Defining clinical pharmacy and support activities indicators for hospital practice using a combined nominal and focus group technique

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Abstract

Background Although clinical pharmacy is a crucial part of hospital pharmacist’s day-to-day activity, its performance is not usually subject to a holistic assessment. Objective To define a set of relevant and measurable clinical pharmacy and support activities key performance indicators (cpKPI and saKPI, respectively). Setting Portuguese Hospital Pharmacies. Method After a comprehensive literature review focusing on the metrics already in use in other countries, several meetings with directors of hospital pharmacies were conducted to obtain their perspectives on hospital pharmacy practices and existing metrics. Finally, five rounds with a panel of 8 experts were performed to define the final set of KPIs, where experts were asked to score each indicator’ relevance and measurability, and encouraged to suggest new metrics. Main outcome measure The first Portuguese list of KPIs to assess pharmacists’ clinical and support activities performance and quality in hospital pharmacies. Results A total of 136 KPIs were assessed during this study, of which 57 were included in the original list and 79 were later added by the expert panel. By the end of the study, a total of 85 indicators were included in the final list, of which 40 are considered to be saKPI, 39 cpKPI and 6 neither. Conclusion A set of measurable KPIs was established to allow for benchmarking within and between Portuguese hospital Pharmacies and to elevate professional accountability and transparency. Future perspectives include the use of both cpKPIs and saKPIs on a national scale to identify the most efficient performances and areas of possible improvement.

Keywords Hospital pharmacy · Key performance indicators · Portugal

Impacts on practice

• This work intends to promote the discussion around performance indicators and to raise awareness and know-how on the current and future role of the Hospital Pharmacies, by determining a framework to develop it assessment on a recurrent basis.
• For the first time in Portugal, a set of relevant and measurable indicators are defined in order to assess hospitals’ pharmacies performance, using a combined nominal group/focus group technique.
• The definition of these performance indicators is considered to be a landmark in hospital pharmacy in Portugal and it is the first step to the first national study to assess all hospital pharmacies of the NHS.
• Since an international benchmarking system is not established for hospital pharmacies, it is essential to cultivate an internal culture of activity monitoring and internal
Introduction

Hospital pharmacists strive to continuously maintain and improve medication management and patient pharmaceutical care to the highest possible standards. Their roles include participating in medication management, which encompasses the entire way in which medicines are selected, procured, delivered, prescribed, administered and monitored [1, 2]. These activities are performed whilst ensuring the 7 “rights” are respected: right patient, right dose, right route, right time, and the right drug with the right information and documentation.

Clinical pharmacy is defined as “a health science discipline where pharmacists provide patient care that optimizes medication therapy and promotes health, wellness, and disease prevention” [3–5]. Therefore, clinical pharmacy is deemed an integral component of this process, being responsible for ensuring that patients receive the right medicine at the right time by an efficient and economic system [6].

Although traditionally pharmacists were mostly concerned with procuring, dispensing, manufacturing and supplying drugs [2], clinical pharmacy has become so relevant that pharmacists spent an average of 47% of their time on clinical activities, 37% on distribution and 16% on management activities, as shown by an Australian study [7].

In fact, in Portugal, as in other countries, the hospital pharmacy concept lies in the existence of two major areas: support sector and clinical activities [8]. The first integrates management and organization, acquisition and stock management, storage and conservation, repackaging, production/compounding, and distribution. The clinical area involves all the activities related to clinical pharmacy/pharmaceutical care (e.g., therapeutic review, medication reconciliation, pharmaceutical consulting, clinical pharmacokinetics, counselling or pharmacovigilance).

In Portugal, the pharmaceutical profession emerged in the thirteenth century [9]. Out of 15,000 practicing pharmacists, 9% are in hospital pharmacies [8]. Given the evolution of healthcare and patient’s needs and demands, the 2008 Hospital Medicine Program allowed hospital pharmacists to participate and develop quality improvement initiatives, promoting a patient safety culture [8, 10–12].

Evidence suggests that when clinical pharmacists integrate the multidisciplinary team, their interventions can help reduce the likelihood of mortality, length of stay, adverse-drug-event prevalence and improve patients’ quality of life [6, 16], by ensuring medication reconciliations/reviews [5, 13–15]. Therefore, a way to assess both quality and impact of the services provided to patients is by quantifying and monitoring clinical activities through audits, service reviews, incident reports and surveys to patients, and by ensuring that complaint management and control procedures are in place [5, 13, 17].

A known strategy to track and continuously assess performance is through the use of clinical pharmacy Key Performance Indicators (cpKPIs) [6]. According to several studies, cpKPIs could be used to evaluate the quality of care [17–19], to help define a patients’ healthcare expectations regarding a clinical pharmacist, to allow benchmarking within and between organizations, to elevate professional accountability and transparency [5], and to allow the tracking of the organization’s progress towards achieving predefined goals and standards of care [4, 5]. They also play an important part in rewarding good performance, in improving resource allocation and efficiency, and in identifying and reducing clinical errors, whilst maximizing healthcare outcomes and balancing patient’s wants and needs [17–20]. Given the wide range of services provided, assessing pharmacists’ productivity and quality of care is somewhat difficult [21, 22]. Thus, it is also relevant to establish KPIs addressed to support activities (saKPI).

Despite the evidence supporting the importance of defining KPIs to quantify pharmacists contribution to patient care [5, 19, 20, 23–26], three main barriers were identified by several authors regarding their implementation: (i) resistance to change related to documenting clinical activities due to increased workload, practice environment constraints and competing priorities; (ii) disbelief of KPIs’ real benefits, value and existing support from other pharmacists and hospital administrations; and, (iii) uncertainty of how to address quality versus quantity or the influence KPIs may have in the future of pharmacy practice [6, 27–29].

Nevertheless, several countries have already started developing their own standard KPIs, such as Australia [13, 26], Belgium [19, 25], Brazil [20, 34, 35], Canada [4, 5, 36, 37], Finland [38], Spain [39, 40], UK [17], USA [41–44], New Zealand [22, 45], and the Netherlands [46]. However, there is no current international consensus on KPIs [2, 4–6, 13, 21, 29].

Aim of the study

In Portugal, most hospital pharmacies only collect some internal data for certification/accreditation purposes or ad hoc situations. Currently, there is no national standard system for activity monitoring, nor any nationwide framework that enables comparisons/benchmarks amongst pharmacies’ performances regarding their clinical or support activities. Thus, the main goal of this study is to define, for the first time in Portugal, a national set of relevant and measurable
cpKPIs/saKPIs to assess the National Health System Hospital Pharmacies’ performance and quality.

**Ethics approval**

As a service development and evaluation study, it was exempt from formal ethics approval. All study participants were given full information and provided signed, informed consent.

**Method**

**Study design**

Consensus cpKPI/saKPI were determined using a combined nominal group/focus group technique, which combines the prioritisation process of a standard nominal group technique with the in-depth discussion of a focus group [47]. The expert panel was encouraged to assess both the relevance and measurability of the original candidate KPI, and to suggest new candidate indicators, for five rounds. After each round, an in-person panel meeting was held, promoting in-group discussions about the candidate KPIs and to clarify questions regarding the definition of any new proposed KPI (Fig. 1).

**Defining the KPIs**

Two stages were developed to define the first list of cpKPI/saKPI: (1) Literature review and exploratory meetings; (2) Expert panel rounds.

| 57 | Candidate KPI |
|----|---------------|
|    | Comprehensive literature search and review |
|    | Meetings with Directors of Hospital Pharmacies |

| Round 1 |
|---------|
| In-person meeting |
| Presentation of the project methodology |
| Presentation of the original candidate KPIs to the expert panel |
| The expert panel scored individually each original candidate KPI |

| Round 2 |
|---------|
| In-person meeting |
| Original candidate KPIs: presentation and discussion of the results from the assessment of both relevance and measurability |
| The expert panel were asked to suggest new candidate KPIs |

| Round 3 |
|---------|
| In-person meeting |
| Inclusion of new suggested candidate KPIs |
| The expert panel scored individually each new suggested candidate KPI |

| Round 4 |
|---------|
| In-person meeting |
| New suggested candidate KPIs: presentation and discussion of the results from the assessment of both relevance and measurability |

| Round 5 |
|---------|
| Final set of KPIs |
| Final revision of the KPIs |
| Definition of the source of information |

Fig. 1 Study methodology
(1) Literature review and exploratory meetings

Two investigators (HL and ARL) conducted a comprehensive literature review focusing on KPIs used in other countries. To account for existing national practices, meetings were held with several renown hospital pharmacists, who shared their perspectives on currently implemented practices and metrics. After this process, a list of 57 candidate KPIs was defined.

The annual European Association of Hospital Pharmacists (EAHP) survey is annually deployed to measure the progress, key barriers and drivers of the implementation of their six Statements: (i) Introductory Statements and Governance; (ii) Selection, Procurement and Distribution; (iii) Production and Compounding; (iv) Clinical pharmacy Services; (v) Patient Safety and Quality Assurance; and, (vi) Education and Research. Since several Portuguese hospital pharmacies already participate in the survey [1, 48], each EAHP Statement was divided into several Assessment Areas and specific candidate KPIs were defined to assess each Area.

(2) Expert panel rounds

To reach the final list of KPIs, five rounds with an expert panel were performed from January of 2019 to March of 2020.

Round 1

The first round presented to the expert panel the key project moments, the main goals and methodology, all of which previously defined with the Portuguese Pharmaceutical Society, and the 57 candidate KPIs, categorised by EAHP Statement.

After this round, the expert panel had four weeks to rate each indicator in two different dimensions: Relevance and Measurability. The former was defined as the ability to reflect the hospital pharmacy performance or the clinical pharmacist’s direct impact on patient care, while the latter was defined as the ability to easily collect data to calculate the KPI within the hospital.

Each panel member used a five-point Likert scale to assess both dimensions: 1 = Totally Irrelevant/Totally Impossible; 2 = Not Relevant/Impossible; 3 = Neutral/Neutral; 4 = Relevant/Easy; 5 = Very Relevant/Very Easy.

At the beginning of the study, three criteria were defined by the expert panel to determine which KPIs would be included in the final list: (i) if the average relevance score for each indicator was low (rating equal or lower than 3 points), the indicator would be excluded, regardless the measurability score; (ii) if the average relevance score was high (rating higher than 3 points) and the measurability low, the indicator would be excluded; and, (iii) if the average relevance and measurability scores were high, the indicator would be included in the final list.

Round 2

After collecting all panellist scores and calculating the average score for each indicator, a second in-person meeting was held to present and discuss the results regarding relevance and meaurability of the original candidate KPIs. In each in-person meeting, consensus concerning indicators with scores close to cut-off points were obtained by majority.

Round 3

The expert panel was given four weeks to suggest new candidate KPIs per EAHP Statement. Following this time, a third in-person panellist meeting was held for discussion and clarification regarding the proposed KPIs and their definitions.

Round 4

The expert panel was then asked to rate the new set of suggested KPIs according to their relevance and measurability, using the five-point Likert Scale. The fourth in-person round took place after having all the scores calculated for each indicator.

Round 5: Final set of KPIs

Finally, after assessing both original and suggested candidate KPIs, a last in-person meeting was held to present the final list and to define the sources of information available within the hospitals to measure each KPI.

KPI Definition

Concerning the definition of the candidate KPIs, the authors agreed that all should: (i) reflect the current hospital pharmacists activities, (ii) be evidence-based, (iii) be aligned with clinical pharmacists’ goals, objectives and practices, (iv) be feasible to measure, (v) be relevant to clinical outcomes, and (vi) be used across all types of Hospital Pharmacies (e.g., rural, urban, teaching or non-teaching hospitals). A glossary indicating each rational, measurement unit, target-population and data-source was then prepared for each suggested candidate KPI.

The expert panel

A panel of eight experts was specifically selected for this project by the board members of the Portuguese Pharmaceutical Society, considering their professional curricula, expertise, and contributions for the development of clinical pharmacy in Portugal. These experts are renowned hospital pharmacists having also professional responsibilities since
they are Pharmaceutical Society representatives and members of pharmaceutical associations in Portugal.

As for their main characteristics, the average age was 48.7 years old, mostly females, with around 25 years of experience as a pharmacist and around 10 years of experience as hospital pharmacy director (Table 1).

The definition of a panel consisting exclusively of pharmacists aims to ensure that the defined cpKPIs/saKPIs are unanimously agreed upon, and that they effectively measure their performance. In an analogy of the Gettysburg Address speech by former U.S. President Abraham Lincoln, this expert panel was created to define the cpKPI/saKPI list for Hospital Pharmacy “of the pharmacists, by the pharmacists, for the pharmacists”.

Results

Round 1 and 2: assessing the original list of the candidate KPIs

Following an extensive literature review, 57 candidate KPIs were included in the original list, categorized into six EAHP Statements (Table 2), where 22 were considered as saKPI, 33 cpKPI and 2 neither.

After assessing their relevance, only two were considered as “not relevant” (rating lower than 3 points) by the expert panel and therefore were excluded.

Regarding measurability, although 21 KPIs were considered relevant (rating equal or higher than 4 points), data collection capability was low. For example, the ‘Number of pharmacists rounds’ or the ‘Number of adverse events reported by patients’ were considered as some of the most relevant KPIs, however, the ability to measure them ranged from 1.5 to 2.1 points. Similarly, the three KPIs rated as ‘Totally Impossible’ to measure (rating equal or lower than 1.3 points) were also considered to be highly relevant (rating equal or higher than 4 points).

Rounds 3 and 4: expert panel suggested candidate KPIs

The following rounds sought not only to include the new suggested candidate KPIs (round 3), but also to assess their relevance and measurability (round 4) (Table 3).

After the third round, the expert panel suggested 79 new KPIs: 37 saKPI, 38 cpKPI and 4 neither.

Concerning their relevance and measurability (round 4), six KPIs were considered as totally relevant (rating 5 points) by all panel members and easily measured (rating equal to or higher than 4 points).

After the fourth round, 26 of the total suggested KPIs were excluded, 5 due to their low relevance and 21 due to their low ability to be measured (rating equal or lower than 3.0 points).

Round 5: defining the final set of KPI

Finally, a last in-person meeting was held with the expert panel to present the final list of KPIs, and to define the sources of information to calculate each metric (round 5).

The expert panel defined a final list with 85 KPIs to assess all six EAHP Statements: 14 to assess the introductory statements; 10 on selection, procurement and distribution; 6 on production and compounding; 16 on clinical pharmacy services; 25 on patient safety and quality assurance; and 14 on education and research (Table 4). Concerning the type of KPI, 40 are saKPIs, 39 cpKPIs and 6 neither.

Discussion

Although being the first study to define a Portuguese set of saKPIs/cpKPIs to assess hospital pharmacy performance and quality based on EAHP Statement, other countries have deployed similar studies, as previously mentioned.

Though some authors argue that setting benchmarks by accreditation bodies or certifications by international
| EAHP Standards and Management | Assessment area | Key performance indicators | Type of KPI | Relevance (average) | Measurability (average) | Final list |
|-------------------------------|----------------|---------------------------|-------------|---------------------|------------------------|-----------|
| I. Statement of Introductory Principles and Management | Human resources | Number of Full Time Equivalent (FTE) Professionals, adjusted by number of beds | saKPI | 4.7 | 4.7 | Y |
| Human resources | Burden of absenteeism hours by pharmacist FTE | saKPI | 4.3 | 4.5 | Y |
| Technology/Software | Existence of an electronic prescription system integrated with the pharmacy (Identify in which production lines) | cpKPI | 4.3 | 4.8 | Y |
| Technology/Software | Existence of a double-check medication repackaging system | saKPI | 4.3 | 4.3 | Y |
| Technology/Software | Existence of a double-check system in the production / compounding of sterile products | saKPI | 4.5 | 4.7 | Y |
| Technology/Software | Existence of a double-check system in the production / compounding of non-sterile products | saKPI | 4.5 | 4.7 | Y |
| Certifications/Accreditations | Existence of a quality management system | saKPI | 3.4 | 2.9 | N |
| Technology/Software | Pharmacists routinely used a mobile device while providing patient care | cpKPI | 2.3 | 2.0 | N |
| Technology/Software | Pharmacy track and monitor trends in financial metrics | saKPI | 2.4 | 3.1 | N |
| II. Selection, procurement and distribution | Inventory and logistics management | Drugs stock turnover rate (in days) | saKPI | 4.2 | 4.0 | Y |
| Drug distribution | Existence of an automated inpatient medication preparation system (which one?) | saKPI | 4.5 | 4.5 | Y |
| Drug distribution | Existence of an automated outpatient medication distribution system (which one?) | saKPI | 4.5 | 4.5 | Y |
| Drug distribution | Number of drugs dispensed to outpatients | cpKPI | 4.3 | 4.2 | Y |
| Drug distribution | Existence of an automated inpatient distribution system (which one?) | saKPI | 4.5 | 4.5 | Y |
| Drug distribution | Existence of an automated outpatient dispensing system (which one?) | saKPI | 4.5 | 4.5 | Y |
| Drug distribution | Percentage of hospital beds in Unit Dose | saKPI | 4.7 | 4.5 | Y |
| Inventory and logistics management | Drugs obsolescence rate (lost due to expiry date) | saKPI | 4.3 | 2.5 | N |
| Drug distribution | Total inpatient doses dispensed per number of inpatient discharges | saKPI | 3.5 | 2.8 | N |
| Drug distribution | Total inpatient doses returned | saKPI | 4.3 | 2.8 | N |
Table 2 (continued)

| EAHP Standards | Assessment area | Key performance indicators | Type of KPI | Relevance (average) | Measurability (average) | Final list |
|----------------|----------------|----------------------------|-------------|---------------------|-------------------------|------------|
| III. Production and preparation | Drug preparations | Ability to prepare internally sterile and injectable preparation blends | saKPI | 4.8 | 2.6 | N |
| | Drug preparations | Number of biological controls performed | saKPI | 4.8 | 2.0 | N |
| | Drug preparations | Number of sterile and injectable preparation blends performed | saKPI | 4.8 | 2.0 | N |
| IV. Clinical Pharmacy services | Prescription review and reconciliation | Number of inpatient prescriptions validations (medication review), adjusted by pharmacist FTE | cpKPI | 5.0 | 4.3 | Y |
| | Prescription review and reconciliation | Number of outpatient prescription validations (medication review), adjusted by pharmacist FTE | cpKPI | 4.5 | 4.5 | Y |
| | Prescription review and reconciliation | Number of pharmacist interventions in patient therapy, adjusted by pharmacist FTE | cpKPI | 4.5 | 4.5 | Y |
| | Prescription review and reconciliation | Number of blood products dispensed, per 1000 patients discharged | saKPI | 4.4 | 4.3 | Y |
| | Prescription review and reconciliation | Number of narcotic and psychotropic requests analysed, per 1000 patients discharged | cpKPI | 4.3 | 4.2 | Y |
| | Rounds | Number of pharmacists rounds | cpKPI | 4.7 | 2.1 | N |
| | Prescription review and reconciliation | Average of admitted days that patients receive medication review by a pharmacist | cpKPI | 4.0 | 1.5 | N |
| | Prescription review and reconciliation | Proportion of patients for whom pharmacists participate in interprofessional patient care rounds to improve medication management | cpKPI | 4.5 | 1.5 | N |
| | Prescription review and reconciliation | Number of medication reconciliations up to 72 h after admission | cpKPI | 4.5 | 1.5 | N |
| | Prescription review and reconciliation | Number of medication reconciliations at discharge | cpKPI | 4.5 | 1.5 | N |
| | Outpatient activity | Number of outpatient’s pharmaceutical consultations/appointments | cpKPI | 4.5 | 2.1 | N |
| | Information sharing | Number of patients with written information regarding prescribed medications at discharge | cpKPI | 4.5 | 1.2 | N |
| | Information sharing | Number of outpatients with written information regarding prescribed medications | cpKPI | 4.5 | 1.2 | N |
| | Information sharing | The percentage of patients satisfied with the information they received about their medications while in hospital | cpKPI | 4.0 | 1.3 | N |
| EAHP Standards | Assessment area | Key performance indicators | Type of KPI | Relevance (average) | Measurability (average) | Final list |
|----------------|----------------|---------------------------|-------------|---------------------|-------------------------|------------|
| V. Patient safety and quality assurance | The seven rights (patient, medication, dose, route, time, information and documentation) | Existence of inpatient pharmacokinetic monitoring protocols (yes / no) | cpKPI | 4.8 | 4.7 | Y |
| | The seven rights (patient, medication, dose, route, time, information and documentation) | Existence of outpatient pharmacokinetic monitoring protocols (yes / no) | cpKPI | 4.8 | 4.7 | Y |
| | Strategies to identify and reduce errors | Rate of nonconformities in total number of internal audits | cpKPI | 4.5 | 4.0 | Y |
| | Strategies to identify and reduce errors | Rate of nonconformities in total number of external audits | cpKPI | 4.5 | 4.0 | Y |
| | Monitoring and reporting of adverse events | Rate of patients with medication errors (reported events), per 1000 patients discharged | cpKPI | 5.0 | 4.5 | Y |
| | High-risk drug management | Existence of an active pharmacovigilance system (yes / no) | cpKPI | 5.0 | 4.3 | Y |
| | High-risk drug management | Number of active pharmacovigilance follow-ups performed | cpKPI | 4.6 | 4.3 | Y |
| | The seven rights (patient, medication, dose, route, time, information and documentation) | Proportion of patients at high risk of venous thromboembolism that receive appropriate prophylaxis | cpKPI | 4.5 | 1.7 | N |
| | The seven rights (patient, medication, dose, route, time, information and documentation) | Percentage of patients interviewed by a pharmacist by the end of the following working day after admission | cpKPI | 4.0 | 2.1 | N |
| | Monitoring and reporting of adverse events | Number of adverse events reported by staff | cpKPI | 4.5 | 2.1 | N |
| | Monitoring and reporting of adverse events | Number of adverse events reported by patients | cpKPI | 4.0 | 1.5 | N |
| | Monitoring and reporting of adverse events | Number of medication errors reported by staff | cpKPI | 4.5 | 3.0 | N |
| | Monitoring and reporting of adverse events | Number of medication errors reported by patients | cpKPI | 4.0 | 1.5 | N |
| | Monitoring and reporting of adverse events | Number of pharmacy attributable events (storage, ordering, administration, preparation/dispense, monitoring) | saKPI | 4.0 | 1.5 | N |
organizations is the first step of healthcare quality cycle [49], only one study from Brazil referred to the importance of measuring the existence of updated written operational procedures for all clinical pharmacy activities [34].

About the KPIs included in the second statement, the ‘Drugs stock turnover’ comprises a commonly used criterion for assessing the efficiency of pharmacies’ purchasing and supply chain [26]. Given the importance of this metric, three indicators were defined in the Magarinos-Torres et al. (2007) study to assess the stock turnover, namely the number of medication units lost, the value spent in lost medication, and the existence of updated reports on medication availability [34].

Our expert panel included the highest number of KPIs in the “clinical pharmacy services” statement, which is aligned with the indicators referred across the literature. The KPI ‘Existence of medication reconciliations up to 72 h after admission’ is one of the most frequently mentioned in the literature [4, 5, 17, 19, 26, 45]. Although the time interval defined for reconciliation varies between 24 to 72 h, there is a consensus across the literature that it is highly relevant and measurable, not only by identifying the existence or non-existence of these reconciliations, but also by the importance of quantifying the proportion of patients who received formal documented medication reconciliation at discharge [4, 26].

Aligned with several studies [4, 19, 26, 45], KPIs related to patients’ education and information sharing are highly recommended. In the Lloyd et al. (2017) study, the expert panel argues that patients have to receive written/verbal counselling before discharge, and that they should also receive a document with an accurate medication list detailing any therapy changes [26]. In two other studies, both panel groups defined a specific KPI to measure the proportion of patients who have face-to-face discussions about their medication before discharge [4, 45].

Concerning the clinical pharmacy services, the development of outpatient pharmaceutical consultations was considered an important area of clinical intervention, aiming for medication reconciliation, drug interactions management, adverse reactions detection, patient education among others [50–52]. Therefore, outpatient pharmacy and consultation has become an important part of pharmacists’ tasks [52, 53].

As for the statement patient safety, although the number of adverse events reported by staff and/or by patients is one of the KPIs most frequently referred to in the literature, this indicator can assume different definitions. For example, in a study from Brazil, this KPI is mentioned as ‘Number of problems that occurred related to medications’ and ‘Number of problems related with medications identified and notified’ [34]; in a study from Belgium, it’s referred to as ‘Number of interventions accepted and activities performed to prevent, detect, assess, manage, report, and/or document adverse
| EAHP Standards | Assessment area | Key performance indicators | Type of KPI | Relevance (average) | Measurability (average) | Final list |
|----------------|----------------|----------------------------|-------------|--------------------|------------------------|------------|
| I. Statement of introductory principles and management | Certifications/Accreditations | Pharmacy Certification (which one? number of cycles) | saKPI | 5.0 | 5.0 | Y |
| | Certifications/Accreditations | Pharmacy Accreditation (which one? number of cycles) | saKPI | 5.0 | 5.0 | Y |
| | Human resources | Ratio between pharmacists and technicians FTEs | saKPI | 4.3 | 5.0 | Y |
| | Human resources | Number of postgraduate pharmacists | saKPI | 4.2 | 4.5 | Y |
| | Human resources | Number of pharmacists with a master's or a PhD degree | saKPI | 4.2 | 4.5 | Y |
| | Human resources | Ratio between Specialists Pharmacists and total of Pharmacists | saKPI | 4.4 | 4.5 | Y |
| | Pharmacy committee | Existence of equal representation in the Therapeutic Pharmacy Committee (Identify TPC composition) | cpKPI | 5.0 | 5.0 | Y |
| | Pharmacy committee | Number of drugs introduced in the Health Technology Assessment Information System (SIATS), adjusted by pharmacist FTE | cpKPI | 4.3 | 4.3 | Y |
| | Human resources | Number of professionals with performance evaluation in the year | saKPI | 3.5 | 2.3 | N |
| | Pharmacy committee | Number of monthly meetings of the Therapeutic Pharmacy Committee | cpKPI | 3.9 | 2.2 | N |
| | Pharmacy committee | Rate of medication prescriptions requiring justification and opinion deliberation of the Therapeutic Pharmacy Committee | cpKPI | 4.5 | 2.7 | N |
| | Pharmacy committee | Rate of new medicines and another products introduction | cpKPI | 4.3 | 2.7 | N |
| II. Selection, procurement and distribution | Medication form | Ratio between biosimilar and biological medications | saKPI | 4.3 | 4.0 | Y |
| | Drug distribution | Percentage of hospital beds in Pyxis | saKPI | 4.7 | 4.5 | Y |
| | Drug distribution | Number of Special Use Authorizations, adjusted by pharmacist FTE | cpKPI | 4.8 | 4.0 | Y |
| | Medication form | Existence of a medication form (yes / no) | saKPI | 2.5 | 4.7 | N |
| | Medication form | Number of orders placed outside the medication form | saKPI | 3.0 | 4.0 | N |
| | Inventory and logistics management | Percentage of drugs with an expiration date < 1 month | saKPI | 3.8 | 2.5 | N |
| | Inventory and logistics management | Average time to stock-out of essential medications | saKPI | 4.2 | 2.6 | N |
| | Drug distribution | Number of special use authorization processes initiated | cpKPI | 3.8 | 2.9 | N |
| EAHP Standards                   | Assessment area                             | Key performance indicators                                                                 | Type of KPI | Relevance (average) | Measurability (average) | Final list |
|----------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------|-------------|---------------------|-------------------------|------------|
| III. Production and preparation  | Operating procedures                        | Existence of Standard Operating Procedures (SOPs) for every time-specific sterile preparation activities | saKPI       | 4.8                 | 4.7                     | Y          |
|                                  | Operating procedures                        | Existence of Standard Operating Procedures (SOPs) for every time-specific non-sterile preparation activities | saKPI       | 4.8                 | 4.7                     | Y          |
|                                  | Facilities and staff                        | Number of preparations performed in outsourcing, adjusted by pharmacy FTEs                  | saKPI       | 4.8                 | 4.5                     | Y          |
|                                  | Drug preparations                           | Percentage of contaminations from biological controls                                       | saKPI       | 4.5                 | 4.2                     | Y          |
|                                  | Drug preparations                           | Number of non-sterile preparations, per 1000 patients discharged                           | saKPI       | 4.5                 | 4.2                     | Y          |
|                                  | Drug preparations                           | Number of sterile preparations, per 1000 patients discharged                               | saKPI       | 4.5                 | 4.2                     | Y          |
|                                  | Facilities and staff                        | Existence of conditions in hospital for the development of sterile preparations (parenteral nutrition; Chemotherapy or other IV mixtures) | saKPI       | 2.9                 | 2.9                     | N          |
|                                  | Drug preparations                           | Number of contaminated preparations                                                       | saKPI       | 4.2                 | 2.6                     | N          |
|                                  | Drug preparations                           | Number of patients discharged with parenteral nutritional preparations and in follow-up    | cpKPI       | 4.1                 | 2.4                     | N          |
|                                  | Facilities and staff                        | Existence of conditions in hospital for the development of non-sterile preparations (oral suspensions, syrups, ointments, etc.) | saKPI       | 2.8                 | 2.8                     | N          |
|                                  | Drug preparations                           | Ability to prepare internally requested biological controls                                 | saKPI       | 4.8                 | 2.7                     | N          |
|                                  | Drug preparations                           | Use of operator sleeve control when handling cytotoxic drugs (CTX)                          | saKPI       | 2.9                 | 4.0                     | N          |
| EAHP Standards | Assessment area | Key performance indicators | Type of KPI | Relevance (average) | Measurability (average) | Final list |
|----------------|----------------|----------------------------|-------------|---------------------|-------------------------|------------|
| IV. Clinical pharmacy services | Rounds | Percentage of services with pharmacist rounds | cpKPI | 4.8 | 4.0 | Y |
| Prescription review and reconciliation | Number of inpatients with therapeutic reconciliation, adjusted by pharmacist FTE | cpKPI | 4.6 | 4.0 | Y |
| Prescription review and reconciliation | Existence of medication reconciliations up to 72 h after admission (yes / no) | cpKPI | 4.8 | 4.0 | Y |
| Prescription review and reconciliation | Existence of medication reconciliations at discharge (Yes / No) | cpKPI | 4.8 | 4.0 | Y |
| Prescription review and reconciliation | Number of blood products orders analysed, per 1000 patients discharged | cpKPI | 4.5 | 4.0 | Y |
| Prescription review and reconciliation | Number of blood products returned per 1000 patients discharged | saKPI | 4.4 | 4.0 | Y |
| Prescription review and reconciliation | Number of narcotic and psychotropic requests dispensed, per 1000 patients discharged | saKPI | 4.4 | 4 | Y |
| Outpatient activity | Existence of specific outpatient pharmaceutical consultations (Identify which specialties) | cpKPI | 4.8 | 4 | Y |
| Outpatient activity | Number of outpatient pharmaceutical consultations, adjusted by pharmacist FTE | cpKPI | 4.5 | 4.2 | Y |
| Information sharing | Existence of written information regarding prescribed medications at discharge (yes / no) | cpKPI | 4.8 | 4.0 | Y |
| Information sharing | Existence of written information regarding outpatients prescribed medications (yes / no) | cpKPI | 4.8 | 4.0 | Y |
| Rounds | Percentage of medical visits accompanied by pharmacists | cpKPI | 4.5 | 1.5 | N |
| Rounds | Number of patient complaints recorded during visits | cpKPI | 4.2 | 1.3 | N |
| Prescription review and reconciliation | Number of prescriptions analysed, adjusted by pharmacist FTE | cpKPI | 4.6 | 1.6 | N |
| Prescription review and reconciliation | Number of validated prescriptions, adjusted by pharmacist FTE | cpKPI | 4.5 | 1.6 | N |
| Prescription review and reconciliation | Number of suggested changes to prescription, adjusted by pharmacist FTE | cpKPI | 4.6 | 1.6 | N |
| V. Patient safety and quality assurance | The seven rights (patient, medication, dose, route, time, information and documentation) | Number of inpatient pharmacokinetics monitorizations, adjusted by pharmacist FTE | cpKPI | 4.4 | 4.2 | Y |
| The seven rights (patient, medication, dose, route, time, information and documentation) | Rate of inpatient medicines in clinical pharmacokinetics (which ones) | cpKPI | 4.5 | 4.2 | Y |
| The seven rights (patient, medication, dose, route, time, information and documentation) | Number of outpatient pharmacokinetics monitorization, adjusted by pharmacist FTE | cpKPI | 4.4 | 4.1 | Y |
| EAHP Standards | Assessment area                                                                 | Key performance indicators                                                                 | Type of KPI | Relevance (average) | Measurability (average) | Final list |
|----------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------|---------------------|-------------------------|------------|
|                | The seven rights (patient, medication, dose, route, time, information and documentation) | Rate of outpatient medicines in clinical pharmacokinetics (which ones)                          | cpKPI       | 4.5                 | 4.2                     | Y          |
|                | The seven rights (patient, medication, dose, route, time, information and documentation) | Rate of Serum therapeutic concentrations levels in total concentration levels                   | cpKPI       | 4.8                 | 4.2                     | Y          |
|                | The seven rights (patient, medication, dose, route, time, information and documentation) | Antibiotic use rate (3 classes) in Defined Daily Dose (DDD), per 1000 discharged patients      | cpKPI       | 4.3                 | 4.0                     | Y          |
|                | Strategies to identify and reduce errors                                       | Existence of a process that ensures medication batch traceability in outpatient care (yes / no) (which one) | saKPI       | 4.8                 | 4.5                     | Y          |
|                | Strategies to identify and reduce errors                                       | Existence of a process that ensures traceability of all medication batches on inpatient care (yes / no) (which one) | saKPI       | 4.8                 | 4.5                     | Y          |
|                | Strategies to identify and reduce errors                                       | Existence of a process that ensures chemotherapy medication batch traceability (yes / no) (which one) | saKPI       | 4.8                 | 4.5                     | Y          |
|                | Strategies to identify and reduce errors                                       | Existence of a process that ensures blood product medication batch traceability (yes / No) (which one) | saKPI       | 4.8                 | 4.5                     | Y          |
|                | Strategies to identify and reduce errors                                       | Number of internal clinical audits                                                             | saKPI       | 4.7                 | 4.0                     | Y          |
|                | Strategies to identify and reduce errors                                       | Number of external clinical audits                                                             | saKPI       | 4.5                 | 4.3                     | Y          |
|                | Monitoring and reporting of adverse events                                      | Number of adverse events reported to National Pharmacovigilance System, per 1000 patients discharged and per number of outpatients followed | cpKPI       | 5.0                 | 5.0                     | Y          |
|                | High-risk drug management                                                       | Number of notifications to the National Pharmacovigilance System that results from active pharmacovigilance, adjusted by pharmacist FTE | cpKPI       | 5.0                 | 5.0                     | Y          |
|                | High-risk drug management                                                       | Existence of a list of high-risk medications (yes / no)                                       | saKPI       | 4.2                 | 4.3                     | Y          |
|                | High-risk drug management                                                       | Percentage of medications stored according to the LASA (Look-Alike, Sound-Alike) nomenclature | saKPI       | 5.0                 | 4.0                     | Y          |
|                | High-risk drug management                                                       | Compliance Index of the last audit according to the LASA (Look-Alike, Sound-Alike) nomenclature | saKPI       | 4.8                 | 4.0                     | Y          |
|                | High-risk drug management                                                       | Existence of active medication-related information (yes / no)                                  | cpKPI       | 4.7                 | 4.5                     | Y          |
|                | The seven rights (patient, medication, dose, route, time, information and documentation) | Number of prescriptions with incorrect dosage                                                  | cpKPI       | 4.6                 | 2.4                     | N          |
| EAHP Standards | Assessment area                                                                 | Key performance indicators                                                                                   | Type of KPI | Relevance (average) | Measurability (average) | Final list |
|----------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------|---------------------|-------------------------|------------|
|                | The seven rights (patient, medication, dose, route, time, information and documentation) | Number of patients who did not take medication in the last 24 h                                                                 | cpKPI       | 4.7                 | 2.1                     | N          |
|                | Strategies to identify and reduce errors                                        | Number of medication incidents per 1000 days                                                                 | cpKPI       | 4.6                 | 2.2                     | N          |
|                | Monitoring and reporting of adverse events                                      | Number of hospitalized patients with complete record of allergic reactions within 24 h after admission      | cpKPI       | 4.0                 | 1.5                     | N          |
|                | Monitoring and reporting of adverse events                                      | Number of patients with morbidity resulting from a preventable adverse effect                              | cpKPI       | 4.3                 | 1.5                     | N          |
|                | High-risk drug management                                                       | Number of therapeutic reconciliations in polymedicated patients with polymedication, adjusted by pharmacist FTE | cpKPI       | 4.3                 | 1.8                     | N          |
| VI. Education and research | Education                                                                      | Number of undergraduate trainees, adjusted by pharmacy FTE                                               | n.a         | 4.3                 | 4.0                     | Y          |
|                | Education                                                                      | Number of undergraduate trainees, adjusted by pharmacist FTE                                               | n.a         | 4.3                 | 4.0                     | Y          |
|                | Education                                                                      | Number of postgraduate trainees, adjusted by pharmacy FTE                                                | n.a         | 4.3                 | 4.0                     | Y          |
|                | Education                                                                      | Number of postgraduate trainees, adjusted by pharmacist FTE                                               | n.a         | 4.3                 | 4.0                     | Y          |
|                | Continuing education                                                           | Time spending on training, adjusted by pharmacist FTE                                                     | saKPI       | 4.2                 | 4.0                     | Y          |
|                | Continuing education                                                           | Time spending on training, adjusted by pharmacist FTE                                                     | saKPI       | 4.2                 | 4.0                     | Y          |
|                | Clinical trials participation                                                  | Number of new clinical trials involving hospital pharmacists, adjusted by pharmacist FTE                   | cpKPI       | 4.8                 | 4.5                     | Y          |

EAHP European association of hospital pharmacists, saKPI support activity key performance indicator, cpKPI clinical pharmacy key performance indicator, FTE full time equivalent, Y yes, N no, n.a. not applicable, Relevance and Measurability scores ranged from 1–5 points
| EAHP Standards | Assessment area | Key performance indicators | Type of KPI | Relevance (average) | Measurability (average) | Numb. KPI |
|----------------|----------------|----------------------------|------------|---------------------|-------------------------|----------|
| I. Statement of introductory principles and management | Certifications/Accreditations | Pharmacy Certification (which one? number of cycles) | saKPI | 5.0 | 5.0 | 1 |
| | Certifications/Accreditations | Pharmacy Accreditation (which one? number of cycles) | saKPI | 5.0 | 5.0 | 2 |
| | Human resources | Number of Full Time Equivalent (FTE) Professionals, adjusted by number of beds | saKPI | 4.7 | 4.7 | 3 |
| | Human resources | Ratio between pharmacists and technicians FTEs | saKPI | 4.3 | 5.0 | 4 |
| | Human resources | Burden of absenteeism hours by pharmacist FTE | saKPI | 4.3 | 4.5 | 5 |
| | Human resources | Number of postgraduate pharmacists | saKPI | 4.2 | 4.5 | 6 |
| | Human resources | Number of pharmacists with a master's or a PhD degree | saKPI | 4.2 | 4.5 | 7 |
| | Human resources | Ratio between Specialists Pharmacists and total of Pharmacists | saKPI | 4.4 | 4.5 | 8 |
| | Pharmacy committee | Existence of equal representation in the Therapeutic Pharmacy Committee (Identify TPC composition) | cpKPI | 5.0 | 5.0 | 9 |
| | Pharmacy committee | Number of drugs introduced in the Health Technology Assessment Information System (SiATS), adjusted by pharmacist FTE | cpKPI | 4.3 | 4.3 | 10 |
| | Technology/Software | Existence of an electronic prescription system integrated with the pharmacy (Identify in which production lines) | cpKPI | 4.3 | 4.8 | 11 |
| | Technology/Software | Existence of a double-check medication repackaging system | saKPI | 4.3 | 4.3 | 12 |
| | Technology/Software | Existence of a double-check system in the production / compounding of sterile products | saKPI | 4.5 | 4.7 | 13 |
| | Technology/Software | Existence of a double-check system in the production / compounding of non-sterile products | saKPI | 4.5 | 4.7 | 14 |
| EAHP Standards                                      | Assessment area                                      | Key performance indicators                                                                 | Type of KPI | Relevance (average) | Measurability (average) | Numb. KPI |
|-----------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------|---------------------|-------------------------|-----------|
| II. Selection, procurement and distribution          | Medication form                                      | Ratio between biosimilar and biological medications                                       | saKPI       | 4.3                 | 4.0                     | 15        |
|                                                     | Inventory and logistics management                    | Drugs stock turnover rate (in days)                                                       | saKPI       | 4.2                 | 4.0                     | 16        |
|                                                     | Drug distribution                                     | Existence of an automated inpatient medication preparation system (which one?)            | saKPI       | 4.5                 | 4.5                     | 17        |
|                                                     | Drug distribution                                     | Existence of an automated outpatient medication distribution system (which one?)          | saKPI       | 4.5                 | 4.5                     | 18        |
|                                                     | Drug distribution                                     | Number of drugs dispensed to outpatients                                                   | cpKPI       | 4.3                 | 4.2                     | 19        |
|                                                     | Drug distribution                                     | Existence of an automated inpatient distribution system (which one?)                      | saKPI       | 4.5                 | 4.5                     | 20        |
|                                                     | Drug distribution                                     | Existence of an automated outpatient dispensing system (which one?)                       | saKPI       | 4.5                 | 4.5                     | 21        |
|                                                     | Drug distribution                                     | Percentage of hospital beds in Unit Dose                                                   | saKPI       | 4.7                 | 4.5                     | 22        |
|                                                     | Drug distribution                                     | Percentage of hospital beds in Pyxis                                                        | saKPI       | 4.7                 | 4.5                     | 23        |
|                                                     | Drug distribution                                     | Number of Special Use Authorizations, adjusted by pharmacist FTE                           | cpKPI       | 4.8                 | 4.0                     | 24        |
| III. Production and preparation                      | Operating procedures                                  | Existence of Standard Operating Procedures (SOPs) for every time-specific sterile preparation activities | saKPI       | 4.8                 | 4.7                     | 25        |
|                                                     | Operating procedures                                  | Existence of Standard Operating Procedures (SOPs) for every time-specific non-sterile preparation activities | saKPI       | 4.8                 | 4.7                     | 26        |
|                                                     | Facilities and staff                                  | Number of preparations performed in outsourcing, adjusted by pharmacy FTEs               | saKPI       | 4.8                 | 4.5                     | 27        |
|                                                     | Drug preparations                                    | Percentage of contaminations from biological controls                                     | saKPI       | 4.5                 | 4.2                     | 28        |
|                                                     | Drug preparations                                    | Number of non-sterile preparations, per 1000 patients discharged                          | saKPI       | 4.5                 | 4.2                     | 29        |
|                                                     | Drug preparations                                    | Number of sterile preparations, per 1000 patients discharged                             | saKPI       | 4.5                 | 4.2                     | 30        |
| EAHP Standards | Assessment area | Key performance indicators | Type of KPI | Relevance (average) | Measurability (average) | Numb. KPI |
|----------------|----------------|----------------------------|-------------|---------------------|------------------------|----------|
| IV. Clinical pharmacy services | Rounds | Percentage of services with pharmacist rounds | cpKPI | 4.8 | 4.0 | 31 |
| | Prescription review and reconciliation | Number of inpatients with therapeutic reconciliation, adjusted by pharmacist FTE | cpKPI | 4.6 | 4.0 | 32 |
| | Prescription review and reconciliation | Number of inpatient prescriptions validations (medication review), adjusted by pharmacist FTE | cpKPI | 5.0 | 4.3 | 33 |
| | Prescription review and reconciliation | Existence of medication reconciliations up to 72 h after admission (yes / no) | cpKPI | 4.8 | 4.0 | 34 |
| | Prescription review and reconciliation | Existence of medication reconciliations at discharge (Yes / No) | cpKPI | 4.8 | 4.0 | 35 |
| | Prescription review and reconciliation | Number of outpatient prescription validations (medication review), adjusted by pharmacist FTE | cpKPI | 4.5 | 4.5 | 36 |
| | Prescription review and reconciliation | Number of pharmacist interventions in patient therapy, adjusted by pharmacist FTE | cpKPI | 4.5 | 4.5 | 37 |
| | Prescription review and reconciliation | Number of blood products orders analysed, per 1000 patients discharged | cpKPI | 4.5 | 4.0 | 38 |
| | Prescription review and reconciliation | Number of blood products dispensed, per 1000 patients discharged | saKPI | 4.4 | 4.3 | 39 |
| | Prescription review and reconciliation | Number of blood products returned per 1000 patients discharged | saKPI | 4.4 | 4.0 | 40 |
| | Prescription review and reconciliation | Number of narcotic and psychotropic requests analysed, per 1000 patients discharged | cpKPI | 4.3 | 4.2 | 41 |
| | Prescription review and reconciliation | Number of narcotic and psychotropic requests dispensed, per 1000 patients discharged | saKPI | 4.4 | 4.0 | 42 |
| | Outpatient activity | Existence of specific outpatient pharmaceutical consultations (Identify which specialties) | cpKPI | 4.8 | 4.0 | 43 |
| | Outpatient activity | Number of outpatient pharmaceutical consultations, adjusted by pharmacist FTE | cpKPI | 4.5 | 4.2 | 44 |
| | Information sharing | Existence of written information regarding prescribed medications at discharge (yes / no) | cpKPI | 4.8 | 4.0 | 45 |
| | Information sharing | Existence of written information regarding outpatients prescribed medications (yes / no) | cpKPI | 4.8 | 4.0 | 46 |
| EAHP Standards | Assessment area                                                                 | Key performance indicators                                                                 | Type of KPI | Relevance (average) | Measurability (average) | Numb. KPI |
|----------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------|---------------------|------------------------|-----------|
| V. Patient safety and quality assurance | The seven rights (patient, medication, dose, route, time, information and documentation) | Existence of inpatient pharmacokinetic monitoring protocols (yes / no) | cpKPI       | 4.8                 | 4.7                    | 47        |
|                          | The seven rights (patient, medication, dose, route, time, information and documentation) | Number of inpatient pharmacokinetics monitorizations, adjusted by pharmacist FTE | cpKPI       | 4.4                 | 4.2                    | 48        |
|                          | The seven rights (patient, medication, dose, route, time, information and documentation) | Rate of inpatient medicines in clinical pharmacokinetics (which ones) | cpKPI       | 4.5                 | 4.2                    | 49        |
|                          | The seven rights (patient, medication, dose, route, time, information and documentation) | Existence of outpatient pharmacokinetic monitoring protocols (yes / no) | cpKPI       | 4.8                 | 4.7                    | 50        |
|                          | The seven rights (patient, medication, dose, route, time, information and documentation) | Number of outpatient pharmacokinetics monitorization, adjusted by pharmacist FTE | cpKPI       | 4.4                 | 4.1                    | 51        |
|                          | The seven rights (patient, medication, dose, route, time, information and documentation) | Rate of outpatient medicines in clinical pharmacokinetics (which ones) | cpKPI       | 4.5                 | 4.2                    | 52        |
|                          | The seven rights (patient, medication, dose, route, time, information and documentation) | Rate of Serum therapeutic concentrations levels in total concentration levels | cpKPI       | 4.8                 | 4.2                    | 53        |
|                          | The seven rights (patient, medication, dose, route, time, information and documentation) | Antibiotic use rate (3 classes) in Defined Daily Dose (DDD), per 1000 discharged patients | cpKPI       | 4.3                 | 4.0                    | 54        |
| Strategies to identify and reduce errors | Existence of a process that ensures medication batch traceability in outpatient care (yes / no) (which one) | saKPI | 4.8                 | 4.5                    | 55        |
| Strategies to identify and reduce errors | Existence of a process that ensures traceability of all medication batches on inpatient care (yes / no) (which one) | saKPI | 4.8                 | 4.5                    | 56        |
| Strategies to identify and reduce errors | Existence of a process that ensures chemotherapy medication batch traceability (yes / no) (which one) | saKPI | 4.8                 | 4.5                    | 57        |
| Strategies to identify and reduce errors | Existence of a process that ensures blood product medication batch traceability (yes / No) (which one) | saKPI | 4.8                 | 4.5                    | 58        |
| Strategies to identify and reduce errors | Number of internal clinical audits | saKPI | 4.7                 | 4.0                    | 59        |
| Strategies to identify and reduce errors | Number of external clinical audits | saKPI | 4.5                 | 4.3                    | 60        |
| EAHP Standards                  | Assessment area                                                                 | Key performance indicators                                                                 | Type of KPI | Relevance (average) | Measurability (average) | Numb. KPI |
|---------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------|---------------------|-------------------------|-----------|
|                                 | Strategies to identify and reduce errors                                        | Rate of nonconformities in total number of internal audits                                    | cpKPI       | 4.5                 | 4.0                     | 61        |
|                                 | Strategies to identify and reduce errors                                        | Rate of nonconformities in total number of external audits                                   | cpKPI       | 4.5                 | 4.0                     | 62        |
|                                 | Monitoring and reporting of adverse events                                       | Number of adverse events reported to National Pharmacovigilance System, per 1000 patients discharged and per number of outpatients followed | cpKPI       | 5.0                 | 5.0                     | 63        |
|                                 | Monitoring and reporting of adverse events                                       | Rate of patients with medication errors (reported events), per 1000 patients discharged     | cpKPI       | 5.0                 | 4.5                     | 64        |
|                                 | High-risk drug management                                                        | Existence of an active pharmacovigilance system (yes / no)                                   | cpKPI       | 5.0                 | 4.3                     | 65        |
|                                 | High-risk drug management                                                        | Number of active pharmacovigilance follow-ups performed                                      | cpKPI       | 4.6                 | 4.3                     | 66        |
|                                 | High-risk drug management                                                        | Number of notifications to the National Pharmacovigilance System that results from active pharmacovigilance, adjusted by pharmacist FTE | cpKPI       | 5.0                 | 5.0                     | 67        |
|                                 | High-risk drug management                                                        | Existence of a list of high-risk medications (yes / no)                                     | saKPI       | 4.2                 | 4.3                     | 68        |
|                                 | High-risk drug management                                                        | Percentage of medications stored according to the LASA (Look-Alike, Sound-Alike) nomenclature | saKPI       | 5.0                 | 4.0                     | 69        |
|                                 | High-risk drug management                                                        | Compliance Index of the last audit according to the LASA (Look-Alike, Sound-Alike) nomenclature | saKPI       | 4.8                 | 4.0                     | 70        |
|                                 | High-risk drug management                                                        | Existence of active medication-related information (yes / no)                               | cpKPI       | 4.7                 | 4.5                     | 71        |
Table 4 (continued)

| EAHP Standards | Assessment area | Key performance indicators | Type of KPI | Relevance (average) | Measurability (average) | Numb. KPI |
|----------------|----------------|-----------------------------|-------------|---------------------|-------------------------|-----------|
| VI. Education and research | Education | Number of undergraduate trainees, adjusted by pharmacy FTE | n.a | 4.3 | 4.0 | 72 |
| | Education | Number of undergraduate trainees, adjusted by pharmacist FTE | n.a | 4.3 | 4.0 | 73 |
| | Education | Number of postgraduate trainees, adjusted by pharmacy FTE | n.a | 4.3 | 4.0 | 74 |
| | Education | Number of postgraduate trainees, adjusted by pharmacist FTE | n.a | 4.3 | 4.0 | 75 |
| | Continuing education | Time spending on training, adjusted by pharmacy FTE | saKPI | 4.2 | 4.0 | 76 |
| | Continuing education | Time spending on training, adjusted by pharmacist FTE | saKPI | 4.2 | 4.0 | 77 |
| | Research and publications | Number of national peer-reviewed publication, adjusted by pharmacist FTE | n.a | 4.5 | 4.0 | 78 |
| | Research and publications | Number of international peer-reviewed publication, adjusted by pharmacist FTE | n.a | 4.7 | 4.0 | 79 |
| | Clinical trials participation | Number of clinical trials involving hospital pharmacists | cpKPI | 5.0 | 4.5 | 80 |
| | Clinical trials participation | Number of clinical trials involving hospital pharmacists, adjusted by pharmacist FTE | cpKPI | 5.0 | 4.5 | 81 |
| | Clinical trials participation | Number of new clinical trials involving hospital pharmacists, adjusted by pharmacist FTE | cpKPI | 4.8 | 4.5 | 82 |
| | Clinical trials participation | Existence of a standardized process for implementation and follow-up of clinical trials | saKPI | 5.0 | 4.5 | 83 |
| | Clinical trials participation | Number of patients in clinical trials in which the pharmacist is involved, adjusted by pharmacist FTE | cpKPI | 4.8 | 4.3 | 84 |
| | Clinical trials participation | Experimental medication dispensing error rate | cpKPI | 5.0 | 4.0 | 85 |

EAHP European association of hospital pharmacists, saKPI support activity key performance indicator, cpKPI clinical pharmacy key performance indicator, FTE full time equivalent, n.a. not applicable. Relevance and Measurability scores ranged from 1–5 points.
activities will allow better activity assessment, leading to improved performance in hospital pharmacists’ clinical and support roles. Communicating across all players that KPI measurement to monitor status quo, increasing workload in data collection, ensuring data quality and, most importantly, communicating across all players that KPI measurement to monitor performance in hospital pharmacists’ clinical and support activities will allow better activity assessment, leading to an improvement in inpatient and outpatient quality of care, enabling continuous future development and planning with greater certainty.

Despite this study’s major contribution to hospital pharmacists’ clinical and support activities, future research should focus on gathering external stakeholders’ feedback on relevant KPIs, developing consensus indicators for outpatient care or for subspecialty areas, which require different and/or supplemental metrics to help improve quality of patient care and further develop clinical pharmacy practice. Thus, future research ought to contribute to a more complete understanding of KPIs’ role in this field.

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Conflicts of interest HL and ARL are IQVIA employees, HF and APM are board members of the Portuguese Pharmaceutical Society.

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Conclusion

Defining these 85 cpKPIs/saKPIs is a first step towards assessing Hospital Pharmacy performance and quality. Major challenges are expected to arise during the implementation of these KPIs at a national level. Some of which include: defying the status quo, increasing workload in data collection, ensuring data quality and, most importantly, communicating across all players that KPI measurement to monitor performance in hospital pharmacists’ clinical and support activities will allow better activity assessment, leading to an improvement in inpatient and outpatient quality of care.

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