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A Pharmacoeconomic Evaluation of Type 2 Diabetes Drugs in Central Pharmacies in Sivas Province

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ABSTRACT:
Purpose: In this study, prescriptions of 391 patients with type 2 diabetes mellitus selected from pharmacies in Sivas city center by mass sampling method were analyzed and the aim was to investigate the pharmacoeconomic suitability of these drugs considering the chronic complications associated with diabetes.
Material and Methods: This study is characterized as a descriptive cost analysis in which retrospective analysis was conducted on 391 prescriptions issued to Type-2 Diabetes Patients after obtaining the required permissions, including approval from the Ethics Committee. Patient prescription data were collected from pharmacies comprising the sample group over a three-month period in Sivas Province. The demographic features such as age and gender of the patients and the medications prescribed for Type 2 Diabetes were analyzed, and the costs associated with these prescription drugs were calculated. In addition, additional diseases of Type 2 Diabetes patients were also scrutinized within the scope of the study.
Results: According to the data obtained, the drugs prescribed to diabetic patients with chronic diseases were found to be appropriate. However, when all diabetic patients were examined, it was determined that the prescribed amount of insulin preparations was high and not pharmaceutically appropriate. It was revealed that the cost of type 2 diabetes medications for 391 patients was 77.852,79₺, and the prescription price was 199.11₺.
Conclusion: Type 2 diabetes is characterized by insulin resistance in tissues such as liver, muscle and fat as a result of detectable damage to pancreatic beta cells. The disease is also associated with genetics, environmental factors and lifestyle. In our country, 22.6% of the health budget is allocated to the treatment of diabetes and its complications. Due to the increasing frequency of patients with type 2 diabetes, effective and rational treatments to reduce the burden of the disease on the health budget have become an important issue for both payers and policy makers, but it needs to be emphasized and examined from a pharmacoeconomic perspective in future studies.
Keywords: *Drug Cost; Insulin; Pharmacoeconomics; Type 2 Diabetes*

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INTRODUCTION

Type 2 diabetes mellitus (DM) is a disease characterized by insulin resistance in tissues such as the liver, muscle, and fat, resulting from detectable damage to pancreatic beta cells. Other complications associated with this steadily increasing disease and a rise in mortality rates due to diabetes are becoming more prevalent. According to a study conducted by the International Diabetes Federation (IDF), the cost of treating type 2 diabetes patients was estimated to be $850 billion in 2017, and this number is expected to increase by 8% by 2045 (Eray and Balcı 2005; Tanrıverdi et al., 2013).

In our country, 22.6% of the health budget is allocated to the treatment of diabetes and its complications. In 2012, a budget of approximately 10 billion₺. was allotted to type 2 diabetes patients in Turkey and due to the increasing prevalence of

diabetes, the Turkish government initiated a diabetes management program in 2015 (Yaman, 2019). The expenses associated with diabetes may rise and deteriorate as inexpensive medications for diabetes fail to adequately treat the patient and result in adverse effects, highlighting the importance of cost-effective treatments with favorable side effects to alleviate the health burden. In this study, the prescriptions of 391 Type-2 diabetes patients from pharmacies were selected by mass sampling method in Sivas Province to investigate the pharmacoeconomic appropriateness of these drugs by considering chronic complications related to diabetes. To address this issue, the prescriptions of 391 individuals with Type-2 diabetes were examined from pharmacies selected through mass sampling in the Sivas Province center. The study investigated the pharmacoeconomic appropriateness of these medications by considering the chronic complications associated with diabetes.

Pharmacoeconomics

Healthcare costs are constantly increasing worldwide, especially in newly developing countries. In many countries, this increase even prevents the economic growth of the countries. The primary drivers of economic growth typically stem from technological innovations and the importation of products. For this reason, countries find it appropriate to reduce their expenditures in this field and to follow certain policies. Pharmacoeconomics is the scientific discipline best suited for conducting thorough evaluations and providing guidance in this particular field (Güven, 2016; Karuranga et al, 2017). Pharmacoeconomics has garnered increasing attention globally and in Turkey, particularly in recent times. With the introduction of numerous drugs into the healthcare sector and advancements in technology, there has been an increase in drug costs and concerns regarding risks and side effects, leading to a growing demand for medical economics expertise in the multidisciplinary realm. In essence, pharmacoeconomics involves assessing the benefits of healthcare treatments and allocating costs accordingly (Çetin, 2010).

It is necessary to increase the number of people with knowledge and support in pharmacoeconomics, including pharmacoeconomics evaluations in drug license applications, to establish hospital formulations in a hospital or national context, to support their use, to compare existing drugs with new formulations and marketed drugs, to compare them in terms of cost and to determine whether they replace SSIs. The inclusion of pharmacoeconomic methods in the determination of drug use is also essential in terms of rational drug use. Prioritizing only drug costs in reimbursement is a false workaround (Acar, 2005). Pharmacoeconomics is a scientific discipline focused on examining, comparing, and evaluating pharmaceutical products and services. Pharmacoeconomic analyses employ various methods such as cost-benefit, cost-effectiveness, cost-minimization, and cost-utilization to assess different aspects of pharmaceutical interventions (Acar, 2005; Çetin, 2010)

Pharmacoeconomics in terms of Health Economics

Health economics is a discipline that aims to protect the health of individuals in society, enable people to live independently of others, increase the welfare of public health, and utilize the opportunities of economics to achieve this goal (Güven, 2016). In addition, health economics is the application of economics to all relevant areas of the health industry. Therefore, health economics aims to provide the highest service with the most appropriate budget in all areas that use and require the financial resources of the field. The most critical problem in health economics is the scarcity of resources. Health economics also works to develop and improve this issue. It aims to use limited resources most efficiently. The primary purpose of health expenditures is to reduce diseases and significantly promote economic development in the future by protecting the labor force, saving health costs, and providing sustainable health services (İlbars, 2008).

Pharmacoeconomics, considered a sub-branch of health economics, is a discipline that compares different products, treatments, surgical procedures, and even medical services using specific analytical methods (Acar and Yeğenoğlu, 2006).

Development of Pharmacoeconomics

Although pharmacoeconomics has remained in the

background for many years, from the recent past to the present, it emphasizes the importance of health costs and budgets allocated to pharmaceutical products and services every year. Medical economics was initially created as a sub-branch of health economics. The priorities of general economics are almost the same as those of medical and health economics. The basic idea of economics is the efficient use of limited resources (Acar and Yeğenoğlu, 2006; İlbars, 2008; Özsarı, 2014).

During the 1960s, pharmacy gained increasing importance and was recognized within academic literature as a clinical discipline. The most important foundations of pharmacoeconomics were laid in the 1970s. The first pharmacoeconomics book in the literature was written in 1973, and the first article was written in 1978. The main point of this published article is the determination of costs, which is the nature of utility and efficiency analysis (Acar and Yeğenoğlu, 2006; İlbars, 2008; Özsarı, 2014). Pharmacoeconomic analyses started to receive more attention, especially after the 1980s. A continuous growth can be observed in its development due to its pharmaceutical and economic benefits to the environment and the alternatives it offers in practice.

MATERIALS AND METHODS

Type of Research

This study is characterized as a descriptive cost analysis in which retrospective analysis was conducted on 391 prescriptions issued to Type-2 Diabetes Patients after obtaining the required permissions, including approval from the Ethics Committee. Patient prescription data were collected from pharmacies comprising the sample group over a three-month period in Sivas Province. The demographic features such as age and gender of the patients and the medications prescribed for Type 2 Diabetes were analyzed, and the costs associated with these prescription drugs were calculated. In addition, additional diseases of Type 2 Diabetes patients were also scrutinized within the scope of the study.

Population of the Study

The population of the research consists of pharmacies in the borders of Sivas Province Central district.

Sample of the Study

The cluster sampling method was used as the sampling method. The sample consisted of treatment prescriptions for type 2 diabetes among patients aged 18 and older, collected over a three-month period in the city center of Sivas. The pharmacies included in the sample of the study were randomly determined by evaluating them as a cluster. Demographic characteristics, drugs in the prescriptions, and prescription drug costs were calculated based on the patient prescription information between the specified periods.

Dependent and Independent Variables of the Study

In the study, diagnoses and prescription costs of Type 2 Diabetes disease constitute the dependent variable of the research. Age, gender and additional disease diagnoses constitute the independent variable.

Tools and Materials Used in the Study

For this study, prescriptions for Type 2 diabetes were obtained from pharmacy records in Sivas through the medulla systems, forming the sample. This process adhered to the guidelines set by the ethics committee at the University and was conducted with the necessary permissions obtained from the Sivas Pharmacists' Chamber. Following the collection of prescriptions, a database was created utilizing the SPSS (Statistical Package for Social Sciences) software version 22 for Windows. Subsequently, statistical analyses were conducted on this database

Implementation of the Research

The research was carried out on adult patients over 18 who received Type 2 diabetes medications with their prescriptions between 01/09/2020 and 31/12/2020 in pharmacies located in the central district of Sivas province and constituting the sample. For this purpose, in accordance with the permission obtained from the Sivas Chamber of Pharmacists, the pharmacies comprising the sample were informed that prescription analysis would be carried out in line with the research.

Data Analysis

SPSS 22 statistical package program was used for data analysis. Mean ± standard deviation, minimum, and maximum scores were used for continuous variables, and frequency (f) and percentage (%) were used for categorical variables. The normal distribution of continuous variables (drug costs and age) was analyzed by the Kolmogorov-Smirnov (K-S) test, skewness, and kurtosis coefficients. Spearman-Brown Rank Difference Correlation Coefficient was calculated to explore the relationship between continuous variables. The Mann-Whitney U test was employed to assess the differences between the means of the two groups. A significance level of 0.05 was utilized for statistical analysis, indicating the threshold for determining whether any observed differences were statistically significant.

Ethical Aspects of the Study

The study adhered to ethical standards by obtaining approval from the Ethics Committee, and it followed both national and international guidelines of Good Clinical Practice, as outlined in the Declaration of Helsinki. All submitted studies underwent an in-depth ethical and scientific inspection in a timely, comprehensive, and independent manner to ensure compliance with ethical principles and standards.

Findings Related to Prescription Records

In the study, there were prescription records of 391 patients. Of the 391 patients analyzed, 236 (60.4%) were female and 155 (39.6%) were male. The mean age was 62.51±12.49 years.

The classification of prescribed Type 2 Diabetes medicines is presented in Table 1.

Table 1 indicates that 146 (37.3%) of the prescribed drugs were oral antidiabetics, 152 (38.9%) insulinomimetic drugs, 161 (41.2%) insulin preparations and 69 (17.6%) SGLT inhibitors. The categorization of Type 2 Diabetes drugs with respect to gender and age is presented in Table 2.

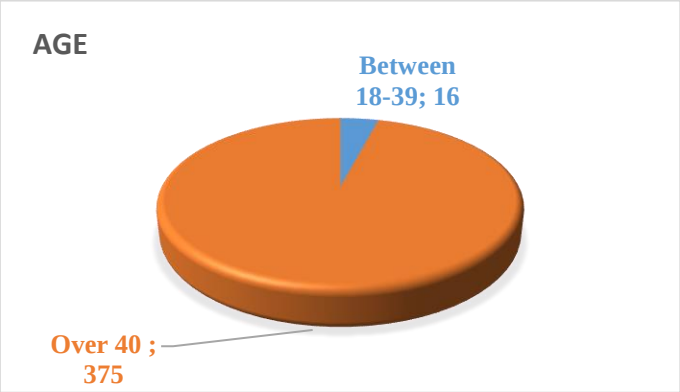

Figure 1. Participants by Age

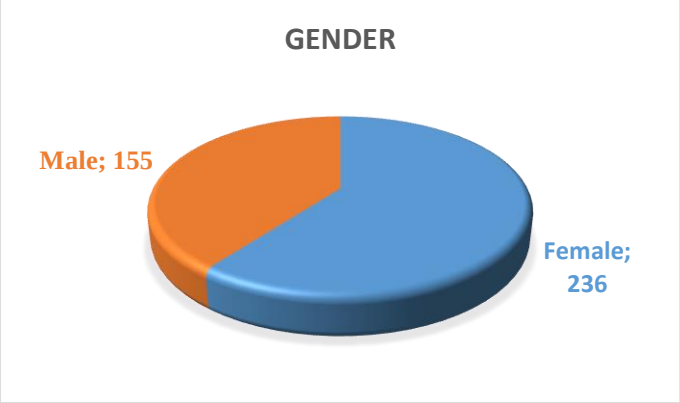

Figure 2. Participants by Gender

Table 1. Classification of Type 2 Diabetes Drugs

		F	%
1.	Oral Antidiabetic Drugs	146	37.3
2.	Insulinomimetic Drugs	152	38.9
3.	Insulin Preparations	161	41.2
4.	SGLT (Sodium–glucose cotransporter) Inhibitors	69	17.6

Table 2. Classification of Type 2 Diabetes Drugs by Gender and Age

		Female f (%)	Male f (%)	Total f (%)
1.	Oral Antidiabetic Drugs	83 (56.8)	63 (43.2)	146 (100)
2.	Insulinomimetic Drugs	88 (57.9)	64 (42.1)	152 (100)
3.	Insulin Preparations	101 (62.7)	69 (37.3)	161 (100)
4.	SGLT Inhibitors	45 (65.2)	24 (34.8)	69 (100)
		18-39 f (%)	**40 or more f (%)**	**Total f (%)**
1.	Oral Antidiabetic Drugs	4 (2.7)	142 (97.3)	146 (100)
2.	Insulinomimetic Drugs	2 (1.3)	150 (98.7)	152 (100)
3.	Insulin Preparations	12 (7.5)	149 (92.5)	161 (100)
4.	SGLT Inhibitors	2 (2.9)	67 (97.1)	69 (100)

Table 3. The Most Prescribed Oral Antidiabetic Drugs, Insulinomimetic Drugs**,** Insulin Preparations, SGLT Inhibitors

	F	%
Glifor	78	19.9
Betanorm	19	4.9
Diaformin	16	4.1
GalvusMet	62	15.9
Janumet	46	11.8
Trajenta	17	4.3
Lantus	65	16.6
Novorapid	58	14.8
Novomix	24	6.1
Lantus	65	16.6
Novorapid	58	14.8
Novomix	24	6.1

Upon analysis of Table 2, it is observed that there is no change in the ranking of drug groups used by both women and men. While insulin preparations are in first place both in women and men, SGLT inhibitors hold the last place. The classification of Type 2 Diabetes drugs according to age is illustrated in Table 2. The analysis of table 2 and 3 demonstrates that insulin preparations were prescribed the most, whereas SGLT inhibitors were the least in the age groups of 18-39 and over 40 years.

In Table 3, the first three most prescribed oral antidiabetic drugs for type 2 diabetes patients can be seen as Glifor, Betanorm and Diaformin, respectively. According to Table 3, GalvusMet, Janumet and Trajenta can be regarded as the top three most prescribed insulinomimetics for type 2 diabetes patients. In the following, the most prescribed three insulin preparations. An analysis of Table 3 indicates that the top three most prescribed insulin preparations for type 2 diabetes patients can be seen as Lantus, Novorapid and Novomix, respectively. The most prescribed SGLT inhibitors are given in Table 3. In Table 3, it is evident that SGLT inhibitors Forziga and Jardiance were prescribed to patients with type 2 diabetes, respectively. Moreover, the distribution of type 2 diabetes drugs prescribed for the top 3 most common comorbidities (hypertension, cholesterol, antiaggregants, diabetic neuropathy) is illustrated in Figure 3.

A review of Table 10 indicates that prescriptions with one drug for each prescription make up 34.8% of the

total, prescriptions with two drugs per prescription constitute 40.4% of the total, prescriptions with three drugs per prescription account for 17.6% of the total, and prescriptions with four or more drugs per prescription comprises 7.2% of the total prescriptions for Type 2 diabetes patients.

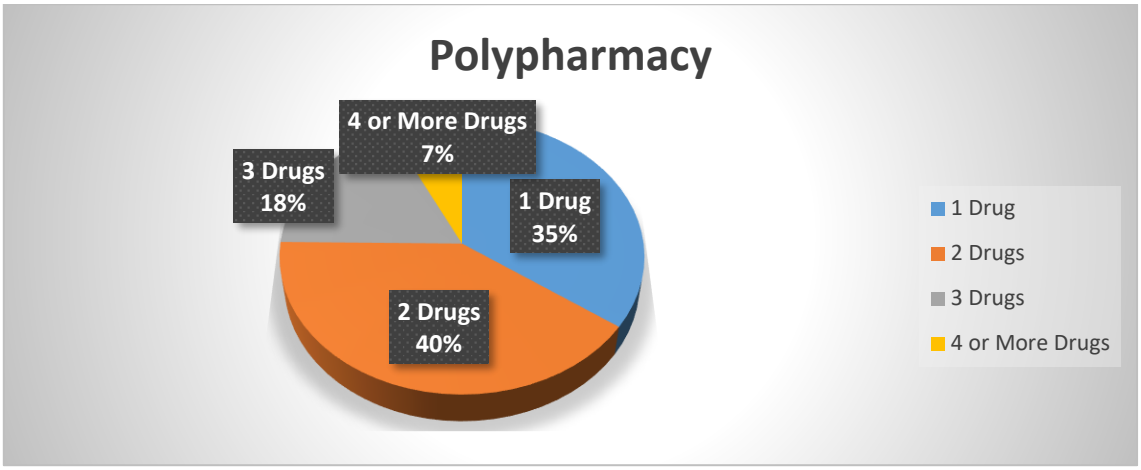

Figure 3. The Distribution of the Number of Medicines Per Prescription

Cost-related Findings

The total drug costs for 391 patients are presented in Table 4.

Table 4 displays that the cost of Type 2 diabetes medication for 391 patients was found to be 77,852.79₺. Besides, the drug cost per prescription was calculated as 199.11₺. A comparison of the drug costs per box of the Type 2 diabetes drug group is also presented in Table 5 below.

When the costs of type 2 diabetes drug groups are analyzed in Table 5, it can be observed that the drugs with the highest cost are 250.51+ 1,103.02 insulin preparations. The lowest-cost drugs are oral antidiabetic drugs, with 34.57+21.63. Type 2 diabetes might be considered a costly disease. It has a significant cost, together with other complications. Expenses related to type 2 diabetes and accompanying problems due to diabetes were calculated in a diabetology center in Italy. The average annual cost per person was computed as €1909.67. Most of these costs are due to medication, followed by hospitalization and investigations.

Furthermore, it was noted that the cost increased in correlation with the severity of complications. With the escalation of diabetes complications, the cost per individual surged to €3141. Consequently, mitigating diabetes complications can also lead to long-term cost reduction (American College of Clinical Pharmacy, 2008; Zozaya et al., 2019).

Table 4. Findings Related to the Cost

	N	Average Drug Cost per Prescription (TRY)	Total Prescription Cost (TRY)
All Prescriptions	391	199.11	77.852,79

Table 5. The Comparison of Drug Costs per Box According to the Classification of Type 2 Diabetes Drugs (TRY)

	N	Mean ± SD	Min. – Max.
1. Oral Antidiabetic Drugs	146	34.57 ± 21.63	10.12 – 188.18
2. Insulinomimetic Drugs	152	140.29 ± 54.62	29.06 – 359.49
3. Insulin Preparations	161	250.51 ± 103.02	53.78 – 539.38
4. SGLT Inhibitors	69	161.56 ± 4.97	157.84 – 168.12

According to the diabetes prevention program, $15,700 was saved for each diabetes prevented. With the emergence of new alternative therapeutic choices in type 2 diabetes, decision-making has become even more difficult, but economic considerations may assist to ease the complexity. However, alternative options might offer greater effectiveness at a higher cost. Consequently, determining the most pharmacoeconomically feasible option has become challenging. For this reason, the literature was systematically reviewed. The economic evaluations of the studies were compared (American College of Clinical Pharmacy, 2008; Zozaya et al., 2019).

DISCUSSION

Diabetes is a disease that is constantly increasing all over the world and in our country. Along with the increasing number of diseases, their cost to our country is also proliferating (Cosentino, 2020; T.C. Sağlık Bakanlığı, 2015). Therefore, this study aimed to investigate the pharmacoeconomic aspects of the drugs used by the patients. For this purpose, individuals were randomly and impartially selected, and their age, gender, and other chronic conditions were also considered. The drugs used by the patients for three months were analyzed, and the cost of their prescriptions was calculated.

Within the scope of the research, the data obtained from 27 pharmacies with the cluster sampling method from 133 pharmacies in Sivas province center, the data of 391 people were examined within the scope of prescription analysis, and approximately 60% of these people are female and 40% are male patients. These data show that the majority of patients with diabetes are women. Type 2 diabetes is a condition typically associated with obesity, which serves as a significant risk factor in determining an individual's probability of developing diabetes. While obesity prevalence differs across societies, it tends to be 2 to 3 times higher in women compared to men, primarily due to increased weight gain with advancing age. According to the Turkish Heart Disease Risk Factors in Adults study, the prevalence of obesity among individuals aged 30 years and older was 25.2% in men and 44.2% in women. This finding aligns with similar studies, including this study (Özdoğan et al., 2015).

According to the TURDEP II study, diabetes in men was found to be lower than in women. Starting from the 40-44 age group, at least 10% of the population was found to have diabetes (Gümüş et al, 2020). When the drugs used by these patients with type 2 diabetes were analyzed, it was observed that insulin preparations were the most commonly used drug group, followed by oral antidiabetics with a slight difference. When analyzed according to gender, it was observed that men preferred oral antidiabetics more.

In another study conducted at Pamukkale University, when the treatment types of 317 diabetes patients were analyzed, it was determined that 12% of the patients used oral antidiabetic drugs, and 74.8% received insulin treatment. In this study, insulin treatment was found to be the most frequently prescribed. It appears that newly developed insulin formulations, utilizing advancing technologies, are given preference in treatment selection (Akan, 2019).

During patient examination, concurrent medication use for other conditions was also assessed. It is noteworthy to mention that hypertension, high cholesterol, antiplatelet agents, and diabetic neuropathy were among the most prevalent conditions observed in patients with Type 2 diabetes.

Moreover, it was determined that diabetes accounted for three-quarters of cardiovascular deaths due to an increased risk of coronary artery disease (CAD). Özdoğan et al. also observed a negative impact on lipid profiles in diabetic patients, with elevated LDL (Low Density Lipoprotein) levels and decreased HDL (Hıgh Density Lipoprotein) levels, indicating a predisposition towards CAD development. This finding supports the high prevalence of hypertension and cholesterol disorders among diabetic patients (Özdoğan et al., 2015). Additionally, findings from the TURDEP II studies revealed that the most common chronic conditions accompanying diabetes included cardiovascular disorders, diabetic foot complications, nephropathy, and neuropathy (Gümüş et al., 2020). These findings are consistent with the results of our research. Furthermore, the

drug Galvus-met, which combines metformin (a biguanide drug increasing insulin sensitivity) and vildagliptin (a DPP-4 inhibitor), was found to be the most preferred among individuals with diabetes. Physicians who did not prescribe Galvus-met opted for insulin preparations such as Lantus and Novorapid instead. Upon analyzing prescription contents, it was observed that Glifor, containing metformin, was the most commonly prescribed oral antidiabetic medication, followed by Lantus, an insulin preparation with prolonged release.

When the polypharmacy rate in the prescriptions of patients with type 2 diabetes was analyzed, it was observed that physicians mostly preferred dual combinations and did not prefer or rarely preferred the use of two or more multiple drugs. Regarding the economic analysis of prescriptions, the cost per prescription for 391 patients was 199.11₺, while the total revenue was 77,852.79₺. It was found that generic oral antidiabetic and insulinomimetic drugs with the same active ingredient had the same price, and there was no price difference.

When the drug groups used in type 2 diabetes were evaluated pharmacoeconomically, it was found out that the lowest cost was oral antidiabetic drugs, and the highest cost drugs were insulin preparations. In this perspective, upon conducting a pharmacoeconomic assessment, it was concluded that insulin preparations were not suitable for cost-benefit analysis, one of the methods employed in pharmacoeconomic evaluation. This determination was based on the observation that insulin preparations were the most favored drug group and were associated with high costs. Upon comparing the drug costs of male and female patients included in the prescriptions, it was observed that there was no significant difference, with a p-value greater than 0.05.

In 2009, a systematic review of the economic evaluation of medicines marketed in Spain was conducted. According to this review, it was concluded that metformin was the most cost-effective treatment. It was concluded that 2nd generation oral antidiabetics should be used as a complement rather than an alternative to metformin (Ramos et al, 2019, Gomes et al, 2019). It needs to be updated to adapt to the development of new therapies and to include economic values. The first-line treatment for patients with type 2 diabetes is usually metformin. Second-line therapies are usually metformin, sulfonylurea, or DPP-4 inhibitors (Ramos et al, 2019, Gomes et al, 2019). Nevertheless, according to some studies of high quality, seven studies compared SGLT2 inhibitors with dipeptidyl peptidase-4 inhibitors, three studies compared SGLT2 inhibitors with sulfonylureas, and three studies compared SGLT2 inhibitors with glucagon-like peptide-1 receptor agonists (GLP-1 RA) (Chin et al., 2019; Yoshida et al., 2020).

3 studies compared SGLT2 with thiazolidinediones, alpha-glucosidase inhibitors, and other antidiabetic drugs, and two compared SGLT2 with metformin. The results showed that SGLT2 was less costly than other treatment options except for GLP-1 RA (Glucagon-like peptide-1 receptor agonists) (Chin et al., 2019; Yoshida et al., 2020). Literature reviews have shown that SGLT2 may be cost-effective compared to many antidiabetic treatments) (Chin et al., 2019; Yoshida et al., 2020). In another study, evidence from phase 3 randomized clinical trials has emerged regarding the direct cardiovascular advantages of SGLT2 inhibitors in patients with type 2 diabetes recently. These findings revealed that patients treated with SGLT2 inhibitors experienced reduced cardiovascular risk. Furthermore, when combined with metformin, SGLT2 inhibitors led to faster achievement of glycemic indices. Although metformin is typically prescribed as a first-line treatment, SGLT2 inhibitors are now recommended as second or third-line treatment options. This study was the first to evaluate the efficacy of metformin and dapagliflozin compared to 'delayed' combination therapy. This combination was found to be more cost-effective than the combination of metformin and other glucose-lowering drugs in reducing diabetes-related complications. It was more cost-effective than sulfonylureas and DPP+i in patients with type 2 diabetes not adequately controlled with metformin (Chin et al., 2019; Yoshida et al., 2020). Regarding cost-utility, SGLT2 can be considered the only alternative with unambiguously positive results.

The application of more intensive therapies in the early stages of type 2 diabetes has been

controversial. Randomized clinical trials have shown that intensive treatment significantly reduces cardiovascular disease, the biggest problem compared to glycemic control. SGLT2 inhibitors constitute the only oral antihyperglycemic drugs with proven direct cardiovascular benefits. Therefore, initiating first-line treatment with dapagliflozin and metformin has been of interest (Huzur, 2018). It is important to be attentive when assessing the results of these studies for several reasons. Firstly, these studies have been conducted since 2009, indicating a significant time span for data collection and analysis. Secondly, there is notable heterogeneity in the methodologies employed across studies evaluating the efficacy of these drugs, making it challenging to compare and interpret the results accurately. Additionally, economic evaluations have inherent limitations. Efficacy data often require supplementation or completion, and such data are typically derived from clinical trials conducted within specific patient groups (Huzur, 2018).

With the development of technology, new technologies are coming to the field of health. These technologies create an economic burden on countries. The aging of the population is another reason for the increase in health costs (Acar and Yeğenoğlu, 2006). In OECD countries, the average human life expectancy has increased with the increase in drug efficacy, education level, and welfare. In Turkey, life expectancy was 48.3 years in the 1960s and has reached 71.6 years in recent years. This shows the increase in health expenditures of our country with the rise in life expectancy (Acar and Yeğenoğlu, 2006; Güven, 2016). The reason why drug costs are the highest in health expenditures is because other health expenses cannot be fully calculated. When Turkey is compared in terms of private-public health expenditures, it might be claimed that although Turkey was in the last three in the 2000s, it has been in the last place in recent years (Güven, 2016). Although Turkey is below other countries in health expenditures, it is at a tolerable level compared to its income. However, considering the continuous increase in health expenditures, effective and rational use of drugs will have a significant impact on the health economy.

From these insights, pharmacoeconomics can be undeniably regarded as an essential field of study. The insufficiency of the studies indicates that more research in this field should be conducted. The fact that there are so few pharmacoeconomic studies is because pharmacoeconomics is not compulsory in our country. Making such studies obligatory will bring positive results to our country both economically and in terms of patient benefit (Acar and Yeğenoğlu, 2006).

CONCLUSION AND SUGGESTIONS

Diabetes Mellitus is gradually spreading in our country and increasing in terms of cost. To alleviate this economic burden, regular control of Hb1Ac levels in patients plays an essential role in early diagnosis and diagnosis. Thus, the economic burden of the country will be alleviated, and unnecessary drug use of patients will be prevented. Some patients can even be kept under control with diet and exercise. The increasing number of DM patients has paved the way for researchers to explore new methods and technologies. In addition to the possibilities of developing technology, products that have been used for a long time should also be evaluated (Gümüş et al., 2020).

Based on the findings and results obtained within the scope of the study, it has been observed that physicians prefer insulin preparations the most. Still, they are not suitable from a pharmacoeconomic point of view since they are the most expensive drug in terms of cost. However, it is essential to consider the principle of utility in this context to thoroughly assess pharmacoeconomics. When type 2 diabetes drugs were compared in terms of pharmacoeconomics, oral antidiabetics were found to be the most appropriate drugs according to the pharmacoeconomic decision matrix. As a result, it is more appropriate for physicians to give oral antidiabetics to patients first from a pharmacoeconomic point of view regarding both cost and benefit. In terms of cost-effectiveness, which is one of the most reliable methods used in the health sector, the choice of drugs with low cost and high effectiveness will be more accurate. If there is no benefit from oral antidiabetic drugs, using insulinomimetics, which are pharmacoeconomically

cheaper, or combined use will be more appropriate. When other drug groups were analyzed, it was found that insulinomimetics were the third most preferred drug group and SGLT inhibitors were among the last preferred drug groups, not preferred or less preferred.

When patient profiles are examined, it is evident that the DPP-4 inhibitor vildagliptin, often the primary choice for patients with high cholesterol, and metformin hydrochloride, a medication from the biguanide group, hold the top positions in prescription preferences. DPP-4 inhibitors are more effective and have lower side effect profiles than SU's. In addition, Metformin prevents hyperlipidemia, decreases LDL and VLDL levels, and increases HDL levels (Thiazolidinedione group drugs possess this effect; however, they are not preferred due to their tendency to cause weight gain and edema. Nonetheless, in instances where the patient has kidney disease, this group of drugs should be considered as the first choice). Given its classification as an oral antidiabetic medication, it stands as the first-choice drug from a pharmacoeconomic point of view. Moreover, physicians in the central district of Sivas province agree that patients with high cholesterol levels should be prescribed this combination of drugs as the primary treatment option. Upon analysis of patients with hypertension, it is observed that the initially preferred drug group consists of medications containing metformin, an active substance derived from biguanide. This drug, considered cost-effective from a pharmacoeconomically, may display interactions with certain blood pressure medications and diuretics when used concomitantly. It may increase the effects of metformin by interacting with blood pressure patients using ACE inhibitors or patients using blood pressure-lowering agents such as nifedipine and furosemide. Since there may be an increased risk of angioedema with side effects such as lactic acidosis, hypoglycemia, etc., physicians should prescribe this drug, taking into account the chronic diseases and medications used by the patients. In antiaggregant and diabetic neuropathy patients, the first choice was again the combination of vildagliptin, a DPP-4 inhibitor, and metformin hydrochloride from the biguanide group. The reason why SUs was not preferred originated from their hypoglycemic effect and other side effects, particularly when used in conjunction with antiplatelet agents. On the other hand, the DPP-4 inhibitor vildagliptin was favored due to its lack of known side effects. Additionally, in these patient groups, insulin preparations were selected as the second-line treatment option if oral antidiabetic drugs failed to achieve the desired effect.

In light of this information, it appears that the drugs prescribed by physicians in the Central district of Sivas province for patient groups with chronic diseases are pharmacoeconomically suitable within the scope of the analysis. However, when considering the total prescription of diabetes drugs, insulin preparations rank first. Therefore, it is recommended to reanalyze diabetes patients without chronic conditions in terms of pharmacoeconomics. In addition, according to recent studies, patients treated with SGLT-2 had more favorable results. Therefore, if metformin is insufficient after first-line treatment, treatment should be supported with SGLT-2 inhibitors.

Through pharmacoeconomic analysis, the patient will receive the best treatment suitable for them, while the institution that covers health costs will favor paying less. While pharmacoeconomics does not solely focus on selecting the cheapest treatment, choosing the most appropriate treatment method for the patient can ultimately lead to reduced healthcare costs. The primary objective is to ensure that the treatment provided is effective for the patient's needs. Achieving this goal requires collaboration among pharmacists, physicians, and healthcare institutions. As a result, patients with type 2 diabetes should be treated to improve their respective glucose and insulin indices. Then appropriate hypoglycemic drugs should be selected based on their economic status and family history to enhance appropriate treatment (Yaman, 2019). To perform pharmacoeconomic analyses, patient's records and data entries should be obtained entirely. For this purpose, healthcare professionals should be informed, and pharmacoeconomic training should be organized. Pharmacoeconomics should be compulsory in undergraduate and graduate programs (Acar and Yeğenoğlu, 2006).

Conflict of Interest

No conflict of interest

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