



ORIGINALS

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Implementation and evaluation of a home pharmaceutical care model through Telepharmacy

Implantación y evaluación de un modelo de atención farmacéutica domiciliar mediante Telefarmacia

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Abstract

Objective: To describe the impact of a Specialized Pharmaceutical Care model that includes pharmacotherapeutic monitoring of patients through an Telepharmacy platform and home medication dispensing.

Method: A descriptive and retrospective study conducted in the Pharmacy Service of a tertiary hospital, between 23 March 2020 and 31 December 2021. A new pharmaceutical care model for chronic ambulatory patients was developed, including: (i) definition of criteria for selecting Telepharmacy candidate patients; (ii) stratification of patients by risk level; (iii) definition of individualized pharmacotherapeutic monitoring; (iv) adaptation of the Pharmacy Service app platform to ensure continuous pharmacotherapeutic monitoring and patient monitoring (e-Oncohealth, e-Midcare and farMcuida), (v) implementation of an appointment system; and (vi) development of a software module for the management of home medication delivery. The impact of this pharmaceutical care model was assessed by analyzing indicators of activity, safety, adherence and perceived quality. Moreover, an additional study on the impact of COVID-19 was developed in order to assess the accessibility of medical care and continuity of treatment through a survey conducted on a random sample of 100 patients.

Resumen

Objetivo: Describir el impacto de un modelo de atención farmacéutica especializada que incluye el seguimiento farmacoterapéutico de los pacientes mediante una plataforma de Telefarmacia y la dispensación de la medicación en el domicilio.

Método: Estudio descriptivo, retrospectivo, llevado a cabo en un servicio de farmacia de un hospital terciario entre el 23 marzo de 2020 y el 31 de diciembre de 2021. Se desarrolló un nuevo modelo de atención farmacéutica para la atención de los pacientes crónicos ambulatorios, que incluye: i) definición de los criterios de selección de los pacientes candidatos a Telefarmacia, ii) estratificación de los pacientes según el nivel de riesgo, iii) definición del seguimiento farmacoterapéutico individualizado, iv) adaptación de la plataforma de apps del servicio de farmacia para garantizar el seguimiento farmacoterapéutico continuo y la monitorización de los pacientes (e-Oncohealth, e-Midcare y farMcuida), v) implantación de un sistema de citación, y vi) el desarrollo de un módulo informático para la gestión de la dispensación y entrega de la medicación en el domicilio. El impacto de este modelo de atención se evaluó mediante el análisis de indicadores de actividad, seguridad, adherencia y calidad percibida. Asimismo, se incluyó un estudio adicional sobre el impacto de la COVID-19 en

KEYWORDS

Telemedicine; Drug-Related Side Effects and Adverse Reactions; Mobile applications; Patient follow-up; Medication adherence; Patient centered care; Safety; Telepharmacy.

PALABRAS CLAVE

Telemedicina; Efectos adversos y Reacciones adversas a medicamentos; Aplicaciones móviles; Seguimiento del paciente; Adherencia al tratamiento; Cuidado centrado en el paciente; Seguridad; Telefarmacia.



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Results: During the study period, 2,737 patients benefited from the new remote pharmaceutical care model. A total of 7,758 Telepharmacy consultations were performed. Pharmacotherapeutic monitoring prevented 1,043 adverse drug reactions, which affected 10.4% of patients (3.6 adverse drug reactions/patient). Mean adherence to treatment was 95.2%. Overall satisfaction with the new model was 9.8/10. All patients would recommend this model to other patients.

Conclusions: The new Pharmaceutical care model increases patient safety and improves treatment adherence, with a high perceived quality. Patient stratification and individualized follow-up via an Telepharmacy platform were crucial to the development of this model.

Introduction

The COVID-19 pandemic caused by the SARS-CoV-2 coronavirus has thrown the world into an unprecedented health crisis in our recent history. The protection measures established, along with fear of infection and the risk of developing severe complications led chronic patients to a situation of vulnerability. Thus, the pandemic has limited chronic patients' access to therapeutic care and adherence to treatment¹.

COVID-19 has posed a challenge to Hospital Pharmacy Services, forcing them to rapidly adapt their operating procedures in order to meet the therapeutic needs of their patients. Telepharmacy emerged as an effective strategy for the dispensation of medicines at patient's home, while the pharmacist provides information and tailored follow-up of the administration, adherence, effectiveness, and safety of their treatment².

Telepharmacy is defined as "remote pharmaceutical practice based on the use of information and communication technologies (ICTs)". Telepharmacy may involve activities such as informed dispensing of medication; health team coordination to ensure continuity of care; remote pharmacotherapeutic monitoring according to patients' needs and resources available³.

However, although numerous professional associations recommend Telepharmacy, including the American Society of Health-System Pharmacists (ASHP)⁴ and the Spanish Society of Hospital Pharmacy (SEFH)⁵, among others^{5,6}, its implementation posed an organizational challenge to hospitals^{7,9}.

The purpose of this study is to describe the implementation and impact of an innovative remote Pharmaceutical Care (PC) model that includes an e-Health platform and home dispensing of medicines.

Methods

An observational, descriptive study was carried out to assess the impact of a new model of personalized remote PC from March 23, 2020 to December 31, 2021. This project was developed by the Pharmacy Service (PS) of Hospital General Universitario Gregorio Marañón, a center that provides pharmaceutical care services, involving the preparation and delivery of drug therapies for more than 11,800 ambulatory patients.

In March 2020, the Management Board of the PS of the Hospital General Universitario Gregorio Marañón, in collaboration with the pharmacists involved in patient care, developed a new PC model to provide PC and deliver medicines to patients at home. This new model includes:

Definition of selection criteria for patient inclusion

Based on the individual, clinical, pharmacotherapeutic and sociocultural needs (autonomy, risk of social exclusion, presence of a caregiver, technological skills and preferences of the patient), all in accordance with the principle of equity. The criteria established included:

- Patients in quarantine for a positive COVID-19 test or close contact with an infected person.
- Patients living alone who cannot travel.
- At-risk patients due to advanced age, plurimorbidity and immunosuppression.
- Nursing home residents.

la accesibilidad de la atención médica y la continuidad de los tratamientos, mediante una encuesta a una muestra aleatoria de 100 pacientes.

Resultados: Durante el periodo de estudio, 2.737 pacientes se han beneficiado del nuevo modelo de atención farmacéutica a distancia. El número de consultas de Telefarmacia realizadas fue 7.758. El seguimiento farmacoterapéutico evitó 1.043 eventos adversos asociados a la medicación, que afectaron al 10,4% de los pacientes atendidos (3,6 eventos adversos asociados a la medicación/paciente). La adherencia media al tratamiento de los pacientes fue del 95,2%. La satisfacción global con el nuevo modelo de atención farmacéutica fue de 9,8/10. El 100% de los pacientes lo recomendaría a otros pacientes.

Conclusiones: Este nuevo modelo de atención farmacéutica aumenta la seguridad del paciente y mejora su adherencia al tratamiento, con unos índices de calidad percibida elevados. La estratificación de pacientes y el seguimiento personalizado mediante la plataforma Telefarmacia resultaron clave en su desarrollo.

- Patients who, for whatever reason, are candidate patients who can benefit from this procedure.

Patient stratification for pharmaceutical care

Patients were stratified by level of risk. Then, a pharmacotherapeutic monitoring model, and periodicity, were tailored to the characteristics of each patient. A set of stratification criteria was established for each condition. In the case of immune mediated diseases, HIV, onco-hematological diseases and multiple sclerosis, the SEFH Ambulatory Patient Stratification Models were adapted¹⁰ (Table 1).

Pharmacotherapeutic monitoring

Two types of remote PC consultations were available, which involved:

- Integral medication review (IMR): information on key aspects of patient's medication and review of the medical history of interest, comorbidities, effectiveness, safety, drug-interactions, quality of life, and patient's satisfaction with the Service of Telepharmacy. Figure 1 displays the model for recording this activity on the medical history of the patient.
- Dispensing follow-up consultation (FC): full medication review, assessment of treatment adherence and tolerance.

To guarantee continuous communication and follow-up of patients, FC was complemented with the use of an e-Health platform available at the Pharmacy Service: the app e-Oncosalud for the management of onco-hematologic patients, and eMidCare for patients with immunity-mediated inflammatory diseases (rheumatoid arthritis, spondyloarthropathies, psoriasis, psoriatic arthritis, Crohn's disease and ulcerative colitis, among others). The FarMcuid app was developed for the management and follow-up of other complex chronic patients, such as patients with HIV and pulmonary hypertension. These apps enable continuous two-way communication with the patient and improve treatment adherence, minimize adverse events and promote self care.

Appointments

For a more effective management of this new pathway, new appointment books were created for PC consultations and medication dispensing. The patient receives an SMS and a letter with the date of appointment for PC and the delivery of medication.

Dispensing

A robot prepares the medication the day before the scheduled date of home dispensing. Along with medication, individualized information about the treatment and procedures of the PS are provided.

Quality control

After the dispensing process has been completed, the pharmacist carries out a quality control. The operator seals the bag that contains the medication to guarantee confidentiality and stores it in optimal storage conditions.

Table 1. Patient stratification for pharmaceutical care and periodicity of telematic follow-up

AREA	STRATIFICATION	CRITERIA	Every	Every	Every	Every	Every	Every	Every	Every	Every	Every	Every
			2	3	4	5	6	7	8	9	10	11	12
			months	months	months	months	months	months	months	months	months	months	months
Allergy	High risk	Patient compliance with some of these criteria is required: <ul style="list-style-type: none"> - Patients receiving therapeutic and preventive treatment for hereditary angioedema - Cognitive deterioration and/or functional dependency - Lack of adherence and/or tolerance problems 		FC			IPR						
	Low risk	Remainder of patients					FC						IPR
Arthropaties	High risk	Adaptation of the stratification model for SEFH patients with immune mediated diseases. Score >25/63: indicates high risk.		FC			IPR						
	Low risk	Score <25/63: indicates low risk.					FC						IPR
Cardiology	High risk	Patient compliance with some of these criteria is required: <ul style="list-style-type: none"> - Lack of adherence and/or tolerance problems - Patients treated with alirocumab/evolocumab in the first year of treatment - Patients receiving off-label drugs - In PH meeting at least one of the following criteria: <ul style="list-style-type: none"> • CF WHO ≥ 3 • Dependent congenital heart diseases • Patients receiving triple therapy 		FC			IPR						
	Low risk	The remainder of patients not meeting the criteria above.					FC						IPR
Dermatology	High risk	Adaptation of the stratification model for SEFH patients with immune mediated diseases. Score >25/63: will indicate high risk.		FC			IPR						
	Low risk	Score <25/63: indicates low risk.					FC						IPR
Gastroenterology	High risk	Patient compliance with some of these criteria is required: <ul style="list-style-type: none"> - Unhealthy life habits: moderate or heavy use of alcohol or abuse drugs. - Mental or behavioral disorders - Cognitive deterioration and/or functional dependency - Limited social support or limiting socioeconomic conditions - Hepatic decompensation - Kidney failure - Patient undergoing transplantation or transplant receptors - Two or more hospitalizations in the previous months - Lack of adherence 		FC			IPR						
	Low risk	The remainder of patients not meeting the criteria above.					FC						IPR

Table 1 (cont.). Patient stratification for pharmaceutical care and periodicity of telematic follow-up

AREA	STRATIFICATION	CRITERIA	Every	Every	Every	Every	Every	Every	Every	Every	Every	Every	Every
			2	3	4	5	6	7	8	9	10	11	12
Oncohematology	High risk	Adaptation of the stratification model for SEFH cancer patients. Score >15/96: will indicate high risk.	FC		IPR								
	Low risk	Score <15/96: indicates low risk.				FC			IPR				
Pediatrics	High risk	Patient compliance with some of these criteria is required: – Frequent admissions – Plurimorbid – Polymedicated patients on complex regimes and frequent changes in regular medication regimes. – Patients with sociosanitary problems	FC		IPR								
	Low risk	The remainder of patients not meeting the criteria above.						FC					IPR

CF: Functional class; FC: Follow-up consultations; PH: Pulmonary Hypertension; WHO: World Health Organization; SEFH: Spanish Society of Hospital Pharmacy; IPR: Integral pharmacotherapy review; HIV: human immunodeficiency virus. Additional pharmaceutical care consultations can be scheduled as needed. For instance, in case of changes of treatment, patients with Lack of disease control/tolerance, patients receiving novel drug therapies requiring a closer follow-up, etc. Likewise, pharmacotherapy monitoring will be complemented at home via the appropriate app (e-Oncosalud, eMidCare, FarMcuida).

Shipping and home delivery

Shipping is performed by a company with experience in the dispensing of medicines that complies with the highest quality standards. Medicines are delivered at the home of patients in working days. Traceability is recorded electronically.

The PS developed a delivery programme called Farhos® for the management of home delivery and their integration into the appointment book of the hospital. This new application developed during the pandemic contains four modules:

- Patient search: module for the identification of candidate patients to home dispensing. The module shows the patients with a home dispensing appointment. This application enables the edition of the actual date of dispensing. Once patients have been selected, they are transferred to the following module (selected patients).
- Selected patients: the module displays the selected patients. The application allows multiple-patient selection to massively print prescriptions and ID labels for shipping, which facilitates the process.
- Patients which medicines has been dispensed: this module performs a shipping traceability analysis. It contains a section to record events, such as cancelled shippings or a color-based visual alert system based.
- Scoreboard: this module makes it possible to monitor the development and performance of the Telepharmacy Service.

Definition of follow-up indicators

A scoreboard of indicators of activity, safety, adherence and perceived quality was developed to evaluate the development and performance of the model.

- Activity was measured according to the number of teleconsultations performed by the patients via telephone, electronic mail or apps.
- The impact of treatment safety was assessed based on the number of adverse drug reactions (ADRs) prevented through remote PM and monitoring via apps. The severity of prevented ADRs was categorized

according to the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP)¹¹.

- Treatment adherence was assessed on the basis of delivery records and Morisky-Green tests delivered in each clinical (remote/face-to-face) interview.
- Perceived quality was assessed (anonymously and voluntarily) using a telematic survey (using a QR code created on Google Form) that was sent to patients, along with their medicines. The *ad hoc* survey consisted of an additive rating scale including ten closed questions, which includes factors such as easiness to communicate with the pharmacist, satisfaction with the integrated care model, and level of recommendation. (supplementary material).

To complement these indicators, an observational study was conducted to assess the impact of COVID-19 on access to pharmaceutical care and continuity of treatments in this population of patients. For that purpose, a survey was carried out in a random sample of 100 patients during the 01/04/2021-31/05/2021 period. The interview consisted of 14 questions that assessed the employment status of patients, the presence and severity of previous COVID-19 infection, access to medical consultations, and hospital medication. Likewise, treatment adherence was assessed using the Morisky-Green test and delivery records.

Results

During the study period, 2,737 patients benefited from the new remote PC model. A total of 7,758 telematic consultations were performed, including 1,230 consultations performed via apps (Table 2).

The most frequently consultations via apps were mostly related to the management of AEDs (21.2%) and compatibility of the treatment with concomitant medication (13.6%). Consultations directly linked to COVID-19 account for 11.5%, and time distribution was directly related to the waves of the pandemic. The most frequent reasons of consultation were doubts about the prevention and management of COVID-19 (7.1%) and the indication and compatibility of COVID-19 vaccines with the treatment (3.4%).

Figure 1. Structured pharmaceutical care record on medical history.

PHARMACEUTICAL CARE (INTEGRAL MEDICATION REVIEW)

Reason of consultation:

Face-to-face/telephone/telematic pharmaceutical care consultation.

Stratification group for pharmacotherapeutic follow-up: High/low risk

Indication:

It is confirmed that the patient is receiving hospital medication with: _____

History of interest/comorbidities:

Known drug allergies:

Laboratory analysis:

Other concomitant treatments, including herbal products: Indicate active substance/dose/interval

Presence of clinically relevant interactions: Yes (indicate type –Lexicomp– and recommendation offered) /No

Assessment of tolerance to treatment:

The patient does not report any adverse drug reactions/The patient reports the following adverse drug reactions: _____

The following recommendations are issued: _____

Assessment of adherence (Morinsky-Green):

Do you sometimes forget to take your medicines? No/Yes
Do you take your medicines at the indicated times? No/Yes
When your disease is well controlled, do you stop taking your medicines? No/Yes
If you experience adverse events, do you stop taking your medicine? No/Yes

Adherence according to the record of dispensations: _____

Assessment of quality of life:

Mobility=; Personal care=; daily life activities=; Pain/discomfort; Anxiety/depression=; VAS=

Assessment of satisfaction with the service of informed home dispensing of medicines (VAS):

Other comments:

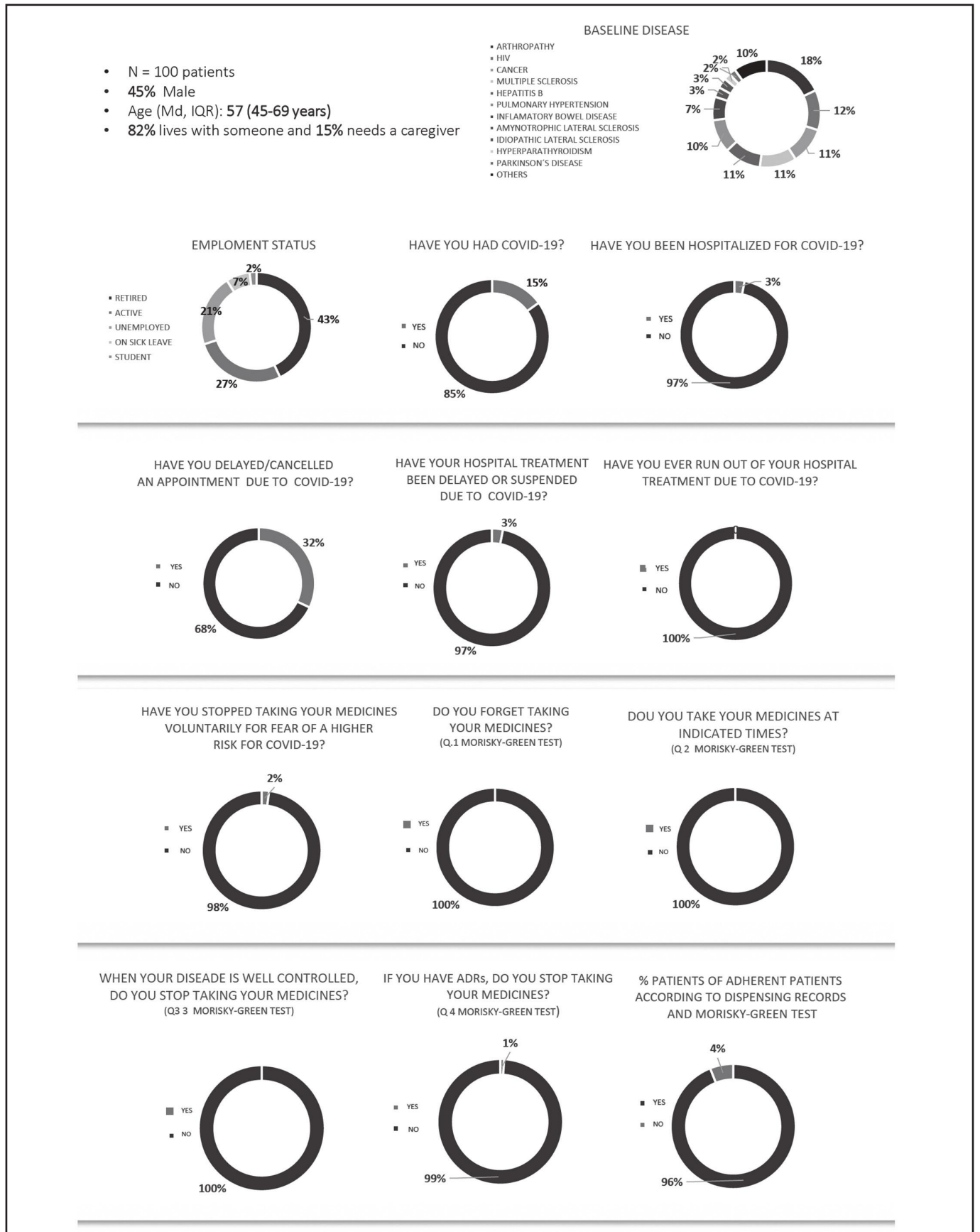
The patient is informed of the relevance of keeping adherent to their treatment, as well as on the storage, route of administration, and potential adverse drug reactions related to their medication.
In case of any doubt related to the treatment, the patient will contact the Pharmacy Service.

Signed
Pharmacy Service

Table 2. Results for activity and perceived quality indicators

INDICATORS OF ACTIVITY	
Number of patients included in the Telepharmacy program including home delivery of medicines (% respect to the total of ambulatory patients attended)	2,737 (23.1%)
Patient distribution by clinical area (%)	
<i>Immune mediated diseases</i>	27.6%
<i>Oncohematology</i>	16.8%
<i>Neurology</i>	13.5%
<i>Infectious</i>	8.7%
<i>Gastroenterology</i>	6.7%
<i>Cardiology</i>	6.1%
<i>Pediatrics</i>	5.5%
<i>Ophthalmology</i>	5.5%
<i>Nephrology</i>	4.6%
<i>Other</i>	4.9%
% of patients included in the program living > 30 km from the hospital	29.5%
No. teleconsultations performed	7,758
No. of consultations received via app	1,230
No. of face-to-face pharmaceutical care consultations	1,921
Total of pharmaceutical care consultations (teleconsultations and face-to-face)	9,679
% of teleconsultations with respect to total	75.2%
No. of dispensations performed	10,049
INDICATORS OF SAFETY	
No. of prevented adverse drug reactions (ADRs)	1,043
No. of prevented ADRs that may potentially cause temporary damage or require intervention (NCC MERP = E category)	501
No. of prevented ADRs that may potentially cause temporary damage or require hospital admission (NCC MERP = F category)	141
No. of prevented ADRs that may potentially cause permanent damage (NCC MERP = G category)	51
No. of prevented ADRs that do not cause any damage (NCC MERP = C/D category)	350
INDICATORS OF THERAPEUTIC ADHERENCE	
% Overall adherence	95.2%
% Adherence by disease	
<i>Patients with ophthalmological diseases</i>	98.8%
<i>Patients with infectious diseases</i>	96.7%
<i>Patients with gastroenterological diseases</i>	96.5%
<i>Patients with immune mediated diseases</i>	96.4%
<i>Patients with multiple sclerosis and amyotrophic lateral sclerosis</i>	95.9%
<i>Onco-hematologic patients</i>	95.2%
<i>Patients with heart diseases</i>	92.4%
<i>Pediatric patients</i>	90.2%
<i>Patients with chronic kidney disease/transplant recipients</i>	90.0%
INDICATORS OF PERCEIVED QUALITY	
% of patients satisfied with the integral telehealth model	98.4%
% of patients satisfied with the apps	97.9%
% patients who would recommend the service to other patients	100%
Overall rate of satisfaction with the Telepharmacy service	9.8

Figura 2. Resultados específicos del estudio del impacto de la COVID-19 en la atención sanitaria.



Remote PM prevented 1,043 ADRs, which affected 27.9% of patients. In total, 18.4% of ADRs could have had severe effects on the patient (NCC MERP \geq F categories). Mean adherence to treatment was 95.2%.

The overall satisfaction rate in relation to this model, as reported by 417 patients, was 9.8/10. In total, 98.4% of patients were satisfied with this new service, and 97.9% with the use of the apps. All patients would recommend this integral Telepharmacy service to other patients. The aspects most appreciated by patients included the 7/365 availability of pharmaceutical care and PM and the rapidity of response by the pharmacist to answer questions.

Figure 2 displays the specific results of the study on the impact of COVID-19 on the health services provided to these patients. According to this study, no patients had any problems to receive their medication as a result of the COVID-19 pandemic, and only 25 of patients had stopped taking their medication for fear of having a higher risk for infection. Ninety-six percent of the patients surveyed showed an optimal treatment adherence, which is confirmed by delivery records and the Morisky-Green test.

Discussion

This article describes the implementation of a Telepharmacy model developed to ensure pharmacotherapeutic monitoring and access to treatment by more than 2,500 patients. This model prevented over 1,000 ADRs in a period of 20 months, and was effective in maintaining high treatment adherence rates in most of patients.

According to the national survey conducted by the Platform of Patient Organizations in 529 patients with chronic diseases during the first months of the pandemic, 69% of the patients cancelled, at least once, a medical consultation due to the COVID-19 pandemic. Near 25% of patients missed a dose, and 8.5% reported having been out of medication during the state of alarm¹². According to our study, no patients found any difficulty in continuing their treatment, and only 2% stopped taking their medication for fear of having a higher risk for infection.

In our case, patient stratification and tailored PM through an e-Health platform were key to guaranteeing the continuity of pharmaceutical care and treatment adherence. Patient stratification enables the Pharmacy Service to intensify PC in vulnerable patients needing close PM. App-based monitoring facilitated follow-up and communication. Patients could consult their pharmacist at any time of the day, who provided recommendations and simple tools to improve tolerance and adherence to treatment. Specifically, this project prevented 1,043 ADRs in 10.4% of patients, with 18% being severe.

With respect to the use of ICTs, the pandemic has been a turning point in the use of these tools, which offer a broad variety of advantages for patient monitoring. A recent research demonstrated a 64% increase in the demand for home health services due to the pandemic. It is estimated that

this percentage will be seven times higher by 2025¹³. In the field of Hospital Pharmacy, experiences with Telepharmacy are growing in number. According to the survey on the situation of Telepharmacy in PS in Spain during the pandemic¹⁴, 87.6% of hospitals performed teleconsultations prior to the dispensing of their medication. Several studies confirm that teleconsultations improve health outcomes. Margusino-Framiñán *et al.* observed that medication dispensing together with PC consultation improves health outcomes in patients with HIV¹⁵. Likewise, Megías-Vericat *et al.* observed that 95% of patients with hemophilia perceived that the PC and home delivery program improved adherence to treatment¹⁶.

Finally, this model received a satisfaction rate of 9.8 points out of 10 on the survey. User satisfaction with the app and home dispensing service exceeded 97% in the two cases, which is consistent with the literature^{2,14,16,17}. The ENOPEX study conducted by the SEFH in 9,442 patients revealed that 91% preferred continuing with the service of Telepharmacy after the suspension of the state of alarm¹⁶. According to the 'Stada Health Report', 82% of Spaniards is in favor of using teleconsultations for clinical follow-up¹⁸.

The development of this project has been a challenge for this PS from an organizational and resource point of view. In this sense, the collaboration of the Managing Board of the hospital, technology suppliers of the PH, health professionals and patients were crucial for its implementation.

The new model of Telepharmacy and automatization of PC increases patient safety and improves treatment adherence, with high perceived quality. Patient stratification and individualized follow-up via an e-health platform were crucial to the development of this model.

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Conflict of interests

No conflicts of interest.

Contribution to the scientific literature

This paper describes an innovative model of remote pharmaceutical care that includes patient stratification, personalized pharmacotherapeutic monitoring via an e-health platform, and medication dispensing. The new Telepharmacy care model increases patient safety and improves treatment adherence, with high perceived quality.

SUPPLEMENTARY FILES

1. Satisfaction survey for the new pharmaceutical care model.

SURVEY:

1. Have you been informed by your hospital pharmacist of the possibility of having medication sent to your home?

- Yes
 No (please indicate how): _____)

2. Did you have any questions related to your treatment while the state of emergency was in force?

- Yes
 No

3. If you did have questions, was the information provided by the pharmacist helpful?

- Yes
 No
 In my case, my questions were resolved by another healthcare provider

4. How do you feel about the treatment offered by the pharmacist who assisted you on the phone?

- Highly satisfied
 Satisfied
 Neither satisfied nor dissatisfied
 Dissatisfied
 Very dissatisfied

5. Were the agreed deadlines for medication delivery met?

- Yes
 No

6. Are you satisfied with the process followed to deliver the medication at your home?

- Highly satisfied
 Satisfied
 Neither satisfied nor dissatisfied
 Dissatisfied
 Very dissatisfied

7. Would you recommend this service to other people in the same situation?

- Yes
 No
 DK / NO

8. Would you like this Service to continue in the future?

- Yes
 No
 DK / NO

9. Please provide your overall assessment of the care received by the pharmacy department

- 1 2 3 4 5 6 7 8 9 10

10. Would you like to make any suggestions?

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