ORIGINAL ARTICLE
DOI: 10.4274/tjps.galenos.2023.36080

Pharmacist Impact on Medication Adherence and Drug-Related Problems in Patients with Epilepsy

Short Title: Pharmacist Role in Treatment of Epilepsy

Esra Özdağ[1], Oğuzhan Fırat[2], Aysel Çoban Taşkın[3], Irem Fatma Uludag[3], Ufuk Sener[3], Kutay Demirkan[2]
[1]İzmir Tepecik Training and Research Hospital, University of Health Sciences, İzmir, Turkey
[2]Department of Clinical Pharmacy, Hacettepe University, Faculty of Pharmacy, Ankara, Turkey
[3]Department of Neurology, İzmir Tepecik Training and Research Hospital, University of Health Sciences, İzmir, Turkey

Corresponding Author Information
Oğuzhan Fırat
ogzhnfrt@gmail.com
+905414894206
https://orcid.org/0000-0002-8726-8530
07.10.2022
08.01.2023
10.01.2023

ABSTRACT
Objectives: Drug-related problems (DRPs) and non-adherence are important barriers to ensuring optimal antiseizure drug treatment. The aim was to improve medication adherence, detect and manage DRPs and decrease the number of seizures with pharmacist-led education in patients with epilepsy.
Material and Methods: A prospective and interventional study was conducted in collaboration with the department of neurology the rational drug usage unit of hospital pharmacy in a university hospital. The impact of pharmacist-led education on medication adherence and interventions in the management of DRPs was assessed in patients with epilepsy who were admitted to the outpatient clinic. A total of 39 patients with epilepsy were evaluated in terms of medication adherence, DRPs and seizure control over two months follow-up period and patient satisfaction with pharmacy services at the end of the study.
Results: A total of 59 DRPs were detected and 71.2% of them were accepted and implemented both by physicians and/or patients and, pharmacist interventions solved 62.7% of DRPs. The number of patients with high-level medication adherence significantly increased from 17 to 28 by pharmacist-led education ($p<0.001$). The number of seizures decreased in 19 patients (48.7%) during the 2 months period. Patient satisfaction was high in all patients.
Conclusion: It is shown that the contribution of the pharmacist, in the treatment of patients with epilepsy, is beneficial in the improvement of medication adherence, detection and management of DRPs and decrease in the number of seizures.
Keywords: drug-related problems, epilepsy, medication adherence, patient education, pharmacist

Introduction

Epilepsy, one of the most common neurological illnesses worldwide and with neurobiological, cognitive, psychological and social consequences, is a chronic neurological disorder characterized by recurrent and unprovoked seizures that frequently begin in childhood or adolescence.[1,2] Therefore, epilepsy may lead to an increase in morbidity and restriction of daily activities and occupational abilities.[3] The lack of seizure control has unfavorable outcomes such as falls, injury, increased admission rate in physician office hospitalization, loss of work and increase in healthcare cost.[4]

Antiseizure drugs (ASMs) are the principal treatment options to control or prevent seizures for patients with epilepsy.[5] Although appropriate use of ASMs reduces the frequency of seizures by approximately 67%, epilepsy can remain unrestrained in some patients.[5,6] In 70-80% of patients with new-onset epilepsy, however, seizures can be entirely controlled with appropriate ASMs choice and medication adherence.[1] Medication adherence refers to the extent to which the recommendations given by a healthcare professional are followed by the patient. Ensuring medication adherence is important in terms of contributing to the drug selection of patients and strengthening the relationship between the healthcare provider and the patient.[7] Drug-specific adherence

problems in patients with epilepsy are considered the high frequency of ASMs, polytherapy and ASMs specific problems such as adverse events ad low efficacy.[8] Additionally, ASMs have serious adverse effects which may lead to discontinuation of drug therapy, non-adherence and a negative impact on the quality of life of patients with epilepsy. Therefore, optimization of treatment has to ensure the aspect of safety and efficacy of ASMs.[9] Another concern is comorbidities and co-medications with ASMs which may enhance the frequency of drug-related problems (DRPs) and drug-drug interactions that may lead to loss of seizure control, adverse effects and toxicity.[10] Clinical pharmacists have many significant roles in this patient group, such as therapeutic drug monitoring, interpretation of laboratory tests, determination of drug-drug interactions and adverse effects of medications, dosage adjustment, and patient education regarding medications and diseases.[11] A systematic review emphasized that clinical pharmacists may have a positive impact on medication adherence, patients' knowledge regarding medications and disease, and the quality of life of patients with epilepsy.[12] In a study, it was revealed that adherence improvement education and motivational interviews provided by the pharmacist reduced the number of seizures and improved ASM knowledge in patients with epilepsy[13].

Drug-related problems contribute to non-adherence or low adherence rates by inappropriate medication use and adverse effects[14]. Since medication adherence is essential to ensure the control of seizures and prevent treatment failure, as a strategy to improve medication adherence, pharmacist-led educational interventions may be beneficial in the management of epilepsy. In this study, we aimed to detect and manage DRPs, reduce the number of seizures and, improve medication adherence through pharmacist-led education in patients with epilepsy.

Material and Methods

Study Design

This study was an interventional, pre-post, collaborative and prospective study with 2 months a 2-month patient follow-up period.

Study Settings

This study was conducted at Health Sciences University İzmir Tepecik Education and Research Hospital between April 15 and October 31, 2019, in Türkiye. The hospital has a rational drug usage unit that belongs to the hospital pharmacy. This study was conducted in collaboration with the rational drug usage unit and the department of neurology.

Study Population

All patients over 18 years old with epilepsy that able to communicate, use more than 4 medications and are willing to sign an informed consent form were involved in the study. Patients who have cognitive impairment (such as dementia, Alzheimer's disease), speech disorder, patients with pregnancy and decline to participate in our study were excluded.

Routinely, patients admitted to the neurology outpatient clinic are received epilepsy care by the physician. Following the physician-patient interview, patients who meet the inclusion criteria are directed to the rational drug use unit by the physician. Within the scope of this study, detection and solution of DRPs and education on disease, medication, and lifestyle changes were provided to patients by the pharmacist in the rational drug unit.

Data Collection

During the first interview, the patient's demographics, routine medications, herbal medications, comorbidities, the number of ASMs, number of seizures were recorded in patient follow-up forms from the hospital information system database and from patients through a face-to-face interview. To determine drug-related problems (DRPs), Pharmaceutical Care Network Europe (PCNE 8.01) classification was performed by the pharmacist. The pharmacist reported the interventions to the physician in order to resolve the identified DRPs. Additionally, we used to assess medication adherence Morisky-Green-Levine Scale (MGLS). After two months, when patients visit their physicians for routine follow-up, the second patient-pharmacist interview was conducted. During the second interview, MGLS and the Patient Satisfaction with Pharmacist Services Questionnaire (PSPSQ 2.0) were applied and the number of seizures within those two months was recorded.

Tools

In the first pharmacist-patient interview, the pharmacist applied the MGLS to assess the medication adherence level. The self-reporting medication adherence scales have many advantages such as being cost-effective, brief, patient-centered and having good psychometric properties. Developed by Donald E. Morisky and validated by Morisky, Green and Levine, self-reporting MGLS which consists of 4 'yes' (0 point) and 'no' (1 point) questions are used to evaluate the medication adherence of patients with chronic diseases. The medication adherence level of patients was determined as low (0 point), medium (1-2 points) and high (3-4 points). The validity of the MGLS was validated and translated into Turkish by Yilmaz in 2004.[15]

The PCNE classification is an instrument that is periodically updated and widely used for the classification of DRPs. In our study, PCNE was used to classify pharmacist identified DRPs and their causes, interventions, and outcomes. The PCNE version 8.01 consists of 5 main domains (P: Problems; C: Causes; I: Planned intervention; A: Acceptance; O: Status of acceptance). [16]

Developed by Shakarkar et al. PSPSQ 2.0 is an instrument evaluating the satisfaction of patients with chronic diseases in pharmaceutical services.[17] PSPSQ comprises 22 questions and each question are scored on a 4-point Likert scale strongly agree, agree, disagree, and strongly disagree) ranges from 1 to 4 points. Additionally, three sub-dimensions (quality of care, patient-pharmacist relationship, and overall satisfaction) are involved in PSPSQ. The study of validation and translation into Turkish was conducted by Okuyan et.al. The translated form of PSPSQ consists of 20 questions excluding the 5th and 19th questions.[18]

Interventions

Pharmacist-led education service was provided to patients during the face-to-face pharmacist-patient interview. The educational interventions were determined by the physician and pharmacist. Educational interventions aim to increase medication adherence. In this context, following to determining the patient's medication usage pattern, the importance of medication adherence, non-adherence and its leading to problems was learning objectives. To identify drug-related problems, we used patient information and hospital information database notes. The pharmacist asked questions about prescribed or over-the-counter medicines, herbal drugs, and adverse effects during the patient-pharmacist interview. Additionally, drug interaction assessment was checked by using web tools. If the pharmacist determined a DRP, then it was classified according to PCNE. Following this process, pharmacist interventions were proposed to physician or patients. While for the interventions at the prescriber level, the acceptance rate of interventions and status of DRPs were assessed in the first interview, for the interventions at the patient level, the acceptance rate and status of DRPs were assessed in the second interview.

Statistical Analysis

The quantitative variables were described by using means, standard deviations (SD), medians (minimum-maximum), and frequencies (percentage) were detailed for categorical variables. The Wilcoxon test was used to evaluate the differences in DRPs rate before and after pharmacist-led education. The significance level was defined as $p<0.05$. The SPSS program version 25.0 was used to perform all statistical analyses (IBM Corporation, New York, USA).

Ethical Approve

The study was approved by Tepecik Education and Research Hospital non-interventional research ethic committee (No: 2019/6-10).

Results

The data from a total of 39 patients with epilepsy (56.4% male) ensuring inclusion criteria were analyzed in this study. During the study period, 78 interviews were conducted by the pharmacist. The mean (± SD) age of patients was found 43.6 ± 12.6 years. Most of the patients stated no alcohol consumption, no herbal supplement or non-prescription medication use and ability to manage self-care (89.7%, 76.9% and 79.5%, respectively). The most common comorbidities were reported as major depression (25.6%), hypertension (18%) and hypothyroidism (10.3 %). The mean number of drugs per patient was 5.5 ± 1.1 and the mean number of ASMs was 2.7 ± 1.0. Additionally, the most used ASMs were reported as sodium valproate (71.1%), carbamazepine (56.4%), levetiracetam (38.6%) and lamotrigine (38.6%). The clinical characteristics of patients are shown in Table 1.

Medication adherence was found moderate level in 21 patients (53.9%) at the baseline and, a significant increase in medication adherence was observed after pharmacist led-education and the number of patients with high-level medication adherence was increased from 17 to 28 ($p<0.001$) (Table 2). When the influence of education level on medication adherence was evaluated, the number of patients with high-level medication adherence increased after education both in primary school (from 6 patients to 17 patients) and high school (from 9 patients to 11 patients) graduates ($p<0.001$).

The number of seizures decreased in 19 patients (48.7%), increased in 3 patients (7.7%) and, not changed in 17 patients (43.6%) during the 2 months periods before and after pharmacist led-education. All patients were satisfied with the pharmacist service (PSPSQ 2.0; disagree 0%, strongly disagree 0%). Higher satisfaction among patients was detected according to each part of PSPSQ 2.0, (quality of care, patient-pharmacist relationship, overall satisfaction) at the end of the study (Table 3).

A total of 59 DRPs (1.5 DRPs per patient) were detected over the study period (Table 4.). The majority of DRPs were associated with treatment safety based on adverse drug reactions of ASMs. Patient-related DRPs causes were associated with inappropriate drug use. The majority of pharmacist interventions were at the patient level such as patient counseling, especially on drug use (62.7%). Most of the interventions (71.2%) were accepted and implemented by both physicians and patients and 62.7% of DRPs were completely solved via pharmacist interventions.

Discussion

The fundamental components of epilepsy therapy are seizure control and minimizing DRPs. The emergence of DRPs in routine practice, on the other hand, is an unavoidable undesirable circumstance. Furthermore, DRPs contribute to lower medication adherence, quality of life, and treatment satisfaction. In this study, DRPs and

impact of pharmacist-led education on medication adherence rate was assessed in 39 patients with epilepsy. We found that the education provided by pharmacist positively affected medication adherence rate as well as solved the vast majority of DRPs.

Medication adherence requires ensuring optimal pharmacotherapy, to prevent treatment failures in patients with epilepsy. Besides, pharmacists have a key role to ensure medication adherence through educational methods and pharmaceutical care. The baseline ASMs adherence rate was found 43.6% which is slightly lower than other studies in Ethiopia (55.7%) and in China (51.9%).[10,17] Patient characteristics (cultural, socio-demographic and education levels, etc.), study methods and tools used to measure medication adherence might be caused this discrepancy. Medication adherence can be assessed in a variety of ways, including pill counting, therapeutic drug monitoring, and electronic tools, even though there is no gold standard. In our study, medication adherence was measured using a self-report tool, but the use of an additional method to assess medication adherence could have supported the results.

Many studies show the positive impact of pharmacists on medication adherence in the literature. Consisting of previous studies, our study showed that medication adherence was positively affected by pharmacist-provided educational interventions.[13] Besides, the differences in education level among patients with epilepsy may have influenced the difference in the effect of pharmacist-led education on medication adherence. Similar to our findings, higher medication adherence was detected in patients with higher educational levels compared to patients with lower educational levels in a recent study.[7] Therefore, in particular high educational status patients, pharmacist-led educational interventions may be more beneficial to improve medication adherence. Ensuring optimal medication adherence may have an important role in reducing the frequency of seizures. A positive correlation between poor medication adherence and an increased number of seizures was found in recent studies.[3,20] Similar to the literature, the frequency of seizures was also decreased in our study due to increased medication adherence with pharmacist-led education.

DRPs are an obstacle to ensuring optimal drug therapy and high medication adherence and preventing seizures. The detection and solution of DRPs have an important role to manage the treatment appropriately. In our study, it was found that DRPs per patient were 1.5 on treatment effectiveness. In a study, it was found that the DRP of patients admitted to rheumatology and internal diseases outpatient clinic was 2.4 per patient and 63% of DRPs were clinically significant.[21] This discrepancy may be explained by more drugs used in rheumatology and internal disease, the high number of patients and the high incidence of possible drug-drug interactions. Additionally, solutions of DRPs must be conducted together with patients and health care professionals. Results from our study, the vast majority of DRPs were solved by pharmacist intervention as consistent with a study.[22]

The safety of ASMs has a key role to maintain treatment and preventing problems of other existing comorbidities. In a study, optimal ASM treatment of patients with epilepsy at a nursing home was challenged by adverse effects and drug-drug interactions.[23] Findings from our study, treatment safety (possible adverse effects) and treatment effectiveness problems were found as major problems. Drug-drug interactions were not clinically significant, and this may be explained by the existence of relatively young patients and the low incidence of polypharmacy in our study. The major cause of detected DRPs was patient-related problems (inappropriate drug use by patients) and therefore, the planned intervention was provided at the patient level in our study. Besides, the pharmacist's interventions and recommendations regarding the management of DRPs are highly accepted by physicians. In our study, most of the interventions were at the patient level but as consistent with other studies intervention at the prescriber level was highly accepted and applied.[21,24]

Patient satisfaction with pharmacy services may be positively affected by pharmacist led-education and in patients with chronic diseases such as epilepsy. Similar to our findings, the satisfaction of patients with chronic disease was found high in other studies as well.[18] Besides, in a brief communication, it was shown that patient satisfaction was improved by ensuring high medication adherence in patients with epilepsy[25].

Study Limitations

This study has some limitations. The number of patients was limited due to the short study period and the distance between locations of the neurology department and rational drug usage unit. In addition, due to the involvement of younger patients, fewer comorbidities and less drug use, the determination of DRPs was also limited.

Conclusion

In conclusion, the pharmacist in the multidisciplinary team has key roles such as ensuring medication adherence, detection and management of DRPs and contributing to optimal treatment during the follow-up period of patients with epilepsy. Due to high patient satisfaction and improved medication adherence, pharmacist-led education plays an important role to ensure optimum therapy.

Acknowledgment

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. Shawahna R, Atrash A, Jebril A, Khalaf A, Shaheen E, Tahboosh H. Pharmacists' knowledge of issues in pharmacotherapy of epilepsy using antiseizure drugs: a cross-sectional study in Palestinian pharmacy practice. Epilepsy & Behavior. 2017;67:39-44.
2. AlAjmi R, Al-Aqeel S, Baz S. The impact of a pharmacist-led educational interview on medication adherence of Saudi patients with epilepsy. Patient Preference and Adherence. 2017;11:959.
3. Gabr WM, Shams ME. Adherence to medication among outpatient adolescents with epilepsy. Saudi Pharmaceutical Journal. 2015;23(1):33-40.
4. Hovinga CA, Asato MR, Manjunath R, Wheless JW, Phelps SJ, Sheth RD, et al. Association of non-adherence to antiseizure drugs and seizures, quality of life, and productivity: survey of patients with epilepsy and physicians. Epilepsy & Behavior. 2008;13(2):316-22.
5. Ernawati I, Wardah Rahmatul Islamiyah S. How to improve clinical outcome of epileptic seizure control based on medication adherence? A literature review. Macedonian journal of medical sciences. 2018;6(6):1174.
6. Niriayo YL, Mamo A, Gidey K, Demoz GT. Medication belief and adherence among patients with epilepsy. Behavioural Neurology. 2019; 2019:2806341.
7. Gurumurthy R, Chanda K, Sarma G. An evaluation of factors affecting adherence to antiseizure drugs in patients with epilepsy: a cross-sectional study. Singapore Medical Journal. 2017;58(2):98.
8. Malek N, Heath CA, Greene J. A review of medication adherence in people with epilepsy. Acta Neurologica Scandinavica. 2017;135(5):507-15.
9. Baftiu A, Lima MH, Svendsen K, Larsson PG, Johannessen SI, Landmark CJ. Safety aspects of antiseizure drugs—a population-based study of adverse effects relative to changes in utilisation. European Journal of Clinical Pharmacology. 2019;75(8):1153-60.
10. Nasir BB, Berha AB, Gebrewold MA, Yifru YM, Engidawork E, Woldu MA. Drug therapy problems and treatment satisfaction among ambulatory patients with epilepsy in a specialized hospital in Ethiopia. PloS One. 2020;15(1):e0227359.
11. Shawahna R. Development of key performance indicators to capture in measuring the impact of pharmacists in caring for patients with epilepsy in primary healthcare: a Delphi consensual study. Epilepsy & Behavior. 2019;98:129-38.
12. Reis TM, Campos M, Nagai MM, Pereira L. Contributions of pharmacists in the treatment of epilepsy: a systematic review. American Journal of Pharmacy Benefits. 2016;8(3):e55-e60.
13. Tang, F., Zhu, G., Jiao, Z., Ma, C., Chen, N., & Wang, B. (2014). The effects of medication education and behavioral intervention on Chinese patients with epilepsy. Epilepsy & Behavior, 37, 157-164.
14. Mroueh, L., Al-Hajje, A., Salameh, P., Preux, P. M., Boumediene, F., Ratsimbazafy, V., & Jost, J. (2022). Management of epilepsy in Lebanon: Medication reviews and drug-related problems. Pharmacoepidemiology and Drug Safety, 31(5), 583-591.
15. Yilmaz S, Buzlu S. Side effects of medications and adherence to medication in patients using antipsychotics. Florence Nightingale Journal of Nursing. 2012;20:93-103.
16. Pharmaceutical Care Network Europe. 2018 [Available from: https://www.pcne.org/upload/files/215_PCNE_classification_V8-01.pdf.
17. Sakharkar P, Bounthavong M, Hirsch JD, Morello CM, Chen TC, Law AV. Development and validation of PSPSQ 2.0 measuring patient satisfaction with pharmacist services. Research in Social and Administrative Pharmacy. 2015;11(4):487-98.
18. Okuyan B, Hucum H, Sancar M, Ay P, Izzettin FV. Turkish Validation of Patient Satisfaction Towards Patient Oriented Pharmacy Services Questionnaire in Patients with Chronic Disease . Clinical and Experimental Health Sciences. 2016;6(4):150-4.
19. Liu J, Liu Z, Ding H, Yang X. Adherence to treatment and influencing factors in a sample of Chinese epilepsy patients. Epileptic Disorders. 2013;15(3):289-94.
20. Jones R, Butler J, Thomas V, Peveler R, Prevett M. Adherence to treatment in patients with epilepsy: associations with seizure control and illness beliefs. Seizure. 2006;15(7):504-8.
21. Viktil KK, Blix HS, Moger TA, Reikvam A. Polypharmacy as commonly defined is an indicator of limited value in the assessment of drug-related problems. British Journal of Clinical Pharmacology. 2007;63(2):187-95.
22. Smith CP, Christensen DB. Identification and clarification of drug therapy problems by Indian Health Service pharmacists. Annals of Pharmacotherapy. 1996;30(2):119-24.
23. Midlöv P, Bondesson Å, Eriksson T, Petersson J, Minthon L, Höglund P. Descriptive study and pharmacotherapeutic intervention in patients with epilepsy or Parkinson's disease at nursing homes in southern Sweden. European Journal of Clinical Pharmacology. 2002;57(12):903-10.

24. Blix HS, Viktil KK, Reikvam Å, Moger TA, Hjemaas BJ, Pretsch P, et al. The majority of hospitalised patients have drug-related problems: results from a prospective study in general hospitals. European Journal of Clinical Pharmacology. 2004;60(9):651-8.
25. Sweileh WM, Ihbesheh MS, Jarar IS, Taha ASA, Sawalha AF, Sa'ed HZ, et al. Self-reported medication adherence and treatment satisfaction in patients with epilepsy. Epilepsy & Behavior. 2011;21(3):301-5.

Table 1. Clinical characteristics of patients (n=39)

	n (%)
Gender	
Women	17 (43.6)
Men	22 (56.4)
Education	
Illiterate	4 (10.3)
Primary School	23 (59.0)
High School	12 (30.8)
Comorbidity	
No comorbidity	17 (43.5)
1	18 (46.2)
2	4 (10.3)
The number of antiseizure drugs	
1	5 (12.8)
2	9 (23.1)
3	18 (46.2)
4	5 (12.8)
5	2 (5.1)

Table 2. The medication adherence level according to MGLS before and after education (n=39)

	Before Education	**After Education**	
Medication adherence, MGLS	**n (%)**	**n (%)**	**p**
Low	1 (2.6)	1 (2.6)	<0.001
Moderate	21 (53.9)	10 (25.6)	
High	17 (43.6)	28 (71.8)	

MGLS: Morisky-Green-Levine Scale; Statistical analysis: Wilcoxon

Table 3. Pharmacist services satisfaction of patients according to PSPSQ 2.0 (n=39)

	Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**
	n (%)			
Quality of Care	11 (28.6%)	28 (71.4%)	0 (0%)	0 (0%)
Patient-Pharmacist Relationship	17 (44.5%)	22 (55.5%)	0 (0%)	0 (0%)
Overall Satisfaction	33 (85.5%)	6 (14.5%)	0 (0%)	0 (0%)

PSPSQ 2.0: Patient Satisfaction with Pharmacist Services Questionnaire - version 2.0

Table 4. DRPs according to PCNE 8.01 classification (n=59)

Domains			
Problems (P)	**Code**	**Definitions**	**n (%)**
Treatment effectiveness	P1.2	Effect of drug treatment not optimal	12 (20.3)
	P1.3	Untreated symptoms or indication	8 (13.6)
Treatment safety	P2.1	Adverse drug event (possibly) occurring	31 (52.5)
Others	P3.2	Unnecessary drug-treatment	5 (8.5)
	P3.3	Unclear problem/complaint	3 (5.1)
Causes (C)	**Code**	**Definitions**	**n (%)**
Drug selection	C1.4	Inappropriate combination of drugs or drugs and herbal medication	3 (5.1)
Dispensing	C5.1	Prescribed drug not available	2 (3.4)
	C5.2	Necessary information not provided	1 (1.7)
Drug use process	C6.1	Inappropriate timing of administration and/or dosing intervals	7 (11.9)
	C6.2	Drug under-administered	1 (1.7)
Patient related	C7.1	Patient uses/takes less drug than prescribed or does not take the drug at all	8 (13.6
	C7.2	Patient uses/takes more drug than prescribed	1 (1.7)
	C7.4	Patient uses unnecessary drug	4 (6.8)
	C7.5	Patient takes food that interacts	4 (6.8)
	C7.7	Inappropriate timing or dosing intervals	1 (1.7)
	C7.8	Patient administers/uses the drug in a wrong way	22 (37.3)
	C7.9	Patient unable to use drug/form as directed	3 (5.1)
Other	C8.1	No or inappropriate outcome monitoring	2 (3.4)
Planned Interventions	**Code**	**Definitions**	**n (%)**
At Prescriber Level	I1.3	Intervention proposed to prescriber	2 (3.4)
	I1.4	Intervention discussed with prescriber	13 (22.0)
At Patient Level	I2.1	Patient (drug) counselling	37 (62.7)
	I2.4	Spoken to family member/caregiver	1 (1.7)
At Drug Level	I3.4	Instructions for use changed to ...	4 (6.8)
	I3.5	Drug stopped	1 (1.7)
Other intervention or activity	I4.1	Other intervention (specify)	1 (1.7)
Intervention Acceptance	**Code**	**Definitions**	**n (%)**
Intervention accepted (by prescriber or patient)	A1.1	Intervention accepted and fully implemented	42 (71.2)
	A1.2	Intervention accepted, partially implemented	11 (18.6)
	A1.3	Intervention accepted but not implemented	4 (6.8)
	A1.4	Intervention accepted, implementation unknown	1 (1.7)
Other (no information on acceptance	A3.1	Intervention proposed, acceptance unknown	1 (1.7)
Status of the DRP	**Code**	**Definitons**	**n (%)**
Not known	O0.1	Problem status unknown	3 (5.1)
Solved	O1.1	Problem totally solved	37 (62.7)
Partially solved	O2.1	Problem partially solved	14 (23.7)
Not solved	O3.1	Problem not solved, lack of cooperation of patient	5 (8.5)

DRPs: drug-related problems, PCNE 8.01: Pharmaceutical Care Network Europe - version 8.01

Morisky-Green-Levine Scale

	Yes	No
Do you ever forget to take your medicine?		
Are you careless at times about taking time your medicine?		
When you feel better do you sometimes stop taking your medicine?		
Sometimes if you feel worse when you take the medicine, do you stop taking it?		

Pharmaceutical Care Network Europe- version 8.01

Domains		
Problems (P)	**Code**	**Definitions**
Treatment effectiveness	P1.2	Effect of drug treatment not optimal
	P1.3	Untreated symptoms or indication
Treatment safety	P2.1	Adverse drug event (possibly) occurring
Others	P3.2	Unnecessary drug-treatment
	P3.3	Unclear problem/complaint
Causes (C)	**Code**	**Definitions**
Drug selection	C1.4	Inappropriate combination of drugs or drugs and herbal medication
Dispensing	C5.1	Prescribed drug not available
	C5.2	Necessary information not provided
Drug use process	C6.1	Inappropriate timing of administration and/or dosing intervals
	C6.2	Drug under-administered
Patient related	C7.1	Patient uses/takes less drug than prescribed or does not take the drug at all
	C7.2	Patient uses/takes more drug than prescribed
	C7.4	Patient uses unnecessary drug
	C7.5	Patient takes food that interacts
	C7.7	Inappropriate timing or dosing intervals
	C7.8	Patient administers/uses the drug in a wrong way
	C7.9	Patient unable to use drug/form as directed
Other	C8.1	No or inappropriate outcome monitoring
Planned Interventions	**Code**	**Definitions**
At Prescriber Level	I1.3	Intervention proposed to prescriber
	I1.4	Intervention discussed with prescriber
At Patient Level	I2.1	Patient (drug) counselling
	I2.4	Spoken to family member/caregiver
At Drug Level	I3.4	Instructions for use changed to ...
	I3.5	Drug stopped
Other intervention or activity	I4.1	Other intervention (specify)
Intervention Acceptance	**Code**	**Definitions**
Intervention accepted (by prescriber or patient)	A1.1	Intervention accepted and fully implemented

	A1.2	Intervention accepted, partially implemented
	A1.3	Intervention accepted but not implemented
	A1.4	Intervention accepted, implementation unknown
Other (no information on acceptance	A3.1	Intervention proposed, acceptance unknown
Status of the DRP	**Code**	**Definitons**
Not known	O0.1	Problem status unknown
Solved	O1.1	Problem totally solved
Partially solved	O2.1	Problem partially solved
Not solved	O3.1	Problem not solved, lack of cooperation of patient