BMJ Open

Person-centred care provided by a multidisciplinary primary care team to improve therapeutic adequacy in polymedicated elderly patients (PCMR): randomised controlled trial protocol

Carol Rovira ,[1,2] Pilar Modamio ,[1] Joaquim Pascual ,[2] Joan Armengol ,[2] Cristian Ayala ,[2] Joan Gallego ,[2] Eduardo L Mariño ,[1] Anna Ramirez ,[2] The PCMR (Person-Centred Medication Review) Study Group

To cite: Rovira C, Modamio P, Pascual J, *et al*. Person-centred care provided by a multidisciplinary primary care team to improve therapeutic adequacy in polymedicated elderly patients (PCMR): randomised controlled trial protocol. *BMJ Open* 2022;**12**:e051238. doi:10.1136/bmjopen-2021-051238

► Prepublication history for this paper is available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2021-051238).

Received 13 March 2021
Accepted 09 December 2021

[1]Clinical Pharmacy and Pharmaceutical Care Unit. Department of Pharmacy and Pharmaceutical Technology, and Physical Chemistry. Faculty of Pharmacy and Food Sciences, Universitat de Barcelona, Barcelona, Spain
[2]Bages-Berguedà-Moianès Primary Healthcare Service, Institut Catala De La Salut, Barcelona, Spain

Correspondence to
Dr Pilar Modamio;
pmodamio@ub.edu

ABSTRACT

Introduction The increase in elderly population has led to an associated increase in multiple pathologies, frailty, polypharmacy, healthcare costs, decreased quality of life and mortality. We designed an intervention based on person-centred care model. This article outlines a study protocol, which aims to explore the effects of the intervention to improve therapeutic adequacy in polymedicated elderly patients.

Methods and analysis An open, randomised, multicentre, controlled clinical trial. The study population includes polymedicated (≥8 prescription medications) patients ≥75 years old. In the intervention group, the multidisciplinary team (primary care pharmacist, family doctor and nurse) will meet to carry out multidimensional reviews (frailty, clinical complexity, morbidity and therapeutic adequacy) of the study subjects. If changes are proposed to the treatment plan, a clinical interview will be conducted with the patient to agree on changes in accordance with their preferences. Follow-up visits will be scheduled at 6 and 12 months. In the control group, where the usual clinical practice will be followed, the necessary data will be collected to compare the results.

The key variables are the variation in the mean number of incidents (potentially inappropriate prescription) per patient, the number of medications, the number of changes implemented to the treatment plan and the variation in the number of hospital admissions.

Ethics and dissemination This study was approved by the Ethics Committee of the IDIAPJGol and by the University of Barcelona's Bioethics Commission. The results are expected to be published in peer reviewed open-access journals, and as part of a doctoral thesis.

Trial registration number NCT04188470. Pre-results.

Strengths and limitations of this study

- This randomised controlled trial seeks to investigate the effects of a multidimensional intervention and a multidisciplinary collaborative team, which includes the participation of primary care pharmacists.
- Person-centred care is provided which aims to improve the decision-making capacity and autonomy of patients ≥75 on polypharmacy.
- The 1-year follow-up will make it possible to measure the sustainable effects resulting from the intervention.
- Having sufficient time to administer this model is a limitation in the healthcare environment as this multidimensional methodology is time-consuming.
- The results could be subject to bias since it is an open study for patients and healthcare professionals.

INTRODUCTION

In recent years, there has been a 29% increase in the elderly population in Spain.[1 2] Ageing is associated with multimorbidity (suffering from two or more chronic diseases). It has been described that 65% of the population between 65 and 84 years of age has more than one chronic disease. This percentage increases to 82%, in the population aged over 84,[3] in which there is also an increase in the incidence of medicalisation.[4]

Frailty is a multidimensional syndrome which is defined by the state of vulnerability to stressors as a consequence of the limitations of compensatory mechanisms.[5 6] The result of this dynamic process is an increase in vulnerability, dependency and/or mortality.[7 8] Recent published studies[7 8] demonstrate the existence of an association between frailty and other clinical factors; specifically, frailty increases the risk of polypharmacy by 45% (taking five medications or more),[9] while the risk of multmorbidities is multiplied by 2.64. Furthermore, polypharmacy can also decrease medication adherence. A recent meta-analysis suggests that 5.4% of hospitalisations in Canada are attributed to low

adherence to treatment,[10] which in turn causes a worsening of disease control and increases in multimorbidity and healthcare costs.[10 11]

A 2017 cross-sectional study[12] conducted using data collected as part of the Spanish National Health Survey estimated a prevalence of 27.3% of polypharmacy (≥5 medications) and 0.9% of hyperpolypharmacy (≥10 medications) in a non-institutionalised population ≥65 years old, figures which are slightly lower than a population-based cross-sectional study carried out in Europe as a whole.[13] In addition, the Spanish study established an association between polypharmacy and the number of chronic diseases per patient, the extent of functional decline, the patients' own perception of their state of health and contact with the health system,[12] as was mentioned above. However, it is worthwhile distinguishing between appropriate polypharmacy, in which the patient takes five and more medications which are all necessary, and inappropriate polypharmacy in which the patient takes five and more medications', but some of them are not strictly necessary.[9]

Inappropriate drug prescribing can be defined as the use of medications whose risks outweigh their benefits. It also includes the failure to prescribe a necessary medication.[14] Studies have also been published linking frailty with potentially inappropriate medication and a risk of adverse events.[15] The literature shows the ageing population is prescribed potentially inappropriate medications in 20%–50% of cases, a figure which increases to over 75% in the polymedicated population.[16 17]

Therapeutic adequacy is defined as the correct and safe use of medications, considering that both the indication and level of safety depend on the individual's social and clinical context.[18] This includes the appropriate indication, prescription, dispensing, administration and monitoring according to the therapeutic objectives agreed with the patient.[18] There are several support tools to assess the therapeutic adequacy in the geriatric population and/or patients with clinical complexity.[19–22] A review by Spinewine *et al*[23] concluded that the most effective intervention is one which is tailored to the individual by a multidisciplinary team, since it decreases instances of inappropriate medication prescribing. Despite the fact that few studies demonstrate positive health outcomes, a recently published systematic review and meta-analysis estimated there is a 26% reduction in mortality compared with routine clinical practice among elderly patients in nursing homes.[24]

Person-centred care, particularly in relation to the medication review process, has been proposed as a model for complex patients.[25] This model includes a multidimensional assessment (illnesses, clinical evolution, symptoms, socioeconomic factors, vulnerability, cultural factors) carried out by a multidisciplinary team to respond to the clinical complexity of the population.[25] In addition, an individualised therapeutic plan is drawn up which takes into account criteria of therapeutic adequacy in an ageing population with high clinical complexity, together with the individual's preferences. It is a collaborative model, therefore, carried out by a team consisting of pharmacists, doctors, and nursing professionals, making it possible to improve the therapeutic plan and the individual's health.[6] In recent years, the figure of the primary care pharmacist (PCP) has emerged as an expert professional in the use of medications. A published meta-analysis shows that their intervention in conjunction with the healthcare team improves certain clinical outcomes.[26]

Justification

The population's healthcare needs are changing, meaning health systems must adapt, making it necessary to demonstrate the efficacy of the model proposed in the study compared with routine clinical practice. In this particular arrangement, the PCP act as a key member of the team, who, together with the healthcare team, offer enhanced care based on the individual.

There is some published evidence[23 25] regarding the results of the implementation of these interventions, although it is scarce with respect to the primary care setting.[16] This study aims to contribute to research on the subject.

The objective is to outline the design of the study entitled person-centred medication review (PCMR) and to provide information on its design.

Objectives

The primary objective is to evaluate the efficacy of the intervention in improving therapeutic adequacy in polymedicated elderly patients through the application of a person-centred care model. The secondary objectives are to evaluate the safety of the intervention and to record changes in the therapeutic plan at 12 months.

METHODS AND ANALYSIS

The protocol was developed according to the Standard Protocol Items: Recommendations for Interventional Trials 2013 statement.[27]

Study design

This is a multicentre, open-label, parallel group, randomised controlled trial with a 1-year follow-up. The participants are randomly assigned to one of two groups: the experimental group, which receives the intervention, and the control group, which receives the usual care (figure 1). Patient recruitment began in July 2020, with an initial inclusion period of 12 months, which may be extended subject to circumstances, especially during the COVID-19 pandemic that have impacted on people's lives and on the prioritisation in healthcare, and a follow-up period of 12 months after the last patient is recruited.

Scope and study population

The study is being carried out in the public primary healthcare sector in a region of Spain, specifically, Catalonia (Catalan Institute of Health). Catalonia is divided into seven health regions, based on geographical,

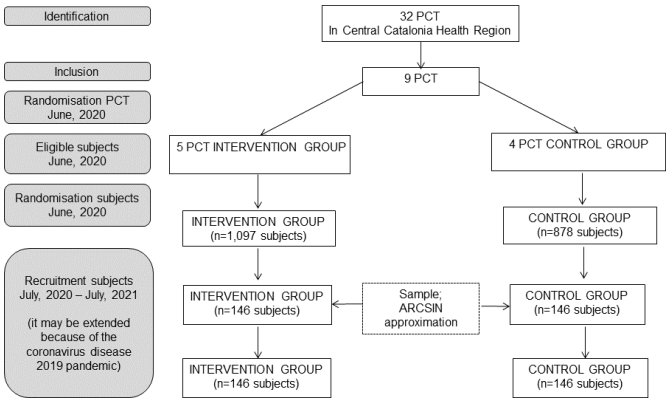

Figure 1 Study flow diagram. PCT, primary care team.

socioeconomic and demographic factors. Each region is in turn subdivided into health sectors, which consist of Basic Health Areas (BHA). The study population are all subjects assigned to 9 BHA in the Central Catalonia health region which meet the selection criteria.

Selection criteria

Inclusion criteria: over 74 years old[12] (since the incidence of polimedication and significant comorbidity increase with the age), polymedicated (≥8 drugs, because the risk of adverse drug reactions (ADR) increase by 4[28] what it would maximise the effectiveness of the intervention given the resources and organisational changes in primary healthcare that the model implies, excluding dermatological, ophthalmological, otological products and medical devices) and/or is a complex chronic patient (CCP),[29 30] or with advanced chronic disease (patients with advanced chronic conditions, PACC).[29 30] As for CCP, since there is no a specific instrument for population screening, the identification is conducted based on expert consensus in the presence of criteria and the results of the three dimensions of complexity, which are summarised in table 1. Sufficient criteria must be met for the referring experts to consider that the management of the case is particularly difficult, and, therefore, to validate clinically and identify who is a CCP. Regarding PACC, in Catalonia, the NECPAL CCOMS-ICO [31] instrument is used for the early identification or screening of PACC. This instrument is based on the negative answer ('I wouldn't be surprised') to the question 'Would you be surprised if this person died over the next year?', associated with the detection of criteria for palliative needs, functional limitation and/or poor nutritional status, multimorbidity, use of resources and/or criteria of severity and progression of advanced diseases. The definition of one of these two conditions, CCP and PACC, is determined by the basic health unit (BHU) before including the patient in the study through usual care.

Exclusion criteria: refusal to participate in the study and/or failure to sign the informed consent form, patients who have not had an appointment at their BHU at least two times in the previous 12 months or patients who are part of the healthcare at home and support team programme (PADES, Home Care and Support Equipment Program) .

Table 1 Criteria for the identification of the complex chronic patient, grouped by domains of complexity

Clinical status	► Multimorbidity or chronic severity pathology ► Advanced chronic disease ► Geriatric syndromes ► Persistent symptoms ► High utilisation of health services ► >5% risk by morbidity group
Social status	Social risk
Healthcare system criteria	► Benefit from multidisciplinary management ► Discrepancies among professionals in patient management ► Benefit in integrated care

Randomisation and allocation of subjects

Stratification is according to the place of study. Thus, nine primary care teams (PCTs) are randomised (1:1) to the control group or the intervention group. The health units (BHU) selected, consisting of a family doctor and a nursing professional who participated voluntarily, belonging to the control group or the intervention group, depending on the PCT in which they work.

Patients from the participating BHUs are then randomly selected (1:1) from a list of potential subjects obtained from the Catalan Institute of Health's database. This is done using computer-generated random numbers. The subjects are assigned to either the control group or the intervention group according to which BHU they belong. The Catalan Institute of Health's research support unit carries out the selection and randomisation process. For the recruitment process of the subjects, the nursing professional calls the patients to tell them about the study and invite them to participate. If they accept, they are asked to come to the health centre. Once the patient has been provided with the information sheet and written informed consent has been obtained, the patient is recruited into the study.

Due to the nature of the intervention, the research team administering the interventions and evaluating the results are not blind to subject allocation. Likewise, it is not possible for subjects to be blinded. However, the research team which records and analyses the data is blinded (figure 1).

Sample size and sampling

The sample size is calculated using the GRANMO V.7.12 program for two independent proportions, considering an alpha risk of 0.05, a beta risk of 0.20 and a loss ratio of 0.15.

In order to detect statistically significant differences between two proportions in the mean reduction in the number of medications per patient, in line with similar

Table 2 Study schedule, inclusion process, interventions and evaluations

	Inclusion/ randomisation		Postrandomisation			End of study
Time	-t_1	0 months	1 month	3 months	6 months	12 months
Inclusion						
Selection	X					
Informed consent	X					
Randomisation	X					
Interventions						
Intervention group		←	—	—	→	
Data collection related to chronicity-complexity		X			X	X
Carry out comprehensive geriatric assessment and frailty assessment		X			X	X
Pharmacotherapeutic review		X			X	X
Evaluate changes in the treatment plan				X	X	X
Agree to interventions with the patient, family member, caregiver			X	X	X	X
Control group		←	—	—	→	
Data collection related to chronicity-complexity		X			X	X
Carry out comprehensive geriatric assessment and frailty assessment		X			X	X
Pharmacotherapeutic review		X			X	X
Baseline data Age, sex, CCP, PACC, environment, frailty index, risk of readmission, educational level, type of caregiver		X				X
Primary variables: No of potentially inappropriate prescriptions, No of medications prescriber per patient, No of changes in the treatment plan, No of hospital admissions		X			X	X
Secondary variables: No of adverse events related to the intervention, No of changes in the treatment plan per year		X			X	X

CCP, complex chronic patient; PACC, patients with advanced chronic conditions.

published studies,[16] assuming that for group 1 it is 0.23 and for group 2 it is 0.10, and allowing for the possible loss of subjects, 146 subjects are needed in each study group. In order to detect statistically significant differences between two proportions in the mean reduction in the number of hospital admissions per patient, according to published sources,[24] assuming it to be 0.18 for group 1 and 0.05 for group 2, and accounting for the risk of subjects withdrawing from the trial, 103 subjects are needed in each group. Therefore, the sample size needed for the study is 146 subjects in each group. (figure 1).

Control group

Patients assigned to the control group are treated according to standard clinical practice and the necessary data is collected to compare the results with the intervention group at three intervals: at baseline, at 6 months and at 12 months (table 2). The nursing professional and the PCP collect the data.

Intervention

For the intervention group, a multidisciplinary team is formed by PCPs, family doctors and nursing professionals. The PCPs are pharmacists with more than 10 years of experience in primary healthcare, trained for the management of chronic conditions and care of older people (postgraduate education). The study involves the two PCPs from the health region, so that there is a PCP in each multidisciplinary group who works in the PCTs.

Periodic meetings of the multidisciplinary group are held following the medication review methodology according to the person-centred care model (figure 2). This requires a comprehensive geriatric assessment to be performed beforehand, consisting of a functional, cognitive and pressure ulcer risk assessment, using standardised scales (Mahoney and Barthel,[32] Pfeiffer,[33] Bergstrom *et al*,[34] GDS-FAST,[35] weight loss and body mass index, an evaluation of the existence of geriatric syndromes, such as risk of falls, dysphagia, urinary incontinence, pain, infection, number of medications and an assessment of the patient's social situation. The assessment makes it possible to detect the existence of frailty and its extent, taking into account the FI[36] frailty index.

In addition, this assessment allows the members of the group to reach a consensus as to the therapeutic objective for each patient, in accordance with recommendations of Holmes *et al*,[37] that is, the shorter the life expectancy and the longer the time needed for a medication to achieve the expected results, the more the therapeutic objective should be less preventive and more directed towards symptomatic control. Following this exhaustive evaluation, the medication review methodology developed by the Spanish Society of Primary Care Pharmacists

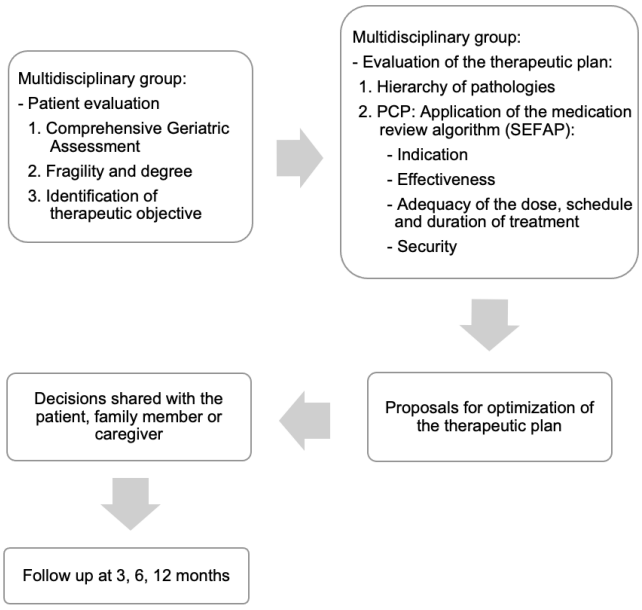

Figure 2 Person-centred care model of the PCMR study (Intervention). PCP, primary care pharmacist; PCMR, Person-Centred Medication Review; SEFAP, Spanish Society of Primary Care Pharmacists.

(SEFAP) is applied.[38] This methodology aims to systematise the process and consists of ranking the pathologies according to the risk of exacerbations, mortality and prioritising them according to the patient's perspective, relating the pathologies with the prescribed medications and subsequently applying the review algorithm, which consists of evaluating parameters such as the indication, the effectiveness, the adequacy of the regimen (dose and frequency of administration) and the duration and safety of the treatment.

PCPs bring proposals for changes to the therapeutic plan that are discussed at the BHU meetings. Later, the family doctor or nurses according to the organisation of each BHU explain to and agree with the patient or caregiver. The proposed changes accepted or not by the patients or caregivers are registered by PCPs to evaluate the main variables of the study. Also, the changes made in the therapeutic plan postintervention are monitored and the necessary changes are made to the therapeutic plan in the follow-up (table 2).

Result variables

The main variables will be measured at the beginning of the study and at 6 and 12 months. All secondary variables, unless otherwise indicated, will be measured at baseline and at 6 and 12 months. Subjects are invited to contact the investigators at any time during the study. A description of the variables can be found in table 3.

Main variables: In order to measure the efficacy of the intervention, four variables are analysed since adequacy is a multidimensional parameter and difficult to evaluate using a single variable. The four variables are: variations in the mean number of potentially inappropriate prescriptions, of medications per patient, of adjustments applied to the therapeutic plan and of hospital admissions. Potentially inappropriate prescriptions are defined as therapeutic duplications,[39] subject to drug safety alerts published by the Spanish Agency of Medicines and Medical Devices over the last 10 years and which have been included in the safety module which is part of the primary care clinical workstation (ECAP), contraindications related to kidney function (glomerular filtration rate ≤30 mL/min/1.73 m^2) and potassium level (K+<3.5 mmol/L or >5.5 mmol/L) included in the ECAP, avoidable medications because are of questionable efficacy (in this case, the most commonly prescribed medications within the Catalan public health system have been considered, specifically, SYSADOA (ATC code M01AX, M01CX) and citicoline (ATC code N06BX06), inadequate duration of a prescription due to excess days, weeks, months or years according to the product data sheet (such as dual antiplatelet therapy for >12 months, bisphosphonate therapy for >5 years in low-risk patients, teriparatide treatment for >24 months, dual treatment for benign prostatic hyperplasia for >12 months, a course of nitrofurantoin for >7 days and the use of a combination of dexketoprofen/tramadol for >5 days, all of which are also included in the ECAP security module. In addition, combinations of urinary antispasmodics and other drugs with a high anticholinergic load[40 41] are also included in the ECAP safety module, together with incidences of medications which are to be avoided in the elderly according to the Beers,[19] STOPP-START,[20] LESS-CROHN[21] and STOPPFrail[22] criteria, inadequate dose and/or frequency according to the medication's product data sheet, the drug with a more efficient alternative, a medication which was not indicated, and necessary medication not-prescribed when there is a health problem which requires treatment and it has not been prescribed.

The number of medications per patient is calculated according to the medications included in the therapeutic plan, which last for more than 1 month (excluding dermatological, ophthalmological, otological and medical devices). The number of adjustments made to the therapeutic plan will be measured according to changes in the treatment plan made after the review and will be classified into the following categories, withdrawal of the medication, decreased dose, increased dose, a change in frequency when the doses are distributed differently, a change in the duration, a change of medication and a new medication when it is added to the therapeutic plan and does not replace any other to treat the health problem.

The number of hospital admissions are obtained from data taken from the minimum basic data set belonging to the Catalan health department, from the shared electronic health record in Catalonia (HC3) and/or from the interview with the patient.

Secondary variables: The number of changes in medication at 12 months and the number of ADR resulting from the intervention are considered. These include

Table 3 Description of data to be collected during the study

Variables	Description or tool to measure the variable	Data source	Data collection times (months)		
			0	6	12
Independent and/or confounding variables					
Sociodemographic	Age categorised by two groups (≥75–84 years, ≥85 years), sex (M/F), environment (rural/urban), educational level (no studies, primary level, secondary level, university level), types of caregiver (formal/informal/no caregiver)	ECAP, nursing professional interviews patient	√		
Chronicity	CCP (YES/NO), PACC (YES/NO)	ECAP	√		
Frailty	Calculated using the IF-VIG test. The tool classifies the degree of frailty according to the following: <0.20 no frailty, >0.20 to <0.36 mild frailty, >0.36 to <0.54 moderate frailty and >0.54 severe frailty	ECAP, nursing professional interviews patient	√		√
Risk of readmission in the next 12 months	Automatic calculation based on urgent admissions to public hospitals over the last year, adjusted for variables such as age, sex, socioeconomic level and morbidity. The morbidity, in this case, is measured using an index called adjusted morbidity group,[45] which measures the morbidity burden of individuals as an hierarchy of pathologies that gives a differential weight to each one, based on clinical criteria provided by expert groups and /or statistical analyses based on mortality or the use of health services. The risk is classified according to the following: <2.5% very low risk, 2.5% to <5% low risk, 5% to <10% mild risk, 10% to <20% high risk and ≥20% very high risk	ECAP	√		√
Result variables					
No of potentially inappropriate prescriptions	Therapeutic duplications are included, safety alerts issued by the AEMPS included in ECAP, relevant contraindications according to the summary of product characteristics and included in ECAP, avoidable medications due to doubtful efficacy, inadequate durations, combinations of antispasmodic medications with other medications with a high anticholinergic load according to the ACB and ARS scales, inappropriate medications according to the STOPP-START, LESSCROHN criteria and STOPPFrail, inappropriate dose and/or regimen according to the technical data sheet, medicines with a more efficient alternative according to medications recommended by the Catalan Institute of Health, drugs not indicated and necessary medications not prescribed	ECAP, security module (self-audit) and medication review by the PCP	√	√	√
No of prescribed medications	Medications which are included in the subject's therapeutic plan, prescribed for a duration greater than 1 month, excluding dermatological, ophthalmological, otological products and medical devices. The name of the medication and the therapeutic group (ATC) will be recorded	ECAP	√	√	√
No of changes made to the therapeutic plan	The changes made in the therapeutic plan as a result of the intervention, namely the withdrawal of a medication, an decrease or increase in dose (mg), a change in frequency (n), the duration of treatment (days), switching from one medication to another and prescribing a new medication	ECAP, researchers, PCPs		√	√
No of hospital admissions	Including acute, subacute and long-stay hospital admissions	MBDS, HC3, interview with subject		√	√
No of adverse events related to medication	Events related to the medication as a consequence of the intervention, including withdrawal syndromes, the rebound effect, the worsening of symptoms, medication errors, the need to visit the emergency room or be admitted to hospital or in the worst case if the patient dies	Researcher interviews patient, HC3		√	√
No of changes in the treatment plan per year	At the end of the follow-up of the subjects, the therapeutic plan will be evaluated, and it will be determined whether a medication that had been withdrawn during the intervention has been reintroduced, if new medications have been prescribed, if the dose has been increased or decreased in the event that it was modified during the intervention	ECAP, the review will be carried out by the PCP in conjunction with other researchers		√	√

ACB, Anticholinergic Cognitive Burden; AEMPS, Spanish Agency of Medicines and Medical Devices; ARS, Anticholinergic Risk Scale; ATC, Anatomical Therapeutic Chemical; CCP, complex chronic patient; ECAP, primary care clinical workstation; HC3, Shared electronic health record in Catalonia; IF-VIG, Frailty Index-VIG; MBDS, minimum basic data set; M/F, Male/Female; PACC, patients with advanced chronic conditions; PCP, primary care pharmacist.

changes in the treatment plan at 12 months, the number of medications the patient was taking before the review, which had been withdrawn and represcribed, the number of medications added to the treatment plan, the number of increases in dosage when it had been decreased or reduction in dosage when it had been increased during the intervention. The adverse events considered are those, which refer to withdrawal syndromes, the rebound effect, the worsening of symptoms, medication errors, emergency visit or hospitalisation or in the worst case if the patient dies.

The causality relationship between the observed adverse events and drug use will be established by clinical judgement. For this purpose, other causes will be considered, such as the natural history of the underlying diseases, concomitant treatment, other risk factors as well as the temporal relationship of the event with drug deprescribing and the evolution in time (complete remission, partial recovery, death, sequelae or persistence). In addition, the summary of product characteristics of all drugs used will be consulted. We will use the WHO-UMC causality assessment system[42] as a practical tool for the selection among the various categories (certain, probable/likely, possible, unlikely, conditional/unclassified, unassessable/unclassifiable).

Assessment of adverse events related to the intervention

Adverse events will be assessed at 6 and 12 months. To do so, the subject will be asked if they have experienced new discomfort or lesions, which have lasted a day or more in the last 2, 4 or 6 months. If participants experience severe symptoms, they will be asked to contact one of the researchers. All adverse events will be included in the final manuscript.

Data collection

The data needed to carry out the study are obtained from the primary care clinical workstation (ECAP) in most cases, and does not require specific training, since it is data commonly used in primary care. Specifically, it requires access to the active intelligence screen for data, which refers to clinical and laboratory variables, chronicity data and tests, the clinical follow-up screen for health problems, the percentage of readmissions and age and the active prescription screen for information on prescribed medications. The dispensing data of the prescribed medication packages will be extracted from the integrated electronic prescription system (SIRE), an application that is accessible via ECAP and/or from the shared electronic health record in Catalonia (HC3). From the latter, it is possible to obtain data on hospital admissions and visits to the emergency room.

In order to calculate the degree of frailty, the 'Índex Fragile-VIG'[36] calculator will be accessed via Internet Explorer or Google Chrome, which likewise does not require special training.

Regarding data collection, it is advisable that nursing professionals are responsible for collecting data related to chronicity and complexity, since it is a routine task for them and that the PCP are in charge of potentially inappropriate prescriptions, since they are trained to carry out this task.

All data must be recorded in the specially designed data collection sheet for each patient.

In accordance with the provisions of Organic Law 3/2018 of 5 December 2018, on the protection of personal data and digital rights, all personal information from the study is kept confidential and will always treated through codes. The files will be kept only for the duration of the study, and will be stored under the custody of the study staff in the directory of the company, to which only the study staff have access. The files are password protected. Participants are assigned an identification (ID) number (study ID) on enrolment that is used in place of names and other protected health information (PHI). The list linking participant PHI to the unique study ID is stored separately from the database. The information is encrypted for transfer to the study database and all servers at the company are equipped with relevant security measures in order to ensure the protection of the data.

Researchers who have not participated in the previous phase of the study and who therefore work with dissociated data in order that it is blinded will carry out the inputting of the data and subsequent analysis.

Statistical analysis

A descriptive analysis of the variables will be carried out, calculating the proportions in the case of qualitative variables and representing them by means of the corresponding figures and the calculation of the mean in the case of a normal distribution for the quantitative variables.

A bivariate analysis will be carried out with a parametric test in the case of a normal distribution, by comparison of means (t-distribution), while in the case of non-normal distribution the Mann-Whitney U test will be used. The χ^2 test will be used to test whether categorical variables are associated and the Cramer V test to measure the effect size, if one exists.

Finally, a multiple regression analysis will be performed to measure the effect of confounding variables on the result of the main variable. SPSS V.24.0 statistical software will be used for this purpose. The confounding variables which have been considered in patient studies are defined according to the Health Survey of Catalonia (ESCA),[43] and the existence of a caregiver and the type of caregiver according to whether they have received specialised formal training.

A per-protocol analysis will be carried out, and the results of patients who have dropped out of the study will not be taken into account. If a significant loss of PACC patients is detected at 12 months, they will be analysed as a different group in the study.

Patient and public involvement

No patient involved.

DISCUSSION

This protocol highlights the characteristics of the PCMR clinical study, one of the few randomised controlled trials conducted in primary care which aims to evaluate a person-centred care process provided by a multidisciplinary team which includes the figure of PCPs as experts on the use of medications to optimise the treatment plan for complex patients with multimorbidity, frailty, and polypharmacy,[26] patients usually excluded from clinical trials and clinical practice guidelines.[9]

The study compares the effect of a structured review of medication by a team, combined with a process of discussion and consensus with the patient with the usual clinical practice. Systematic medication reviews can facilitate shared decision-making and improve medication appropriacy,[16] especially in complex patients with multiple diseases and polypharmacy. It can also improve the safe use of medications, reducing the risk of ADR and mortality.[24]

In addition, this study aims to provide data to evaluate the safety of the intervention. Consequently, the incidence of ADR due to the intervention will be analysed.

PCMR has the following strengths:

- It is a collaborative model involving different types of professionals with different knowledge and perspectives in order to create a global overview of the patient. Furthermore, the literature indicates that the communication process between professionals is key to the proper use of medications.[44]
- The inclusion of PCPs as experts on the safe and appropriate use of medication in the person-centred care process in the primary care setting.[26]
- Person-centred care aims to improve the decision-making capacity and autonomy of polymedicated patients aged ≥75.
- The 1-year follow-up will make it possible to measure prolonged effects resulting from the intervention. A variable related to the safety of the intervention has been included as a secondary variable, which may be relevant.
- The study and analysis of adverse events related changes made to the therapeutic plan in the intervention group, for which no evidence has been found, has also been included.
- As a randomised controlled trial, it will provide more evidence on the model under investigation and its implementation in the health system to date not many experimental studies of its kind have been conducted.
- Patients with dementia are included since they can benefit from the intervention and are usually excluded from studies.

PCMR also has some limitations:

- Despite being randomised, the study is open. This factor may interfere with the results due to the possible contamination of the control group. To mitigate this effect, stratified randomisation has been used with respect to the teams of healthcare professionals (family doctor–nursing professional) assigned to the patients, in order that each team belongs either to the control group or to the intervention group. In addition, the researchers who handle the data will conduct a blind-analysis.
- Recently, training sessions have been held for primary healthcare professionals on the systematic review of medication process, a screen has been activated in the clinical workstation to guide professionals through the process in order to reduce polypharmacy. Each of these factors could contaminate the study results.
- The pre-existing beliefs of healthcare professionals who care for patients can make it difficult to improve the adequacy of the therapeutic plan, but being a randomised trial, with a multidisciplinary team, the participation of experts in the use of medications may help reduce the impact of this factor.
- Time management of healthcare professionals is a limitation; the systematic review of a patient's treatment plan requires a significant amount of time, but in this case, taking into account the published literature and the expected results, the benefit may well make the investment worthwhile.
- The patients' beliefs regarding medication and health may also be a factor, which hinders changes to the therapeutic plan, and affect patient adherence, In order to mitigate the effect an adequate shared decision-making process is recommended.
- The study is not intended to measure patient adherence, being a limiting factor for the evaluation of some variables of the study such as the primary variables (ie, hospital admissions) or the secondary variables (ie, adverse events).

CONCLUSIONS

The PCMR study will compare the effect of collaborative work involving a multidisciplinary team, which includes PCPs, to apply a patient-centred care model with respect to routine clinical practice in order to optimise the therapeutic plan. The researchers also hope that the intervention will avoid or reduce adverse events produced by polypharmacy, especially in frail elderly patients. The study will contribute data to other studies designed to optimise medication.

Ethics and dissemination

This protocol with identity code 19/144-P has been evaluated and approved by the Ethics Committee of IDIAPJGol on 10 July 2019 and by the University of Barcelona's Bioethics Commission. The ethical principles of biomedical research in humans (Principles of Good Clinical Practice and the Declaration of Helsinki) have been met. The study protocol including all items of the WHO Trial Registration Data Set has been completed and registered in accordance with WHO and ICMJE standards. In accordance with Organic Law 3/2018 of 5 December 2018, on data protection and guarantee of digital rights, personal information is encrypted before it is uploaded to the study database. The results of the study will be published

in open access peer-reviewed scientific journals, and as part of a doctoral thesis.

Acknowledgements The authors gratefully acknowledge the help of the participants Raquel Coma Roura, Anna Forcada Arcarons, and Anna Bonet Esteve.

Contributors CR conceived the study and wrote the study protocol. PM, JA, CA and JG initiated study design and assisted with implementation. JP and AR provided statistical expertise in clinical trial design and are conducting the primary statistical analysis. PM and ELM contributed their experience and wrote the study protocol. All authors contributed to changes to the study protocol and approved the final manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iDs
Carol Rovira http://orcid.org/0000-0002-9722-3942
Pilar Modamio http://orcid.org/0000-0003-3193-6285
Joaquim Pascual http://orcid.org/0000-0002-7032-5623
Joan Armengol http://orcid.org/0000-0001-9876-1198
Cristian Ayala http://orcid.org/0000-0002-6142-0530
Joan Gallego http://orcid.org/0000-0002-9915-2324
Eduardo L Mariño http://orcid.org/0000-0003-4386-9315
Anna Ramirez http://orcid.org/0000-0001-8263-1292

REFERENCES

1 Statistical Institute of Catalonia (IDESCAT). Territorial and demographic indicators. Available: https://www.idescat.cat/pub/?id=inddt&n=915&m=m [Accessed Oct 2020].
2 Rodriguez-Mañas L, Rodríguez-Artalejo F, Sinclair AJ. The third transition: the clinical evolution oriented to the contemporary older patient. *J Am Med Dir Assoc* 2017;18:8–9.
3 Mair A, Fernandez-Llimos F, SIMPATHY Consortium. Simpathy. stimulating innovation management of polypharmacy and adherence in the elderly. *Eur J Hosp Pharm* 2017;24:5–6.
4 Melzer D, Tavakoly B, Winder RE, *et al*. Much more medicine for the oldest old: trends in UK electronic clinical records. *Age Ageing* 2015;44:46–53.
5 Rodríguez-Mañas L, Féart C, Mann G, *et al*. Searching for an operational definition of frailty: a Delphi method based consensus statement: the frailty operative definition-consensus conference project. *J Gerontol A Biol Sci Med Sci* 2013;68:62–7.
6 Fhon JRS, Rodrigues RAP, Santos JLF, *et al*. Factors associated with frailty in older adults: a longitudinal study. *Rev Saude Publica* 2018;52:74.
7 Rieckert A, Trampisch US, Klaaßen-Mielke R, *et al*. Polypharmacy in older patients with chronic diseases: a cross-sectional analysis of factors associated with excessive polypharmacy. *BMC Fam Pract* 2018;19:113.
8 Bonaga B, Sánchez-Jurado PM, Martínez-Reig M, *et al*. Frailty, Polypharmacy, and Health Outcomes in Older Adults: The Frailty and Dependence in Albacete Study. *J Am Med Dir Assoc* 2018;19:46–52.
9 Scottish Government Polypharmacy Model of Care Group. Polypharmacy guidance, realistic prescribing. third edition. Scottish government, 2018. Available: https://www.therapeutics.scot.nhs.uk/wp-content/uploads/2018/04/Polypharmacy-Guidance-2018.pdf [Accessed Feb 2021].
10 Lemstra M, Nwankwo C, Bird Y, *et al*. Primary nonadherence to chronic disease medications: a meta-analysis. *Patient Prefer Adherence* 2018;12:721–31.
11 González-Bueno J, Calvo-Cidoncha E, Sevilla-Sánchez D, *et al*. [Spanish translation and cross-cultural adaptation of the ARMS-scale for measuring medication adherence in polypathological patients]. *Aten Primaria* 2017;49:459–64.
12 Gutiérrez-Valencia M, Aldaz Herce P, Lacalle-Fabo E, *et al*. Prevalence of polypharmacy and associated factors in older adults in Spain: data from the National health survey 2017. *Med Clin* 2019;153:141–50.
13 Midão L, Giardini A, Menditto E, *et al*. Polypharmacy prevalence among older adults based on the survey of health, ageing and retirement in Europe. *Arch Gerontol Geriatr* 2018;78:213–20.
14 Hanlon JT, Schmader KE, Samsa GP, *et al*. A method for assessing drug therapy appropriateness. *J Clin Epidemiol* 1992;45:1045–51.
15 Cullinan S, O'Mahony D, O'Sullivan D, *et al*. Use of a frailty index to identify potentially inappropriate prescribing and adverse drug reaction risks in older patients. *Age Ageing* 2016;45:115–20.
16 Campins L, Serra-Prat M, Gózalo I, *et al*. Randomized controlled trial of an intervention to improve drug appropriateness in community-dwelling polymedicated elderly people. *Fam Pract* 2017;34:36–42.
17 Orueta R, Sánchez-Oropesa A, Gómez-Calcerrada RM. Therapeutic appropriateness in chronic patients. *Rev Clin Med Fam* 2015;8:31–47.
18 Gavilan E, Villafaina A. [Polymedication and Health: strategies for therapeutic adequacy]. Available: https://books.google.es/books?id=1_ILCAAAQBAJ&lpg=PA1&hl=es&pg=PA1#v=onepage&q&f=false [Accessed Aug 2021].
19 By the American Geriatrics Society 2015 Beers Criteria Update Expert Panel. American geriatrics Society 2015 updated beers criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc* 2015;63:2227–46.
20 Delgado Silveira E, Montero Errasquín B, Muñoz García M, *et al*. [Improving drug prescribing in the elderly: a new edition of STOPP/START criteria]. *Rev Esp Geriatr Gerontol* 2015;50:89–96.
21 Rodríguez-Pérez A, Alfaro-Lara ER, Albiñana-Perez S, *et al*. Novel tool for deprescribing in chronic patients with multimorbidity: list of evidence-based deprescribing for chronic patients criteria. *Geriatr Gerontol Int* 2017;17:2200–7.
22 Lavan AH, Gallagher P, Parsons C, *et al*. STOPPFrail (screening tool of older persons prescriptions in frail adults with limited life expectancy): consensus validation. *Age Ageing* 2017;46:600–7.
23 Spinewine A, Schmader KE, Barber N, *et al*. Appropriate prescribing in elderly people: how well can it be measured and optimised? *Lancet* 2007;370:173–84.
24 Kua C-H, Mak VSL, Huey Lee SW. Health outcomes of deprescribing interventions among older residents in nursing homes: a systematic review and meta-analysis. *J Am Med Dir Assoc* 2019;20:362–72.
25 Espaulella-Panicot J, Molist-Brunet N, Sevilla-Sanchez D. Patient-Centered prescription model to improve therapeutic adherence in patients with multimorbidity. *Rev Esp Geriatr Gerontol* 2017;52:278–81.
26 Tan ECK, Stewart K, Elliott RA, *et al*. Pharmacist services provided in general practice clinics: a systematic review and meta-analysis. *Res Social Adm Pharm* 2014;10:608–22.
27 Chan A-W, Tetzlaff JM, Altman DG, *et al*. Spirit 2013 statement: defining standard protocol items for clinical trials. *Ann Intern Med* 2013;158:200–7.
28 Onder G, Petrovic M, Tangiisuran B, *et al*. Development and validation of a score to assess risk of adverse drug reactions among in-hospital patients 65 years or older: the GerontoNet ADR risk score. *Arch Intern Med* 2010;170:1142–8.
29 TERMCAT. Terminology of chronicity, 2021. Available: https://www.termcat.cat/en/diccionaris-en-linia/160 [Accessed Jan 2021].
30 Catalan Health Service. Health department. Generalitat of Catalonia. conceptual bases and model of care for frail people, with complex chronicity (CCP) or advanced (PacC). chronic prevention and care program. Socio-sanitary master plan strategic. direction of primary care. Barcelona. Available: https://salutweb.gencat.cat/web/.content/_ambits-actuacio/Linies-dactuacio/Estrategies-de-salut/Cronicitat/Documentacio-cronicitat/arxius/Model-de-Bases-de-Cronicitat.pdf [Accessed Aug 2021].
31 Gómez-Batiste X, Martínez-Muñoz M, Blay C. Identification of people with advanced chronic diseases and the need for palliative care in health and social services: development of the instrument NECPAL CCOMS-ICO©. *Med Clin* 2013;140:241–5.
32 Mahoney FI, Barthel DW. Functional evaluation: the BARTHEL index. *Md State Med J* 1965;14:61–5.
33 Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *J Am Geriatr Soc* 1975;23:433–41.
34 Bergstrom N, Braden BJ, Laguzza A, *et al*. The Braden scale for predicting pressure sore risk. *Nurs Res* 1987;36:205–10.

35 Reisberg B, Ferris SH, Franssen E. An ordinal functional assessment tool for Alzheimer's type dementia. *Hosp Comm Psychiat* 1985;36:593–5.
36 Amblàs-Novellas J, Martori JC, Molist Brunet N, *et al*. [Frail-VIG index: Design and evaluation of a new frailty index based on the Comprehensive Geriatric Assessment]. *Rev Esp Geriatr Gerontol* 2017;52:119–27.
37 Holmes HM, Hayley DC, Alexander GC, *et al*. Reconsidering medication appropriateness for patients late in life. *Arch Intern Med* 2006;166:605–9.
38 et alAmado E, Duran C, Izko N. [Basic elements of the approach to medication in the chronic patient: Information to the patient, conciliation, review and adherence]. Available: https://issuu.com/sefap/docs/sefap [Accessed Nov 2020].
39 Catalan Health Service. Health department. Generalitat of Catalonia. clinical safety in the electronic prescription. methodology for preparing clinical safety content. Barcelona. Available: http://medicaments.gencat.cat/ca/professionals/seguretat/seguretat-clinica-recepta-electronica/ [Accessed Dec 2020].
40 Boustani M, Campbell N, Munger S, *et al*. Impact of anticholinergics on the aging brain: a review and practical application. *Aging health* 2008;4:311–20.
41 Campbell N, Boustani M, Limbil T, *et al*. The cognitive impact of anticholinergics: a clinical review. *Clin Interv Aging* 2009;4:225–33.
42 World Health Organization. The Uppsala monitoring centre. The use of the WHO-UMC system for standardised case causality assessment. Available: https://www.who.int/medicines/areas/quality_safety/safety_efficacy/WHOcausality_assessment.pdf [Accessed Sep 2021].
43 Medina A, Schiaffino A. [Characterization of the population, the sample and methodology of the health survey of Catalonia]. Barcelona: General Directorate of Health Planning, 2019. Available: http://salutweb.gencat.cat/web/.content/_departament/estadistiques-sanitaries/enquestes/Enquesta-de-salut-de-Catalunya/Resultats-de-lenquesta-de-salut-de-Catalunya/documents/2018-resultats/metodologia-2018.pdf [Accessed Dec 2020].
44 Olry de Labry Lima A, Marcos Marcos J, Marquina Marquez A, *et al*. Evidence for deprescription in primary care through an umbrella review. *BMC Fam Pract* 2020;21:100.
45 Monterde D, Vela E, Clèries M. Adjusted morbidity groups: a new useful population morbidity grouper in the primary care setting. *Aten Primaria* 2016;48:674–82.