEO methodology, which could be a good option in a second evaluation phase. The assessment of the clinical dimension in the CLEO methodology uses six levels: negative, null, minor, moderate, major, and avoiding a fatality. The economic and organisational dimensions have three levels: negative, null, and positive (Vo *et al.*, 2021; Eriksson, 2021).

### Conclusion

This study provides evidence of the significant impact of the Pharmacotherapeutic Follow-up Unit at the Instituto Nacional de Cardiología Ignacio Chávez. Through the provision of pharmacist attention to 3015 patients, the unit successfully evaluated medication reconciliation, pharmacotherapeutic profiles, and prescription suitability. Clinical pharmacists played a crucial role in identifying discrepancies and medication errors, thus enabling pharmacist interventions to enhance the quality of prescriptions. The average risk reduction achieved through accepted pharmacist interventions to medical prescriptions was 40.23%, empowering healthcare professionals to make informed therapeutic decisions. Nonetheless, further evaluations and research are warranted to compare these initial findings with future data and expand the scope of assessments to encompass economic and organizational dimensions. This comprehensive approach will provide a more in-depth understanding of the overall impact and effectiveness of the unit's interventions.

### Conflict of interest

The authors declare no conflict of interest.

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