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Impact of a Multidisciplinary Approach to Polypharmacy Management in Community-Dwelling Older Adults: Insights From a Specialized Outpatient Clinic

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ABSTRACT

Objectives: The increase in polypharmacy among older adults increases the risk of drug-related problems, making multidisciplinary interventions essential. This study evaluated the impact of a multidisciplinary polypharmacy consultation on medication management and outcomes in older outpatients.

Methods: This prospective observational study at a Spanish teaching hospital involved geriatricians, clinical pharmacists, and nurses. Older adults (≥ 75 years) with polypharmacy underwent medication review at baseline and at 3 and 6 months. Data on medication use, adherence to Screening Tool of Older Person's Prescriptions (STOOP) criteria, and anticholinergic burden were analyzed.

Results: The study included 104 older adults (mean age 86.2 years; 66% female). An average of 3.6 recommendations per participant was made (63.8% acceptance rate). Common drug-related problems were adverse effects (20%), non-adherence (18.1%), and incorrect dose/regimen (14.4%). Interventions led to an average reduction of 1.7 medications per patient, with 1.3 dosage or regimen changes and 1.1 new prescriptions. The mean number of medications decreased from 9.6 at baseline to 8.9 at 3 months ($p < 0.001$) and remained below baseline at 6 months. STOPP criteria violations per patient dropped from 1.2 to 1.0 ($p = 0.036$). Of the 126 medications flagged by STOPP criteria, 68.3% were addressed, 24.6% discontinued, mainly psychotropics, and 89.3% of these discontinuations were maintained. The anticholinergic burden decreased from 1.3 to 1.1 at 3 months ($p = 0.036$) and remained below baseline at 6 months.

Conclusions: A multidisciplinary clinic effectively managed polypharmacy in older adults by reducing medication load and improving appropriateness per STOPP criteria, highlighting the importance of proactive medication management.

Trial Registration: ClinicalTrials.gov: NCT05408598 (March 1, 2022)

1 | Introduction

Polypharmacy, defined as the concurrent use of multiple medications, affects approximately 30.2% of community-dwelling individuals and nearly 40% of the elderly population [1, 2], and it is a growing problem due to an aging population.

Age-related physiological changes complicate drug metabolism and increase vulnerability to adverse effects [3, 4]. Polypharmacy, along with cognitive decline, limited medication knowledge, and non-adherence, significantly elevates the risk of drug-related problems (DRPs) [5, 6].

Given the high prevalence of potentially inappropriate medications (PIMs), it is crucial to focus on avoiding inappropriate polypharmacy and improving the quality of medication. For example, anticholinergic drugs are frequently used, and associated with cognitive and physical decline. Approximately 20% of older adults use these medications, which pose significant risks to their cognitive function and overall health [7–9].

Addressing these challenges requires comprehensive medication review strategies, particularly deprescribing, to optimize medication use, reduce PIMs and adverse drug reactions (ADR) and improve compliance [10]. The effectiveness of multidisciplinary teams in medication management has been underscored by studies that highlight their role in deprescribing [11–13]. Benefits in clinical outcomes may be achieved, particularly when patient-specific interventions are applied [14]. Medication reviews should have patient-centered approach and address the social and clinical contexts in which older patients live, evaluating their attitudes toward deprescribing, their care goals, and their ongoing interactions with healthcare professionals to adjust treatment plans as needed [15]. Thus, while this article focuses specifically on medication management, it is part of a larger study that also analyzed functional capacity and quality of life in older adults.

Recognizing the need to adapt clinical practice to better meet the needs of older complex patients with a high polypharmacy burden, various proposals for specific interventions in geriatric care have been introduced. It is essential to evaluate the outcomes of these interventions in daily practice to refine them for better results and to ensure that the most effective practices are implemented in each setting.

Our hospital recently introduced a specific consultation focused on polypharmacy in older outpatients, designed with a multidisciplinary and individualized approach within the framework of a comprehensive geriatric assessment (CGA). In this study, we evaluated the outcomes following the implementation of this practice in our hospital. We gathered relevant information on changes in patients' functional capacity and quality of life, while thoroughly collecting data related to the pharmacological treatments of patients attending this consultation. This will help us to understand our patients' medication use patterns, the treatment changes that can be expected from this type of geriatric care, and those that may explain the possible changes in significant clinical variables.

Thus, this study aimed to analyze the treatment modifications resulting from intervention in older patients with polypharmacy in a multidisciplinary outpatient clinic. We assessed the types of recommendations made, their impact on prescribed medications, and their effects at three and 6 months, providing valuable insights into long-term medication management.

2 | Methods

2.1 | Design, Sample, and Recruitment

This prospective observational study was conducted from June 2021 to May 2022 at the outpatient clinic of the Geriatrics Department of the HUN, a public teaching hospital in Pamplona, Spain. The details of the study protocol have been previously published [16]. The study received approval from the Ethics Committee of the Navarra Government (EO 2021/16).

Recently, our hospital established a dedicated polypharmacy consultation service. In this setting, older adults living in the community and experiencing polypharmacy are provided standard care by a multidisciplinary team that includes a geriatrician, nurse, and clinical pharmacist.

Patients were referred to this specialized outpatient consultation by geriatricians from a variety of sources, such as primary care, other geriatric outpatient services, and discharge from hospital admissions. To be eligible for the study, patients had to be 75 years or older, have a life expectancy of at least 3 months (defined by clinical judgment), experience polypharmacy (≥ 5 prescribed medications), and not participate in any medication-related clinical trials. Those who met these criteria were invited to join the study, and written informed consent was obtained from all participants who agreed to take part.

2.2 | Procedure

The clinical pharmacist routinely conducted a comprehensive medication review before each patient's first visit (Step 1), identifying DRPs and documenting recommendations in the patient's digital record, accessible to the entire team. The DRP classification was based on the Pharmaceutical Care Network Europe system (version 9) [17].

During the initial visit (Step 2), the geriatrician and nurse performed a CGA, which is a multidimensional, multidisciplinary process that identifies medical, social, and functional needs, and the development of a care plan to meet those needs [18, 19]. The CGA included standardized scales covering essential health components to evaluate the patient's condition and needs, and the scales used for this study are detailed elsewhere [16].

The structure of an in-person CGA involves the evaluation of four key domains: social, mental, clinical, and functional. Professionals, doctors, and nurses have specific roles in this process.

1. *Social assessment*: Nurses generally conduct this assessment by gathering information about the patient's living situation, support network, and social and financial resources. This helps to identify social needs that may influence the patient's overall health and guide personalized care planning.

2. *Mental assessment*: This phase includes evaluating the patient's cognitive state and mood. Nurses may perform initial screening tests to detect cognitive impairment or signs of depression, while doctors interpret these results and conduct a more in-depth assessment if necessary. Together, they can identify the need for additional mental or social support.
3. *Clinical assessment*: The doctor leads this component of CGA, which includes reviewing medical history, conducting a physical examination, and reviewing medications. Here, doctors identify diseases, chronic conditions, and potential drug interactions. Nurses can provide assistance by gathering preliminary data and updating the patient's medical history.
4. *Functional assessment*: Nurses conduct tests related to mobility, balance, and the patient's ability to perform daily activities, whereas the doctor assesses the clinical relevance of these findings and considers appropriate interventions.

The assessment involved a medical interview, verification of the medication list with input from the patient or caregiver, ADR, adherence assessment, and a review of the pharmacist's recommendations. The geriatrician, in consultation with the patient, made the necessary adjustments based on their goals and preferences. Interventions were classified according to the purpose of this study.

Follow-up consultations (Step 3) were scheduled approximately 3 and 6 months later, either in-person or by phone, depending on the patient's clinical status, following the standard procedure of the outpatient clinic. The choice of modality was based on several key factors: patients with reduced mobility, significant functional impairments, or complex medical conditions were typically scheduled for in-person visits, whereas those in a stable clinical condition with no emergent issues were monitored by phone.

During follow-up consultations, the team updated the CGA. Telephone consultations in a CGA can involve both the geriatrician and nurse, although the structure and focus differ somewhat from in-person consultations. The geriatrician typically leads the telephone consultation, focusing on clinical aspects, reviewing symptoms, mental status, medication, and any relevant changes in the patient's condition since the last consultation. Nurses may participate in some parts of the telephone consultation, especially in gathering preliminary data or following up on the social and functional aspects. For instance, nurses may contact patients or caregivers to collect information on daily well-being, activities of daily living, and social support networks. The main differences are the lack of a direct physical examination (relying instead on the patient's self-assessment or caregiver's observations) and reduced functional assessment due to the lack of functional tests.

2.3 | Data Collection

Data were gathered at baseline (before and after the initial consultation), at 3 and 6 months, and for the discharged patients who received the same intervention. Patient characteristics and outcomes were recorded during consultations and retrieved from the electronic medical records.

2.4 | Outcomes

Medication outcomes included changes in the number of medications, active ingredients, anticholinergic burden assessed using the Drug Burden Index (DBI) [20] and Anticholinergic Cognitive Burden (ACB) scale [21], and the prevalence of PIMs, according to the Screening Tool of Older Person's Prescriptions (STOPP).

2.5 | Statistical Analysis

Sociodemographic and clinical data were summarized as frequencies and percentages for categorical variables and means and standard deviations for quantitative variables. Changes over time were analyzed using linear mixed models, except for STOPP criteria use, which were analyzed using a Poisson mixture model. Model assumptions were checked graphically using residual plots, and the mean–variance equality for the STOPP criteria was verified. Statistical significance was set at $p < 0.05$, and analyses were conducted using SPSS Statistics (version 28.0, IBM Corp., Armonk, NY, USA) and R (version 4.3.2, R Foundation) software.

3 | Results

During the study, 151 patients were referred to the clinic, 47 of whom did not participate in the study. Reasons included having fewer than five medications (19 patients), not attending the initial consultation (24 patients, including 13 no-shows, five deaths, five cancellations, and one hospitalization), three patients with a life expectancy of < 3 months (defined by clinical judgment), and one patient declined to participate (Figure 1). The study enrolled 104 patients, with an average age of 86.22 ± 5.32 years; 66% were women (Table 1).

The pharmacist made 376 recommendations, addressing 415 medications for 97 patients, with an acceptance rate of 63.8%. The most frequent DRP identified was the likelihood of adverse effects (20% of cases), followed by non-adherence (18.1%) and incorrect dose or regimen (14.4%) (Figure 2). The highest acceptance rates were for non-adherence (85%), drug duplication (65%), and drug–drug interactions (64%). The top five drug categories related to the recommendations were antidepressants (8.9%), analgesics and antipyretics (8.2%), gastroesophageal reflux drugs (6.5%), anxiolytics (5.8%), and lipid-modifying agents (5.3%) (Figure 1).

Following the initial consultation (Step 2), 436 interventions were implemented, with 416 directly affecting medication: 41% led to discontinuation (1.7 per patient), 33% involved dosage regimen or dosage form adjustments (1.3 per patient), and 26% resulted in new prescriptions (1.1 per patient). Changes affected various drug types, with 15.9% linked to PIMs per STOPP criteria. The top five drug categories most frequently associated with

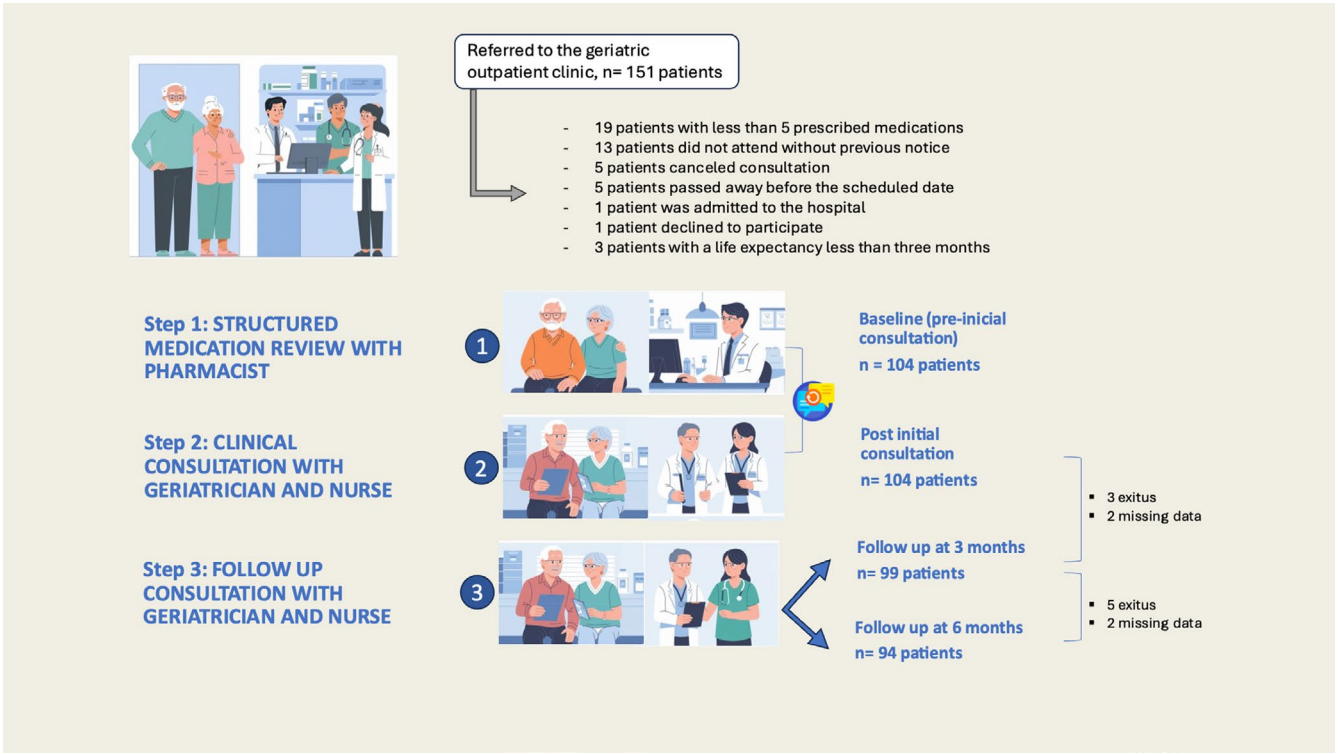

FIGURE 1 | Participants flow chart.

changes in medication were antidepressants (11.1% of the total), lipid-modifying agents (7.7%), other analgesics and antipyretics (6.3%), drugs for peptic ulcers and gastroesophageal reflux disease (4.6%), and blood glucose-lowering drugs (excluding insulin, 4.3%). The remaining 20 interventions included adherence and drug monitoring.

At the 3-month follow-up (Step 3), 99 patients were assessed (three had passed away and two had missing data), and by 6 months, 94 patients were reviewed, with five additional deaths during this period and two patients with missing data.

3.1 | Medication Outcomes

Table 2 outlines the changes in medications, STOPP criteria, and anticholinergic burden from baseline to the 3- and 6-month follow-up.

Regarding PIMs, at the initial consultation, 126 medications met the STOPP criteria, with 68.3% receiving recommendations. Of these, 24.6% were discontinued, primarily from hypnotics, sedatives, opioids, and antipsychotics. Notably, 89.3% of these discontinuations were maintained at the follow-up. Additionally, seven new medications that met the STOPP criteria were introduced (Table 3).

Changes in the anticholinergic burden showed an initial reduction that was largely sustained over 6 months. Figure 3 highlights the evolution of total ACB scores for key medications, with reductions observed in amitriptyline, olanzapine, and paroxetine, whereas clorazepate and trazodone showed slight increases.

4 | Discussion

Our study demonstrates the effectiveness of a multidisciplinary approach for managing polypharmacy in older adults. We observed significant reductions in the number of medications, active ingredients, and PIMs according to the STOPP criteria. The anticholinergic burden was modestly reduced, particularly in the short term, with sustained improvements at 3 months. These findings highlight the need for ongoing interventions to sustain the long-term benefits in medication management.

Given the advanced age and high comorbidity of the cohort (average age > 86 years), personalized, continuous medication reviews are crucial. The high prevalence of DRPs, such as adverse effects, nonadherence, and incorrect dosing, emphasizes the important role of pharmacists in addressing these issues. The high acceptance rate of pharmacist recommendations, particularly those related to nonadherence and drug interactions, underscores the value of this collaborative approach [22]. These results are consistent with other studies identifying non-adherence as a frequent DRP in older adults, particularly among widowed or divorced individuals who are known to have lower medication adherence [23, 24]. The likelihood of adverse effects remains a significant concern because of the complex medication regimens these patients often follow [25].

The prevalence and type of DRPs vary according to the context. For example, community-dwelling patients show higher rates of nonadherence than hospitalized patients [26]. This highlights the need for tailored DRP management strategies, depending on the setting.

Key drug categories involved in recommendations include antidepressants, analgesics, gastroesophageal reflux drugs,

TABLE 1 | Characteristics of study participants.

	Total ($n = 104$)
Age mean (SD)	86.22 (5.32)
Women	69 (66%)
Marital status	
Single	11 (11%)
Married	42 (40%)
Divorced/Separated	1 (1%)
Widower	50 (48%)
Educational level	
Without studies	7 (7%)
Primary education	55 (53%)
Secondary education, baccalaureate, or professional education	40 (38%)
University studies or equivalent	2 (2%)
Comorbidity level	
CIRS-G mean (SD)	15.8 (5.0)
Cognitive function	
Without cognitive deterioration (GDS 1)	19 (18%)
Minor deterioration (GDS 2 and 3)	58 (56%)
Moderate deterioration (GDS 4 and 5)	20 (19%)
Major deterioration (GDS 6 and 7)	7 (7%)
Sensory deficiency	
Visual deficiency (including glasses and/or blindness)	81 (78%)
Hearing deficiency	76 (73%)
MNA	
Normal nutritional status (12–14)	32 (31%)
Risk of malnutrition (8–11)	45 (43%)
Malnutrition (0–7 points)	24 (23%)
Renal function, *GFR* (mL/min/1.73 m^2)	
≥ 60	61 (58.7%)
30–59	38 (36.5%)
15–29	2 (1.9%)
< 15	1 (1.0%)
Others	
Total colesterol (mg/dL) mean (SD)	183.2 (47.2)
Total proteins (mg/dL) mean (SD)	65.1 (9.0)
Albumin (g/L) mean (SD)	38.5 (5.7)
Hemoglobin (g/dL) mean (SD)	14.2 (12.6)
Fe (g/dL) mean (SD)	66.7 (31.6)
Creatine (g/dL) mean (SD)	0.99 (0.39)
Background	
Arterial hypertension	83 (80%)
Diabetes Mellitus	27 (26%)
Dyslipidemia	45 (43%)
Ischemic heart disease	21 (20%)
Heart failure	53 (51%)
Cardiac arrhythmia	37 (36%)
COPD/asthma	20 (19%)
Depressive disorder	64 (62%)
Cerebrovascular pathology	52 (50%)
Chronic liver disease	5 (5%)
Chronic kidney disease	55 (53%)
Sleep disorder	76 (73%)

Note: The results are presented as the mean (SD) or number (%).
Abbreviations: CIRS-G, cumulative illness rating scale-geriatric; COPD, chronic obstructive pulmonary disease; GDS, Global Deterioration Scale; GFR, glomerular filtration rate; MNA, mini nutritional assessment.

anxiolytics, and lipid-modifying agents. The prominence of antidepressants and anxiolytics reflects prevalent psychological and mood-related conditions, whereas the focus on analgesics and antipyretics highlights the complexity of pain management. The emphasis on lipid-modifying agents and gastrointestinal medications is consistent with similar research, although the prominence of these drug categories varies between studies depending on prescription patterns or patient populations [23, 24, 27].

The high number of interventions (436 total, 416 directly affecting medications) reflects the effectiveness of our strategy in deprescribing unnecessary medications and optimizing existing therapies. Our approach compares favorably with those of other studies, showing a more dynamic and extensive application of medication management strategies. For instance, Aharaz et al. reported a 0.9 drug reduction per patient [28], Reumerman et al. reported 1.0 drug discontinuation, 1.0 new medication, 0.3 medication switches, 0.1 dosing adjustments, and 0.23 instances of monitoring advice per patient [29], and Campins et al. reported 1.41 discontinuations, 0.7 dose adjustments, 0.5 substitutions with more cost-effective alternatives, and 0.23 new drug prescriptions per patient [30]. Our results may reflect the benefits of specialized geriatricians and clinical pharmacists. The level of specialization in our team, with a clinical pharmacist focused on geriatrics, contrasts with other studies in which general physicians and less specialized

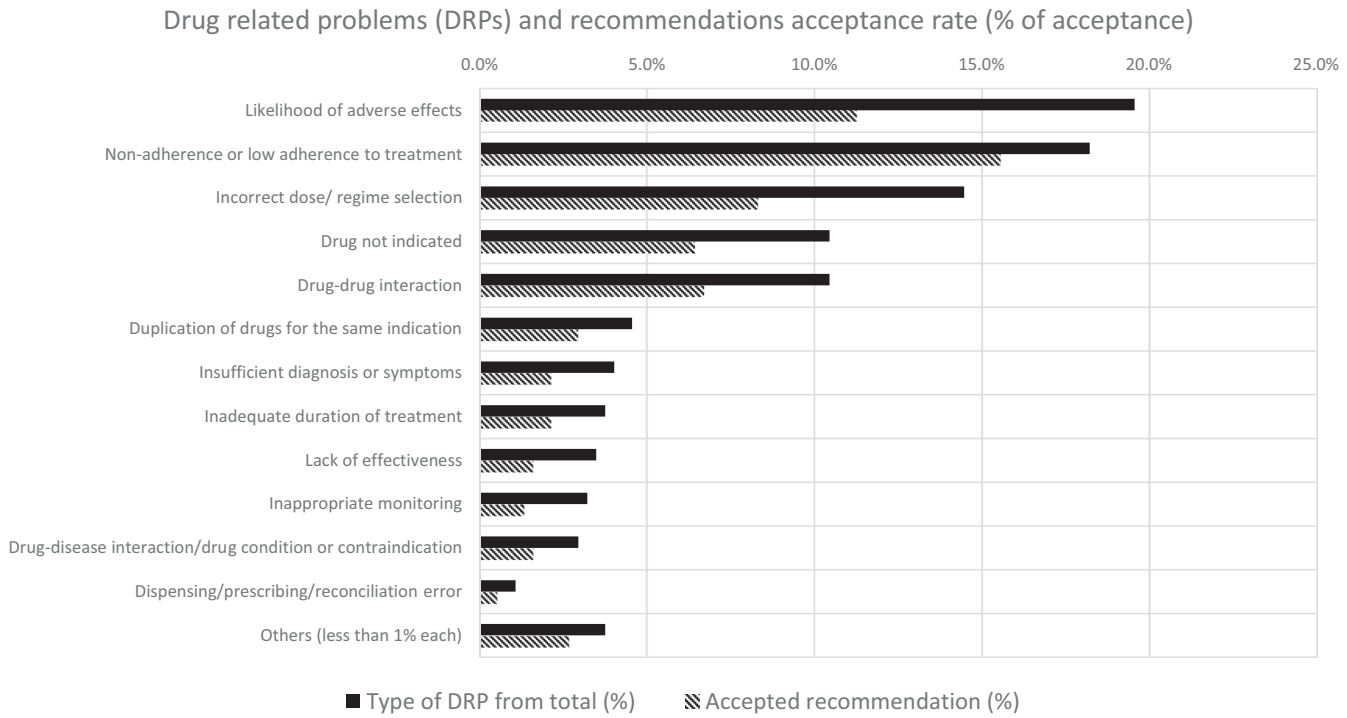

FIGURE 2 | Frequencies of drug-related problems (DRPs) were identified and recommendations issued according to the clinical pharmacist's acceptance rate. Variables are expressed as a percentage of the total ($n = 373$) number of DRPs (n [%]).

pharmacists led the teams, potentially resulting in less extensive medication adjustments.

Our study demonstrated a significant reduction in medications and active ingredients per participant, sustained at 3 months, although the overall reduction was not significant at 6 months, likely due to the limited follow-up reevaluation after the initial focus on deprescribing. This underscores the need for ongoing pharmacist involvement beyond the initial deprescribing efforts, as seen in other studies [31–33].

At 6 months, a 15% decrease in patients with at least one STOPP criterion was observed. Pharmacist interventions led to a 25% reduction in STOPP medications, and 89.3% of these discontinuations were maintained. Despite the general reduction in medications, our population had a high prevalence of PIMs, notably psychopharmaceuticals, such as anxiolytics, hypnotics, sedatives, and antipsychotics [34, 35]. Effective communication among healthcare providers, patients, and families is crucial for reducing PIMs and managing polypharmacy risks [36].

An initial reduction in the anticholinergic burden, as measured by the ACB and DBI scales, was noted, but this improvement diminished over time. While the short-term effectiveness was clear at 3 months, the benefits were not sustained at 6 months without ongoing intervention. The slight increase in ACB and DBI scores suggests a return to previous prescription patterns or the introduction of new anticholinergic medications, highlighting the need for continuous monitoring to maintain long-term improvement. The non-significant changes in DBI indicate that, while anticholinergic burden was initially addressed, broader medication burdens, including dosages and sedative effects, may require more comprehensive strategies for lasting reductions. Proactive, ongoing management is essential to prevent the recurrence of high anticholinergic burden and to ensure long-term safety.

The differences between the ACB and DBI scales reflect varying medication classifications and their respective contributions. These results are consistent with those of other studies showing mixed success in reducing anticholinergic burden, particularly with psychotropic medications [7, 36].

Although reductions in total medications, STOPP criteria, and anticholinergic burden were observed, there were instances in which no changes were made, even when potentially inappropriate medications were identified. This may have been due to a lack of recommendations from the pharmacist or the physician's decision to not modify the treatment. In older, more complex patients, a CGA and multidisciplinary approach are crucial for tailoring treatment to individual goals and preferences. The data demonstrate that most changes are not associated with tools like the STOPP criteria or anticholinergic burden scales, nor does their presence always lead to treatment modifications, even when these criteria are known. These findings underscore the importance of individualized medication reviews beyond explicit tools, such as STOPP criteria or anticholinergic scales.

Our study offers valuable insights into multidisciplinary interventions in geriatric care using a new consultation format. The pragmatic design ensures real-world applicability by maintaining standard practice and minimizing patient inconvenience. The intervention led to reduced medication use and fewer inappropriate prescriptions, with the evolution of treatment changes monitored over time, allowing reevaluations as needed. Improved communication between healthcare providers and patients also contributed to better management of

TABLE 2 | Medication-related outcomes.

	Baseline (pre- initial consultation)	Post- initial consultation	Difference	*p*	3 months	Difference	*p*	6 months	Difference (from baseline)	*p*
No. of medications per participant: mean (SD)	9.6 (3.2) $n=104$	9.2 (3.2) $n=104$	−0.5 (−0.8, −0.1)	**0.009**[b]	8.9 (3.0) $n=99$	−0.7 (−1.1, −0.3)	**<0.001**[b]	9.5 (3.4) $n=94$	−0.2 (−0.5, 0.2)	0.410[b]
No. of active ingredients per participant: mean (SD)	10.6 (3.6) $n=104$	9.9 (3.4) $n=104$	−0.7 (−1.1, −0.3)	**0.001**[b]	9.7 (3.4) $n=99$	−0.8 (−1.2, −0.4)	**<0.001**[b]	10.4 (3.8) $n=94$	−0.1 (−0.5, 0.3)	0.626[b]
STOPP criteria										
Mean (SD)/ patient	1.2 (1.0)	1.0 (1.0)	0.82 (0.63, 1.06)		0.9 (0.9)	0.74 (0.56, 0.96)		0.9 (1.0)	0.75 (0.57, 0.98)	
Patients with at least 1 criterion[a]	75 (72.1%) $n=104$	68 (65.4%) $n=104$		0.129[c]	61 (60.4%) $n=101$		**0.027**[c]	56 (57.1%) $n=98$		**0.036**[c]
Anticholinergic burden	$n=104$	$n=104$			$n=99$			$n=94$		
ACB: mean (SD)	1.3 (1.5)	1.2 (1.3)	−0.1 (−0.3, 0.0)	0.130[b]	1.1 (1.3)	−0.2 (−0.3, 0.0)	**0.036**[b]	1.2 (1.3)	−0.1 (−0.25, 0.06)	0.237[b]
DBI: mean (SD)	0.85 (0.74)	0.82 (0.67)	−0.03 (−0.10, 0.04)	0.415[b]	0.83 (0.70)	−0.02 (−0.1, 0.05)	0.597[b]	0.89 (0.68)	0.05 (−0.03, 0.11)	0.234[b]

Note: Bold values are statistically significant.
[a]For the outcome of the STOPP criteria, the estimators are the risk ratios from a generalized mixed Poisson model. For the remaining variables, the estimators are the betas of the linear mixed model.
[b]From linear mixed model.
[c]From generalized mixed Poisson model.

TABLE 3 | Variability in STOPP medication after the initial consultation categorized by ATC classification ($n = 104$).

ATC classification	Baseline (pre-consutlation) *n* (%)	Post-consultation *n* (%)	STOPP medication withdrawn *n* (%from total withdrawn)	STOPP medication added *n* (%from total added)	Difference before/after consultation
N05B (Anxiolytics)	31 (24.6%)	31 (30.1%)	2 (6.7%)	2 (28.6%)	0
N05C (Hypnotics and sedatives)	20 (15.9%)	15 (14.6%)	5 (16.7%)	0 (0.0%)	−5
N02A (Opioids)	18 (14.3%)	13 (12.6%)	6 (20.0%)	1 (14.3%)	−5
N05A (Antipsychotics)	18 (14.3%)	13 (12.6%)	7 (23.3%)	2 (28.6%)	−5
N03A (Antiepileptics)	7 (5.6%)	6 (5.8%)	1 (3.3%)	0 (0.0%)	−1
N06A (Antidepressants)	6 (4.8%)	4 (3.9%)	2 (6.7%)	0 (0.0%)	−2
B03A (Iron preparations)	5 (4.0%)	5 (4.9%)	1 (3.3%)	1 (14.3%)	0
C01A (Cardiac glycosides)	3 (2.4%)	3 (2.9%)	0 (0.0%)	0 (0.0%)	0
N02B (Other analgesics and antipyretics)	3 (2.4%)	1 (1.0%)	1 (3.3%)	0 (0.0%)	−1
M01A (Anti-inflammatory and antirheumatic products, non-steroids)	2 (1.6%)	1 (1.0%)	1 (3.3%)	0 (0.0%)	−1
B03B (Vitamin B12 and folic acid)	2 (1.6%)	2 (1.9%)	0 (0.0%)	0 (0.0%)	0
A10B (Blood glucose lowering drugs, excl. insulins)	1 (0.8%)	0 (0.0%)	1 (3.3%)	0 (0.0%)	−1
C09A (ACE inhibitors, plain)	1 (0.8%)	0 (0.0%)	1 (3.3%)	0 (0.0%)	−1
H02A (Corticosteroids for systemic use, plain)	1 (0.8%)	0 (0.0%)	1 (3.3%)	0 (0.0%)	−1
M01B (Anti-inflammatory/antirheumatic agents in combination)	1 (0.8%)	0 (0.0%)	1 (3.3%)	0 (0.0%)	−1
B01A (Antithrombotic agents)	1 (0.8%)	1 (1.0%)	0 (0.0%)	0 (0.0%)	0
C03D (aldosterone antagonists and other potassium-sparing agents)	1 (0.8%)	0 (0.0%)	1 (3.3%)	0 (0.0%)	1
G04C (drugs used in benign prostatic hypertrophy)	1 (0.8%)	1 (1.0%)	0	0	0
M05B (drugs affecting bone structure and mineralization)	1 (0.8%)	1 (1.0%)	0	0	0
N04B (dopaminergic agents)	1 (0.8%)	1 (1.0%)	0	0	0
N06D (anti-dementia drugs)	1 (0.8%)	2 (1.9%)	0	1 (11.1%)	+1
S01G (decongestants and antiallergics)	1 (0.8%)	1 (1.0%)	0	0	0

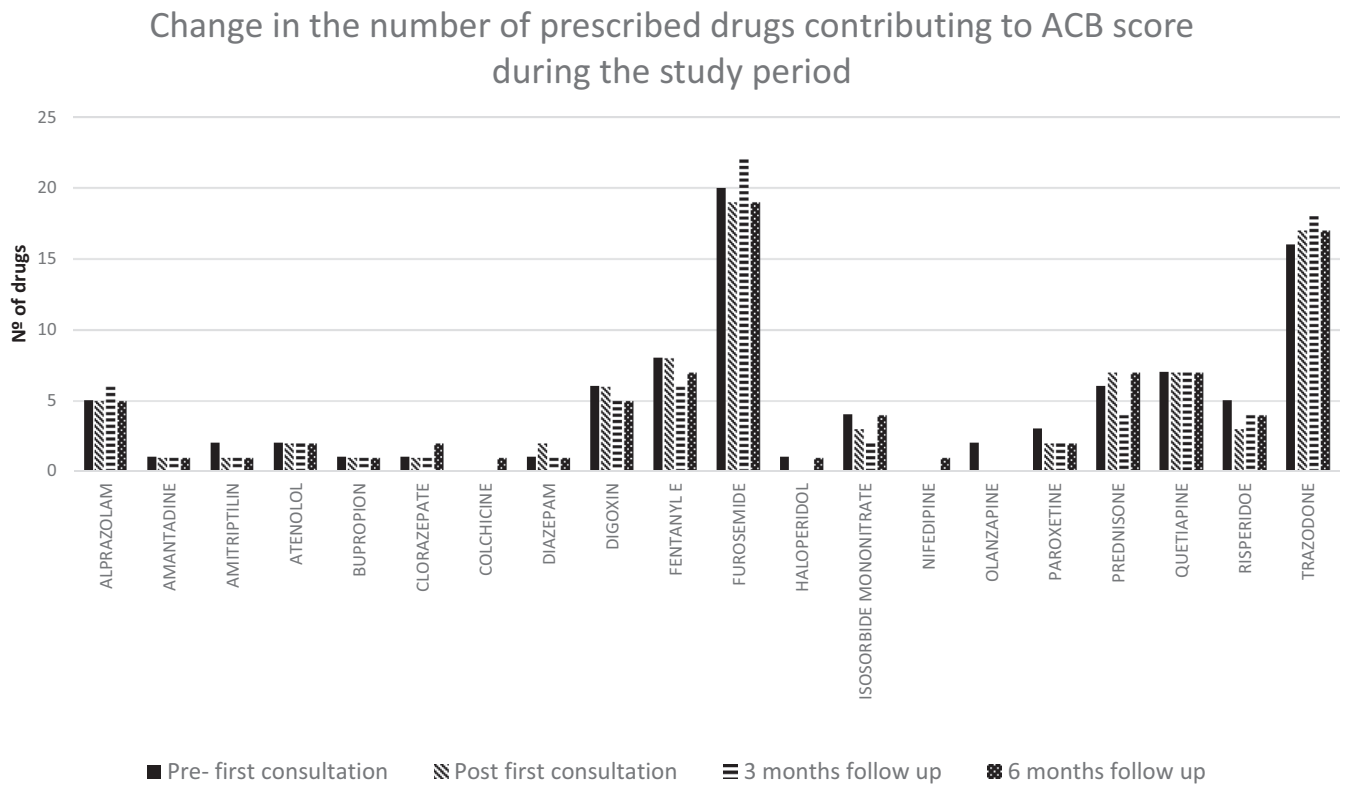

FIGURE 3 | Change in the number of prescribed drugs contributing to ACB score during the study period.

polypharmacy and comorbidities, potentially decreasing primary care and emergency department visits, indicating a positive impact on healthcare utilization.

However, this study had limitations, including the absence of a control group and blinding, which limits causal conclusions and may introduce bias. The pharmacist's involvement was limited to the initial consultation without further follow-up. Further research is needed to explore polypharmacy mechanisms and clinical impact and to identify biomarkers for the early detection of polypharmacy-related complications.

5 | Conclusion

This study on the impact of a specialized outpatient clinic for managing polypharmacy in older adults demonstrated significant detection of DRPs and effective targeted recommendations. These interventions led to reductions in medications, active ingredients, and potentially inappropriate medications (STOPP criteria), along with a modest short-term reduction in the anticholinergic burden. Sustaining these improvements requires ongoing monitoring for their long-term effectiveness.

These results highlight the value of a multidisciplinary approach in addressing the complexities of polypharmacy. Proactive collaborative strategies are essential for optimizing medication regimens, minimizing risks, and improving healthcare outcomes for older adults. Ongoing efforts are needed to maintain these benefits and to explore broader implications for healthcare systems and policies.

Author Contributions

Victoria Roncal-Belzunce: conceptualization, methodology, validation, formal analysis, investigation, data curation, writing – original draft, writing – review and editing, visualization, project administration. **Marta Gutiérrez-Valencia:** conceptualization, methodology, writing – original draft, writing – review and editing, visualization. **Bernardo Abel Cedeño-Veloz:** conceptualization, investigation, validation, supervision. **Ramón San Miguel:** conceptualization, investigation, methodology, validation. **Itxaso Marín-Epelde:** conceptualization, investigation, validation. **Arkaitz Galbete:** methodology, formal analysis, data curation, writing – original draft. **Javier Preciado Goldaracena:** investigation, data curation. **María Irache Ezpeleta:** investigation, data curation. **Karmele Garaioa-Aramburu:** investigation, data curation. **Nicolás Martínez-Velilla:** conceptualization, methodology, validation, formal analysis, data curation, writing – review and editing, visualization, supervision, project administration. All authors reviewed, read, and approved the final manuscript prior to submission.

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The authors have nothing to report.

Ethics Statement

This study followed the principles of the Declaration of Helsinki and was approved by the Clinical Research Ethics Committee (EO_2021/16) of the University Hospital of Navarre.

Consent

All patients or their legal representatives provided written informed consent.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available. However, they can be obtained from the corresponding author upon reasonable request.

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