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Medication Adherence and Glycemic Control in Older Adults with Type 2 Diabetes: A Cross-Sectional Study in a Community Setting

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Abstract: Background/Objectives: Glycemic control is essential for preventing both short- and long-term complications of type 2 diabetes (T2D), requiring strict adherence to pharmacological therapy. Medication adherence directly influences therapeutic effectiveness, making its assessment in clinical practice crucial. This study aimed to evaluate medication adherence in elderly patients with T2D and its association with glycemic control. Methods: A descriptive cross-sectional study was conducted in the Algarve, Portugal, involving 133 elderly patients (≥60 years) with T2D. Cardiometabolic parameters and medication adherence (global, intentional, and unintentional) were assessed. Statistical analyses were performed using IBM SPSS Statistics 28.0. Results: The study population had a mean age of 71.7 ± 5.7 years, with a predominance of male participants (57.9%) and a high prevalence of dyslipidemia and/or hypertension. Cardiometabolic control was generally poor, with only 26.3% achieving blood pressure targets (≤140/90 mmHg), 8.5% maintaining fasting glycemia within the recommended range (70–110 mg/dL), and 13.6% attaining glycated hemoglobin (HbA1c) values ≤ 7%. Despite this, medication adherence was notably high (97.7%), with no significant association with cardiometabolic control ($p > 0.05$). Unintentional non-adherence behaviors, such as forgetfulness and inconsistent medication schedules, were the most frequently reported. Conclusions: Although elderly patients with T2D demonstrated high medication adherence rates, their cardiometabolic control remained suboptimal. Unintentional non-adherence behaviors may contribute to poor glycemic control. However, medication adherence alone does not fully explain these outcomes, highlighting the need to assess adherence to other self-care behaviors, particularly dietary and physical activity patterns. Future interventions should integrate comprehensive lifestyle modifications alongside pharmacological management to enhance overall disease control.

Keywords: type 2 diabetes; glycemic control; medication adherence; cross-sectional study

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Academic Editor: Giancarlo Tonolo

Received: 16 February 2025
Revised: 14 April 2025
Accepted: 21 April 2025
Published: 23 April 2025

Citation: Nascimento, T.; Andrade, A.; Pinto, E.; Cabrita, C.; Pais, S.; Puerta, R.d.l. Medication Adherence and Glycemic Control in Older Adults with Type 2 Diabetes: A Cross-Sectional Study in a Community Setting. *Diabetology* **2025**, *6*, 33. https://doi.org/10.3390/diabetology6050033

1. Introduction

1.1. Background

Diabetes is a chronic disease that affected approximately 828 million people in 2022, according to the NCD Risk Factor Collaboration [1]. In 2021, the International Diabetes Federation estimated a prevalence of 537 million individuals aged 20 to 79 years, with type 2 diabetes accounting for 90% of diagnosed cases [2]. These figures highlight the increasing prevalence of the condition and its growing global impact.

The management of diabetes requires complex pharmacological and non-pharmacological interventions, which are often inadequately followed. Pharmacological therapy is particularly intricate due to the high number of medications prescribed not only for diabetes but also for its associated comorbidities. The complexity of therapeutic regimens poses challenges for both patients and healthcare providers, contributing to issues, such as non-adherence, therapeutic failure, and adverse drug reactions, which significantly impair the patients' quality of life [3,4]. A study analyzing the complexity of diabetes treatment between 1995 and 2003 indicated that therapeutic regimens had become increasingly intricate, with a greater number of patients receiving multi-component care [5].

Adherence to therapy is a key determinant of disease control and prognosis in chronic conditions. It can be defined as the extent to which a patient accepts and follows medical recommendations, encompassing both medication use and necessary lifestyle modifications [6].

Adherence can be assessed through direct or indirect methods, including serum drug concentration measurements, patient self-reporting, pharmacy refill records, and electronic monitoring. In Portugal, given the current drug dispensing framework, the most feasible and accessible method for evaluating adherence relies on indirect self-reporting tools [7].

Non-adherence to treatment is a widespread issue in clinical practice, particularly among asymptomatic patients with chronic diseases, such as diabetes, hypertension, and hypercholesterolemia. It is associated with an increased risk of complications, disease progression, hospitalizations, premature disability, mortality, and a substantial economic burden [8]. The phenomenon of non-adherence results from a complex interplay between the patient, healthcare professionals, and the broader social environment [9]. Despite its critical role in disease management, adherence is seldom systematically measured in clinical practice. However, its assessment, alongside strategies, such as enhanced patient education and improved communication regarding treatment regimens, has been shown to positively influence medication adherence [10–14].

Adherence to therapy in diabetes is crucial for preventing microvascular and macrovascular complications, such as diabetic retinopathy and cardiovascular disease, respectively [15,16]. These complications contribute to increased hospitalization and mortality rates, leading to a substantial rise in direct healthcare costs, not only for national health systems but also for individual patients [17]. According to the International Diabetes Federation (IDF), global healthcare expenditures related to diabetes have surged by 316% over the past 15 years, increasing from USD 232 billion in 2007 to USD 966 billion in 2021 [2].

Previous studies have reported wide variations in the prevalence of treatment adherence among individuals with diabetes, ranging from 15% to 93.1% [18,19]. A meta-analysis estimated an average adherence rate to oral antidiabetic medications of 67.9%, whereas treatment persistence—defined as the proportion of patients remaining on therapy throughout the study period or the duration of continuous medication use without prolonged interruption—was lower, at 56.2% [20]. Adherence and persistence tend to be higher for oral antidiabetic agents compared to injectable therapies. The presence and severity of adverse drug reactions have been linked to lower adherence and persistence. Furthermore, sociodemographic factors, comorbidities, and glycemic control appear to influence both adherence to therapy and treatment persistence in diabetes [21].

1.2. Objectives

Primary Objective: To assess self-reported medication adherence in older adults (≥60 years) with T2D and investigate its association with glycemic control.

Secondary Objectives: To determine the prevalence of polypharmacy, describe unintentional and intentional non-adherence behaviors, and explore potential implications for clinical practice in terms of lifestyle-focused interventions.

2. Materials and Methods

This study followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional research [22] (Supplementary File S1).

2.1. Study Design and Participants

We conducted a cross-sectional, descriptive study, in a non-random sample of community living, autonomous, older adults previously diagnosed with T2D and residing in the Algarve region, Portugal. This study is a secondary analysis of data from an observational study titled Sarcopenia Screening and Health-Related Issues in the Region of Algarve (unpublished), as our sample included only the older adults with T2D that were part of main study.

Sample size calculation for the main observational study, according to methods proposed by Hulley et al. [23], considering a 95% confidence level, a 5% margin of error, and an expected prevalence of sarcopenia of 11.2%, yielded a minimum sample size of 153 participants. Accounting for a 10% rate for drop-outs, the minimum sample size was set at 170 individuals. The sarcopenia prevalence was extracted from the Portuguese National Health and Physical Activity Survey [24], which included a nationally representative sample of Portuguese adults.

Participants were recruited between January and December through invitations and informational materials disseminated via formal and informal institutions and community groups of older individuals, such as parish councils, municipal councils, and other organizations providing services to individuals aged 60 years or older. Data collection was conducted through individual, face-to-face interviews with all those who agreed to participate.

2.2. Variables and Data Collection Tools

Participants provided information on gender, age, educational level, comorbidities, and current medication use. Additionally, they completed a structured questionnaire incorporating several validated instruments, including the Mini Nutritional Assessment to evaluate nutritional status, the WOMAC Index to assess self-perceived pain, stiffness, and functional impairment due to osteoarthritis, and the Treatment Adherence Measure to assess medication adherence. Following the interview, a trained technician collected a blood sample for laboratory analysis of fasting blood glucose and glycated hemoglobin (HbA1c). Blood pressure (BP) was measured using a calibrated sphygmomanometer. T2D was considered adequately controlled when BP values were below 140/90 mmHg, HbA1c was below 7%, and fasting blood glucose ranged between 70 and 110 mg/dL [25,26].

Participants were asked to identify all prescribed and non-prescribed drugs they were taking at the time and were not explicitly instructed to distinguish diabetes medications from other medications for chronic conditions. Pharmacological treatment was assessed and classified according to the Anatomical Therapeutic Chemical (ATC) Classification System, and the total number of medications per patient was recorded. Polypharmacy was defined as the use of five or more medications, while excessive polypharmacy was considered for patients taking ten or more drugs [27].

Among the available instruments for assessing medication adherence, the Morisky Medication Adherence Scale (MMAS-4 and MMAS-8) is one of the most widely used [28,29]. In Portugal, the Treatment Adherence Measure (TAM), based on the MMAS methodology [30], is frequently applied and has been validated for patients with chronic diseases. In contrast, the MMAS-8 has only been validated in a hypertensive population [31]. Medication adherence in this study was evaluated using the TAM, which has demonstrated superior internal consistency compared to the European Portuguese-adapted version of the MMAS-8 (Cronbach's alpha: 0.74 vs. 0.60) [30,31]. Moreover, the TAM exhibits greater specificity than the original MMAS-8 (73% vs. 53%). However, the sensitivity and specificity of the adapted MMAS-8 for European Portuguese were not reported by its authors, precluding a direct comparison of these indicators between the TAM and the MMAS-8 [28–30].

The TAM differs primarily by including seven questions, with responses following a Likert scale format, which enhances both the sensitivity and specificity of the instrument [30]. Therapeutic adherence was considered adequate for participants scoring above 70%, following the method used in its validation study for a Portuguese setting [30]. In addition to overall adherence (questions 1 to 7), scores for intentional (questions 3, 4, and 5) and unintentional (questions 1, 2, and 6) non-adherence were also calculated. Question 7, "Have you ever stopped taking your medication for your illness for a reason other than your doctor's recommendation?", was excluded from the classification of intentional or unintentional non-adherence, as its wording was considered too ambiguous and could pertain to both categories.

2.3. Statistical Analysis

Statistical analysis was conducted using IBM SPSS Statistics 28.0. Data were described using relative and absolute frequencies, means, medians, standard deviations, and interquartile ranges, as appropriate. Given that none of the variables under study followed a normal distribution, as determined by the Kolmogorov–Smirnov test, non-parametric statistical tests were applied. Group comparisons were performed using the Kruskal–Wallis test, chi-square test, and Mann–Whitney U test. Spearman's correlation coefficient and Wilcoxon's signed-rank test were used to analyze relationships between variables. When the chi-square test results were not valid due to low expected cell counts, Fisher's exact test was applied as an alternative.

There were no missing data; therefore, no statistical procedures were necessary to address them.

Correlation strength was classified as weak for coefficient values below 0.1, moderate for values between 0.1 and 0.2, and strong for values above 0.3 [32].

3. Results

This study included 133 individuals diagnosed with type 2 diabetes, with a mean age of 71.7 ± 5.72 years. The majority were male (57.9%; n = 77), and 68.5% (n = 91) had up to four years of formal education (primary education). Most participants had a diagnosis of dyslipidemia and/or hypertension. Blood pressure control (≤140/90 mmHg) was achieved by only 26.3% (n = 35) of the sample, while fasting glycemia (70–110 mg/dL) was within the target range in 8.5% (n = 10), and glycated hemoglobin (HbA1c) values ≤ 7% were observed in 13.6% (n = 16) (Table 1).

Table 1. Sociodemographic and clinical variable descriptions.

Characteristic		*n* (%)
Gender		
	Male	77 (57.9%)
	Female	56 (42.1%)
Education level		
	0 years	5 (3.8%)
	1–4 years	86 (64.7%)
	5–9 years	26 (19.5%)
	10–12 years	9 (6.8%)
	>12 years	7 (5.3%)
Comorbidities		
	Hypertension	113 (85.0%)
	Dyslipidemia	73 (54.9%)
Cardiometabolic parameters		
BP (mmHg)		
	≤140/90 (controlled)	35 (26.3%)
	>140/90 (non-controlled)	98 (73.7%)
Glycemia (mg/dL)		
	70–110 (controlled)	10 (8.5%)
	<70–>110 (non-controlled)	108 (91.5%)
HbA1c (%)		
	≤7% (controlled)	16 (13.6%)
	>7% (non-controlled)	102 (76.7%)

Abbreviations: BP, blood pressure; HbA1c, glycated hemoglobin.

Regarding pharmacological therapy, all participants used at least one medication classified under ATC group A (Alimentary tract and metabolism). Additionally, 36.8% (n = 49) used at least one drug from ATC group B (Blood and blood-forming organs), 90.2% (n = 120) were taking medications from ATC group C (Cardiovascular system), and 59.4% (n = 79) used at least one drug from other ATC classifications.

The number of medications per individual ranged from 1 to 17, with a mean of 5.8 ± 2.99 (Table 2). Polypharmacy (≥5 medications) was observed in 63% (n = 84) of the participants, with 51.1% (n = 68) taking between five and nine medications and 12% (n = 16) classified as excessively polymedicated (≥10 medications).

Table 2. Sociodemographic and cardiometabolic variable descriptions.

Characteristic	*n*	Mean ± SD	Median [Min–Max] IQR
Age (years)	133	71.7 ± 5.72	72.0 [60–86] 7
SBP (mmHg)	133	151.7 ± 21.98	150.0 [99.0–232.0] 26
DBP (mmHg)	133	79.8 ± 11.92	79.0 [50.0–121.0] 16
Glycemia (mg/dL)	118	163.2 ± 45.22	157.6 [76.0–341.0] 50
HbA1c (%)	118	8.3 ± 1.10	7.95 [6.0–13.0] 1
Number of Medications	133	5.8 ± 2.99	5.0 [1–17] 3

Abbreviations: DBP, diastolic blood pressure; HbA1c, glycated hemoglobin; IQR, interquartile range; SBP, systolic blood pressure; SD, standard deviation.

All participants completed the TAM questionnaire, with 97.7% ($n = 130$) classified as adherent to therapy (score > 4; adherence > 70%). Adherence rates ranged from 61.9% to 100%, with a median of 92.86% and a mean of 92.3 ± 7.08%. The mean values for intentional and unintentional adherence were 96.1 ± 7.91% and 87.3 ± 9.97%, respectively.

Despite the high adherence rates, over 70% of participants did not achieve the recommended targets for key physiological parameters, including blood pressure, fasting glucose, and glycated hemoglobin (HbA1c). The mean systolic and diastolic blood pressure values were 152.0 ± 22.20 mmHg and 78.6 ± 11.30 mmHg, with medians of 149.0 mmHg and 79.0 mmHg, respectively. The mean fasting blood glucose level was 163.2 ± 45.22 mg/dL, while the mean HbA1c was 8.3 ± 1.10% (Table 2).

No statistically significant differences were observed between adherence and sociodemographic or clinical variables. Similarly, no significant associations were found between adherence to therapy and the total number of medications consumed or the presence of polypharmacy ($p > 0.05$), although a moderate correlation was identified between age and the total number of medications ($p = 0.013$; $r = 0.216$).

Although blood pressure and blood glucose values were similarly distributed between adherent and non-adherent individuals ($p > 0.05$), a statistically significant difference was found in the distribution of HbA1c values ($p = 0.010$; $U = 221.500$). However, no significant correlation was detected between adherence percentages and HbA1c values ($p = 0.330$; $r = -0.090$).

Regarding intentional and unintentional non-adherence, no statistically significant differences were observed across the analyzed variables ($p > 0.05$). The correlation between age and lower therapy adherence scores was also non-significant ($p = 0.107$; $r = -0.145$), as was the case for intentional ($p = 0.096$; $r = -0.145$) and unintentional ($p = 0.513$; $r = -0.057$) adherence scores.

Only 34.6% of patients reported never forgetting to take their medication, while 27.1% stated that they were never careless with their dosing schedule. Concerning behaviors related to intentional non-adherence, 21.8% reported having discontinued their medication because they felt better, 11.3% had done so because they felt worse, and only 0.5% reported taking additional doses of their medication due to feeling unwell.

The differences in pharmacological adherence scores were not statistically significant ($p > 0.05$) between groups categorized by blood glucose levels. However, intentional and unintentional adherence scores were lower in patients with uncontrolled fasting glycemia (5.8 ± 0.48 and 5.3 ± 0.55, respectively). Behaviors, such as forgetting to take medication or inconsistent administration schedules, were more frequent in this group. In contrast, although not reaching statistical significance, adherence scores were higher among diabetic patients with uncontrolled HbA1c values (5.8 ± 0.45). In this group, forgetfulness and carelessness regarding medication intake were associated with the lowest adherence scores (Table 3).

Table 3. Medication adherence and glycemic control.

Question	Glycemia (Mean ± SD)		p	HbA1c (Mean ± SD)		p
	Controlled ($n = 10$)	Non-Controlled ($n = 108$)		Controlled ($n = 8$)	Non-Controlled ($n = 110$)	
1. Have you ever forgotten to take your medicine for your illness?	5.2 ± 0.92	5.0 ± 0.89	0.584	4.8 ± 1.17	5.1 ± 0.86	0.411
2. Have you ever been careless with the time of taking medication for your illness?	5.2 ± 0.63	4.9 ± 0.92	0.313	4.9 ± 1.36	4.9 ± 0.87	0.670

Table 3. *Cont.*

Question	Glycemia (Mean ± SD)		p	HbA1c (Mean ± SD)		p
	Controlled (n = 10)	Non-Controlled (n = 108)		Controlled (n = 8)	Non-Controlled (n = 110)	
3. Have you ever stopped taking your medication for your illness because you felt better?	5.8 ± 0.63	5.6 ± 0.93	0.420	5.3 ± 1.49	5.6 ± 0.86	0.582
4. Have you ever stopped taking the medication for your illness, on your own initiative, after having worse feeling?	5.8 ± 0.42	5.8 ± 0.58	0.403	5.6 ± 0.74	5.8 ± 0.55	0.197
5. Have you ever taken one or more pills for your illness, on your own initiative, after feel worse?	5.9 ± 0.32	5.9 ± 0.34	0.469	6.0 ± 0.00	5.9 ± 0.35	0.500
6. Have you ever stopped therapy for your illness because you let it end your medicines?	5.8 ± 0.42	5.9 ± 0.33	0.293	5.8 ± 0.00	5.9 ± 0.30	0.736
7. Have you ever stopped taking medication for your illness for any reason other than be the doctor's recommendation?	6.0 ± 0.00	5.8 ± 0.63	0.317	6.0 ± 0.00	5.8 ± 0.63	0.375
Adherence Score	5.7 ± 0.34	5.6 ± 0.39	0.340	5.5 ± 0.71	5.6 ± 0.36	0.820
%	94.5 ± 5.62	92.7 ± 6.53		91.1 ± 11.85	93.0 ± 5.94	
Intentional Score	5.8 ± 0.36	5.8 ± 0.48	0.754	5.6 ± 0.74	5.8 ± 0.45	0.766
%	97.2 ± 6.00	96.2 ± 8.03		93.8 ± 12.40	96.5 ± 7.48	
Non-Intentional Score	5.40 ± 0.54	5.3 ± 0.55	0.534	5.1 ± 0.98	5.3 ± 0.50	0.978
%	90.0 ± 8.99	87.9 ± 9.08		85.4 ± 16.25	88.3 ± 8.39	

Abbreviations: SD, standard deviation.

4. Discussion

4.1. Therapy Adherence

This study assessed medication adherence in 133 elderly patients with T2D and its association with cardiometabolic control. Approximately 63% of the participants were polymedicated and exhibited poor cardiometabolic control. However, adherence to therapy was notably high (97.7%), with no statistically significant differences observed between individuals with and without adequate cardiometabolic control. Despite this, patients with uncontrolled glucose levels tended to have poorer health parameters.

Participants classified as non-adherent had significantly higher HbA1c values compared to adherent participants ($p = 0.010$; $U = 221.500$). However, this finding was not supported by the correlation analysis between the continuous adherence percentage and HbA1c values ($p = 0.330$; $r = -0.090$). This apparent discrepancy is likely due to the high adherence rate observed and generally poor glycemic control across the sample, with 76.7% classified as uncontrolled. Thus, while participants below the adherence threshold (70%) showed significantly worse glycemic control, the large group above this threshold exhibited similarly elevated HbA1c values, minimizing variability and resulting in a weak overall correlation. Overall, the findings suggest that adherent and non-adherent individuals present similar clinical outcomes.

Diabetes is a chronic condition in which adherence to therapy is a critical determinant of disease control, playing a key role in preventing severe complications. Non-adherence to therapy is not merely a patient-related issue but rather a multifaceted problem influenced by socioeconomic, medical, psychological, and pharmacotherapeutic factors [33–35].

The complexity of pharmacotherapeutic regimens is a well-documented contributor to non-adherence. Although no significant differences were found in this study between adherence and polypharmacy, chronic patients—who are often older and polymedicated—generally experience greater difficulty in understanding their medication and managing their treatment independently [36]. In T2D, both polypharmacy and complex therapeutic regimens have been identified as key factors influencing adherence [37]. Additionally, beliefs about medication, perceived treatment efficacy, and fear of hypoglycemic episodes have been reported as barriers to adherence [17]. These challenges, when combined with factors, such as lack of family support, poor communication between healthcare professionals and patients, and insufficient information about pharmacotherapy, further contribute to non-adherence [38,39]. However, some studies suggest that greater regimen complexity and disease severity may, in certain cases, enhance patient engagement and motivation, ultimately leading to improved adherence [40].

There are multiple strategies to enhance adherence to therapy, many of which involve simple yet effective interventions. These include improved medical and pharmaceutical guidance, patient education to foster a better understanding of the disease and the benefits of treatment, and the use of adherence-supporting devices that help prevent forgetfulness [33,34]. Studies have shown that such interventions significantly improve adherence rates and, consequently, enhance disease control [41,42]. A systematic review and meta-analysis indicated that the complexity of the therapeutic regimen is not among the primary barriers to non-adherence [43].

Considering patients' preferences regarding their treatment is another key factor in promoting adherence [44]. In T2D, patient-centered pharmaceutical interventions—whether delivered in a community or clinical setting by pharmacists alone or as part of multidisciplinary teams—have been shown to be effective in improving self-care, medication adherence, and cardiometabolic control, as previously demonstrated [45]. Tools, such as the Morisky Medication Adherence Scale, have been widely used to monitor adherence and provide valuable insights into patient behavior [46,47].

In the present study, adherence to therapy was assessed using a subjective tool that relies on patients' self-reported behavior. While such methods are susceptible to greater bias compared to direct measures—such as serum drug concentration analysis or biochemical and physiological parameters—they offer practical advantages [48]. Although biased, subjective adherence measures are concise, easy to implement in medical and pharmaceutical consultations, and cost-effective [49,50]. Moreover, they provide immediate feedback and facilitate the identification of underlying causes of non-adherence, allowing for tailored interventions based on individual patient concerns and needs [51,52].

Despite the existence of multiple adherence assessment methods, no single approach is considered the gold standard. Therefore, it is recommended that adherence evaluations combine more than one methodology to ensure a more accurate assessment [53]. A systematic review and meta-analysis evaluating patient-reported outcome measures for medication adherence in individuals with cardiovascular disease and/or type 2 diabetes concluded that none of the assessed instruments, including the TAM, met the criteria for being classified as both reliable and recommended for these populations [54]. Nonetheless, tools based on the Morisky scale remain among the most widely used in clinical practice and have demonstrated satisfactory results in monitoring medication adherence [47].

In the present study, adherence values greater than 70% were used as the cut-off point, with the adherence rate reaching 97.7%, a figure considerably higher than those typically reported in the literature. It is possible that the participants' low level of education influenced their comprehension of the TAM questions, potentially leading to an overestimation of adherence due to social desirability bias—one of the primary limitations of indirect adherence assessment methods [55]. In addition to low educational attainment, social desirability bias has been identified as a contributing factor to the overreporting of good adherence, which may have influenced the results in this study [56].

A Portuguese study that also employed the TAM tool in diabetic patients reported an adherence rate of 62.3% [57], whereas a study conducted in Brazil using the same methodology and study population observed a higher adherence rate (84.4%) [58]. Although the TAM is based on the Morisky questionnaire, it was originally developed in Portuguese, and its adherence calculation method differs from the original instrument. These discrepancies present a challenge in making direct comparisons across studies. Furthermore, as systematic reviews have reported, adherence rates in diabetes are highly variable, ranging from 15% to 93% [19].

Although no significant differences were found between the mean values of intentional and unintentional non-adherence, the lower scores in items related to unintentional non-adherence suggest that failures in adherence are often due to forgetfulness or a lack of medication availability. A substantial proportion of participants reported having forgotten to take their medication (65.4%) or being careless with their dosing schedule (72.9%). Vries et al. [59] similarly found that more than 80% of non-adherent patients forgot to take their diabetes medication. Indeed, forgetfulness is widely recognized as one of the primary reasons for non-adherence to diabetes therapy [43].

Unintentional non-adherence is particularly prevalent among the elderly, not only due to age-related cognitive decline but also because of factors, such as beliefs about medication and a diminished perception of the necessity of pharmacological treatment [60,61]. Moreover, a diagnosis of diabetes itself has been identified as a predictor of unintentional non-adherence behaviors [61]. Therefore, interventions should not only focus on addressing forgetfulness and adherence to medication schedules but also target cognitive factors, medication-related beliefs, and self-efficacy, as these are essential in improving long-term adherence to therapy [62].

Although the vast majority of study participants (97.7%) were classified as adherent to medication, more than 90% presented glycated hemoglobin (HbA1c) values equal to or above 7%. HbA1c is a well-established marker of diabetes control, reflecting the average blood glucose levels over the preceding three months, and its elevated value suggests a potential overestimation of adherence rates [63]. Similar findings were reported in an Iranian study, where more than 78% of patients classified as highly adherent to therapy exhibited poor glycemic control [64]. However, other studies have demonstrated a statistically significant association between medication adherence and reductions in HbA1c levels [65,66].

The high proportion of therapy-adherent patients with inadequate glycemic control may be attributed to response bias, as patients may report higher adherence due to social desirability, attempting to demonstrate compliance with pharmacotherapeutic regimens and medical recommendations to avoid embarrassment. Moreover, glycemic control is not solely dependent on medication adherence. Adherence to a healthy lifestyle, including regular physical activity and an appropriate diet, plays a crucial role in cardiometabolic regulation [67–69]. Physical activity adherence is particularly low among elderly individuals, with mobility limitations and comorbid conditions causing pain being major barriers to exercise engagement [70–72]. In type 2 diabetes, physical activity is essential for improving cardiometabolic control, much like adherence to dietary recommendations.

It should also be noted that, as previously stated, participants in this study were not specifically instructed to focus solely on their diabetes medications when responding to the

TAM questionnaire. This instrument assesses general adherence to medications and it is possible that patients reporting high adherence might primarily reflect their consistent intake of medications unrelated to glycemic control (such as antihypertensives, lipid-lowering agents, or other chronic-disease medications), rather than specifically adherence to hypoglycemic agents. Thus, the association between adherence and poor glycemic control might partially result from participants interpreting the adherence questionnaire more broadly, encompassing their entire medication regimen rather than isolating diabetes medications. Nevertheless, adherence to these self-care behaviors remains suboptimal among patients with T2D [73–77]. Studies conducted in Portugal also indicate low adherence to self-care practices related to physical activity and diet [45,78]. A recent Portuguese study found high adherence to pharmacological therapy alongside poor adherence to self-care behaviors, with forgetfulness and a lack of adherence to medication schedules being the most frequently reported non-adherent behaviors [79].

4.2. Perspectives for Clinical Practice

The discrepancy between self-reported medication adherence and actual cardiometabolic outcomes underscores the need for comprehensive, multidimensional approaches in clinical practice. Adherence should be understood not only in terms of medication intake but as part of a broader behavioral pattern that includes diet, physical activity, and lifestyle management.

The field of Lifestyle Medicine offers promising implications for clinical practice, as it emphasizes therapeutic lifestyle interventions to manage and treat chronic diseases like diabetes, prioritizing nutritional education, physical activity, stress management, restorative sleep, social connectivity, and reductions in substance use [80,81].

Incorporating Lifestyle Medicine into diabetes management involves structured interventions and multidisciplinary support from professionals, such as nutritionists, exercise physiologists, psychologists, pharmacists, and specially trained nursing staff. These health professionals can identify adherence barriers, provide regular follow-up, personalized counseling, and continuous motivational support, effectively addressing not only medication adherence but also adherence to crucial lifestyle behaviors [82,83].

Integrating dietary management, physical activity prescriptions, behavioral strategies, and continuous education can significantly improve glycemic control, reduce cardiovascular risk, and enhance patient satisfaction and quality of life [83,84]. Thus, incorporating dedicated Lifestyle Medicine strategies into clinical practice is a relevant and practical implication derived from our study's findings.

4.3. Limitations

This study has several important limitations. Firstly, adherence was measured solely through a self-reported questionnaire (TAM). As previously stated, subjective adherence measures are susceptible to biases, such as social desirability and recall bias, particularly in elderly populations with low educational attainment, potentially leading to adherence overestimation [51,52]. Furthermore, it is important to note that the TAM questionnaire and similar instruments have frequently applied adherence thresholds between 70% and 80% to define adherence categorically in various clinical contexts. However, adopting a specific adherence threshold inherently involves trade-offs. While a threshold of >70% effectively identifies clearly non-adherent individuals, it might underestimate or misclassify individuals exhibiting moderate or intermittent non-adherence. In particular, participants who adhere just above the 70% threshold may still experience clinically meaningful lapses in medication-taking behaviors, potentially contributing to suboptimal clinical outcomes. Future studies should consider analyzing adherence as a continuous variable or employing multiple adherence categories (high, moderate, low) to capture nuanced adherence behaviors and their clinical impacts more precisely. Additionally, complementing subjective tools with objective methods (e.g., electronic monitoring devices, pharmacy refill records) could yield more accurate adherence estimates [85].

Secondly, the cross-sectional study design precludes establishing causal relationships between adherence and cardiometabolic outcomes. Longitudinal studies are needed to clarify temporal relationships and confirm causality.

Thirdly, the generalization of these findings might be limited, given that the study population was recruited from a specific geographic region (Algarve, Portugal), characterized by its sociodemographic, cultural, and healthcare access contexts. Thus, the results obtained might differ in populations from other geographic or sociocultural contexts. Additionally, participants were recruited via local community organizations, parish councils, and senior community centers. Such methods may have introduced selection bias, attracting more socially engaged, health-conscious individuals, potentially leading to higher adherence estimates compared to less-engaged elderly populations.

Finally, this study did not include adherence measurements for diet and physical activity, which are essential components of comprehensive diabetes self-management. This limitation restricts the understanding of the interplay among various adherence behaviors and clinical outcomes, and may explain in part the discrepancy between the high adherence rate and the suboptimal cardiometabolic control observed. Future research should integrate a holistic assessment of adherence behaviors (pharmacological and non-pharmacological) to provide deeper insights into diabetes self-management and guide more effective intervention strategies.

5. Conclusions

This study identified high rates of medication adherence among elderly patients with type 2 diabetes; however, cardiometabolic control remained suboptimal. Behaviors related to unintentional non-adherence may partially explain the inadequate glycemic control observed. Nonetheless, medication adherence alone is not sufficient to ensure optimal cardiometabolic regulation, as lifestyle factors, such as diet and physical activity, play a crucial role in disease management.

Future studies in elderly diabetic patients should extend their focus beyond pharmacological adherence to encompass adherence to self-care behaviors, particularly dietary habits and physical exercise. Additionally, interventions aimed at improving cardiometabolic control in this population should incorporate strategies that promote adherence not only to medication but also to lifestyle modifications, ensuring a more comprehensive approach to diabetes management, and ultimately leading to better health outcomes for older adults with diabetes.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/diabetology6050033/s1, File S1: STROBE Statement—Checklist of items that should be included in reports of cross-sectional studies.

Author Contributions: Conceptualization, T.N. and S.P.; methodology, R.d.l.P., T.N. and S.P.; formal analysis, E.P.; investigation, A.A., C.C. and T.N.; data curation, E.P; writing—original draft preparation, A.A. and T.N.; writing—review and editing, A.A., C.C., E.P., R.d.l.P., S.P. and T.N; supervision, R.d.l.P. and S.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the University of Algarve (CEUALg) (CEUAlg Pn°6a)/2021.

Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Data Availability Statement: Due to privacy restrictions, the data presented in this study are only available on request from the corresponding author.

Acknowledgments: We thank Associação para o Estudo da Diabetes Mellitus e Apoio ao Diabético do Algarve (A.E.D.M.A.D.A.) for the support provided.

Conflicts of Interest: The authors declare no conflicts of interest.

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