



Doctors' views and strategies to improve patients' adherence to medication

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Introduction

Non-communicable diseases (NCDs) are the leading causes of death across the world [1, 2], these including cardiovascular disease, cancer, chronic respiratory diseases, and diabetes. This fact represents a great threat to socioeconomic development given that more than 70% of all deaths globally and 80% of deaths in low- and middle-income countries are attributed to NCDs [2]. In 2013, the World Health Organization (WHO) adopted a target of 25% reduction in mortality from NCDs by 2025 [2]. In the European Union, approximately 550,000 people die prematurely each year from NCDs [3], while in Greece, 38% of deaths are attributed to diseases of the circulatory system, 25% to cancer, 20% to respiratory diseases, and 1.85% to diabetes [4]. Morbidity and mortality from these diseases can be avoided by a healthier lifestyle, disease prevention, and medication adherence. The 2018 OECD report [5] states that the health system's resilience, more efficient spending policies, and long-term sustainability can be supported by adopting better strategies aiming at improvements in medication adherence. Cardiovascular diseases (CVDs) are the main type of NCDs, including heart disease, stroke, hypertension, congestive heart failure, and arteriosclerosis, most of them being associated with metabolic syndrome [6]. Despite the existence/implementation of effective therapies, cardiovascular outcomes still remain suboptimal [7–9]. Previous studies [10–17] have documented the relationship between insulin resistance and CVDs, taking into consideration other confounding factors such as body mass index [18–20], smoking, hypertension, high-density lipoprotein (HDL), and low-density lipoprotein (LDL) cholesterol. The 10-year

financial crisis and the current COVID-19 pandemic have had a significant impact on the functioning of the health systems, highlighting the need for more effective and efficient management, at the same time ensuring equity and access to new therapies [21].

Adherence is an important factor in the effectiveness of long-term therapy and is defined by the WHO as “the extent to which a person's behavior-taking medication, following a diet, and/or executing lifestyle changes corresponds with agreed recommendations from a health care provider” [22, 23].

According to Kravitz et al. [24], non-adherence to medication for cardiovascular diseases has been estimated to be higher than 60%. Self-assessed adherence in patients with coronary heart disease is less than 40% for the combination of aspirin, β -inhibitor, and a lipid-lowering agent in both short-term and cohort studies [25]. According to the Ascertaining Barriers for Compliance (ABC) Project, non-adherence in Greece is as high as 50% [26]. The period that follows immediately after discharge from the hospital is one linked to a high risk of medication non-adherence. Nearly one out of four patients is partially or completely non-adherent to treatment received after discharge from the hospital [27]. Concerning hypertensive patients who take just one medication as prescribed, 50% will stop taking antihypertensive medications within 6–12 months and only about 40% will continue statin treatment for 2 years for acute coronary heart disease [25, 28].

Medication adherence obviously greatly affects the effectiveness of treatment and, consequently, health outcomes, and patients' quality of life [29]. Early non-adherence to treatment leads to a significant reduction in life expectancy by 1 year after hospitalization in myocardial infarction [27]. Secondary non-adherence (non-adherence to instructions or non-adherence to the prescription) has been shown to lead to increased mortality and hospitalization rates, plus additional costs [30–33].

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According to Haynes et al. [34], searching for cost-saving or effective health interventions are insufficient in themselves for the successful management of a disease. Instead, they propose improvement in medication adherence. Corroboration of the latter is the fact that patients with high rates of adherence to treatment have a significantly lower risk of cardiovascular events than those with low rates of adherence [35]. Those who did not follow at all the prescriptions given to them after their hospital discharge were 80% more likely to die within 120 days from myocardial infarction compared to those who complied with only parts of their prescription. Even this group of patients with partial compliance to prescriptions had a 44% higher risk of death compared to those who fulfilled most of their prescription requirements [27].

Focusing now on Greece [36–39], previous studies have reported a decreased level of adherence to the Mediterranean diet and increased consumption of cigarettes per capita compared to that of other European countries. In addition, inactivity and blood pressure levels have shown increasing trends [40]. In addition, multiple predictive factors of CVDs, such as the prevalence of depression and already low medication adherence, may have been exacerbated by the recent economic crisis and austerity measures in Greece.

According to the findings of previous studies [41–43], patients' concerns about the therapeutic regimen's side effects, treatment modifications, and communication barriers between patients and physicians contribute to a suboptimal doctor-patient relationship. In addition, a frequent phenomenon is patients' lack of full understanding of their disease [44] and the absence of patient involvement in the treatment decision-making process [45], all of which may lead to lower adherence rates. Based on the above, it is clear that efforts must be made to improve the communication dimension and patients' trust in their physicians. This relationship must be based on both verbal and non-verbal communication so that patients will have an understanding of their illness and the risks and benefits of the chosen treatment [46] and be encouraged to participate in the decision-making process [47–50].

The objective of this study is to explore Greek doctors'/cardiologists' views on their patients' adherence. Additionally, we investigate the possible barriers that they may face when applying adherence-enhancing methods.

Materials and methods

In order to conduct this research study, a structured questionnaire was developed [51] to examine doctors'/cardiologists' views on and strategies for improving patients' medication adherence. The questionnaire was administered to 199 doctors/cardiologists from different urban, semi-urban, and rural regions and major cities across Greece.

A convenient quota sampling procedure was adopted. A major disadvantage of quota sampling is related to non-randomness. However, despite this drawback, in a population-based epidemiological or clinical study, as in the case of our research, it is not necessary to follow the strict rules of an equal probability random sample. Quota sampling is a widely adopted method in empirical research because of its several advantages, among them the fact that it saves money and time and provides important information about the population under investigation if the sampling process is based on a good strata division. In our study, we made a great effort to ensure the best possible representation of doctors' views on patients' adherence by taking into account a number of factors related to the following: the doctor's (i) gender, (ii) age, (iii) work experience/years of specialization, (iv) employment status in public hospital or outpatient clinic, and (vi) average time spent with patient discussing issues related to medication adherence. These factors contribute to obtaining as far as possible an accurate representation of doctors' views on their patients' adherence. A more detailed analysis in the future may take into account a more rigorous random sampling method.

The Web Rating Health electronic tool was used to collect information on doctors' views across regions and major cities in collaboration with the research unit of MBA-Health of the University of Athens, Greece.

Doctors' views on their patients' adherence to treatment were measured on a 5-point Likert scale with the following values: 1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; and 5 = strongly agree. Thirteen questions were addressed to doctors to assess the effectiveness of various interventions in improving patients' medication adherence.

Principal component analysis (PCA) was applied to further analyze the responses to the thirteen questions. The aim of this method was to reduce the multidimensionality of our data into a smaller number of uncorrelated variables defined as principal components. A scree plot diagram was used to display the eigenvalues in a downward curve, ordered from the largest eigenvalue to the smallest (Fig. 3).

Perceived barriers to implementing adherence as viewed by doctors were rated on a 5-point Likert scale, with the following values: 1 = not at all; 2 = slightly; 3 = moderately; 4 = very; and 5 = extremely. Error bars were used to show the statistical significance of different barriers. Cronbach's alpha test was applied to measure internal consistency between the dimensions of adherence. Correlation coefficients were used to estimate the strength of the relationship between the different variables under investigation. Statistical analysis was performed using SPSS v.26. The results are presented using absolute and relative (%) frequencies.

Results

Sociodemographic characteristics

Of a total of 199 medical doctors providing treatment for cardiovascular diseases who completed the questionnaire, 76.9% were men (Table 1). The mean age of the group was 52 years, with a standard deviation of 10.6 years. The majority of them (69.3%) had been licensed practitioners for more than 15 years. Approximately 86.4% were working in private outpatient clinics. Regarding consultation time, 29.6% spent more than 15 min with each patient. Table 1 presents the general sociodemographic characteristics of the sample.

In order to assess the internal consistency of the different dimensions of adherence to medication, we used Cronbach's alpha test. The commonly accepted value for internal consistency is a Cronbach's alpha value of > 0.70 [52]. The results of our analysis revealed a high level of overall internal consistency (Cronbach's $\alpha = 0.895$). The estimated values for specific components (constructs) were as follows: (i) providing information to patients about their disease (Cronbach's $\alpha = 0.867$); (ii) discussion with patient (Cronbach's $\alpha = 0.784$); (iii) adopting common strategy (Cronbach's $\alpha = 0.876$); (iv) barriers (Cronbach's $\alpha = 0.807$); and (v) the effectiveness of the interventions (Cronbach's $\alpha = 0.905$).

Table 1 Basic characteristics of the participants

		<i>n</i>	%
Sex	Male	153	76.9%
	Female	46	23.1%
Age categorization	< 40 years old	12	6.0%
	40–49 years old	90	45.2%
	50–59 years old	40	20.1%
	60–69 years old	45	22.6%
	70+ years old	12	6.0%
Years' work experience in the field with a license	1–5 years	6	3.0%
	6–10 years	22	11.1%
	11–15 years	33	16.6%
	> 15 years	138	69.3%
Main place of work	Public hospital/clinic/polyclinic	27	13.6%
	Private outpatient/clinic/diagnostic	172	86.4%
Average time spent with patients discussing their medication	1–5 min	20	10.1%
	6–10 min	69	34.7%
	11–15 min	51	25.6%
	> 15 min	59	29.6%

Degree of patient non-adherence to medication

As a first step towards determining adherence, the doctors were asked to evaluate their patients' behavior regarding their treatment. Most of them (71.4%) stated that only a small proportion of their patients (less than 15%) did not start their prescribed treatment. Distinguishing between short- and long-term adherence, around 70% of the doctors reported that a large proportion of their patients (between 66 and 100%) present either short- or long-term consistency in adhering to their medication-assisted treatment as it was prescribed (see Table 2).

Views on patient adherence to medication

Most of the doctors (76.1%) believed that non-adherence is in large part voluntary (Fig. 1). They also maintain that adherence is directly connected with patients' worries about treatment, e.g., the possible side effects (63.8%), as well as with patients' views on whether they need treatment (55.3%).

Doctor-patient relationship

An important factor influencing the doctor-patient relationship is the time devoted to each patient. Figure 2 presents (in the form of error bars) the positive relationship between the average time spent per patient and the encouragement of doctors to their patients to be part of the decision-making concerning their treatment. Doctors who are often or always willing to spend more time with their patients discussing the effects of medicinal treatment appear to provide greater encouragement to their patients to play an active role in their treatment by adopting a more positive and constructive attitude towards medication adherence.

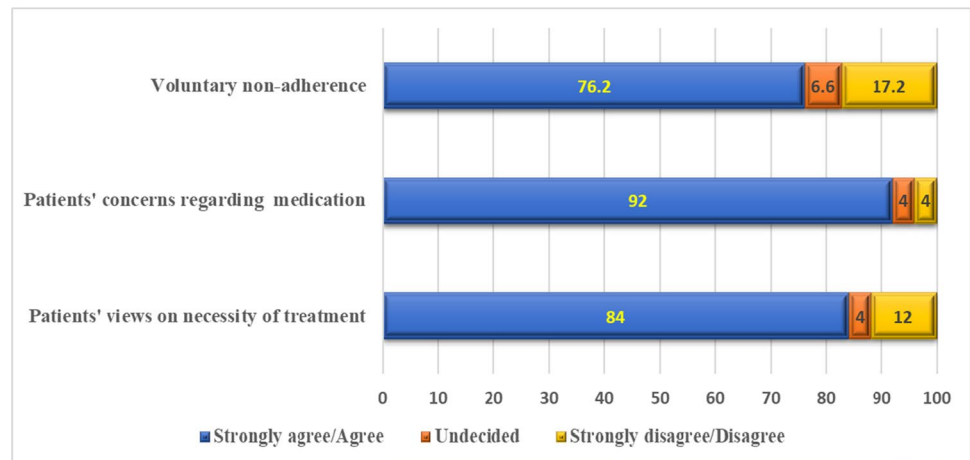
Effectiveness of possible interventions

The doctors who took part in this study were presented with a wide range of medication adherence interventions to be applied to patients, the effectiveness of which was then evaluated. Thirteen questions were addressed to

Table 2 Proportion of adherent patients in the short and long term

Proportion of adherent patients	Short term (less than a year)		Long term (more than a year)	
	<i>n</i>	%	<i>n</i>	%
16–65%	46	23.1	53	26.6
66–85%	90	45.2	87	43.7
86–100%	63	31.7	59	29.6
Total	199	100	199	100

Fig. 1 Opinions on patients' adherence to medication (%)



doctors taking values over a 5-level Likert scale. Interventions considered very/extremely effective were those related to information provided about the disease and the therapeutic regimen along with its possible side effects. The PCA method was applied to the thirteen questions. This method yielded four major components, whose eigenvalues were > 1 , according to the Kaiser criteria [53]. Figure 3 demonstrates the estimated values in a scree plot. These four components taken together accounted for approximately 60% of the total variance of the 13 variables under investigation for PCA (Fig. 3). After using Varimax with Kaiser normalization as the rotation method and calculating the mean values of the four components, we concluded that the second one was rated as best (0.714 out of 0.844) and the third one as worst (0.307 out of 0.844) (Table 3). Therefore, the best-generated components out of our analysis indicated that the underlying explanatory

constructs were that (i) provision of information about the disease and its side effects; (ii) encouraging patients to be part of the decision-making; (iii) suggesting simpler regimens and using medicine-dispensing devices; and (iv) integrating a medication schedule into patients' lifestyle and daily routine are the underlying explanatory constructs (Table 3 and Fig. 3).

With regard to the application of special diaries or electronic and other reminder systems, the doctors, though mindful of possible practical problems causing non-adherence, do not suggest the use of these to their patients.

The results of this analysis demonstrate the necessity for targeted policies related to patients' treatment adherence by taking into account their personal needs, habits, and lifestyle. Adherence is a dynamic concept that requires continuous intervention through innovative and well-documented health education programs.

Fig. 2 Relationship between time spent per patient and patient's participation in decision-making

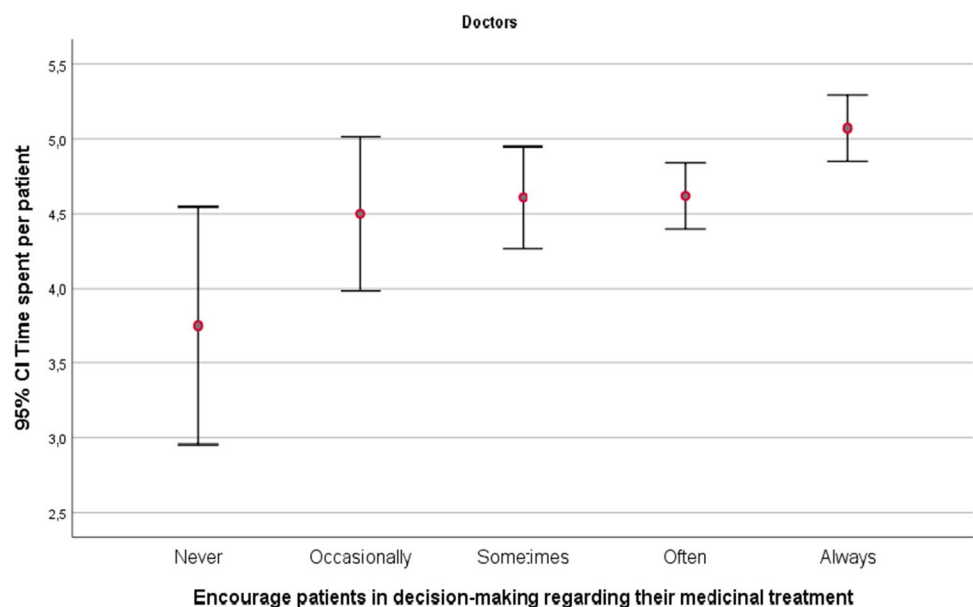
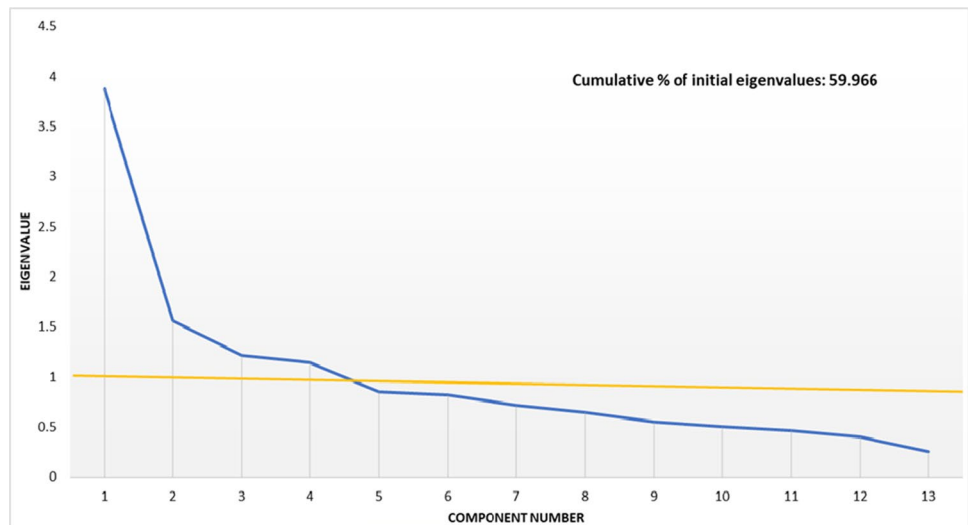


Fig. 3 Scree plot featuring the components used and their eigenvalues



Barriers to the use of interventions that improve adherence

The barriers confronted by doctors in promoting their patients’ medication adherence were investigated over several dimensions related to their workload, training programs, financial incentives, lack of resources, and the absence of an integrated system. Figure 4 provides a visual representation of doctors’ views ordered by their importance. Almost half of the doctors reported that the most important barriers were the lack of integrated care and the limited resources to promote adherence supported by the state. Designing and implementing health reforms promoting integrated care, especially during periods of austerity, economic recession, and pandemics, is, admittedly, a challenging public

health undertaking. Investment in integrated care saves resources and improves adherence [54]. Other reported barriers are related to workload, inadequate training, and lack of financial incentives (Fig. 4). Lack of integrated care was significantly related to lack of adequate public resources ($Rho = 0.318, p < 0.001$), and lack of doctors’ training ($Rho = 0.321, p < 0.001$).

Discussion

To the best of our knowledge, this was the first study conducted in Greece exploring doctors’ perceptions about possible interventions to promote medication adherence and

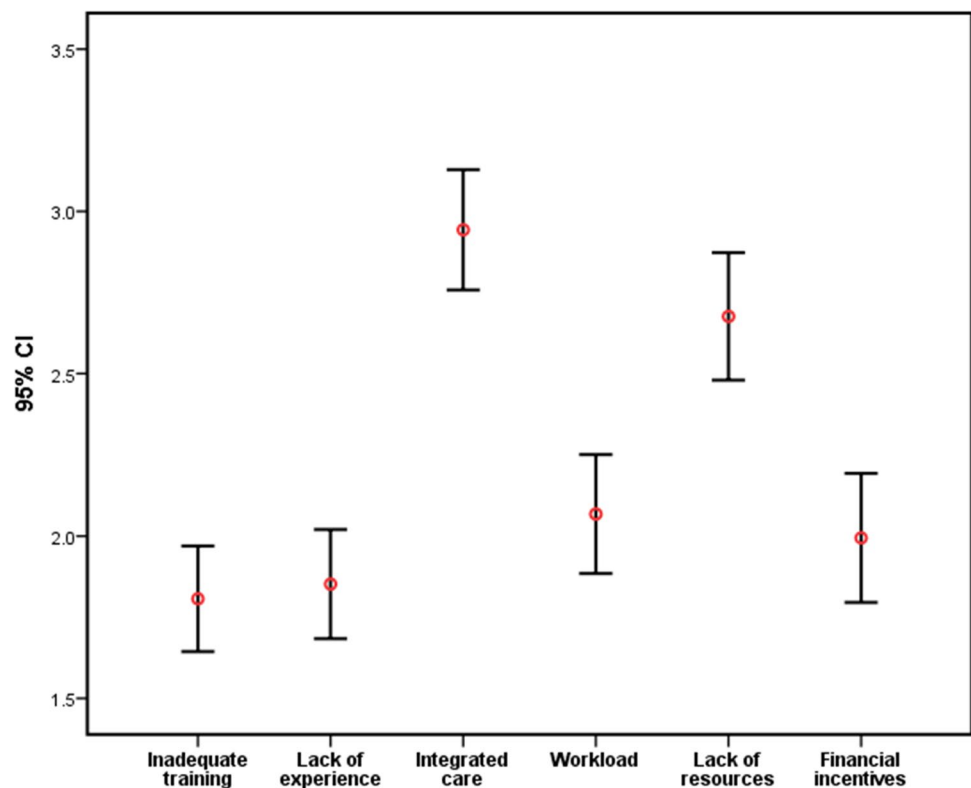
Table 3 Principal component analysis—rotated component matrix

Rotated component matrix	Component			
	1	2	3	4
Reconsidering the therapeutic goals	0.729			
Information about the therapeutic regimen and possible side effects	0.681			
Encouraging the family’s and other caregivers’ participation	0.668			
Practical reasons for not being adherent (bad memory)	0.604			
Discussing with family, friends, and caregivers the patient’s adherence	0.560		0.307	0.413
Information provided about the disease		0.844		
Encouraging patients to participate in decision-making		0.807		
Asking patients if they have reduced or changed the recommended doses		0.712		
Scheduling more frequent visits if there is a problem with the patient’s adherence	0.406	0.495		
Suggesting using dispensers			0.777	
Suggesting simplifying medication by reducing the frequency of administration			0.775	
Suggesting taking medication in combination with regular activities				0.773
Configuring medication regarding the patient’s needs and lifestyle				0.670

Extraction method: principal component analysis

Rotation method: Varimax with Kaiser normalization

Fig. 4 Barriers to the use of interventions that improve adherence (%)



barriers that impede their effectiveness. Despite its limitation pertaining to lack of a quota sampling, our study presents the main issues and provides an analytical framework for health policy interventions.

Medication adherence is a complex and dynamic behavior characterized by three different phases according to the Ascertaining Barriers to Compliance taxonomy, namely, initiation, implementation, and discontinuation [55]. Overcoming non-adherence to medication remains a challenge for doctors, who must grasp the nature of intervention before its application. Interventions to reduce non-adherence can be broadly categorized as educational [56, 57] (those aiming to increase people's understanding of his/her current health condition and the prescribed medication through verbal counseling) or behavioral (those seeking to overcome barriers to adherence by simplifying medication regimens).

As shown in our study, over 30% of doctors reported that the majority of their patients were highly adherent (86–100%) to their treatment concerning both short- and long-term adherence. Moreover, non-adherence is mostly voluntary, while it also seems to be affected by patients' fears about their medication or doubts about its effectiveness.

There are indeed numerous reports showing that patients' non-adherence is related to a fear of side effects [58, 59] and uncertainty concerning the necessity of the treatment, as well as to doubt as to the effectiveness of the treatment [46, 60–63]. A study by Ross et al. [64] concluded that patients'

beliefs about their health condition largely determine their adherence. On the other hand, a review by Van Dulmen et al. [65] demonstrated that providing patients with information about their disease does not necessarily affect adherence, other educational and behavioral strategies possibly achieving this end [66].

Similarly, to previous studies [67–72], doctors appear to appreciate the importance of the (clinical and social) support that patients receive from health professionals and family members as an essential component of treatment adherence. Educational interventions are always preferable because they have been proven to produce an improvement in medication adherence and patient satisfaction [56, 57]. They are not, however, always sustained due to physicians' heavy workload. As previously shown [56, 73–75], there are also a number of technological interventions that enable doctors to monitor their patients' adherence regularly, or even in real time, which can also be used as an individualized personal reminder to the user. However, doctors neither suggest their use nor consider them as extremely or even very effective. This may be attributed to the fact that the employment of such electronic aids requires the ability to use technology-based health tools in a productive way [76–78], which may not always be possible either for some patients or for certain doctors.

After running a PCA, we found that providing information about the medication itself and its possible side effects

and encouraging the patient's participation in decision-making are effective complementary interventions. The same applies to interventions based on the assessment of the patient's adherence according to relatives' views, this being reinforced by more frequent doctor appointments in the case of non-adherence. Regarding possible barriers, almost 50% of the doctors reported that inadequate resources and the lack of integrated care are the main obstacles to effective adherence. Excessively heavy workloads and inadequate training are also considered to be important barriers.

Conclusion

Our findings confirm those of previous studies [51, 79] regarding interventions used to optimize medication adherence and possible barriers to these. A deeper understanding of patients' needs and concerns is necessary if doctors wish to build a relationship with their patients which can lead to better medication adherence and health outcomes in the long run. Doctors' views concerning possible interventions and existing barriers should be taken into consideration, because they can contribute considerably to improving adherence and, hence, to patients' health and quality of life.

Author contribution All authors participated in critically revising the manuscript and all authors approved the final version of the manuscript for submission. John Yfantopoulos designed the study and developed the questionnaire, participated in the statistical analysis, and supervised the execution of the research. Marianna Protopapa, Athanasios Chantzaras, and Platonas Yfantopoulos participated in the statistical analysis. All authors contributed to the interpretation and the analysis of the results. V-Net collected the data using the Web Rating Health electronic tool.

Declarations

Ethical approval In accordance with the design of the survey, an ethics committee approval was not needed.

Informed consent Due to the anonymity of the survey, no individual informed consent was needed.

Conflict of interest The authors declare no competing interests.

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