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A proposal for standardized PREMs implementation in hospital context in Portugal

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Abstract

Patient Reported Experience Measures (PREMs) are essential tools to assess healthcare quality from the patients' perspective, complementing traditional outcome-based evaluations. In Portugal, although healthcare institutions are required to conduct satisfaction surveys, the lack of standardized and interoperable PREMs limits comparability and benchmarking. This paper proposes a framework for the standardized implementation of PREMs in hospitals, supported by interoperability through the HL7 FHIR standard. The solution integrates with hospital information systems to automatically identify clinical encounters, distribute tailored questionnaires, ensure anonymized data collection, and provide real-time analytics through a dashboard with alert mechanisms. The framework was validated in a simulated environment, demonstrating full automation of survey distribution and response analysis, while ensuring patient privacy and usability for healthcare staff. Results indicate that interoperability is a strategic enabler for scalable and sustainable PREMs adoption, fostering continuous quality improvement in healthcare services. Limitations and future work include testing with real hospital systems, expanding to additional clinical contexts, and scaling to national benchmarking.

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1. Introduction

The World Health Organization (WHO) defines health as a "state of complete physical, mental and social well-being and not merely absence of disease or infirmity" [1]. Over the last few decades, the healthcare paradigm has been shifting from a medical and technology-centered approach towards a patient-centered model, emphasizing patients' satisfaction with the health services provided. This transition, combined with advances in digitalization and real-time data analysis, characterizes the current state of healthcare and its focus on continuous improvement [2, 3].

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In this context, ensuring high-quality healthcare requires attention to the patients' needs and perspectives regarding the care they receive. Patient Reported Measures (PRMs) have therefore emerged as key instruments to capture and measure these perspectives. Among them, Patient Reported Experience Measures (PREMs) specifically assess patients' experiences with healthcare services, including communication with staff, accessibility, safety, and comfort [5]. Patient Reported Outcome Measures (PROMs) are another type of PRMs, designed to retrieve information directly from patients about their health outcomes. Examples of such outcomes include symptoms, levels of pain or discomfort, quality of life in aspects related to health or self-care [4]. In this sense, PREMs differ from PROMs because they focus on the patients' experiences during the clinical visit rather than on the results of the care provided [6]. Although PREMs can sometimes be confused with standard client satisfaction surveys, there is an important distinction. While the second simply measures the overall level of client satisfaction with the services provided, PREMs aim to capture a comprehensive account of the clinical visit from the patient's perspective, including technical, personal, and environmental aspects [7].

Building on their focus on patients' experiences, PREMs offer several advantages. By systematically capturing the patients' perspectives, PREMs provide actionable insights that can lead and guide improvements in the services of care [8]. They can also serve as a tool for comparing multiple healthcare institutions, a process typically referred to as benchmarking. Such comparisons enable governments to adjust their policies according to the institutions' needs and realities, while also stimulating healthcare centers to competitively enhance the quality of their services [5]. Despite their advantages, the implementation of PREMs faces multiple barriers. A lack of integration between external systems and hospital software makes access to these tools more difficult and time-consuming, while also placing an additional burden on clinical staff who must navigate between them [9]. Patients' concerns about the privacy of their personal information can reduce their willingness to participate [8]. Finally, the scarcity of professionals specialized in data collection, processing, and analysis limits the ability to extract valuable insights from PREMs [5]. Considering these barriers, this paper describes the development of an interoperable tool for PREMs distribution, collection, and automated analysis of their results, and proposes its implementation in the hospital context in Portugal.

The development of this tool is based on the following research question:

"To what extent can an interoperability-based tool support the provision of PREMs to patients and optimize the collection, processing, and analysis of their responses?"

To guide the project and answer the question above, were established the following objectives:

- Development of a tool that enables the automatic distribution of PREMs to patients according to the reason for their visit to the healthcare facility;
- Creation of a platform for managing and analyzing submitted responses, providing stakeholders with a clear and detailed view of patient-reported experiences, regardless of their background in data analysis;
- Implementation of a notification system for metrics whose values may indicate an urgent need for intervention, allowing for proactive responses to identified issues.

2. Background

In order to better understand the scope and relevance of the proposed tool, it is necessary to situate PREMs within the broader healthcare landscape. Such an analysis enables a more effective application of PREMs and represents an essential step in identifying best practices as well as gaps in existing approaches.

2.1. PREMs in Portugal

In Portugal, the Health Regulatory Authority (ERS) established the requirement for healthcare institutions to implement internal processes that evaluate patient satisfaction through surveys and the use of collected data to continuously improve their quality of care. These surveys must be administered across ambulatory, inpatient, and emergency services, and access not only overall satisfaction but also patients' expectations, the quality of care provided by medical, nursing and administrative staff, as well as comfort, accessibility and waiting times. The data collected through the surveys enables healthcare institutions to identify areas for improvement, however it is also incorporated into one of the dimensions of the national benchmarking process. This comparative analysis is conducted by ERS through the

National Healthcare Evaluation System (SINAS) for hospitals and evaluates several dimensions, including clinical excellence, patient safety, comfort, patient-centeredness, and satisfaction. Healthcare institutions are then classified into three levels of quality, with the third representing the highest level [10]. Despite the implementation of these surveys, in Portugal each healthcare institution can develop its own PREMs, which results in a lack of standardization. The use of standardized surveys would enable more accurate and meaningful comparisons between institutions, providing a stronger basis for benchmarking.

2.2. PREMs Standards

In countries such as the United States of America (USA) and England, standardized PREMs have been developed by governmental institutions and are applied in a national scale. This approach enables governments to gain a clearer understanding the status and needs of healthcare institutions, while also allowing them to allocate funding according to their institutional performances [12, 13].

The american hospital PREMs survey, designated Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), has been used in USA since 2006 [14] and consists of 32 questions divided into three groups:

- 22 core questions addressing central aspects of patients' hospital experiences;
- 3 redirection items designed to guide patients to relevant questions;
- 7 demographic and legislative items to account for cultural differences between hospital areas and support legal reporting.

The National Patient Surveys (NPS) represent England's version of PREMs and are included in the NHS Patient Survey Programme (NPSP). These surveys are divided into five categories according to their target population: children and young people, adult inpatients, urgent and emergency care, maternity, and community mental health [13].

These surveys consist of 50 to 90 questions, focusing on specific target groups in order to obtain more precise information, and are administered in predefined intervals, ranging from once a year to once every two years. In Europe, as a result of a collaborative effort by 15 countries between 1995 and 1999, including Portugal, an instrument was developed to assess medical and organizational services in primary healthcare facilities through patients' feedback: the European Task Force on Patient Evaluations of General Practice Care (EUROPEP) [15]. The original EUROPEP survey consisted of 44 questions. However, after being implemented in eight European countries (Denmark, Finland, Germany, the Netherlands, Norway, Portugal, the United Kingdom, and Sweden), it was concluded that the optimal maximum number of questions would be 25 [15]. Portugal's adaptation of the EUROPEP survey consists in 35 items evaluating medical care, doctor-patient relationship, information and support, availability and accessibility, and organizational services [16]. By analysing the composition of the three standard surveys it can be observed that the fundamental areas of evaluation are very similar, yet the number of questions differs between them. This factor is important to consider, as lengthy surveys may discourage patients from completing them.

2.3. Existing Approaches

While standardized PREMs provide a clear framework for evaluating patient experiences, the effectiveness of their use also depends on the approaches adopted for their distribution, data collection, management, and analysis.

In order to understand how are PREMs and their data managed, A literature search was conducted in four of the most used databases in the biomedical engineering field (Springer Nature, Scopus, PubMed, and IEEE Xplore) for studies published between 2010 and 2024. After filtering and excluding duplicates, only two studies specifically addressing PREMs were identified, while most publications focused on PROMs.

The first study involved the developed of PREMs specifically for parents of pediatric patients. Alongside the survey, a dashboard was created to visualize and analyse the submitted responses. However, the surveys were printed and collected either at the hospital or by mail, and the data was manually entered into the platform. The authors noted that the automated digital distribution of the surveys would be beneficial [17].

The second study was conducted in Italy, focusing on hospitals in the Tuscan and Venetian regions between 2017 and 2019 [18]. This project involved the systematic and automatic collection of patient experience measures in hospitals of these regions through a web application. The surveys were sent to patients after their clinical visits, identified

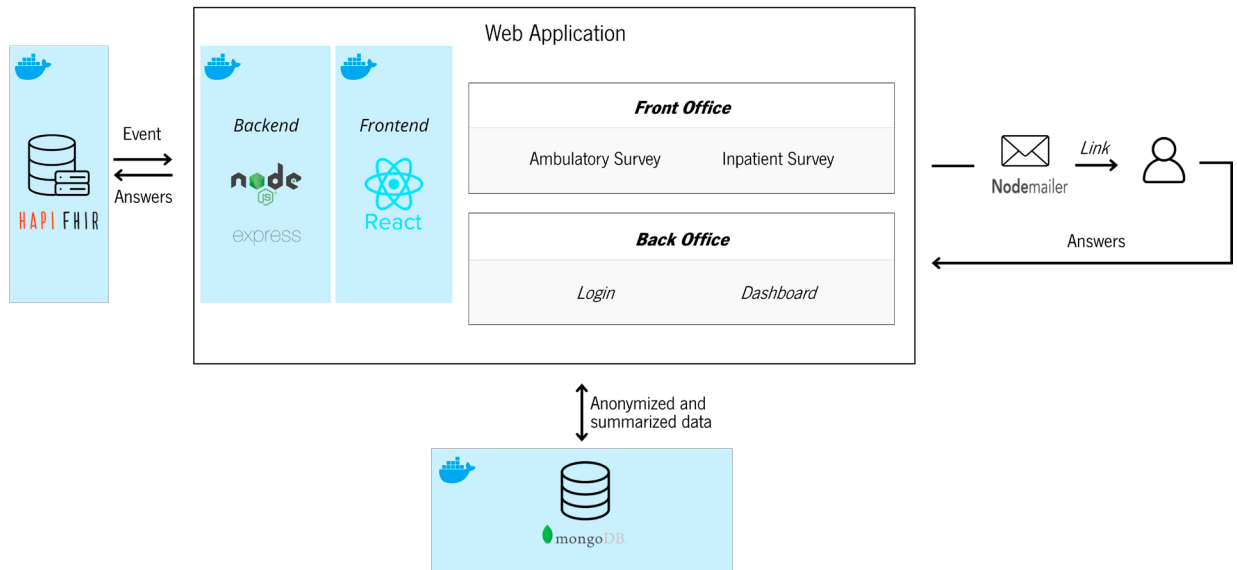


Fig. 1. Architecture of the proposed framework.

through the hospitals' Electronic Medical Records (EMR), as links via email or text messages, and remained available for one month. The questions were mainly standardized and close-ended, with an additional open-ended question to allow patients to express themselves more freely.

A dashboard was also developed to provide graphical visualization of the answers submitted, colour-coded from green to red. However, the clinical staff were responsible for entering the patients' contact information into the platform. Practitioners reported that the initiative did not disrupt their workload and provided them insights into the quality of their work, contributing positively to their motivation, making them feel more valued.

Regarding the adherence to these surveys, response rates varied, with slight increases, to around 30% in some months and nearly 80% in others, however the authors noted that these variations could also be related to the inclusion of additional hospitals and technical fine-tuning activities. The study primarily focused on practitioners' feedback regarding the implementation of the tool.

Overall, the research concluded that the automation of PREMs distribution and collection, real-time analysis of their results, integration with hospital software, and minimal human intervention are key factors in meeting needs of healthcare providers, patients and institutions.

3. Proposed Framework for PREMs Distribution and Management

Based on the gaps in existing technologies and the objectives defined above, the framework proposed in this paper was developed according to the system architecture illustrated in Figure 1.

As presented in Figure 1, the proposed framework is centered around a HapiFHIR server, which serves as the primary repository for hospital data in HL7 FHIR format. This server is used as a simulator of the hospital databases, storing data as HL7 FHIR resources related to patients, practitioners and encounters.

The framework automatically detects healthcare events of inpatient discharges and outpatient visits once a day by default, processing those from the previous day, using the Encounter resource from the HapiFHIR server. These events are categorized, according to the HL7 FHIR notation, with the codes IMP and AMB, respectively, making their identification a simpler process. Only encounters with a defined end date are considered complete and subsequently converted into corresponding questionnaires.

Based on the type of encounter, the system generates a standardized questionnaire and sends a unique access link via email to the patient, valid for two weeks. The questionnaires were selected from the surveys analysed in the state of the art, with HCAHPS used for inpatient discharges and EUROPEP for outpatient visits. Considering the lower demographic diversity in Portugal compared to larger countries such as the USA, and the recommendation of limiting surveys to a maximum of 25 questions to encourage participation, the original 32 questions in HCAHPS were reduced to 25. EUROPEP, originally developed for primary care institutions, was slightly adjusted to fit the context of hospital outpatient visits, resulting in 24 final items. Email distribution is handled via the Node.js Nodemailer module, requiring only the sender and recipient parameters to automate the process, the latter obtained from the Patient resource. Once a patient completes a questionnaire, a confirmation email is sent, the responses are stored in a MongoDB database according to the QuestionnaireResponse resource of HL7 FHIR and the patient's personal data is completely disassociated with the answers. This process seeks to ensure the privacy of the patients and allow them to answer freely from judgment. These responses are then grouped by evaluation area, normalized to account for differences in survey scales, and processed. The resulting data forms the basis for generating monthly, quarterly, and annual statistics, which are made available in real-time to authorized administrative staff through a back-office dashboard.

4. Results and Discussion

In order to analyse the performance of the framework, fictitious data regarding four patients (Carlos Mendes, Ana Ferreira, João Silva, and Maria Oliveira), together with corresponding practitioners and encounters, were added to the HapiFHIR server. Among these encounters, two were particularly relevant for the system execution on July 16th, 2025: João Silva's inpatient stay (IMP), which began on May 29th and ended on July 15th at 08:00, and Carlos Mendes's outpatient visit (AMB) on July 15th from 15:00 to 15:30. According to the system logic, these two finished events should trigger the automatic generation and distribution of questionnaires to the respective patients.

Verification of the sender's email outbox confirmed that both questionnaires were correctly dispatched, enabling patient access to the application's front-office and subsequent survey completion. Therefore, the first objective concerning the automation of PREMs distribution, defined at the outset of this study, can be considered successfully achieved.

Additionally, ensuring the anonymization of submitted answers is essential. In the framework's database, the only parameter linking a patient to a survey is the email address, which is deleted immediately after the responses are submitted.

Following this, the dashboard updates in less than three seconds, displaying the latest statistics on general satisfaction, recommendation rate, courtesy and respect, attention, clarity in communication, and time devoted by both doctors and nurses. The dashboard also presents metrics on cleanliness and comfort, as well as recommendations and alerts. The latter are colour-coded: red indicates urgent intervention is required, yellow signals monitoring is needed, and green represents excellent performance. With the dashboard fully operational, both the second project objective - automated analysis and visualization of PREMs data - and the last objective - implementation of notifications for critical metrics - can be considered achieved.

With all objectives successfully implemented, it can be concluded that the proposed solution meets the original requirements.

However, some limitations of the framework should be noted. The evaluation was conducted in a simulated environment, which may not fully reflect performance under larger volumes of data and in real hospital context. Additionally, the current application handles only two types of encounters and is not yet adapted to other clinical events.

5. Conclusions and Future Work

This work presented an interoperable application, capable of integrating with existing hospital information systems via a medical standard, the HL7 FHIR. The framework ensures not only the questionnaire distribution, but also data protection and anonymity, and automates key processes such as clinical event detection and data analysis. The results obtained in a simulated environment demonstrate that the proposed solution successfully meets the defined objectives, providing structured, comparable, and actionable patient feedback.

Despite these achievements, some limitations remain, including testing only in a simulated environment, support for only two types of clinical events, and the requirement for digital literacy among patients. Future work should focus on addressing these limitations by expanding the range of encounters detected, always seeking to find a standardized survey adjusted to it, integrating the system with real hospital information systems, and scaling the solution to support multiple institutions, enabling benchmarking at a national level. Additional considerations for real-world implementation include legal and ethical approvals, as well as user adoption challenges among healthcare professionals and patients.

This way, considering the research question defined in the beginning of the project, it can be concluded that interoperability is not only a technical advantage but also a strategic factor for the sustainable, efficient, and scalable collection of patient-reported experience metrics, contributing to the continuous improvement of healthcare service quality.

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