

Original Article

## Rational Use of Diabetes and Non-Diabetes Medications and Contribution of Nurses to it: A Cross-Sectional Study

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### Abstract

**Background:** Diabetes is a chronic disease in which rational medication use is important. However, studies reporting the rational use of medication and the contribution of nurses to diabetic patients are limited.

**Purpose:** To determine the rational use of diabetes and non-diabetes medications by people with diabetes and the contribution of nurses to rational medication use and to make recommendations for rational medication using training.

**Methods:** The study was used a descriptive and cross-sectional design. Using Raosoft sample size calculator, the sample size was determined with a margin of error of 5% and a confidence interval of 95%, assuming a response rate of 50%. The participants completed self-report questionnaires (n = 381). Descriptive analyzes were performed.

**Results:** Most people with diabetes (70.86%) use insulin and about half (42.78%) use OAD. The most commonly used diabetes medications are biguanide (79.8%) and long-acting insulin (53.4%). The most common non-diabetes medications were the cardiovascular system medications (20.7%). 24.1% of participants knew about rational medication use, 17.1% knew that diabetes medications can interact with other medications and foods. 7.6% had 6 or more boxes of medicine in their medicine cabinet. 4 boxes or more of medications are thrown away (15%) per year, and they are reused (65.6%) if they are suitable for the disease. 26.6% think that the duration of the report affects the treatment. Nurses gave limited information on use of medication (57.0%).

**Conclusion:** The rational use of diabetes and non-diabetic medication should be increased. Nurses should improve the medication-related behavior of patients with diabetes.

**Keywords:** diabetes and non-diabetes medications; nurses; people with diabetes; rational medication use

### Introduction

Correct and appropriate use of medicines is one of the most important aspects of disease therapy (Atif et al. 2017; Prasetyo et al., 2020). The World Health Organization defines the rational use of medicines (RUM) as follows: "Patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and

at the lowest cost to them and their community" (WHO, 2002). However, because people may use medicines based on inadequate knowledge, perceptions, and habits, (Pandey and Chaudhari, 2017) the irrational use of medicines is a major global problem. More than half of medications are used irrationally while there is insufficient promotion of RUM (WHO, 2020).

Diabetes is a chronic disease that requires multiple medications because of the disease itself and comorbidities (ADA,2019; Chehade and Mooradian, 2000). Therefore, effective treatment requires correct diagnosis and the right medication. This requires correct consideration of dose, duration, application pathway, treatment success, side effects, the interaction of multiple medications, medication compliance, and costs (Davies et al., 2018; Miraci et al. 2015).

The rational use of medications for diabetes and its comorbidities is important (Zheng, Ley and Hu, 2018) because misuse causes sub-optimal glycemic control, long-term co-morbidity, and decreased quality of life (Abbas et al., 2015; Kassahun et al., 2016). Current diabetes treatment involves selection of tailored medications that match the characteristics of individuals with diabetes rather than standard treatments (Chan and Abrahamson, 2003). For example, some medications are preferred because they reduce the risk of cardiovascular disease while some others are preferred because they are antihypertensive or induce weight loss in obese people. Therefore, RUM is important in selecting medications to match the existing health problems and life habits of people with diabetes (Chehade and Mooradian, 2000; Dunning and Manias, 2005) by placing them at the center of pharmaceutical care (Davies et al. 2018). People with diabetes also have many important responsibilities regarding RUM, such as taking the correct dose of medication at the right time, knowing about potential side effects and interactions, and not wasting medication (Brown and Bussell, 2011). Conversely, irrational use is commonly characterized by using medications without consulting a physician, recommending medications to others, reusing the same medications based on previous symptoms, using medications on the advice of people other than nurses (Cengiz and Ozkan, 2020; Tiv et al., 2012; Şendir et al., 2015). Although nurses play an important role in promoting RUM (Atif et al. 2017; Prasetio et al. 2020, Brown and Bussell, 2011), they sometimes only provide information verbally without offering sufficient information, especially on side effects (Dunning and Manias, 2005).

Various studies have evaluated knowledge, awareness, and attitude in the use of diabetes medications (Pandey and Chaudhari, 2017; Abbas et al., 2015; Al-Maskari et al., 2013). However, these studies did not address the perspective of

people with diabetes regarding RUM, and whether they use diabetes and other medications rationally.

Rational medication use is not well known among diabetes treatment providers, so nurses should be trained in this regard. Irrational use of diabetes medications can complicate metabolic control, and cause increased comorbidities, costs, and deaths (Prasetio et al. 2020; WHO,2002). Nurses can determine the needs of people with diabetes through descriptive studies of RUM to strengthen their diabetes education, and improve their contribution areas. Prevention of irrational use of medication may reduce risks to people with diabetes.

The study evaluates the rational use of diabetes and non-diabetic medications and the contribution of nurses to RUM from the perspective of people with diabetes. It then makes recommendations for medication therapy management (MTM) training programs for people with diabetes. It addresses the following research topics: (i) the rational use of diabetes and non-diabetes medications; (ii) participation in RUM by people with diabetes; and (iii) the contribution of nurses and aspects that need improvement.

## Methods

**Participants and settings:** This cross-sectional descriptive study was carried out in the diabetes outpatient clinics of three cities (Bartın, Karabük, Zonguldak) in northwest Turkey. Based on the number of diabetes patients admitted to these diabetes outpatient clinics, the sample size was calculated assuming a total of 3.000 diabetes in the three cities. Using Raosoft sample size calculator, the sample size was determined with a margin of error of 5% and a confidence interval of 95%, assuming a response rate of 50% (Raosoft sample size). This yielded an estimated sample size of 341. In total, 425 patients were screened for participation of which 44 were excluded based on our exclusion criteria. The study was completed with 381 people with diabetes who completed a data collection form created by the researchers based on the literature. The design of the study is shown in Figure 1.

**Ethical considerations:** Ethics approval was obtained for the research from the University Ethics Committee (Decision Number: 2019/188). In addition, institutional permissions were obtained from the Health Directorate of the three provinces where the study was conducted. The

purpose of the research was explained, and oral and written approvals were obtained from each participant.

**Data analysis:** SPSS 25 package program was used to analyze the research data. Descriptive statistics were expressed as means (X), standard deviations (SD), numbers (n), and percentages (%). Statistical analyses were conducted before the missing data in the study was completed. The number of samples is specified in the relevant part of the table.

## Results

**Characteristics of participants:** The sociodemographic and clinical characteristics of the participants are shown in Table 1. The mean age was  $58.92 \pm 12.34$  years (range = 19-86), 65.6% were female, and 73.5% were primary school graduates. Most had Type 2 diabetes (87.4%) while about half had a diagnosis lasting 10 years or more (48.3%). The most common comorbidities were hypertension (54.1%) and hypercholesterolemia (32.3%). Mean FPG was  $184.79 \pm 78.96$  mg/dL (range = 55 - 590) while mean A1C was  $8.75 \pm 2.08$  (range = 5.25 - 16.30).

**Rational use of diabetes and non-diabetes medications:** Used OAD medications, insulin groups, and non-diabetes medications are shown in Figure 2. Biguanides (79.8%) and long-acting insulin (39.3%) were used the most commonly used from the OAD and insulin group, respectively. The most commonly used non-diabetes medications were cardiovascular system (CVS) (20.7%) and antihyperlipidemic (18.4%) medications. Rational use behaviors for diabetes and non-diabetes medications are shown in Table 2. Most of the group (70.86%) use insulin and about half (42.78%) use OAD. The number of OAD medications used daily was  $1.85 \pm 0.60$  (range = 1-10). The mean insulin dose was  $37.40 \pm 20.04$  U/day (range = 10-130 U) while 11.5% of participants with diabetes used 7 to 10 medications per day. Most people with diabetes used their medication regularly (85.8%) and at the recommended dose (91.6%).

However, very few people with diabetes knew that diabetes medications can interact with other medications (17.1%). The mismatch between duration of the time of the medical reports and medications hindered continuation of treatment in 26.6% of the group. Medications were prescribed as monotherapies in 26.6% of patients. People with diabetes (7.6%) had six or more boxes of

medicine in their medicine cabinet. They threw away an average of 4 or more boxes of medicine a year (15%) but also frequently reused medicines (65.6%) if they were appropriate for the disease.

**Rational medication use by people with diabetes and the contribution of nurses:** The participants' rational use behaviors for diabetes and non-diabetes medications are shown in Table 3. Approximately a quarter of people with diabetes had knowledge about RUM (24.1%) while over half of nurses (57.0%) gave information about it. While a few people with diabetes had received training on the interactions of medications with food and other medications (17.8%), about one third used herbal products instead of medications (31.8%). Nurses gave limited information on RUM (57.0%). They offered the least information about medication prices (11.8%) and the most about name (76.4%) and dose (78.5%).

## Discussion

This study investigated the RUM behaviors of people with diabetes while using diabetes and non-diabetes medication and identified how healthcare providers contribute to RUM based on the perspective of people with diabetes (MTM) training programs for people with diabetes. The findings indicate that the behaviors of people with diabetes should be improved in terms of RUM and that the contribution of nurses to this should be increased. These findings suggest several recommendations for rational medication using for therapy management.

In our study, the majority of participants had Type 2 diabetes that had continued for over 10 years (Pushpa, Nagesh and Ramesh, 2020). As in many diabetes studies, they were quite old on average (Pushpa, Nagesh and Ramesh, 2020; Abebaw et al., 2016), which is significant because age can affect compliance with diabetes treatment and appropriate use of diabetes medications (Kassahun et al. 2016, Abebaw et al., 2016).

Most participants in our study were women, similar to a study in India (Pushpa, Nagesh and Ramesh, 2020) but in contrast with other reports from Ethiopia (Kassahun et al. 2016). A third of our participants were primary school graduates, which is significant because insufficient education level (as well as short duration of diabetes) can hinder diabetes treatment compliance and the appropriate use of diabetes

medications (Ramesh et al., 2011). The high FPG, TPG, and A1C levels of our participants indicate that their blood glucose levels were not good, as in many studies.

**Table 1. Characteristics of participants**

Characteristics of diabetics	n (%)
<b>Age</b>	58.92±12.34 (Min: 19, Max:86)
<b>Gender</b>	
Male	131 (34.4)
Female	250 (65.6)
<b>Marital status</b>	
Married	317(83.2)
Single	28(7.3)
Other	36(9.4)
<b>Educational Status</b>	
Primary school	280 (73.5)
Secondary school	39 (10.2)
High school	40 (10.5)
University	22 (5.8)
<b>Economic condition</b>	
Income > expenses	66 (17.3)
Income = expenses	234 (61.4)
Income < expenses	81 (21.3)
<b>Diabetes Type</b>	
Type 1	48 (12.6)
Type 2	333 (87.4)
<b>Duration of Diagnosis</b>	
<1 year	36 (9.4)
1-5 years	68 (17.8)
5-10 years	93 (24.4)
≥10 years	184 (48.3)
<b>Comorbidities</b>	
Hypertension	206 (54.1)
CVD	109 (28.6)
Hypercholesterolemia	123 (32.3)
Retinopathy	78 (20.5)
Neuropathy	59 (15.5)
Diabetic foot	21 (5.5)
Nephropathy	35 (9.2)
<b>Biochemical Analysis</b>	
FPG (n: 381)	184.79 ±78.96 (Min: 55, Max:590 mg/dL)
PPG (n: 114)	224.76 ±87.063 (Min:85, Max:610 mg/dL)
HbA1c (n: 242)	8.75±2.08 (Min:5.25, Max:16.30)

**Table 2. Rational use of diabetes and non-diabetes medications**

Using Diabetes Medications	n (%)
Using OAD	163 (42.78)
Number of OADs used/day	1.85±0.60 (Min:1, Max:4)
Using insulin	270 (70.86)
Mean insulin dose (U/day)	37.40±20.04 (Min:10, Max:130 U)
Insulin Therapy	270 (70.86)
Monotherapy	72 (37.9)
Two medication combination	118 (62.1)
Three medication combination	80 (20.9)
<b>Number of medications used/day</b>	
1-3	213 (55.9)
4-6	124 (32.5)
7-10	44 (11.5)
<b>Rational Use Behaviors of Diabetes Medication</b>	
Regular use of medicines	327 (85.8)
Fulfilling the storage conditions of medications	340 (89.2)
Knowing how to use insulin	314 (82.4)
Taking the medication at the recommended dosage	349 (91.6)
Knowing when to use OAD	353 (92.7)
Knowing effects of medications	229 (60.1)
Knowing the side effects of medications	151 (39.6)
Knowing the interaction of diabetes medications with other medications	65 (17.1)
<b>What to do in case of side effects</b>	
Do nothing	31 (8.1)
Self search for solutions	61 (16.0)
Consulting a healthcare provider	289 (75.9)
Reading the medication prospectus	194(50.9)
Checking the expiry date	285(74.8)
Avoiding diabetes medications	191 (50.1)
Medical report duration affects the treatment	99 (26.6)
<b>Rational Use Behaviors of Non Diabetes Medication</b>	
<b>Unused medicine at home</b>	
None	230 (60.4)
1-5 boxes	121 (31.8)
≥ 6 boxes	29 (7.6)
<b>Average number of medications discarded a year</b>	
None	217 (57.0)
1-3 boxes	104 (27.3)
≥ 4 boxes	59 (15.5)
<b>How are the medications disposed of at home?</b>	
Storing for use when necessary	97 (25.5)

Throwing it away	93 (24.4)
Giving to the nearest nurses	184 (48.3)
Giving to friends/neighbors	7 (1.8)

**Which medications are reused at home?**

Those suitable for a disease	250 (65.6)
Non-expired medications	86 (22.6)
I do not pay attention to anything	45 (11.8)

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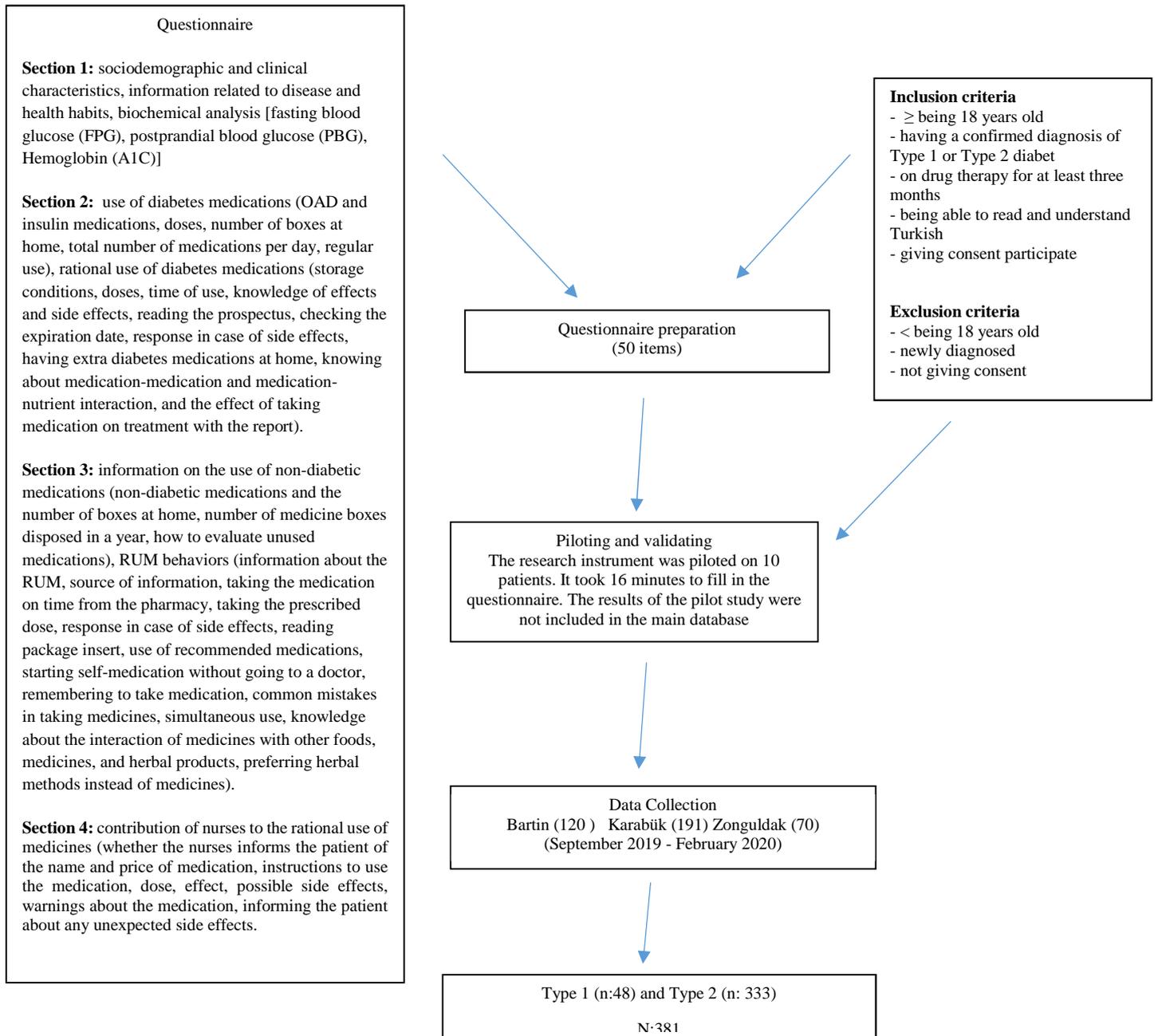
**Table 3. Participation in rational use of medication by people with diabetes and contribution of nurses**

<b>Participation in RUM by people with diabetes</b>	<b>n (%)</b>
Knowledge on rational medication use	92 (24.1)
<b>Information source</b>	
Internet and television	16 (17.39)
Health care professional	73 (79.36)
Family and friends	3 (3.25)
<b>Regular use of medications</b>	
Getting the medication from the pharmacy on time	371 (97.4)
Taking the medication at the recommended dose	356 (93.4)
Knowing the effects of the medication	175 (45.9)
Knowing the side effects of the medication	120 (31.5)
<b>What to do in case of side effects</b>	
Do nothing	15 (3.9)
Solving the problem on my own	51 (13.4)
Consulting healthcare provider (doctor+ nurse +pharmacist)	315 (82.7)
Status of reading the medication prospectus	190 (49.9)
<b>Common medication mistakes made while taking medication</b>	
Skipping the medication, not using it	240 (63.0)
Using the medication at an incorrect dosage	29 (7.6)
Administering the medication at a wrong time	73 (19.2)
<b>Thought and behavior characteristics regarding medication use</b>	
Recommended medication use	48 (12.6)
Do not self-medicate	54 (14.2)
<b>Behavior after forgetting skipping medication</b>	
Using immediately	166 (43.6)
Waiting for the next time of the medication	157 (41.2)
Decision-making during the elapsed time	58 (15.2)
Using medicines together	183 (48.0)
<b>Time of use of medications</b>	
Until the recommended time	239 (62.7)
Until the medications are finished	94 (24.7)
Until the complaints stop	48 (12.6)
	68 (17.8)
<b>Training on herbal product use</b>	
<b>Using herbal products instead of medications</b>	121 (31.8)
<b>Contribution of nurses to rational medication use *</b>	
Providing information about the name of the medication	291(76.4)
Giving information about the price	45 (11.8)
Describing the instructions to use	285 (74.8)
Giving information about dosage	299 (78.5)
Informing about its effect	208 (54.6)
Informing about its side effect	180 (47.2)

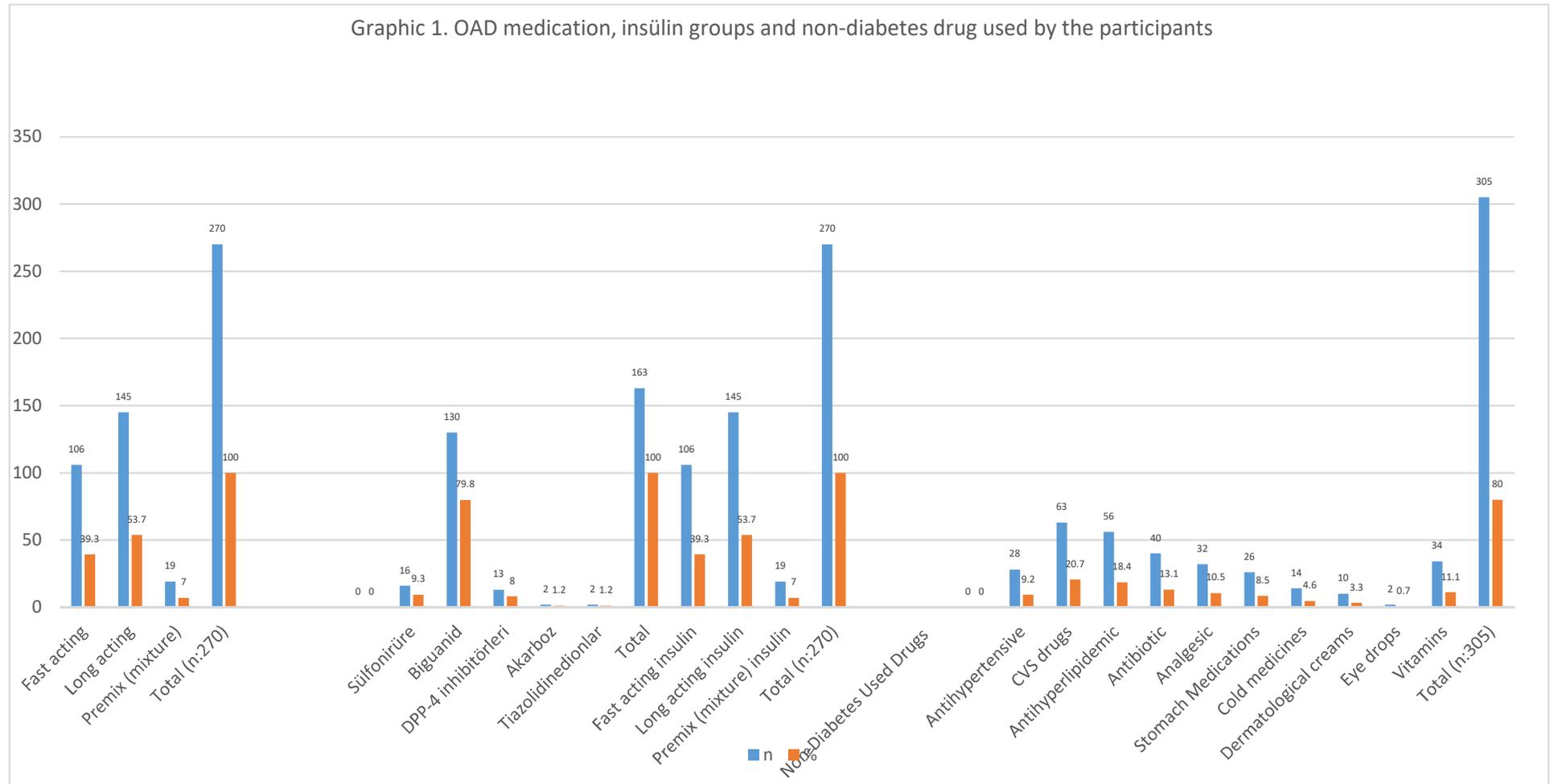
Warning about medication	197(51.7)
Explaining how to apply	298 (78.2)
Telling to stop applying in case of an unexpected effect	232 (60.9)

\* Multiple choices were marked

**Figure 1. Flowchart of Study**



**Figure 2. OAD medication, insülin groups and non-diabetes drug used by the participants**



This raises the risk of comorbidities (Abbas et al., 2015, Pushpa, Nagesh and Ramesh, 2020), of which the most common are hypertension and hypercholesterolemia (Pushpa, Nagesh and Ramesh, 2020). Thus, considering age, blood glucose parameters, and comorbidity, these people with diabetes need to develop their RUM behaviors.

Although this study included more participants with Type 2 diabetes, insulin use was greater than OAD use. This shows that normal blood sugar levels cannot be achieved with OAD therapy and lifestyle changes along; rather, more insulin therapy is needed. Biguanides were the most commonly prescribed oral anti-diabetic (79.8%) alone with long-acting insulin medications (39.3%), in line with Patel et al. (2013) (Patel et al., 2013). This contrasts with previous reports that glibenclamide and mixed insulin were the most commonly prescribed antidiabetic medications (Pushpa, Nagesh and Ramesh, 2020; Kumar et al., 2020). Among second-generation sulfonylureas, glimepiride was the most commonly prescribed along with metformin, which is in accordance with findings from India (Kumar et al., 2020).

Although most studies report a high rate of regular use of medications by people with diabetes (Abebaw et al., 2016, Arifulla et al., 2014), some studies contradict this (Tiv et al., 2012; Gangwar et al., 2013).

In our study, 10% of participants took 7-10 medications a day while 85% used their medication regularly. However, they do not know enough about the recommended dose, storage conditions, or insulin administration. Correcting these behaviors, which are incompatible with RUM, will improve the health of individuals with diabetes. Most participants do not know about the effects, side effects, duration of use of OAD medications, and the interaction of diabetes medications with other medications and foods, probably because of not reading medication package inserts. Many also fail to check expiration dates. This confirms previous findings that patients lack information about diabetes medications, particularly about their effects and side effects (Gangwar et al., 2013; Mourão et al., 2013). Thus, developing RUM behaviors in people with diabetes could improve their blood glucose levels and metabolic control.

In Turkey, the state pays for diabetes medications so long as a medical report is provided. For a

quarter of participants, however, the continuation of their treatment was affected by a mismatch between their use of diabetes medications and the period covered by the medical report. They, therefore, store extra diabetes medications because they fear that they will run out of medication. Other studies have also reported that economic factors hinder medication use in diabetes patients (Arifulla et al., 2014, Wabe et al., 2011).

Hypertension was the commonest comorbidity observed while CVS and antihyperlipidemic medications were the most frequently used medications. Previous studies also reported that antiplatelet and antihyperlipidemic medications were the most commonly used (Patel et al., 2013), presumably because hypertension and hyperlipidemia are the most common comorbidities associated with diabetes. However, the use of antihypertensive medications in our study was low, indicating that hypertension is not being treated effectively. Management of hypertension in diabetes is important to prevent complications. Therefore, it is important to develop the rational use of antihypertensives in diabetes.

About half of the people with diabetes had kept extra non-diabetes medication at home. This shows that a significant portion of people with diabetes had diabetes complications. However, a small number of people with diabetes had six or more boxes of nondiabetes medication in their medicine cabinets. When examined how they disposed of the unused medications, it was determined that an average of 4 or more boxes of medication were wasted annually, was given the medications that could be used to the nearest health institution and reused if they were suitable for the disease. Although at a low rate, dangerous medication use behaviors such as giving unused medications to neighbors/friends and taking care of nothing in the next use are observed.

Regular counseling and training can improve the awareness of people with diabetes (Gangwar et al., 2013). Evaluating medication knowledge and usage behaviors in people with diabetes and providing education accordingly can increase RUM. The low rate of benefiting from other sources other than nurses such as the internet as an educational resource and the high rate of not reading the prospectus are behaviors that may adversely affect rational medication use. Rational

medication use behaviors such as regular use of medications, getting medicines from the pharmacy on time, and using the recommended dosage may be affected positively health of people with diabetes. However, not reading the prospectus, not knowing the effect and side effects, medication-medication, and medication-nutrient interaction may be affected negatively people with diabetes' health. Again, although the rate of self-medication use was low, it poses a threat to the health of people with diabetes. Similarly, in previous studies, the most common problem reported in the treatment of diabetes in similar studies is skipping medication, not getting the medication on time, taking the wrong medication, and using extra medication (Şendir et al., 2015, Arifulla et al., 2014; Mohamadloo and Ramezankhani, 2020). These are important issues that should be emphasized in the rational medication use education of people with diabetes.

The participants in our study mostly obtain information from their nurses regarding medication dosage, administration method, name, and instructions for use. This confirms previous findings that people with diabetes get the most information about medication use from nurses (Arifulla et al., 2014, Williams et al., 2007; Hartayu and Suryawati, 2012). An experimental study showed that medication education given by nurses to people with diabetes lowered A1C and fasting plasma glucose (Mourão et al., 2013). However, our findings also indicate that the participants received insufficient information about side effects, medication interactions, and warnings during educations.

There are several limitations to this study. Firstly, the participants were selected from a predefined geographical region, which may not be representative of all people in Turkey. Secondly, this study was a cross-sectional design, which prevented the observation of RUM behaviors among people with diabetes. On the other hand, including several hospital centers strengthened the study as it allowed us to include a wide variety of patient profiles.

## Conclusion

The results of this study highlight how the rational use of diabetes and non-diabetic medications is important for successful diabetes management. In addition, the results emphasize that nurses should make a greater contribution to improving RUM.

According to the results of the study; using multiple medications, knowing the effects, side effects, medication-medication, medication-food interactions of diabetics and non-diabetic medications and what to do in case of a problem, reading the prospectus, what to do in case of forgetting the medication intake, arranging the duration of reports appropriately, not taking medication on the recommendation of someone else, not having too much and unnecessary medicine, and preventing the waste of medicine are important issues for people with diabetes.

## Practical implications

Although an experimental design is required to confirm, rational medication use behaviors, our results offer some practical suggestions. Rational medication use concepts should be developed in people with diabetes. Both people with diabetes and nurses should be trained regarding the positive outcomes of rational medication use. If non-diabetic medications are used irrationally then comorbidity, costs, and deaths can increase. After determining the needs of people with diabetes regarding rational medication use, nurses can then provide appropriate medication education to improve their contribution. By evaluating the rational use of diabetes and non-diabetic medications, this study demonstrated the need for RUM education and identified the points that need improvement. These findings can guide comprehensive and understandable follow-up MTM programs and training.

**Ethical considerations:** Ethics approval was obtained for the research from Ethics Committee of University (Decision Number: 2019/188). In addition, institutional permissions were obtained from the Health Directorate of 3 provinces where the study was conducted. The purpose of the research was explained, and oral and written approvals were obtained from the diabetics who agreed to participate in the study.

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