

Medication adherence and persistence in type 2 diabetes mellitus: perspectives of patients, physicians and pharmacists on the Spanish health care system

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Objective: A good relationship between diabetes patients and their health care team is crucial to ensure patients' medication adherence and self-management. To this end, we aimed to identify and compare the views of type 2 diabetes mellitus (T2DM) patients, physicians and pharmacists concerning the factors and strategies that may be associated with, or could improve, medication adherence and persistence.

Methods: An observational, cross-sectional study was conducted using an electronic self-administered questionnaire comprising 11 questions (5-point Likert scale) concerning factors and strategies related to medication adherence. The survey was designed for T2DM patients and Spanish National Health System professionals.

Results: A total of 963 T2DM patients, 998 physicians and 419 pharmacists participated in the study. Overall, a lower proportion of pharmacists considered the proposed factors associated with medication adherence important as compared to patients and physicians. It should be noted that a higher percentage of physicians in comparison to pharmacists perceived that "complexity of medication" (97% vs 76.6%, respectively) and "adverse events" (97.5% vs 72.2%, respectively) were important medication-related factors affecting adherence. In addition, both patients (80.8%) and physicians (80.8%) agreed on the importance of "cost and co-payment" for adherence, whereas only 48.6% of pharmacists considered this factor important. It is also noteworthy that nearly half of patients (43%) agreed that "to adjust medication to activities of daily living" was the best strategy to reduce therapeutic complexity, whereas physicians believed that "reducing the frequency of administration" (47.9%) followed by "reducing the number of tablets" (28.5%) was the most effective strategy to improve patients' adherence.

Conclusion: Our results highlight the need for pharmacists to build a stronger relationship with physicians in order to improve patients monitoring and adherence rates. Additionally, these findings may help to incorporate greater patient-centeredness when developing management strategies, focusing on adjusting medication regimens to patients' daily lives.

Keywords: type 2 diabetes mellitus, adherence, persistence, factors, strategies

Introduction

Diabetes is a highly common metabolic disease whose prevalence worldwide has increased in recent decades.¹ In 2013, its prevalence was estimated at 8.3%, affecting 382 million people;² notably, a further increase to 592 million is expected by 2035.³ The estimated prevalence of type 2 diabetes mellitus (T2DM) in Spain is 13.8%, with approximately 6% of the population being undiagnosed.⁴ Other chronic conditions are

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common among T2DM patients; most adults with diabetes have at least one comorbid chronic disease,⁵ and obesity, dyslipidemia and hypertension^{4,6-8} are the most prevalent.

Diabetes management is mainly aimed at keeping blood glucose levels stable and preventing or delaying development of other medical complications. T2DM patients typically require pharmacotherapy for hyperglycemia control, along with diet and exercise.^{9,10} In addition to this medication, these patients require pharmacologic therapy for the control of other chronic conditions. As a result, diabetic patients need complex medication regimens. In Spain, poorly controlled T2DM patients are highly prevalent (51.4%), and one of the most important factors associated with poor glycemic control is the complexity of the disease and therapy.¹¹

Correct adherence to prescribed medication is crucial for the control of diabetes and related comorbidities.¹² A significant barrier to achieving clinical outcomes, however, is poor medication adherence,^{13,14} which is associated with increased morbidity, mortality, health care expenditure and hospital admissions.^{15,16}

Nonadherence to medication is a critical problem among patients with chronic diseases, and in this regard, adherence rates of 50% have been reported for long-term therapies.¹⁷ Like other chronic conditions, medication adherence in diabetes is considered suboptimal. A recent systematic review found that only a 22.2% of studies reported a good adherence ($\geq 80\%$) among the diabetic population.¹⁸

Several studies have been conducted to understand non-adherence and to identify the determinants associated with it showing that medication adherence is influenced by numerous factors that may be related to patients, medication or environmental issues.^{19,20} Additionally, results have demonstrated that simplifying medication regimens and improving patient's motivation and education could be effective strategies to improve adherence.²¹

Moreover, recent evidence indicates that T2DM patients' involvement in the disease management may improve adherence to therapy.²² Thus, some studies reported that patients increased their engagement and motivation if they perceived their preferences are considered in the development of management strategies, and consequently, medication adherence and clinical outcomes may improve.²³

Different models of health care should be considered in which the patient must play an active role along with health care professionals.²⁴ In this sense, pharmacists contribute significantly to diabetes management by serving as a bridge between patients and physicians and by ensuring the continuing of care which is essential to improve adherence and

achieve clinical outcomes.²⁵ Therefore, a good interaction between patients and a health care team comprising physicians, nurses and pharmacists is critical to achieve disease understanding and thereby improve patients' adherence and self-management.

Nevertheless, it has been recently proved that patients and physicians under the Spanish National Health System (NHS) have different views concerning diabetes medical management.²⁶ In addition to this, there is enough evidence to suggest that patients and health care professionals may have different perceptions of adherence.^{27,28}

Due to these reasons, in order to improve strategies for better adherence to medication, it is necessary to understand the perspective of both patients and health care professionals. To this end, a real-world survey was designed to obtain the views and opinions of patients, physicians and pharmacists and to identify the differences between these three groups related to the factors associated with medication adherence and persistence and the strategies which may improve them from the Spanish NHS perspective.

Research design and methods

The present study involved a cross-sectional, electronic self-administered survey on patients, physicians and pharmacists working in the Spanish Public NHS.

The study protocol was approved by the Clinical Research Ethics Committee of the Hospital Universitario Puerta del Hierro Majadahonda (Madrid, Spain) approval number Acta n° 308, dated March 9, 2015, and written informed consent was obtained from all participants before their inclusion in the study.

Participants

A sample size of 1,036 T2DM patients was calculated based on the general adult population in Spain ($N=38,581,569$)²⁹ and recent data on the prevalence of T2DM patients (13.8%).⁴ In addition, the sample size for physicians ($N=1,005$) and pharmacists ($N=875$) was calculated according to the number of physicians (primary care [PC]: $N=28,498$, endocrinology: $N=879$ and internal medicine: $N=3,357$)³⁰ and pharmacists ($N=18,628$)³¹ practicing in the Spanish NHS. Sample size was estimated by assuming the maximum variability criterion, with a confidence level of 95% and a precision of 4%. Recruitment was conducted from June 2015 to September 2015, until the desired sample size was achieved.

Patients

Adult T2DM patients with at least one comorbidity associated to diabetes such as obesity, hypertension and/or

dyslipidemia and who were able to provide appropriate answers to the survey questions were eligible to participate in the study. Patient selection was conducted with support from the Spanish Diabetes Federation (FEDE: Federación de Diabéticos Españoles).

Members of other societies belonging to the FEDE from 17 autonomous communities were invited to participate.

Physicians

Physicians were eligible to participate if they have been practicing medicine in the Spanish Public NHS for at least 5 years post-training residency. In addition, they had to provide their informed consent.

Pharmacists

To be eligible for participation, the pharmacists had to be managers or employees of a pharmacy for at least 5 years. In addition, they had to provide their informed consent.

Study variables

Sociodemographic variables (age, gender, place of residence) were obtained for all participants.

Education level, employment status and clinical variables such as time since T2DM diagnosis, type and duration of medication and comorbidities (hypertension, dyslipidemia and obesity) and their treatment were recorded exclusively for T2DM patients.

Physicians also reported their medical specialty, area of health care and the estimated number of T2DM patients seen per month. Furthermore, pharmacists reported the pharmacy area and approximate number of T2DM patients attended per month.

A version of the Morisky Medication Adherence Scale (MMAS-4) validated for Spanish population was used to evaluate adherence.³²

Survey design

An ad hoc electronic-based survey consisting of 11 questions was designed for patients, physicians and pharmacists based on the information obtained from a review of the literature. The survey was structured into two parts: 1) factors associated with adherence to and persistence with T2DM medication and 2) strategies to improve T2DM medication adherence and persistence. All questions were scored using a 5-point Likert scale (Table 1). The answers reflected T2DM patients' self-perception in addition to the perception of physicians and pharmacists about their T2DM population. Patients were allowed to answer by phone in case of limited access to internet.

Statistical analysis

A descriptive analysis using SPSS version 19.0 was applied. Categorical variables were described as absolute and relative frequencies, whereas central tendency and dispersion were reported for quantitative variables. The Chi-square test was

Table 1 Ad hoc self-administered survey used in the study

Importance given to:	
Factors associated with adherence and persistence	Patient characteristics
	Patients motivation
	Patients knowledge about medication adherence
	Patients-clinicians shared decision making
	Patients confidence in the effectiveness of medication
	Patients knowledge about medication
	Patients knowledge about disease
	Environmental characteristics of patients
	Patients' place of residence
	A family member or patient's friend has the condition
	Medication administration supervision
	Medication characteristics
	Cost and co-payment
	Complexity of medication container
	Organoleptic characteristics
	Long-term medication
	Complexity of administration
	Adverse events
	Multiple medications
	Disease characteristics
	Coexistence of different diseases (comorbidities)
	Asymptomatic disease
	Absence of disease complications
	Chronic disease
	Health care professional characteristics
	Doctor
	Coordination among physicians and pharmacist
	Easy-to-follow medical instructions
	Physician's motivation
	Physician's attitude
	Doctor-patient relationship
	Nurse
	Accessibility to the health care center
	Coordination among physicians and nurses
	Easy-to-follow nurse instructions
	Nurse's motivation
	Nurse's attitude
	Nurse-patient relationship
	Pharmacist
	Coordination among nurse and pharmacist
	Easy-to-follow pharmacist instructions
	Pharmacist's motivation
	Pharmacist's attitude
	Pharmacist-patient relationship

(Continued)

Table 1 (Continued)

Importance given to:	
Strategies to improve T2DM medication adherence and persistence	Health care professional who provided the information
	Pharmacist
	Nurse
	Physician
	Ways by which information was provided by health care professionals
	Group education
	Home visit (individualized education)
	Audiovisual content
	By email/web
	By phone
	In writing
	Oral
	Complexity of therapeutic regimen
	To reduce complexity of medication regimen
	Ways to reduce the complexity of therapeutic regimen
	Adjust medication regimen to activities of daily living
	Modify route of administration
	Reduce the number of tablets
	Reduce the frequency of administration
	Techniques to improve adherence to medication
	Mobile applications
	Medication schedule
	Reminders over telephone, mail or email
	Pill dispensers (weekly)
	Pill dispensers (daily)
	Tablet counting
	Social support
	Involvement of family and friends

Note: All questions were scored using a 5-point Likert scale.

Abbreviation: T2DM, type 2 diabetes mellitus.

applied to compare the scores distribution obtained for each question between the different groups. For all tests, statistical significance was set at $P < 0.05$. In order to simplify the analysis, a 3-point Likert scale was used instead of a 5-point Likert scale, for which we merged some responses (Not at all important/Somewhat important) and (Important/Very important).

Results

Description of the participants

A total of 963 patients, 998 physicians and 419 pharmacists distributed across 17 Spanish autonomous communities participated in the study and were included in the analysis.

The clinical characteristics of T2DM patients and the sociodemographic characteristics of all participants (patients, physicians and pharmacists) are described in Table 2.

Patients' mean age was 60.4 (standard deviation [SD]: 15.5) years, and approximately half of the study subjects were female (50.1%). Of the total participants, 22% ($n=212$) had

college education, and 43.3% ($n=417$) were retired when the survey was conducted. The mean time since T2DM diagnosis was 11.3 (SD: 8.9) years. All patients were treated with prescribed medication for their diabetes. Mean time from medication start was 10.5 (8.2) years. Of the total, 88.5% ($n=852$) received oral medication, while 27.5% were receiving combined therapy (oral + injectable).

Of the total physicians, 68.8% ($n=687$) were male with a mean age of 52.8 (SD: 7.9) years. Overall, 80.9% ($n=805$) of participants were PC physicians and had been practicing medicine for a median of 26 (range 19–32) years. Participants reported seeing a median of 90 (range 50–150) T2DM patients per month.

Finally, pharmacists' mean age was 43.9 (SD: 9.9) years, and only 28.4% ($n=119$) were male. Participants reported practicing pharmacy for a median of 17 (range 10–25) years, and 45.7% ($n=192$) indicated seeing more than 100 T2DM patients per month.

Adherence and persistence

Morisky–Green questionnaire results showed that more than half of T2DM patients who participated in the study (65.4%; 95% confidence interval [CI]: 62.4–68.4) reported taking their medication correctly. In line with this data, most physicians (86.3%; 95% CI: 84–88.3) and pharmacists (84.6%; 95% CI: 80.8–87.8) believed that more than half of patients adhered to their medication.

Questionnaire scores

Factors associated with adherence to and persistence with T2DM medication

Comparing patients', physicians' and pharmacists' scores, statistically significant differences were found for all the questions evaluated ($P < 0.001$).

Related to patients' characteristics

The relative importance given to different factors related to patient's characteristics which may influence T2DM medication adherence and persistence is shown in Table 3. Overall, both patients and physicians shared the view that patients' characteristics are important factors for medication adherence. However, the proportion of pharmacists who deemed these features important was lower compared to the other groups. As an example, most patients (85.5%) and physicians (84.5%) answered that patient–clinician decision making was an important factor for adherence to medication, while only 47.3% of pharmacists considered this factor important. Interestingly, compared to other groups, a higher percentage

Table 2 Sociodemographic and clinical characteristics of T2DM patients, physicians and pharmacists

Characteristics	T2DM patients (n=963)	Physicians (n=998)	Pharmacists (n=419)
Age, years, mean (SD)	60.4 (15.5)	52.8 (7.9)	43.9 (9.9)
Male, n (%)	481 (49.9)	687 (68.8)	119 (28.4)
Place of residence, n (%)			
Rural (<5,000 inhabitants)	67 (7)	125 (12.5)	19 (4.5)
Semi-urban (5,000–19,999 inhabitants)	187 (19.4)	191 (19.1)	71 (16.9)
Urban (≥20,000 inhabitants)	709 (73.6)	682 (68.3)	329 (78.5)
Educational level, n (%)			
No education	69 (7.2)	–	
Primary school	275 (28.6)		
High school	176 (18.3)		
Job training	151 (15.7)		
College studies (undergraduate)	212 (22)		
College studies (graduate)	80 (8.3)		
Employment status, n (%)			
Worker	282 (29.3)	–	
Freelance	82 (8.5)		
Incapacity	18 (1.9)		
Student	1 (0.1)		
Unemployed	54 (5.6)		
Retired	417 (43.3)		
Housework	94 (9.8)		
Other	15 (1.6)		
Time from diagnosis, years, mean (SD)	11.3 (8.9)	–	
Time duration of T2DM medication, years, mean (SD)	10.5 (8.2)	–	
Oral medication type, n (%)			
Oral	852 (88.5)	–	
Injectable	398 (41.3)		
Combined (oral and injectable)	265 (27.5)		
Comorbidities, n (%)			
Hypertension			
Diagnosis	656 (68.1)		
Pharmacological treatment	585 (89.2)		
Hypercholesterolemia		–	–
Diagnosis	575 (59.7)		
Pharmacological treatment	451 (78.4)		
Hypertriglyceridemia			
Diagnosis	359 (37.3)		
Pharmacological treatment	236 (65.7)		
Obesity			
Diagnosis	354 (36.8)		
Pharmacological treatment	57 (16.1)		
Medical specialty, n (%)			
Primary care	–	805 (80.9)	–
Others*	–	190 (19.1)	–

Notes: *Endocrinology and nutrition: n=59 (6%); internal medicine: n=59 (6%); cardiology: n=47 (4.7%); others: n=25 (2.5%).

Abbreviations: T2DM, type 2 diabetes mellitus; SD, standard deviation.

of physicians (72.3%) perceived that patients' environmental characteristics like "a family member or patient's friend has the condition" were important compared with the patients themselves (55.4%) and pharmacists (53.1%).

Related to medication and disease characteristics

Results showed that in general, physicians gave greater importance to medication and disease features compared

to patients and pharmacists (Table 4). Among these results, it should be noted that a significantly higher percentage of physicians in comparison to pharmacists perceived that "complexity of medication administration" (97% vs 76.6%, respectively) and "adverse events" (97.5% vs 72.2%, respectively) were important medication-related factors affecting adherence. In addition, both patients (80.8%) and physicians (80.8%) agreed on the importance of "cost and co-payment"

Table 3 Importance given to patients' characteristics

Frequency of importance given to factors associated with adherence (%)				
Group	Patient characteristics	Not important	Neither important nor unimportant	Important
Patients		2.8	9.7	87.5
Physicians	Patient motivation	0.6	4.3	95.1
Pharmacists		8.2	15.6	76.3
Patients		3.0	8.9	88.1
Physicians	Patients knowledge about medication adherence	1.6	6.0	92.4
Pharmacists		11.9	13.6	74.5
Patients		2.6	11.9	85.5
Physicians	Patients–clinicians shared decision making	3.3	12.2	84.5
Pharmacists		27.1	25.6	47.3
Patients		1.1	7.3	91.6
Physicians	Patients confidence in the effectiveness of medication	1.1	9.1	89.8
Pharmacists		4.8	16.2	79.0
Patients		1.5	7.2	91.4
Physicians	Patients knowledge about medication	1.9	9.1	89.0
Pharmacists		8.6	18.7	72.7
Patients		1.8	6.0	92.2
Physicians	Patients knowledge about disease	1.1	3.3	95.6
Pharmacists		6.4	15.8	77.8
Environmental characteristics of patients				
Patients		7.6	20.6	71.8
Physicians	Patients' place of residence	3.3	18.0	78.7
Pharmacists		12.6	30.1	57.3
Patients		11.2	33.4	55.4
Physicians	A family member or patient's friend has the condition	4.4	23.2	72.3
Pharmacists		14.4	32.5	53.1
Patients		8.2	18.4	73.4
Physicians	Administration supervision	3.6	15.2	81.2
Pharmacists		5.5	21.7	72.8

Notes: Patients: n=963; physicians: n=998; pharmacists: n=419. $P<0.001$ in all comparisons.

for adherence; nevertheless, only 48.6% of pharmacists considered this factor important. Similarly, most patients and physicians indicated that an “asymptomatic disease” (80.7% and 87%, respectively) and an “absence of disease complications” (80.6% and 80%, respectively) were important disease-related factors for adherence, while only 60% of pharmacists agreed with these statements.

Related to health care professionals' characteristics

Table 5 reports the relative importance placed by patients, physicians and pharmacists on different factors related to health care professionals' characteristics. In this respect, it should be noted that a higher percentage of pharmacists perceived their characteristics were important compared to patients and physicians. As an example, 75.1% of pharmacists thought that “coordination between physicians and pharmacists” was important for medication adherence. Nonetheless, only 55% of physicians agreed with this statement. Similarly, the results showed that the majority of pharmacists indicated that their own motivation (91.5%), attitude (94.2%)

and relationship with patients (85.3%) were important factors influencing adherence, whereas the proportion of physicians who deemed these factors important was significantly lower (57.3%, 62.3% and 52.9%, respectively).

Strategies to improve T2DM medication adherence and persistence

Statistically significant differences between patients', physicians' and pharmacists' scores were found for all questions evaluating the importance given to strategies which may improve adherence and persistence ($P<0.001$).

Information provided by health care professionals

Consistent with results described, the majority of pharmacists (94.7%) believed that the information they provide to patients about medication is important. Conversely, a lower percentage of physicians (59.6%) perceived that this information contributes significantly to medication adherence and compliance. In addition, most physicians (99.2%) believed that the information they give to patients about medication

Table 4 Importance given to medication and disease characteristics

Frequency of importance given to factors associated with adherence (%)				
Group	Medication characteristics	Not important	Neither important nor unimportant	Important
Patients	Cost and co-payment	8.0	11.2	80.8
Physicians		4.5	14.7	80.8
Pharmacists		26.4	25.0	48.6
Patients	Complexity of medication container	18.5	24.3	57.2
Physicians		6.6	20.6	72.7
Pharmacists		18.1	26.5	55.4
Patients	Organoleptic characteristics	14.9	23.4	61.7
Physicians		8.5	34.7	56.8
Pharmacists		22.1	34.6	43.3
Patients	Long-term medication	4.9	15.0	80.1
Physicians		2.3	12.5	85.2
Pharmacists		9.1	23.0	67.9
Patients	Complexity of administration	5.4	13.0	81.6
Physicians		0.2	2.8	97.0
Pharmacists		7.2	16.3	76.6
Patients	Adverse events	3.5	10.4	86.1
Physicians		0.2	2.3	97.5
Pharmacists		9.6	18.2	72.2
Patients	Multiple medications	5.5	18.2	76.3
Physicians		0.5	3.0	96.5
Pharmacists		7.2	18	74.8
Disease characteristics				
Patients	Coexistence of different diseases (comorbidities)	2.4	15.2	82.5
Physicians		0.9	8.3	90.8
Pharmacists		6.6	17.8	75.7
Patients	Absence of disease complications	3.0	16.4	80.6
Physicians		2.8	17.2	80.0
Pharmacists		13.4	26.5	60.1
Patients	Asymptomatic disease	2.8	16.5	80.7
Physicians		3.1	9.9	87.0
Pharmacists		15.3	21.1	63.6
Patients	Chronic disease	2.2	11.0	86.8
Physicians		0.8	4.7	94.5
Pharmacists		5.8	15.9	78.3

Notes: Patients: n=963; physicians: n=998; pharmacists: n=419. $P<0.001$ in all comparisons.

along with nurses (95.5%) is important to improve patients' adherence (Table 6).

However, when physicians' and patients' preferences regarding the information pathways were compared, physicians showed a higher predilection for oral (41.6% physicians vs 35.9% patients), written (36.2% physicians vs 30.4% patients) and group education (14.6% physicians vs 4% patients) to provide information to their patients, while patients showed a greater preference for communication over the phone (2.7% patients vs 0.3% physicians), email (10% patients vs 2.1% physicians) or home visits (8.8% patients vs 0.6% physicians) ($P<0.001$).

Complexity of the therapeutic regimen

Physicians believed that reducing the frequency of administration (47.9%) followed by reducing the number of tablets

(28.5%) was the most effective strategy to improve patients' adherence. However, a high percentage of patients (43%) thought that adjusting medication regimen to activities of daily living was the best strategy to improve their medication adherence, and only 15.5% of them considered a reduction in the frequency of medication administration as an effective strategy (Figure 1).

Other techniques

Finally, the questionnaire showed that both pharmacists and physicians agreed on the effectiveness of pill dispensers (81.7% and 77.6%, respectively) and tablet counting (57.6% and 52.2%, respectively) in improving patients' adherence. However, in the patients' opinion, accomplishing medication schedules (66.9%) and reminders given over telephone, by mail or email (47.1%) were the most effective strategies to improve

Table 5 Importance given to health care professionals characteristics

Frequency of importance given to factors associated with adherence (%)											
Group	Physician characteristics	Not important	Neither important nor unimportant	Important	Nurse characteristics	Not important	Neither important nor unimportant	Important	Pharmacist characteristics	Not important	Neither important nor unimportant
Patients	Coordination among physicians and pharmacists	–	–	–	Coordination among physicians and nurses	2.5	9.8	87.7	Coordination among nurses and pharmacists	8.1	21.1
Physicians	Easy-to-follow medical instructions	9.2	35.5	55.3	Easy-to-follow nurse instructions	1.2	4.5	94.3	Easy-to-follow pharmacist instructions	14.8	38.2
Pharmacists	Physician's motivation	11.2	13.7	75.1	Nurse's motivation	–	–	–	Pharmacist's motivation	–	–
Patients	Physician's attitude	2.5	8.9	88.6	Nurse's attitude	3.7	11.0	85.2	Pharmacist's attitude	5.7	13.3
Physicians	Doctor-patient relationship	0.8	8.1	91.1	Nurse-patient relationship	1.4	10.5	88.1	Pharmacist-patient relationship	7.9	22.5
Pharmacists	Accessibility to the health care center	–	–	–	–	–	–	–	–	3.6	9.0
Patients	Physician's motivation	0.5	7.2	92.3	Nurse's motivation	3.9	13.2	82.9	Pharmacist's motivation	7.7	21.9
Physicians	Physician's attitude	0.4	3.2	96.4	Nurse's attitude	1.0	6.9	92.1	Pharmacist's attitude	10.0	32.7
Pharmacists	Doctor-patient relationship	–	–	–	–	–	–	–	–	1.9	6.5
Patients	Physician's attitude	1.0	6.8	92.2	Nurse's attitude	3.0	14.5	82.5	Pharmacist's attitude	6.7	19.1
Physicians	Doctor-patient relationship	0.0	1.6	98.4	Nurse-patient relationship	0.9	5.2	93.9	Pharmacist-patient relationship	8.3	29.4
Pharmacists	Accessibility to the health care center	–	–	–	–	–	–	–	–	0.7	5.1
Patients	Physician's motivation	1.5	6.3	92.2	Nurse's motivation	3.7	15.6	80.6	Pharmacist's motivation	7.8	19.0
Physicians	Physician's attitude	0.3	1.6	98.1	Nurse's attitude	1.1	5.9	93.0	Pharmacist's attitude	10.5	36.6
Pharmacists	Doctor-patient relationship	–	–	–	–	–	–	–	–	2.7	12.1
Patients	Physician's attitude	2.7	9.3	88.0	–	–	–	–	–	–	–
Physicians	Doctor-patient relationship	2.9	19.0	78.1	–	–	–	–	–	–	–
Pharmacists	Accessibility to the health care center	–	–	–	–	–	–	–	–	–	–

Notes: Patients: n=963; physicians: n=998; pharmacists: n=419. $P < 0.001$ in all comparisons, with the exception of "Easy-to-follow medical instructions" ($P=0.009$) and "Easy-to-follow nurse instructions" ($P=0.004$).

Table 6 Importance given to the information provided by health care professionals**Frequency of importance given to strategies to improve T2DM medication adherence and persistence (%)**

Group	Information provided by health care professionals	Not important	Neither important nor unimportant	Important
Patients		5.7	20.4	73.9
Physicians	Pharmacists	8.9	31.5	59.6
Pharmacists		1.0	4.4	94.7
Patients		3.1	14.5	82.3
Physicians	Nurses	0.5	4.0	95.5
Pharmacists		–	–	–
Patients		0.9	5.1	94.0
Physicians	Physicians	0.1	0.7	99.2
Pharmacists		–	–	–

Notes: Patients: n=963; physicians: n=998; pharmacists: n=419. $P<0.001$ in all comparisons.

Abbreviation: T2DM, type 2 diabetes mellitus.

their medication adherence. Moreover, physicians were the group of participants who gave greatest importance to mobile applications (53.4%) for improving medication adherence in contrast with pharmacists (34.2%) or patients (45.3%). Surprisingly, “family and friends involvement in patient’s disease” was considered less important by patients (70.6%) compared to physicians (96.1%) and pharmacists (90.3%) (Table 7).

Discussion

The present study gathered opinions from patients, physicians and pharmacists about the factors and the strategies which may improve adherence to medication for the treatment of diabetes and other related chronic diseases. The views expressed by the three groups were consistent in various aspects; however, several differences were identified.

A high proportion of physicians and pharmacists considered that more than a half of patients adhere to their medication. In agreement with these considerations, almost

two-third of T2DM patients reported good adherence. These results show that, in general, both physicians and pharmacists were able to estimate how well the patient is adhering to the medication. In addition, the rate of nonadherence reported in the study (34.6%) is similar to that reported in a previous study conducted in Spain.³³

To achieve good medication adherence, the majority of patients considered it “important” to have knowledge about their disease and medication. Moreover, most subjects placed great importance on disease features such as chronicity, the presence of comorbidities or complications. These findings suggest that the majority of patients with T2DM diabetes interviewed understand the importance of taking medication and at the same time acknowledge the importance of being adequately informed about their disease, comorbidities and the benefits of medication.

The study showed that patients considered their relationship with physicians and their participation in the medication

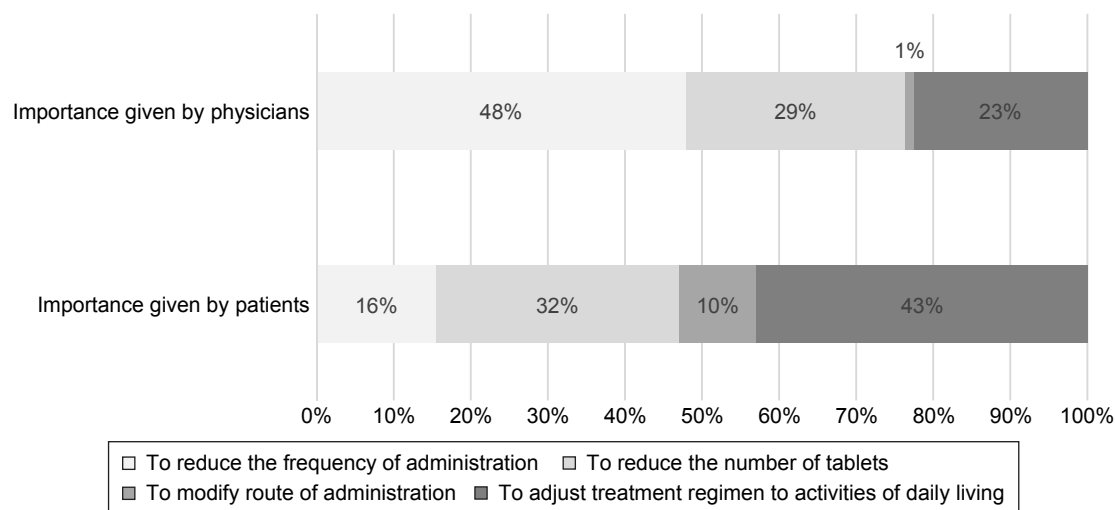
**Figure 1** Importance given to strategies to reduce the complexity of therapeutic regimen.

Table 7 Importance given to techniques to improve adherence to medication and social support

Frequency of importance given to strategies to improve T2DM medication adherence and persistence (%)				
Group	Techniques to improve adherence to medication	Not important	Neither important nor unimportant	Important
Patients	Mobile applications	27.9	26.8	45.3
Physicians		13.9	32.7	53.4
Pharmacists		30.7	35.2	34.2
Patients	Medication schedule	10.9	22.2	66.9
Physicians		6.9	25.2	67.9
Pharmacists		14.6	32.0	53.3
Patients	Reminders over telephone, mail or email	24.0	28.9	47.1
Physicians		18.2	39.7	42.1
Pharmacists		28.5	28.8	42.7
Patients	Pill dispensers (weekly)	10.0	24.3	65.7
Physicians		4.2	18.2	77.6
Pharmacists		4.9	13.3	81.7
Patients	Pill dispensers (daily)	9.0	22.8	68.1
Physicians		2.5	14.2	83.3
Pharmacists		4.0	15.6	80.4
Patients	Tablet counting	15.2	28.8	56.1
Physicians		14.9	32.9	52.2
Pharmacists		13.8	28.6	57.6
Social support				
Patients	Involvement of family and friends	7.8	21.6	70.6
Physicians		0.4	3.5	96.1
Pharmacists		1.5	8.2	90.3

Notes: Patients: n=963; physicians: n=998; pharmacists: n=419; $P<0.001$ in all comparisons with the exception of "Tablet counting" ($P=0.218$).

Abbreviation: T2DM, type 2 diabetes mellitus.

decision-making process very important for improving adherence. Supporting this idea, a recent observational study showed that insulin adherence was directly correlated with physician attention and engagement.³⁴ This result emphasizes the need for integrating patients' perspectives in the development of care planning and decision making, in order to increase their motivation and consequently their medication adherence.³⁵

As previously reported³⁶ and in accordance to our findings, patients' and physicians' opinions and perspectives concerning medication adherence differed to some extent. Thus, related to the strategies aimed at improving adherence, nearly half of patients agreed that to adjust their medication regimen to activities of daily living was the best strategy to reduce therapeutic complexity, in contrast to physicians who believed that reducing the frequency of administration followed by reducing the number of tablets was the most effective strategy to improve patients' adherence.

The present findings are also consistent with previous studies, in which PC physicians and specialists emphasized the need to lower the number of daily diabetic medications to improve patients' adherence, clinical outcomes and quality of life,³⁷ whereas T2DM patients considered adjusting medication regimen to their daily lives more essential,²² stating that

a more flexible dosing regimen that could be adapted to them would be an effective strategy to improve their adherence to antidiabetic therapy.

Our descriptive analysis is the first, to our knowledge, in which not only patients' and physicians' but also pharmacists' perceptions in relation to medication adherence were elicited and compared. We believe that the present results provide a more comprehensive view of patients and health care professionals. In this sense, our results highlight that this group of professionals show significant differences in comparison with the other two groups of participants. Interestingly, we found many similarities between patients' and physicians' responses concerning adherence, while pharmacists' view on patients' adherence and their own role in patient care differed significantly from those reported by the other two groups. As an example, a lower percentage of pharmacists were of the opinion that specific disease and medication features were important for medication adherence compared to patients and physicians.

These results were unexpected as pharmacists perform closer patient monitoring than physicians and are aware of the occurrence of adverse events and patients' comorbidities.³⁸ In addition, our results show that a higher proportion of pharmacists believed that the role they play in managing

patient adherence is important in comparison with patients and physicians. Previous studies have shown a more positive view of patients about pharmacists, in the sense, that patients believed that a multidisciplinary approach including pharmacists as the main actors together with physicians could improve diabetes management, especially in cases of clinical complexity, multi-morbidity and polymedication.³⁹

This observational study has some inherent limitations in terms of its susceptibility to bias and confounding, restricting its ability to define causality.⁴⁰ Another important aspect to consider is related to the lack of objective variables such as glycemic control and the absence of a direct measure of medication adherence. However, the method applied (MMAS-4) has been widely used and validated in Spanish patients with chronic diseases.

Additionally, sample size was calculated to be representative of each group of participants, and recruitment was performed in an independent and unbiased manner supported by important organizations (Spanish Diabetes Federation and the RedGDPs – Spanish Physician Association). However, participants might not represent the whole population. In addition, the possibility that some questions may have been misinterpreted cannot be ruled out.

The final limitation concerns the lack of validation of the questionnaire. Hence, the findings obtained in the present study should be interpreted with some caution.

Despite the limitations outlined, this study has several strengths such as the large number of participants included and the relevant information related to daily clinical practice in Spain.

Conclusion

The present study offers useful information about T2DM patients', physicians' and pharmacists' views on medication adherence, providing useful insights into highly influential aspects in medical decision making within the NHS.

According to our results, health care professionals should acknowledge patients' opinions and preferences in the development of medication management strategies, focusing on adjusting medication dosages and timing to patients' daily lives in order to improve their adherence. Thus, our results suggest that the most effective way to manage poor adherence is to identify patients' barriers to medication compliance and to implement strategies that are specific to overcome those barriers instead of the classical approach of simplifying a complex medication regimen. It is important to highlight that this strategy coincides with the one recommended by the most recent guidelines for diabetes care.⁴¹

Importantly, a major barrier to optimal adherence management has been previously identified as a fragmented and poorly coordinated health system.⁴² In this regard, our study acknowledges the need for pharmacists to build a stronger relationship with patients and physicians in order to work closely in designing, implementing and monitoring therapeutic plans to improve adherence rates, especially when treating diabetes patients with clinical complexity, multi-morbidity and polymedication.

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Disclosure

The authors report no conflicts of interest in this work.

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