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Article

Evaluation of turkish pharmaceutical track and trace system (ITS): perspective of community pharmacists

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Turkish Pharmaceutical Track & Trace System (ITS) is implemented as a system in which drug movements are tracked in order to ensure drug safety. The system is integrated among drug stores, pharmacies and reimbursement institutions. As the pharmacies are the primary users, their evaluations regarding the system are considered important. In this study, it was aimed to evaluate the pharmacies'- a shareholder of ITS in Turkey- satisfaction level for ITS and problems and suggestions encountered in the system. The most expressed contribution of ITS to the pharmacists' work was the ease of medicine tracking and control with 27.1%. The average satisfaction level of pharmacists about ITS was found to be 2.9±1.2. In the research, the most expressed of the regarding the areas of ITS that need to be developed is 'work without interruption' with 37.1%. ITS application has provided advantages for pharmacies in many aspects that facilitate operations. However, continuous development of technology, increasing information resources and diversity, changing expectations, and utilization levels of the users require the constant improvement of the performance of the system.

Keywords: Pharmacy. Health information technology. Track and trace system. Turkey.

INTRODUCTION

Information and communication technologies are defined as a collection of technologies that enable data to be collected, stored, processed, transmitted between users and accessed when requested (Işık, Akbolat, 2010). As in many sectors, the need for systems based on information and communication technologies is increasing in the health sector. The use of these technology-based systems is becoming widespread in the pharmaceutical industry as well as in the health promotion, the patient diagnosis and treatment procedures, monitoring and evaluation.

The pharmaceutical industry is considered as a sensitive field as it causes economic losses and medicines that directly affect human health. For this reason, the industry has experienced significant changes in recent years in line with the regulations made by the governments for counterfeit or expired medicines (Moniveena, Pramod Kumar, Venkatesh, 2019). Medicine tracking and tracing systems have started to be developed by many countries, especially in order to prevent adverse conditions caused by drugs. From these systems, systems with the prevalence of use by different countries are being developed against drug counterfeiting, especially systems that provide instant and past tracking of the drug (Moniveena, Pramod Kumar, 2017).

While tracking is the ability to determine the current status of a product at any time, the term traceability is often defined as the ability to determine the origin and various stages of the production and distribution processes of consumer goods. Tracing is based on traceability data (previous locations, processing, and maintenance and usage history) that make up the history of a product (Kelepouris *et al*., 2006). Track-and-trace systems, on the other hand, are the systems that provide the opportunity to see the position of a product at any time in the distribution system and the traceability of the past road map. Track-and-trace systems are methods that provide assurance

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against adverse situations such as counterfeiting, misleading, low standardization, mislabeling and expiration date in drug supply (Traynor, 2011).These systems provide advantages in detecting adverse conditions that may occur in the form of a reduction in medication errors, automatic pharmacy billing, effective inventory control, ease of product withdrawal, theft and misleading in pharmaceutical processes (Moniveena, Pramod Kumar, 2017).

In Turkey, Turkish Pharmaceutical Track & Trace System (ITS), the main objective of which is patient safety, was started to be used in January 2010. ITS is a system that includes computers, databases, computer software used to operate this database, and communication infrastructures with the aim of keeping track of drugs that have been traceable with QR codes starting from production or import with notifications from every point they pass. The system ensures the supply of original and safe drugs by preventing drug counterfeiting and drug trafficking attempts threatening human health. ITS also controls the sale of a drug only once, with sales approvals received from reimbursement companies, in line with the notification received from the manufacturer or importer, pharmaceutical warehouse and pharmacies (Turkish Medicines and Medical Devices Institution, 2019).With the system, it is possible to determine the position of drugs in the procurement and distribution stages. The system can track every movement in the supply chain, starting with the production and import of medicines with electronic product code technology. The inlet and outlet of the drug are reported and it is maintained in a real-time database by recording the last seen state, time and location using the QR codes that is available on each drug box (Turkish Medicines and Medical Devices Institution, 2019). Integration of ITS among the pharmaceutical manufacturers, pharmaceutical warehouses, hospitals, pharmacies and the reimbursement companies has been made. ITS functions in line with the statements of these shareholders. ITS is being tried out successfully in Turkey, and it leads other countries in this regard (Altunkan *et al*., 2012). In this study, ITS satisfaction levels, problems encountered in the system and suggestions of the pharmacies, which are a shareholder in Turkey, are evaluated.

MATERIAL AND METHODS

Data collection tool

Survey method was used in the research. The questionnaire form was prepared by the researchers as a result of the literature review. The form is composed of questions related to the level of satisfaction as well as socio-demographic questions and evaluation of the ITS application. The questions were asked in two ways, open and closed-ended. The questionnaire was sent to pharmacists via face-to-face interview, and e-mail and answers were received. Instead of pharmacists who refused to participate in the study, although they were included in the sample, the pharmacists who were determined as substitutes were interviewed.

Population and sample

The research was conducted with pharmacists operating in Turkey. 26.115 pharmacies in 81 provinces of Turkey constitute the population of the study. In determining the research samples, 81 provinces based stratified sampling method and systematic random sampling method were used, and the number of samples was determined as 378.

Data analysis

In the research, content analysis was made to the data obtained from open-ended questions, the answers were evaluated one by one, and the common opinions were gathered and classified. SPSS software was used to analyze the data obtained from closed-ended questions. Statistical significance of the data was evaluated with the T-test and $p < 0.05$ was accepted as statistical significance.

RESULTS

378 pharmacists working in different provinces of Turkey have participated in the research. 46.3% (175) of the pharmacists participating in the study are men, and 53.7% (203) are women. The average age of the

participating pharmacists is 38.4 ± 9.3. It was found that the pharmacists participating in the study run a pharmacy for an average of 13.5 ± 9.1 years. The average number of daily prescriptions of pharmacists were found to be 57.5 ± 36.1, and the maximum number of daily prescriptions were stated to be 200 (Table I).

TABLE I - Main characteristic features of participating pharmacists

Variable		n	%	Mean ± Sd (Min.-Max.)
Age	<25	6	1.6	38.4±9.3 (23-77)
	25-34	133	35.2	
	35-44	157	41.5	
	45-54	57	15.1	
	≥55	25	6.6	
Pharmacy period (years)	<5	77	20.4	13.5±9.19 (1-48)
	5-14	144	38.1	
	15-24	108	28.6	
	25-34	41	108	
	≥35	8	2.1	
Number of daily prescriptions	<20	28	7.4	57.5±36.1 (5-200)
	20-49	160	42.3	
	50-79	111	29.4	
	≥80	79	20.9	
ITS Satisfaction level	1	63	16.7	2.9±1.2 (1-5)
	2	69	18.3	
	3	127	33.6	
	4	80	21.2	
	5	39	10.3	

The average level of satisfaction of pharmacists from ITS was found to be 2.9 ± 1.2 on the scale of 5 = very satisfied and 1 = not satisfied (Table I). In the research, a significant difference was found between the ITS satisfaction levels of those who stated that they had problems in ITS and expressed the aspects of ITS that needed improvement and those who did not experience any problems ($p < 0.05$) (Table II).In addition, a significant difference was found between those who stated that ITS had a positive contribution to their work and operations and those who did not ($p < 0.05$) (Table II).

TABLE II - Evaluation of pharmacists' satisfaction levels from ITS according to their problems in ITS

		n	Satisfaction level		t	p
			mean	sd		
Status of having problems in ITS	Yes	300	2.72	1.17	-5.991	0.0001
	No	78	3.60	1.08		
Status of indicating positive contribution of ITS	Yes	184	3.24	1.15	5.560	0.0001
	No	194	2.57	1.17		

In the research, it was determined that the participating pharmacists actively used the medicine tracking system. The pharmacists were asked if ITS provided convenience in their work and 48.6% (184) of the participating pharmacists stated that ITS contributed positively to their work. The most expressed contribution of ITS's contribution to pharmacists' work was the ease of medicine tracking and control with 27.1%. This contribution of ITS was specified by 53 pharmacists and constituted 27.6% of all contribution statements. In the second place, the most mentioned contribution was the expression of preventing counterfeiting with 16.7% (Table III).

TABLE III - Positive contributions of ITS to the pharmacists' work and operations

Contributions of ITS to pharmaceutical operations	**n**	**%**
Those who stated that ITS had positive contributions	184	48.6
Those who do not state any positive contribution	194	51.4
Total	**378**	**100.0**
Positive contributions		
Facilitating medicine tracking and control	53	27.6
Prevention of the counterfeiting	32	16.7
Removing cutting the drug clippings	29	15.1
Facilitating inventory tracking	21	10.9
Seeing where the patient gets the medicine	15	7.8
Reducing the error rate	9	4.7
Fast transactions	7	3.6
Prevention of drug loss	6	3.1
Reduction of workload	5	2.6
Saving time	4	2.1
Providing regularity	2	1.0
Seeing announcements about medicines	2	1.0
Prevention of informal medicine	2	1.0
Ending of lending medication	2	1.0
Removing unfair competition	1	0.5
Seeing the amount of medication given to the patient	1	0.5
Facilitating access to medications	1	0.5
Total	**192**	**100.0**

Another finding obtained in the research was about the areas of ITS that need to be improved. In the research, 37.1% (73) of the pharmacists' expressions regarding the areas of ITS that need to be developed constituted ensuring proper working of ITS without interruption. The statements about the ITS infrastructure needs to be improved, the pharmacist's ability to see the stock and vendor stock status of the drug and that ITS should not be used as a sanction tool for pharmacists were expressed at the rate of 9.1% (18) (Table IV).

TABLE IV - Recommendations for the development and operation of ITS

Recommendations for the development and operation of ITS	n	%
Continuous operation of ITS should be ensured	73	37.1
ITS infrastructure should be developed	18	9.1
The pharmacist should be able to see the stock status of medicine of the warehouse and vendor company	18	9.1
ITS should not be used as a sanctioning tool for the pharmacies	18	9.1
Working speed should be increased	13	6.6
Medication inlets and outlets should be updated instantly at ITS	11	5.6
ITS should be able to work in harmony with the pharmacy software	10	5.1
The pharmacist should be able to list the medicines that he/she already has	7	3.6
The program should be simplified	6	3.0
In cash sales, the drug should be dropped from the system instantly	3	1.5
A security information form should be placed in the system	2	1.0
ITS call center should be created	1	0.5
One single QR codes should be given for multiple purchases	1	0.5
Warehouse shipping errors should be resolved	1	0.5
Pharmacists should be trained on ITS	1	0.5
A certain amount of margin of error should be left every year and a decrease from stock should be possible	1	0.5
QR codes should be brought in the injection tips and strips	1	0.5
A swap should be opened outside the province	1	0.5
In case of recalling or withdrawal of a drug, it should be possible to process over ITS.	1	0.5
It should be ensured that the patient can be given medicine shortly before the end of the medication.	1	0.5
The closing of ITS should be prevented before the ongoing process in ITS is ended.	1	0.5
ITS website should be developed	1	0.5
Cosmetic products should be included in ITS	1	0.5
Equivalent medicine selection should be easier	1	0.5
Compatibility with the color recipe system should be increased	1	0.5
System maintenance should be done out of the active hours	1	0.5
Time must be given to terminate the expired medicines	1	0.5
Should be transparent	1	0.5
Collective drug swap should be prevented	1	0.5
Total	**197**	**100,0**

DISCUSSION

Health information technologies cover a wide variety of technologies for the management and transmission of health information for consumers, providers, payers, insurers and all other healthcare-related groups (Blumenthal, Glaser, 2007). In the health services

organization, patient-centered information systems function as essential and work integrated with other health information systems (Yusof *et al*., 2008).

ITS is used for ensuring the tracking of medication and patient safety in Turkey. Pharmacies, which we can qualify as the most important shareholder of ITS, actively use the system intensively. In evaluating information systems, three-way evaluation can be made as technological, human and organization (Yusof *et al*., 2008). In this study, a human-oriented assessment was made, and it was aimed to determine the facilities, development suggestions and satisfaction levels of pharmacists during the use of ITS.

In healthcare systems, pharmacies play a vital shareholder role both in direct communication with the patients and are an active element in the system with their financial dimension. In this framework, information systems are being developed that facilitate business processes in order to make pharmacies more efficient. ITS was established for improving business processes of pharmacies as well as ensuring the tracking of medicines and patient safety in Turkey; the pharmacies constituted the main component of the system. For this reason, the evaluations made by the pharmacies regarding the operability of the system should be considered as the evaluations that should be given importance and taken into consideration in the development of the system.

In this framework, the satisfaction level of the participating pharmacists from ITS was questioned and it was seen that the level of satisfaction from ITS of the participating pharmacists is above the moderate level. Considering the fact that the majority of the participants stated that they had problems in ITS, the level of satisfaction was considered to be an expected level. When the difference between the status of having a problem and the satisfaction level was evaluated, it was seen that this difference was significant.

Nearly half of the pharmacists participating in the research stated that ITS provided convenience in their work and the most commonly stated of these facilities were "ensuring that drugs can be tracked and controlled", "preventing drug counterfeiting" and "easing inventory tracking". The importance of information technologies in pharmacy applications has been accepted and it is stated that these technologies are widely used in drug stock management. More efficient and more accurate and proper results are obtained with stock management and evaluation methods (Ak, 2011). In addition, it has been stated that information systems are considered to be important in pharmaceutical operations in many aspects, such as financial, security and pharmaceutical services in addition to stock transactions (Westerling *et al*., 2010a).

The pharmaceutical supply chain is a complex system that begins with the processing of pharmaceutical raw materials by manufacturers and includes distribution of it from its source to drug stores, hospitals, pharmacies and other providers (Brechtelsbauer *et al*., 2016). The fact that the system has a complex structure requires the use of information technologies in terms of good operability. In a study, it was concluded that information technologies help pharmacists make their work easier and they focus more on pharmaceutical services. In another study, pharmacists stated that in the future, information technologies will benefit them in terms of complex logistics and pharmaceutical services (Westerling *et al*., 2010b).

For pharmacists, the preparation and presentation of the medicines to the patients take the vast majority of daily working times. In the research, it was stated by the pharmacists that ITS had positive effects on efficiency such as time-saving, acceleration of the procedures, allocating more time to the patients. Similar to the findings obtained in the research, it is stated that the use of technological equipment or software saves time for pharmacists and has a positive effect on efficiency (Jeroen *et al.,* 2019). Thanks to these effects of ITS, it is thought that pharmacists can provide services such as counselling and information to their patients.

It was stated by pharmacists participating in the research that ITS is also an application that prevents the production and delivery of counterfeit drugs to patients and which had a positive effect on pharmacy. The importance of establishing secure information systems against the production and distribution of the counterfeit drugs that threaten patients' health is also expressed in many studies (Lei *et al.,* 2005; Otoshi, Tomıta, Kaneko, 2007; Westerling, Haikala, Airaksinen, 2011).In a study conducted in Turkey in 2012, it was emphasized that the

aim of ITS was to "prevent corruption such as illegal reprinting of drug boxes and re-invoicing of medicines charged from reimbursement institutions" (Yorulmaz *et al*., 2012). In addition to providing benefits in many aspects such as inventory management, cost advantage, time-saving and medicine tracking with ITS, many obligatory procedures such as cutting, preserving, processing and sending the drug clippings to the reimbursement institution have been eliminated. This is stated in the study as a positive aspect, which is often expressed by the participating pharmacists. In modern state understanding, it is provided to give public services in a digital environment and to minimize bureaucratic procedures by using the information systems (Eren, Durna, 2005).The governments have been transforming into *e-states* with the intensive use of information and communication technologies (Buffat, 2015).

Human factor and user satisfaction play an essential role in the success of new technological applications. For this reason, the quality of technological applications affects users' perception of ease of use (Chiou, Fang, 2005).User satisfaction can be decisive, especially in the success of new technological systems (Bulut, Yıldız, Kaya, 2019). Although the introduction of new technological applications potentially offers significant advantages, this may not mean that the application can be continued successfully. For this reason, in order for ITS application to be entirely successful and continuous, the evaluations of the end-user pharmacists gain importance.

In addition to stating the positive contributions of ITS, the pharmacists participating in the research also made suggestions regarding the ITS's improvement and disruptive aspects and identified the problems they faced. The problems frequently encountered by the participating pharmacists in the use of ITS was the frequent interruption of the system and the lack of infrastructure. Littlejohns, Wyatt and Garvican (2003) stated that among the reasons that led to the failure of health information systems, there were conditions such as the inconsistencies in the expectations of manufacturers and users of the system, insufficient attention to the complexity of the processes, and not considering the social, cultural and computer usage or education of users.

The pharmacists mentioned not only system-related problems in ITS but also stated different suggestions and aspects that should be developed, such as not using the system as a sanction for the pharmacists, integration with the other systems, and ensuring that they can see the availability of the medicine in warehouses and vendors. It is stated that health information systems should facilitate the operation of the users rather than prevent them (Kellermann, Jones, 2013).

CONCLUSION

The pharmaceutical ITS application, the primary purpose of which is the patients' safety, has provided the advantages with its many aspects that facilitate procedures for pharmacies, which are among the basic shareholders, as well as providing safe production, distribution and access of medicines to the patients. However, the continuous development of technology, increasing information resources and diversity, changing expectations and utilization levels of the users require the constant improvement of the performance of the system. This development will play a key role in achieving the desired efficiency and effectiveness with the opinions of all shareholders, especially the users of the system.

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