İÇ HASTALIKLARINDA İLERİ ARAŞTIRMALAR

Editör: Dr.Öğr.Üyesi Demet ÇELİK

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İÇİNDEKİLER

RATIONAL DRUG USE

Berna DINCER[1]

1. INTRODUCTION

Drugs are artificial components used to diagnose diseases, fight diseases or prevent detected diseases. When used with the right method, they can even put an end to life-threatening negative situations, while when used with the wrong method, they have the capacity to create a result that can put the lives of patients at risk and even end their lives. Due to such a high level of seriousness, drug use has a very important place in terms of public health (1,2). Rational drug use can be defined as the use of drugs consciously and with the right methods. RD (rational drug use) is a form of design that positively affects the treatment processes of patients, increases the success of treatment, offers a rational approach in protecting health and aims to minimise the damage caused to the national economy by drugs used unconsciously. It is a summary of a systematic approach covering many sub-headings such as comprehensive evaluation of the individual's problem, accurate diagnosis, determination of appropriate treatment, selection of high level of evidence and reliable treatment, writing the appropriate prescription, initiation of treatment by giving the patient understandable information,

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monitoring and evaluation of the results of treatment (2,3). While the use of medicines, which is increasing rapidly with the production worldwide, is economically devastating for countries, irrational use of medicines is a major blow to this crisis. AOIC (irrational drug use) may manifest itself as problems such as prescription of drugs not in accordance with current guidelines, use of drugs by wrong methods and in doses other than the required doses, prescription of drugs that are not suitable for special patient groups, use of expensive drugs when not necessary or misuse of antibiotics, insufficiency of effective and safe drugs, wrong dose, duration and excessive use of drugs. The damage caused to the national economy by each drug used incorrectly also manifests itself at these stages (4,5,6). Patients' drug use behaviours may be influenced by the socioeconomic status of patients, their previous experiences and the guidance from their social environment as well as the drug recommendations of physicians. As a result of these influences, patients may use the medicines they have based on their previous experiences, buy medicines based on recommendations or obtain medicines from pharmacies without a prescription. These misbehaviours may continue after consulting a doctor and may lead to AOIC (7). According to a statistical report published by the World Health Organisation, it has been observed that more than half of the drugs distributed in the world are used improperly. It is seen that such a high rate and AOIC has an impact on many fields such as psychology and economy, especially in the field of health. The high rate triggers the necessity to inform the society (8). Studies conducted in Turkey show that a large proportion of drugs are used irrationally. This situation leads to negative results such as undesirable drug interactions, delay in the treatment of diseases, increase in adverse events and development of resistance (9). The main reasons for the increased use of drugs include the rapid increase in the population and the diversification and proliferation of chronic diseases. The magnitude of inaccuracies caused by the

increasing number of options results in some complications and deaths. It is a very important issue to use the drug with the correct procedures and to ensure its follow-up with certain methods (8). The World Health Organisation offers activities and recommendations in all steps of the drug use process starting from the provision of drugs in order to improve EHR and to prevent the negative effects of EHR on public health and the economy. Among these recommendations, informing the society about AIC has an important place (10). In this study, in order to determine the extent of AIC, which is a social health problem, especially in geriatric individuals, it was aimed to determine AIC and the factors affecting it in geriatric patients receiving inpatient treatment. In addition, it was aimed to meet the needs of geriatric patients for discharge medication education appropriate to their AIC levels while providing discharge education starting with hospitalisation.

2. GENERAL INFORMATION

2.1.Drug Use and Definition of Drug

According to the definition made by the Ministry of Health of the Republic of Turkey to explain the drugs, drugs are components that show therapeutic or suppressive effects on the disease factor in the patient and provide immunological, pharmacological or metabolic effects and change, regulate, improve the physiological state of the patient and are applied to the patient to help diagnose the patient (11). From a simpler point of view, drugs are substances that are used to protect living organisms from diseases, to diagnose the existing condition, to apply the planned treatment or to correct functional disorders and that contain one or more auxiliary products and are administered in dosages (12). Drugs are composed of components including pure chemicals or equivalent herbal or animal mixtures that are

used in the field of health and have a great effect on biological processes (13). These drugs used during diseases are specially prepared substances used for protection, treatment and diagnosis. These ingredients, which will take the form of drugs, are firstly examined through an experimental study phase for the safety of life. Afterwards, auxiliary substances are added to make them suitable for use, and the process of shaping the drug and creating the form of use is completed. When this stage is completed, the mandatory approvals are obtained and the drug reaches the stage where it can be placed on the market. During the sales process of the drugs, the process is also followed afterwards in order to control and observe the side effects and the effects of the effects on the patient (14). The forms of drugs vary according to their areas of use. The most common ones are tablets, capsules, liquids, injectable drugs, creams and ointments and suppositories. Tablets, as they are known, are medicines that are taken by mouth, are in solid form containing various mixtures and come in many different types, sizes and colours. Capsules are softer than tablets and are coated with gelatine. Liquids are medicines that are sometimes taken by mouth and sometimes by injection and are available in forms such as drops, syrups, solutions and suspensions. Injectable drugs are administered subcutaneously, intramuscularly or intravenously, while creams and ointments are applied on the skin to provide local effects. Suppositories are solid forms of medication administered rectally or vaginally and melt with body temperature to release the drug. In fact, all of these various forms of drugs are toxic substances. If they are not used in the correct and proper way, they can cause very serious effects that can result in life risks and even death. When these drugs, which are toxic substances in one way or another, are used regularly and correctly, the expected improvement factor in terms of health will start to be seen in some way (15). All of the drugs, which are defined as common in the world, constitute an integral part of the health system, and considering the fact that they are

toxic substances, they are seen as one of the biggest factors of the problems experienced in the field of health. As expected, all professions at both ends of the health field and in the intermediate parts are affected by these problems in different doses but in different ways. The primary and profound addressee of the problem is, of course, the patients. Therefore, their primary duty is to consume these medicines at the time of need, in an amount sufficient to meet the need and only within the need (16). In the World Health Organisation's data examining patients' attitudes towards medicines, it is stated that more than half of the available medicines are used inappropriately. This inappropriate use consists of simple and preventable reasons such as discontinuation of treatment, use of over-the-counter medication, errors arising at the stage of prescribing medication, and use of medication based on personal opinions and without expert knowledge (17). The rate of misuse of drugs is so risky and large that it is necessary to control the process of drug use and to ensure that the necessary people are adequately informed and aware of all possible risks. The issue of AIK has emerged in order to fill the gap here, and has opened a new field for us to investigate the conditions necessary to regulate the system and to purify it from risks and to produce solutions.

2.2.Drug Consumption and Its Importance

In parallel with the developments in the field of health, the increase in the options that can be preferred in the field of diagnosis and treatment has increased in recent years, offering a large number of drug choices to the consumption of people. The increase in the types and number of drugs produced has increased the importance of drug use and required users to be more careful. The drug revolution and the fact that crowded populations benefit from health care services with the introduction of different options in treatment have led to a great increase in the use of drugs together with the need for drugs (18). Drugs are great factors that

protect people from diseases and facilitate their fight against diseases. Depending on the progression of the diseases, the age and physical health status of the user and many other factors, the treatment method and the doses used change the effect rates of the drugs to a great extent. Even if all these data are processed and applied correctly, the fact that the users take the drugs correctly also affects the improvement and deterioration of their health (19). It should not be forgotten that drugs, which play an important role in patient health and public health, may also cause unwanted or unexpected effects in users, contrary to their protective and therapeutic properties. While it is possible to ensure correct drug use by fulfilling many steps almost perfectly by many people, some unexpected results will always be possible. Until we reach this area, which is difficult to predict and intervene, even eliminating the errors and deficiencies in other steps will greatly reduce the rates of problems experienced (1).

2.3.Factors Affecting Drug Consumption

Until forty years ago, the term "pharmaceuticals" was only transformed between the patient, the physician and the pharmacy, but in the following years the cycle has been radically broken. With the increasing industrialisation, the increase in the labour force, the acceleration in population growth and the constantly developing and changing technology, brand new business areas and professions have been derived. Following the developments that created brand new professions within the business areas and professions that were divided into specialised areas, humanity has had to act in groups and coordinate a whole work as never before. The pharmaceutical sector has also had its share of this change, fragmented into different specialisations, transformed on the threshold of science, and like the sudden and rapid proliferation of cancer cells, both the variety of drugs and the areas ofspecialisation have increased. In this period of ruptures in both the production and distribution sectors, the issue of the correct use

of drugs that directly and strongly affect the human body is of great importance. On the way to the user, all related specialised professions and all steps, even if they are not in communication, do a team work and take responsibility for the safe use of medicines. In this period when diversification and competition have increased so much, the market is filled with various tricks and advertisements, people are given rosy promises even though they directly and greatly affect human health, and the control of the very scattered diversity has become equally difficult and, as seen, almost impossible; some institutions that focus on and are obsessed with materialism, bypassing the ethics of the business and the sanctity of human life, have spread around like poisonous vines. Drug safety, which is a very important issue for sectors such as the pharmaceutical sector with high seriousness, impact and potential causes, should be taken into consideration at least by the remaining people and should be implemented in the right ways (18). In addition, with the increasing population living together, in many environments and under many interactions, and with the collapse of technology and social media into social life at an incredible speed, people are in communication and together as never before in history. Since this communication is not always provided by educated, knowledgeable and expert people, and even to a large extent, it is carried out with conversations that are transferred from experience and are far from scientific, information pollution is increasing rapidly as expected. The correct use of drugs, which is on the negative side of these interactions, is a very important issue that should be learnt and implemented by the society. While people can live with a lot of ignorance, they should not forget that their lives will be at risk if they remain uninformed about issues that will affect their lives in such a primary way.

2.4.Rational Drug Use

Smart drug use has emerged to determine the most accurate diagnosis, treatment and intervention for the patient. It is a mechanism that enables the evaluation of the entire process by observing the physical, psychological and physiological effects of the drugs used on the patient, which are applied after planning what the situation is and how the most appropriate treatment process should be (20). According to the statements made by the World Health Organisation, EHR includes all the rules that ensure that drugs are supplied at the dose that will meet the needs of the users according to the needs of the users, at the necessary time, at an appropriate cost to the users and the society (6). In Turkey, the Social Insurance Institution (SSI) explained that in AIC, drugs should be used at the dose they should be, at the time they should be administered, at the time they should be administered, with the level of knowledge they should have, taking into account the financial situation (21). From a different perspective, AIC is the process of planning, maintaining and following up the treatment in the form of a correct, safe and inexpensive method (5). In order to obtain the best efficiency from the drugs used in treatment, these drugs should be used correctly and as they should be with physician follow-up (20). The first major developments in the field of EHR occurred in 1975 with the definition of national drug policy and necessary drug patterns presented by the World Health Organisation (22,23,24). AIC starts with the patient's explanation of his/her complaint. It is very important that this step is completed accurately and completely. Afterwards, it is described as a stage that includes determining the treatment that will resolve the patient's complaints and complaints, choosing the most appropriate and effective treatment for the patient, adding the right drugs to the decided treatment, explaining to the patient how to use the drugs and examining the effects of the drugs after treatment (6). Steps such as correct selection of drugs, protection of drugs, prescribing stage, and reporting stage of the prescription constitute a series of categories of EHR. The physician who

prescribes the medication, the pharmacist who prepares the medication in the right environment, the nurse or some other health workers who bring the medication to the patient and the patient who takes this medication are called the parties who take responsibilities in the EHR process. If we look under the name of EHR; the doctor, pharmacist, nurse, healthcare worker, patient and patient relatives, other employees in the pharmaceutical sector, media channels and educational institutions who decide on the diagnosis and the drugs to be used are classified as the people who are expected to take responsibility (6,20). When all production, distribution and access steps are passed, it is seen that physicians are at the first step of EHR. The drug choices made by physicians among all this diversity should be correct and specific to the general health status of the patient. The doctor should carefully listen to the patient's complaint, determine the correct diagnosis and treatment, and decide whether to treat the patient with or without medication. Determine the drugs that will be right for the patient and question the interaction between drugs if more than one drug is planned to be used. In addition, with the selection of the drugs that are most suitable for the symptoms, age and physiological condition of the person who will receive the treatment, the drug doses should be planned in a way that is sufficient for the patient, at the minimum level, with the minimum duration of drug use and the cheapest in terms of cost. Along with the correct dose for each drug, the duration of use and the amount of use should also be specified in the prescription. If needed, the patient's relatives should also be included in the treatment to ensure that the patient progresses in the treatment in the right way (22,25,26,27). After the treatment decisions and drug selection processes, the pharmacy step comes and the pharmacy is the step of answering the prescription. The nurses who make the final touch to the patient with the drugs are the ones who combine the patient and the drug with the principle of 10 correct drug administration. As the work is not over after the drug is

administered, trainings should be organised for the patient and the patient's relatives about the drugs to be used in the preparation of the patient's discharge process. The patient's compliance with the treatment, response and recovery process should be evaluated and the effects of the drugs should be closely monitored. In the event that these follow-ups are not performed and problems occur at any step in bringing the patient together with the medication, the efficacy of the treatment will be directly affected and thus it will be seen that the AIC targets are far away (8,20,27). There are also some criteria for AIC, which are clearly mentioned in many places with many definitions. It is important to fulfil these criteria one by one with all these definitions and practices. According to these criteria; drugs should be preferred rationally, there should be implementation steps for rational drug management in the relevant companies that produce drugs, rational prescribing and reporting should be performed by the necessary people, rational drug intake should be performed, adequate and understandable information should be provided for use, and drug use should be performed rationally and in compliance with all requirements. In summary, AIC is a definition that covers the period from the meeting of the drug with the patient to its separation according to waste rules (7,8,28,29). The step of listening to the patient's problems is very important for defining the patient, clarifying the treatment target and selecting the most effective and safe form of treatment among the options. Afterwards, a prescription is created with the right drug for the patient, the prescription is explained to the patient and the treatment is started after making sure that the patient understands it. Then, the response of the treatment in the patient and the patient's compliance with the treatment are evaluated. This is a process in which it is important that the patient plays the most active role and can be followed up primarily by the patient and his/her relatives. In terms of the treatment process, the treatment process is successfully managed when all persons in the relevant steps fulfil their duties carefully

and accurately (10,25). Difficulties such as financial difficulties, lack of education and information, the possibility of manipulation of the drug use process by other uninformed people, and problems in access to drugs and healthcare services may affect the course of the treatment process of patients. One of the most critical issues that may hinder the treatment process and prevent AIC is age. With the gradual advancement of the average age, today's people face completely different challenges. Increasing industrialisation and population have diversified and multiplied diseases. Thus, it is seen that old age, together with the broken immunity and melting physiological process, brings various chronic diseases in its wake. While increasing chronic disorders bring along an increase in the use of drugs, it also increases the possibility of geriatric individuals who benefit greatly from drugs to be harmed by drugs (30). Together with all the problems, chronic disorders frequently seen in geriatric individuals in general and their diversity make it necessary to carry out the treatment and intervention process in a way that is completely appropriate for the individual and the disorders he/she has in order to evaluate, manage and intervene in detail the symptoms and signs seen in them in every situation encountered. Once the outline of the problems has been drawn up, the work is left in the hands of those who can manage it professionally and wisely (31). Therefore, the most important and effective step of treatment is the rational selection of the drugs to be administered. Drugs should be prescribed considering their interactions with each other and with the physiological state of the patient. In geriatric patients, there is another step that is at least as important. Follow-up of drug use and compliance with treatment in geriatric patients may be much more difficult than in other patients. In particular, problems such as overuse of medication, underuse of medication, misuse of medication, use of medication at the wrong times, forgetting and skipping the doses to be taken, and psychological resistance to taking medication support the high risk of drug use in geriatric

patients (32). In geriatric patients who are in the process of drug treatment, the high number of drugs they use due to their chronic diseases increases the frequency of some complications in patients. Apart from the problems related with the doses, times, frequencies and continuity of the drugs, many new complications may be observed in geriatric patients due to interactions as a result of taking many drugs at the same time and these many drugs acting on completely different mechanisms in the body. Besides all these, the most critical part of AIC is the compliance of patients to treatment (33,34). Convincing and believing in the necessity of drugs, especially in geriatric patients, is a very important start for treatment compliance. Geriatric patients who are not convinced that treatment will be provided in this way may tend to use drugs more irregularly or not at all. For this reason, patients should be involved in the treatment processes that are decided by authorised persons in the belief that they are beneficial, and the compliance of the patients who are partners in the decisions should be taken into consideration. Patients may sometimes think that they are managing these processes correctly and properly and that they are using these medicines rationally. This, of course, does not always provide objectivity. Even if the patient calls himself/herself as such, the professional acceptability of this may be questionable in some cases. It is also important for patients to get rid of some of their prejudices and habits from the past in order to comply with the treatment. Therefore, AIC should be analysed and managed from a holistic point of view, that is, from both the patient's and the medical point of view (35). When the patients' belief in the treatment and their confidence in the benefit of the drugs are also provided, the next important issue is that the patients have knowledge and skills related to the use of drugs or that these knowledge and skills are provided to them in some way. EHR is also related to medication errors. Patients should have sufficient knowledge and skill level to play an active role in this process and to maintain their

treatment effectively (36). Perhaps, at this stage, it may be useful to use narration materials in accordance with the physical structures of the patients. It may be useful to use large and clearly written warnings for patients whose eyes can somehow see, perhaps to use audible warnings in patients who are predicted to have problems in reading, to ensure that reminders are made from time to time and, if necessary, to educate the patient's relatives about drug use. When the opposite is the case and patients fail to achieve AIC, fail to learn, and fail to master their medication, patients' participation in treatment and treatment organisation decreases. Drug interactions and resistance may be observed when insufficient attention is paid and ignored. This may prolong treatment and hospitalisation processes, increase disease relapses, create brand new health problems and lead to an increase in infection-related symptoms. Such an unfavourable functioning of the process may shake the patients' belief in treatment, make it difficult for them to cope, and may completely reverse a process that could have gone well and cause irreversible problems (37). Even the combination of all these possibilities, which may be challenging for both the national economy and the individual economy of the patients, reveals the necessity of rational use of the drugs used. It is important to inform the public about this process, which is important for both the society and the patients. AIC, which can create a domino effect in many areas from the belief of the society in the field of health to the health budgets allocated by the countries, has secretly existed since the beginning of the use of drugs.

2.5.Rational Drug Use in The World

The first official step for EHR was taken when the World Health Organisation shared a list of essential medicines. Countries taking this list as a guide have renewed the essential drug lists of their own countries with the prepared list. The essential medicines mentioned in the lists can be explained as

medicines that meet the health service needs of the society, that should always be in sufficient number and dose, and that the society can afford. The purpose of renewal of the essential drug list is to prioritise the prescription of certain drugs for common diseases and to provide convenience in terms of cost and accessibility (38). Accordingly, the WHO List of Essential Medicines has been updated every two years since 1977, and the 21st WHO List of Essential Medicines and the 7th WHO List of Essential Medicines for Children were updated in June 2019 (39). In 1989, an international AIC network was established and it was aimed to realise projects for the expansion of AIC. In 1997, the 1st International Conference on Improvement of Drug Use was established and appropriate research on rational medication was the subject of the meeting. In 1999, 156 of the member countries of the World Health Organisation designed a basic drug list by taking national standard treatment guidelines as an example (40). As can be seen from all these universal steps, efforts were made to take formalised steps for AIC and countries were supported by the World Health Organization for AIC.

2.6.Rational Use of Medicines in Turkey

In Turkey, problem-based AIC education was initiated in 1996 at Marmara University Faculty of Medicine with the education model made with the World Health Organisation and Groningen University. With this practice, AIC has been expanded by integrating it with medical education (41). In 2006, deep differences were made in the social security system and health services provided through the Social Insurance Institution, Bağkur and Emekli Sandığı were gathered under a single institution as the Social Security Institution and transformed into compulsory General Health Insurance in 2012. The Social Security Institution has been making arrangements for the medicines on the reimbursement list provided in the Communiqué on Health Practices, which it shares, and has been

creating savings in the use of medicines in Turkey. In 2013, a compulsory electronic prescription system was introduced in order to prevent problems experienced during the drug prescribing and supply phase (42). In 2010, a Branch Directorate for Rational Drug Use in Turkey was established under the umbrella of the General Directorate of Pharmaceuticals and Pharmacy in order to examine the current studies on RD, to plan appropriate pathways in line with the demands of people in the country at different stages of RD and in parallel with the rest of the world, and to design detailed policies by authorised persons. In addition, district representative offices were planned in provinces (43). In 2012, with the establishment of the Turkish Medicines and Medical Devices Agency, the Department of Rational Drug Use and Drug Supply Management was established. Subsequently, the National Action Plan for Rational Drug Use was designed by the relevant persons in the same years. Rational Drug Use Coordinatorships were opened in all provinces and finally, in 2014, the National Action Plan for Rational Drug Use was approved. The aim of this plan is to take initiatives to strengthen RDM and to establish co-operation. It is aimed to make AİK a behaviour, to create awareness and to raise awareness. As a health service that reaches all people in different segments of the society and in different economic conditions, RDM has become a matter of great importance for the states (44).

2.7.Principles of Rational Drug Use

In this position where EHR is so universalised, EHR is of course divided into some principles. In treatments carried out using these principles, especially physicians are required to prepare and keep the treatment plan up to date in terms of effectiveness, safety, appropriateness and costs throughout the processes in which patients are treated.

2.8.Effectiveness

The principle of efficacy is related to the reasons for the use of medicines. The effectiveness of medicines is analysed by looking at how much the medicines being taken help the treatment being applied. In this criterion, the properties of the drugs and their effects on the patient are seen as the most important criteria.

2.9.Safety

The principle of safety is the criterion for evaluating the side effects of the drugs in use and the results of interactions that may harm health, such as drug-drug and drug-nutrient interactions.

2.10. Compliance

The principle of appropriateness is a principle that requires the planned treatment to be specific to the patient. The drugs to be given are selected and prescribed according to this principle, taking into account the physiological, psychological and financial status of the patient and in a completely individualised manner. The parts that will benefit and harm the patient in the use of drugs are examined, and the advantages and disadvantages of drug use are taken into consideration.

2.11. Cost

In the cost principle, it is made by taking into consideration the factors that will not affect the effectiveness of the treatment in a negative way, the treatment that the patient needs can be provided, the country's Social Security Institution facilities and reimbursement plans, the use of drugs for acute and chronic diseases, the total cost of treatment, and the cost of drugs. Thus, AIC is maintained in a way that all these principles are combined and blended (25,26).

3. RESULTS AND EVALUATION

Rational use of medicines (RUM) is defined as “the use of medicines appropriate to the clinical needs of patients, in doses that meet their individual requirements, for an adequate period of time, with the least cost to themselves and society”. Other practices that fall outside this definition are irrational drug use. The World Health Organization (WHO) estimates that more than half of the world's medicines are procured or prescribed inappropriately. Factors that negatively affect rational drug use include misleading or inaccurate information, inadequate information of consumers about use, profit-oriented prescribers and pressure on physicians to prescribe, profitable incentive activities, and the fact that the relevant industry is not well regulated by the competent authorities. Nurses should be informed about rational drug use, understand the importance of the package insert, have information such as expiration date control, etc. and receive training on this subject. In addition, they should be able to apply rational drug use in their own lives outside the hospital environment.

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DİYABET VE DİJİTAL SAĞLIK TEKNOLOJİLERİ

Demet ÇELİK

Yasemin ŞANLI

Gamze GÖKE ARSLAN

1. GİRİŞ

1.1. Diyabet Tanımı, Önemi ve Komplikasyonları

Diyabet, pankreasın insülin hormonunu yeterli üretememesi ve/veya vücudun ürettiği insülini etkili bir şekilde kullanamaması durumunda ortaya çıkan önemli ve uzun süren bir hastalıktır (World Health Organization [WHO], 2016). Diyabet bireyleri, toplumları ve sağlık sistemlerini etkilemekte olup en önemli sağlık sorunlarından biridir (Coşansu, 2015). 2019 yılında küresel diyabet prevalansının %9.3 olduğu, bu oranın 2030 yılında %10.2'ye yükseleceği tahmin edilmektedir (Saeedi ve diğerleri, 2019). Diyabet hastalığına yönelik komplikasyonlar aşağıdaki tabloda sunulmaktadır. (Tablo 1)

Tablo 1: Diyabet komplikasyonları

Nefropati	Ayak sorunları
Nöropati	Serebro Vasküler Olay
Retinopati	Cinsel problemler
Gebelik komplikasyonları	Akut komplikasyonlar
Kardiyovasküler hastalık	Kalp krizi
Ağız komplikasyonları	Kanser

(International Diabetes Federation [IDF], 2024)

2. Diyabet ve Dijital Sağlık Teknolojileri

Diyabet, yaşamı tehdit eden ve sonuçları ağır, ekonomik yük oluşturan küresel bir kronik hastalık krizidir (Sloane ve diğerleri, 2016). Bu yüzden diyabet teknolojileri de günden güne önem kazanmaktadır. Geliştirilen teknolojiler diyabet yönetimine katkı sağlamaktadır (Polat Topçuoğlu & Ünsal Avdal, 2021). Bilgi ve iletişim teknolojisi, diyabet hastalığı başta olmak üzere tüm durumlarda hayatı kolaylaştırmaktadır (Islam ve diğerleri, 2016). Diyabet bakımında yararlanılan altı teknoloji sistemi şunlardır:

- Tele sağlık,
- Diyabet dijital verilerinin elektronik sağlık kaydına dahil edilmesi,
- Nitel hipoglisemi alarmları,
- Yapay zeka
- Diyabet cihazlarının siber güvenliği
- Diyabet kayıtları (Klonoff ve diğerleri, 2023).

Tablo 2: Diyabetin yönetimi için kullanılan dijital sağlık uygulamalarının türleri

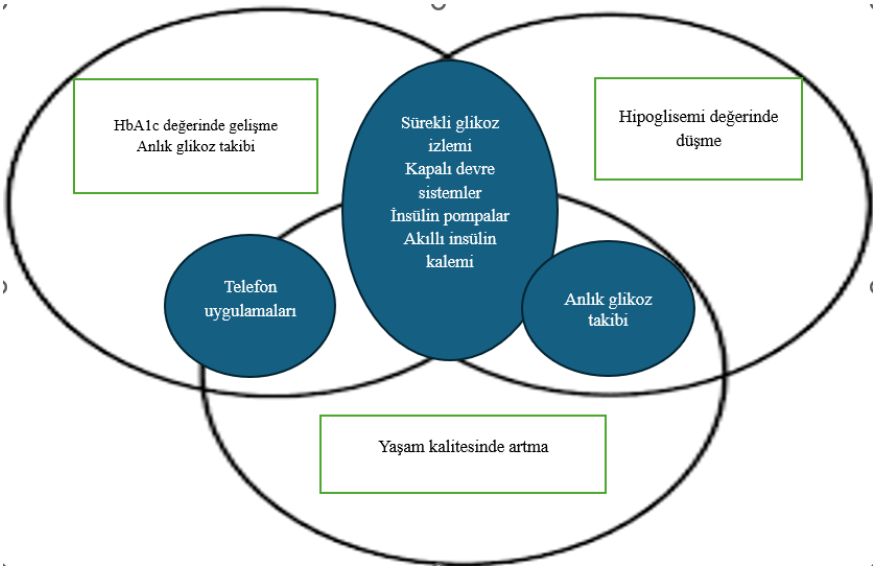
Kategori	**Tanım**
Beslenme uygulamaları	Karbonhidrat, yağ, protein ve enerji içeriklerinin yer aldığı veri tabanlarını sunmaktadır. Yemek planlamasını ve insülin dozunu desteklemektedir.
Fiziksel aktivite uygulamaları	Kullanıcıların aktivitelerini takip etmelerine, kalori saymalarına ve egzersiz için hedefler belirlemelerine ve kilo yönetimine izin vermektedir.
Glikoz izleme uygulamaları	Glikoz verilerini, genellikle glikozu ölçen harici bir cihazdan kaydetmektedir. Glikoz seviyelerini grafiksel olarak görüntüleyerek hasta ve sağlık personeli için glikoz kontrolünün yönetimine yardımcı olmaktadır.
İnsülin titrasyonu uygulamaları	Bolus hesaplayıcılarını geleneksel kan şekeri ölçerleriyle entegre ederek diyabetli kişilerin bazal, prandiyal ve düzeltme insülin dozlarını hesaplamalarına yardımcı olmaktadır.
İnsülin iletim uygulamaları	İnsülin pompaları ve akıllı kalemler için veri toplamak ve görüntülemek; bolus hesaplayıcıları, ve donanım yazılımı güncelleme uygulamalarını içermektedir. Bu tür uygulamalar ayrıca hastalık ile ilgili karar sürecine destek olmaktadır.
Otomatik insülin dağıtım sistemleri (Ayrıca kapalı devre kontrol sistemleri, yapay pankreas sistemleri glisemik kontrol için otonom sistem olarak da bilinmektedir.)	Sürekli glikoz izleme (SGİ) sistemi, insülin infüzyon pompası ve bilgisayar kontrollü algoritmadan oluşmaktadır ve SGİ sistemi ile hastanın insülin pompası arasındaki iletişime olanak tanımaktadır.

(ADA, 2020)

Tablo 3: Kullanım alanlarına göre diyabet için uygulanan dijital sağlık teknolojileri için potansiyel başarı ölçütleri

Kullanım Alanları	**Ölçüt**	**Ölçüt**	**Ölçüt**
Diyabetli hastalar	Hipoglisemi durumunda azalma	Glikoz regülasyonu	Daha az aşırı kilo alımı
Diyabetli kişilerin bakıcıları veya aile üyeleri	Diyabet yönetimine daha az zaman harcanmaktadır.	Daha az mali yük	Özellikle şiddetli hipoglisemi olmak üzere kontrolsüz diyabet vakalarının daha az olması
Klinisyenler	Planlanmamış ziyaretlerle uğraşmaya daha az zaman harcanmaktadır.	Bakımın klinik olmayan yönlerine daha az zaman harcanmaktadır.	Daha uygun geri ödeme modelleri
Ödeyiciler	İyileştirilmiş değer ve daha az maliyet	Bakımda eşitlik ve daha az atık	Önleyici tedbirlere daha iyi erişim ve bu tedbirlerin etkinliği
Sanayi	Değer temelli sağlık hizmetlerinin daha geniş çapta benimsenmesi	Daha düşük olumsuz klinik sonuç oranları	Daha düşük araştırma ve geliştirme maliyetleri

(Kerr ve diğerleri, 2019)



Şekil 1: Diyabette Kullanılan Dijital Sağlık Ürünlerinin Faydalarının Şematize Edilmesi

2.1.Sürekli Glikoz İzleme (SGİ)

Son yıllarda diyabet teknolojisinde önemli ilerlemeler meydana geldi ve SGİ diyabet yönetiminde önemli bir unsur olarak ortaya çıkmaktadır. Parmak delme ve kan alma içeren geleneksel yöntemlerin aksine, SGİ cihazları daha kullanıcı dostu ve daha koruyucu bir çözüm sunmaktadır (IDF, 2024).

SGİ cihazları 4 eşittir.

Gerçek zamanlı SGİ: Hastanın glikoz seviyelerini düzenli ölçer ve belirli glikoz seviyelerinde kullanıcıya alarm sağlamaktadır.

Aralıklı SGİ: Glikoz seviyelerini bir okuyucuya ya da akıllı telefona aktarıldığında göstermektedir.

Profesyonel SGİ: Diyabetli bireye gerçek zamanlı olarak gösterilmeyen glikoz seviyelerini ölçen cihazlardır. Sürekli ölçüm yapmaz.

Körlenmemiş SGİ: Hastaya gösterilen, glikoz seviyelerini ölçen cihazlardır (Meşe & Sarı Sönmez, 2022).

SGİ Avantajları

SGİ avantajları aşağıda maddeler halinde sıralanmaktadır:

- Günlük hipoglisemi ve hiperglisemi değişmeleri belirlenebilir.
- Glikoz değerlerinin sadece noktasal değil, değişim eğrisi de takip edilmektedir.
- Egzersiz öncesi, sırasında ve sonrasındaki glisemik değişkenlik bakılmaktadır.
- Akut hastalık, menstrüasyon, egzersiz gibi durumlarda insülin doz ayarını kolaylaştırmaktadır.
- Diyabetlinin eğitiminde davranış değişikliği sağlamayı ve problem çözme becerilerine yardımcı olmaktadır.
- Gece boyunca oluşan glikoz dalgalanmaları, yemek öncesi ve sonrasındaki glikoz düzeyleri, en yüksek ve en düşük glikoz değerleri olmak üzere gün içindeki glikoz değişimleri ve ortalama glikoz değeri belirlenmektedir (Özcan & Bektaş, 2021).

SGİ Dezavantajları

SGİ dezavantajları aşağıda maddeler olarak sıralanmaktadır:

- Maliyet
- Öğrenme sürecinde zorluk
- Alarm yorgunluğu – cihaz kullanıcılarının sık ve/veya yanlış alarmlarla tekrar tekrar rahatsız edildiği durum

- Sensörün vücutta/vücutta sürekli bulunması
- Deri üzerinde yan etkiler
- Bilgi yüklenmesi (ADCES, 2024).

2.2. İnsülin Pompaları

İnsülin pompaları, geleneksel enjeksiyon rutinlerinin aksine, insülinin daha doğru ve bireyselleştirilmiş bir şekilde verilmesini sağlamaktadır (Rimon ve diğerleri, 2024). Otomatik insülin pompası teknolojileri aşağıda maddeler olarak sunulmaktadır. (Tablo 4)

Tablo 4: Otomatik insülin pompası teknolojileri

Pompa tipi	Özelliği
Sensörle güçlendirilmiş pompa	İnsülin ve gerçek zamanlı insülin pompası kullanımı
Düşük glikozda duraklatan pompa	Glikoz değeri önceden belirlenmiş bir sınırın altına düştüğünde 2 saate kadar insülin iletimini otomatik olarak duraklatan, gerçek zamanlı SGİ ile entegre insülin pompası
Düşük glikoz tahmininde duraklatan pompa	Glikoz değerinin önceden belirlenmiş bir limitin altına düşeceğini tahmin ederek, otomatik olarak insülin iletimini durduran gerçek zamanlı SGİ ile entegre edilmiş insülin pompası
Hibrit kapalı devre	Hem hipoglisemiyi hem de hiperglisemiyi en aza indirmek için otomatik bazal hız ayarı yapan, gerçek zamanlı SGİ ile entegre edilmiş

	insülin pompası. Öğünler için manuel boluslar gerektirmektedir.
Tam kapalı devre	Hem hipoglisemiyi hem de hiperglisemiyi en aza indirmek için otomatik bazal hız ayarı yapan, gerçek zamanlı SGİ ile entegre edilmiş insülin pompası. Öğünler için manuel boluslar gerektirmez.

İnsülin pompası terapisi için klinik hususlar ve ideal nitelikler sunulmaktadır. (Tablo 5)

Tablo 5: İnsülin pompası terapisi için klinik hususlar ve ideal nitelikler

İnsülin Pompası Terapileri İçin Klinik Hususlar	
Şafak fenomeni	Diyabet yönetiminde daha fazla esneklik isteği
Gebelik	Daha az enjeksiyon isteği
Sık ve/veya gece hipoglisemisi	Öngörülemeyen yeme alışkanlıkları
Hipoglisemi farkında olmama	Değişken programlar veya vardiyalı çalışma
Glisemik hedeflere ulaşılamaması	Küçük dozlarda insüline ihtiyaç duyma (yani, pediatrik hastalar)
İnsülin Pompası Uygulanacak Hastalarda Aranan Koşullar	
Sağlık ekibiyle eğitimi tamamlamaya ve takibi için motive olmak	İnsülin pompasını çalıştırmak için uygun el becerisi ve görüşe sahip olmak veya pompayı çalıştırmaya yardımcı olacak kişinin olması

Karbonhidratları sayımı yapmaya uygun ve istekli hastalar	Hipoglisemi için ek nitelikler askıya alma teknolojileri
Kan şekerini günde dört ile altı kez takip edenler	Gerektiğinde yemekler için bolus ve yüksek kan şekeri düzeltmesi yapmaya istekli ve yetenekli olmak
Vücutta bir sensör ve infüzyon seti takmaya istekli hastalar	Cihaz ve kullanılacak malzemeler için yeterli sigorta kapsamına dahil olma veya ödeme yapabilme

(Berget ve diğerleri, 2019)

2.3. Giyilebilir Sağlık Teknolojileri

İnsanların kullandığı aksesuarlara ve kıyafetlere entegre edilmiş, giyilebilir teknolojiler olarak adlandırılmaktadır. Bu teknolojiler sayesinde, özel veriler akıllı dedektörler aracılığıyla akıllı cihazlara aktarılmaktadır ve böylece bireyin tıbbi durumuyla ilgili izlemi sistemli bir şekilde uygulanabilmektedir (Erkılıç & Yalçın, 2020). Giyilebilir sağlık teknolojisi devam eden ve uzaktan takip için çok umut verici bir platformdur. Gerçek zamanlı veri toplanmasını kolaylaştırmıştır ve kişiselleştirilmiş tedavi sağlamıştır (Maina ve diğerleri, 2024). Ayrıca giyilebilir cihazlardan toplanan veriler, önleyici tıp ve kronik hastalık yönetiminde araştırma ve geliştirmeyi ilerleten geniş bir sağlık bilgisi deposuna katkıda bulunmaktadır (Karimian ve diğerleri, 2024). Yapay zeka ve bluetooth gibi bilgisayar sistemlerinin ve teknolojilerinin geliştirilmesi, giyilebilir cihazların entegrasyonunu ve pratikliğini daha da ileri seviyeye getirmektedir (Çelik ve diğerleri, 2024). Giyilebilir sağlık teknolojileri kapsamında kullanılan ürünler belirtilmektedir. (Tablo 6)

Tablo 6: Giyilebilir sağlık teknolojileri kapsamında kullanılan ürünler

Akıllı Saat	Akıllı Ayakkabı
Akıllı Yüzük	Akıllı Gömlek
Akıllı Çorap	Akıllı Anahtarlık
Akıllı Gözlük	Akıllı Parmak
Akıllı Anahtar	Akıllı Dövme
Akıllı Bileklik	Beyin-Bilgisayar Arayüz
Akıllı Pantolon	Çip

(Rodrigues ve diğerleri, 2018)

Giyilebilir teknolojilerin sınıflandırılması sunulmaktadır. (Tablo 7)

Tablo 7: Giyilebilir teknolojilerin sınıflandırılması

İşlevsellik	Tekli fonksiyon Çoklu fonksiyon
Çeşit	Aktif Pasif
Konum	İnvaziv Non invaziv
İletişim türü	Kablolu Kablosuz
Tekli ya da çoklu kullanım	
Kullanım alanı	Askeri Sağlık Güvenlik Veri işleme Sese duyarlı Basınca duyarlı Aktivite takibi

(Park ve diğerleri, 2014)

2.4. Mobil Uygulamalar

Mobil sağlık uygulamaları (m-Sağlık) içeren dijital sağlık teknolojileri, özellikle COVID-19 salgını sonrasında kronik hastalıkların kendi kendine yönetiminde hızla popülerlik kazanmıştır Ancak, piyasada çok çeşitli diyabete özgü m-Sağlık uygulamaları bulunsa da, klinik etkinliklerini destekleyen kanıtlar hala sınırlıdır (Stevens ve diğerleri, 2022). Diyabeti hedef alan son m-Sağlık müdahaleleri hedefleri ve bileşenleri bakımından çeşitlidir ve insülin yönetimi uygulamaları, otomatik metin mesajları, sağlık günlükleri ve sanal sağlık koçluğu içermektedir (Shan ve diğerleri, 2019).

Akıllı telefonlarda ve diğer kablosuz cihazlarda sağlanan sağlık uygulamaları, glikoz izleme verilerine yanıt olarak yaşam tarzı müdahaleleri veya ilaç ayarlamaları diyabetli kişileri desteklemek için kullanılmaktadır (Fleming ve diğerleri, 2020). Dijital cihazlar, yemek, egzersiz, uyku ve glisemik ölçümleri gerçek zamanlı olarak izleyerek diyabet yönetimine yardımcı olmaktadır. Bu durum sağlık çalışanlarına klinikte karar verme süreçlerinde rehberlik edebilmektedir (Edelman ve diğerleri, 2024).

Tablo 8: Diyabet hastalığına yönelik mobil uygulamalar ve özellikleri

Uygulama Adı	Platform	Tip	Ücret	Hasta Yararları
Diabetic Diet	Android	Yaşam stili destekleme	Ücretsiz	Sağlıklı beslenme rehberleri
MyFitnessPal	Apple/Android	Yaşam stili destekleme	Ücretsiz	11 milyon gıda maddesinin bulunduğu veritabanı Paketlenmiş

				gıdalar için barkod tarayıcı Topluluk desteğiyle kilo verme ve egzersiz için özel hedefler
AppleHealth	Apple	Yaşam stili destekleme	Ücretsiz	Glikoz ve ilaç/İnsülin takibi
RxSaver	Apple/Android	Reçeteli ilaç maliyeti tasarrufu	Ücretsiz	İlaç fiyatlarının karşılaştırılması Kuponlar ve kişisel reçete listesi için "İlaçlarım" listesi
FreeStyle LibreLink	Apple/Android	Sürekli Glikoz Ölçümü	Ücretsiz	Gerçek zamanlı glikoz değerleri her dakika güncellenmektedir. Hedefteki Zaman ve Günlük Desenler dahil geriye dönük glikoz eğilimleri ve desenleri olan uygulama içi raporlar Glikoz bilgilerini sorunsuz bir şekilde paylaşmak için sağlık çalışanları ve bakıcılarla bağlantı kurar

				Yiyecek, insülin ve aktivite günlüğü
Meal IQ	Android	Yaşam stili destekleme	Temel: Ücretsiz; Premium: Abonelik	Diyet, maliyet, malzemeler ve makro besin öğelerine dayalı kişiye özel yemek planlaması Çevrimiçi marketlere bağlı
Beat Diabetes	Android	Yaşam stili destekleme	Ücretsiz	Temel eğitim kullanıcılar için yeni diyabet Komplikasyonlar ve tedaviler hakkında bilgi Modern tıp ve Ayurvedik uygulamalar
Sugar Sense	Apple	Yaşam stili destekleme	Ücretsiz	Glikoz, insülin, karbonhidrat, kilo ve egzersiz takipçisi Adım sayacı Tahmini A1C

(Delgada & James, 2020)

2.5. Tele Sağlık

Amerika Birleşik Devletleri Sağlık ve İnsan Hizmetleri Bakanlığı'nın Sağlık Kaynakları ve Hizmetleri İdaresi, tele sağlığı, klinik sağlık bakımını, hasta ve profesyonel sağlık eğitimini desteklemek ve tanıtmak için elektronik bilgi ve telekomünikasyon kullanımı olarak tanımlanmaktadır.

Tele-sağlık uygulamaları birçok katkı (glisemik kontrolü sağlamak, akut ve kronik komplikasyonları azaltmak, öz-yönetim becerilerini geliştirmek gibi) sağlamaktadır (Gürçay & Taşkın Yılmaz, 2022). Tele sağlık hizmetlerinin avantajları, dezavantajları ve gelecek zamandaki kullanılma alanları sunulmaktadır. (Tablo 9)

Tablo 9: Tele sağlık hizmetlerinin avantajları, dezavantajları ve gelecek zamandaki kullanılma alanları

Avantajları	Dezavantajları	Gelecek Zamandaki Kullanılma Alanları
Sağlık hizmetlerine ve sağlık eğitimine kolaylıkla erişim (örneğin, tele-eğitim) Hastalar için daha fazla kolaylık ve zaman tasarrufu Etkin maliyet Patojenlere ve alerjenlere daha az maruz kalma Takip ziyaretlerini, sevkleri ve uzun vadeli hasta izlemeyi tamamlamanın etkili yolu	Tele sağlık ve tele tıbba erişimde istikrarsızlık İnternet, teknolojik cihazlar ve hasta bilgisine bağlı olması Elektrik kesintisi/düzensiz internet İnternet bağlantısında sorun yaşama riski Veri ihlali olasılığı/güvenlik endişeleri	Farklı demografik özelliklere sahip hastaların telemedikal hizmetlere eşit erişimini sağlamak Siber güvenliği ve hasta bilgilerinin gizliliği korunmasını iyileştirmeye devam etmek Hasta bakımını kolaylaştırmak için sağlam platformlar oluşturmak

(Aldzhyan ve diğerleri, 2023)

Tele sağlık ve ilgili tanımlar sunulmaktadır. (Tablo 10)

Tablo 10: Tele sağlık ve ilgili tanımlar

Tele sağlık ve çeşitleri	Tanım
Tele sağlık	Tele sağlık, tıbbi bir ekip tarafınd sağlık hizmeti sunmanın bir yolu ve teknoloji aracılığıyla v paylaşımını içermektedir.
Tele tıp	Tele tıp, bir doktorun bir lokasyonda tıbbi bilgi/tavsiyeyi, hastanın ise farklı bir lokasyonda tıbbi bilgi/tavsiyeyi paylaşması anlamına gelmektedir.
Tele bakım	Tele bakım, hastaların sağlıklarını bağımsız olarak izlemelerine ve bakıcıları/destek sistemleriyle bağlantı kurmalarına hizmet eden teknolojik platformların kullanılmasını içermektedir.
e-Sağlık	Yerel ve küresel sağlık hizmetlerini iyileştirmek için sağlık hizmetleri, halk sağlığı ve iş hakkında küresel düşünme biçimini ifade etmektedir.
Mobil Sağlık	Hastaları izlerken biyolojik değişiklikleri tespit etmek ve bu verileri sağlık yönetimi gruplarına iletmek için mobil cihazların kullanımını ifade etmektedir.

(Aldzhyan ve diğerleri, 2023)

3. Sonuç

Sonuç olarak, son zamanlarda diyabet yönetiminde dijital teknolojilerin kullanımı artmaktadır. Bu nedenle hemşirelerin eğitici rolünü yerine getirmeleri, internet kullanımında bireyleri doğru bilgi kaynaklarına yönlendirebilmeleri ve danışmanlık
rollerini devam ettirmeleri önemlidir (Erdoğan ve Bulut, 2017). Hemşirelerin teknolojik gelişmeler konusunda bilgi sahibi olması, diyabetli bireylerin teknoloji ile ilişkili öz yönetiminde rehberlik ve danışmanlık yapabilmesi ve olası sorunlara karşı çözüm üretebilmesi oldukça önemlidir (Meşe ve Sarı Sönmez, 2022).

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