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STUDY OF THE SEASONAL DYNAMICS TENDENCIES OF SALES OF SUBSTITUTION THERAPY MEDICATIONS FOR DRY-EYE SYNDROME TREATMENT IN UKRAINE

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Ключові слова: *синдром сухого ока, засоби замінної терапії, сезонні коливання, реалізація*

Ключевые слова: *синдром сухого глаза, средства заместительной терапии, сезонные колебания, реализация*



Abstract. Study of the seasonal dynamics tendencies of sales of substitution therapy medications for dry-eye syndrome treatment in Ukraine. Tomashevskaya Yu.O., Kryvoviaz O.V., Makarenko O.V., Koval V.M. *The purpose of the article was to study the seasonality of retail sales of substitution therapy medications for dry eye syndrome treatment over the period of five years (2016-2020) in comparison with the annual monthly variations, taking into consideration the probable atypicity of the 2020 indices due to the influence of the pandemic. To achieve the stated goal, retrospective, structural and graphic methods were used; a marketing analysis of the national pharmaceutical market from the point of presence of substitution therapy medications for dry eye syndrome was conducted. The next stage was the identification of seasonal variations in the time series of sales of the medications for treatment of conditions accompanied by the dry eye syndrome in Ukraine over the period of 2016-2020. The analysis of retail sales of substitution therapy medications for dry eye syndrome treatment over the period of 2016-2020 indicates a steady presence of seasonal peaks in March, August and December. The information received in the course of the study is necessary both for the patients and the employees of pharmaceutical companies engaged in wholesale and retail sales of medicines and medical devices. In terms of the patients, there is a possibility to use preventative measures in order to limit the influence of a number of studied aggressive factors. And on the Based on the indexes of the seasonal demand for dry eye syndrome substitution therapy medications, pharmaceutical enterprises will be able to form the corresponding stock of the necessary medications thus ensuring the exists actual availability of substitution therapy medications for the population. This will indirectly but positively impact the treatment of patients with dry eye syndrome.*

Реферат. Дослідження сезонних тенденцій динаміки реалізації засобів замісної терапії синдрому сухого ока в Україні. Томашевська Ю.О., Кривов'яз О.В., Макарєнко О.В., Коваль В.М. *Метою роботи стало дослідження сезонності роздрібної реалізації засобів замісної терапії синдрому сухого ока за 5-річний термін (2016-2020 рр.) порівняно зі щорічними місячними коливаннями, зважаючи на ймовірну нетиповість показників 2020 р. внаслідок впливу пандемії. Для досягнення поставленої мети було використано ретроспективний, структурний та графічний методи; здійснено маркетинговий аналіз вітчизняного фармацевтичного ринку з огляду на наявність засобів замісної терапії синдрому сухого ока. Наступним етапом роботи було визначення сезонних коливань у рядах динаміки реалізації препаратів для усунення станів, що супроводжуються синдромом сухого ока, в Україні за 2016-2020 роки. При аналізі роздрібної реалізації засобів замісної терапії синдрому сухого ока за період 2016-2020 рр. спостерігається стала тенденція щодо наявних піків сезонності в березні, серпні та грудні. Отримана в результаті проведеного дослідження інформація є необхідною як для пацієнтів, так і для працівників фармацевтичних підприємств оптової та роздрібної реалізації лікарських засобів та виробів медичного призначення. Щодо пацієнтів – є можливість застосовувати запобіжні заходи з метою перешкодження впливу ряду досліджуваних агресивних чинників. Фармацевтичні ж підприємства, спираючись на показники сезонності попиту на засоби замісної терапії синдрому сухого ока, зможуть здійснювати формування товарних запасів, що забезпечать фізичну доступність засобів замісної терапії для населення, тим самим опосередковано позитивно впливаючи на якість лікування пацієнтів із синдромом сухого ока.*

Dry eye syndrome (DES) manifests itself through the feeling of discomfort in the eyes and/ or by the presence of visual symptoms and inflammatory processes on the ocular surface [8]. This happens due to the decrease in the production of lacrimal fluid as well as tear film instability [7].

DES is quite a widespread disease (according to various data, the DES occurrence among the adult population ranges from 10 to 30%); it is a “disease of civilization”, which is directly dependent on the scientific-technical progress and has a considerable influence on patients’ quality of life, as it causes the distortions in the functioning of the visual analyzer [5, 11].

The aggravation of symptoms, caused by the dry eye syndrome is connected with the use of systemic medications; instillation of eye drops as well as with the influence of environmental factors (including the microclimate inside the buildings) [9].

The specific need to study the correlation between the frequency of DES occurrence within the population and the climate factors is indicated by the numerous studies and publications of scientists from various countries of the world [10, 14]. These studies show the relation between the development or progression of various pathogenic types of DES and the change of the nature and intensity of the influence of the studied factors (air temperature and humidity, air-conditioning or heating inside the buildings etc.) on the visual analyzer [6, 12].

In addition, studies demonstrate the influence of the use of visual displays on DES frequency in the corresponding groups of the population [5]. A rapid increase of this factor was observed due to the introduction of quarantine limitations caused by the coronavirus COVID-19 pandemic, which introduced changes in all fields of activity: in the education, professional activity and even leisure. Starting

from March 2020, various computer technologies oriented at distance-based functions are being widely introduced.

Due to the lack of data on DES seasonality in Ukraine, it was decided to study this issue by analyzing monthly indices of DES substitution therapy medications (STMs) sales and thus tracing the dynamics in the popular demand for the stated group of medications. This information is necessary both for the patients and the employees of pharmaceutical companies engaged in wholesale and retail sales of medicines and medical devices. In terms of the patients, there is a possibility of apply preventative measures in order to limit the influence of a number of studied aggressive factors (take breaks while working with gadgets, use humidifiers inside the buildings, wear sunglasses in during certain seasons, use air conditioners with high-quality filters etc.) [14]. And on the basis of indexes of the seasonal demand for DES STMs, pharmaceutical enterprises will be able to form the corresponding stock of the necessary medications thus ensuring the actual availability of STMs for the population. This will indirectly but positively impact the treatment of DES patients.

The purpose of the article was to study the seasonality of retail sales of DES STMs over the period of five years (2016-2020) in comparison with the annual monthly variations, taking into consideration the probable atypity of the 2020 indices due to the influence of the pandemic.

MATERIALS AND METHODS OF RESEARCH

The authors have previously conducted a marketing analysis of the national pharmaceutical market regarding the presence of substitution therapy medications for dry eye syndrome treatment. The analysis was based on the data of the State Register of Medicinal Products of Ukraine [2] and the State Register of Medical Equipment and Medical Devices [3]. The data on quantitative sales indices for the above mentioned group of goods over the period of 2016-2020 was obtained with the help of the database of the "PharmXplorer" market research system provided by the "Proxima Research" Ltd. Company [13]. The sales indexes were analyzed in actual volume – number of packages (thousands of units).

To identify seasonal variations in the time series of sales of the medications for treatment of conditions accompanied by the dry eye syndrome in Ukraine over the period of 2016-2020, we applied the constant mean method [1], in which a mean value is calculated for the time series and then

compared with the average value over the above mentioned years.

The mean monthly sales volume of the medications used for dry eye syndrome treatment during 2016-2020 was calculated with the following formula:

$$\bar{y}_c = \frac{\sum y_i}{n} \quad (1);$$

where, \bar{y}_c – is the mean monthly sales volume for a certain month over the studied period;
 y_i – index of a certain month of a certain year; n – number of years.

The constant mean was calculated with the following formula:

$$\bar{y}_t = \frac{\sum \bar{y}_c}{n} \quad (2)$$

where, \bar{y}_t – mean volume of sales of medications used for dry eye syndrome treatment;
 \bar{y}_c – mean monthly sales volume of a certain month over the studied period; n – number of months.

The seasonality index was determined with the following formula:

$$I_{ces.} = \bar{y}_c / \bar{y}_t \quad (3)$$

To calculate seasonal peaks, the following formula was used:

$$P_{ces.} = I_{ces.} - 1 \quad (4)$$

In order to achieve the set goal, the statistical methods (analysis of time series by the method of constant mean with the calculation of indexes and peaks of seasonality), as well as retrospective, structural and graphic methods were used [1]. Analysis of the results was performed using Microsoft Excel (Product ID 00414-50000-00000-AA978).

RESULTS AND DISCUSSION

The studied group of medications was made up by DES STMs, which are registered on the pharmaceutical market of Ukraine as medications of the S01X A20 group – "Artificial substitutes of the lacrimal fluid and other neutral medications" as well as medical devices (multi-purpose solution, means for ophthalmological use and solutions for rinsing, irrigation, treatment) [4].

Based on the data received for each individual STM concerning the retail sales in every month of the studied period (thousands of packages), a monthly index of the total number of sold packages of all STMs, mean monthly sales volume

of a certain month over the studied period and seasonality indexes were calculated (Table).

The study of seasonal variations presupposes aims to detect a general tendency of sales indexes variation for the studied group of medications within a certain time period as well as to determine the level of seasonality.

In order to do so, we conducted the analysis of monthly time series for every year of the studied period as well as for a 5-year period as a whole.

The study of seasonal variations was conducted with the help of seasonality indexes.

The analysis of seasonal variations for DES STMs sales over the period of 2016-2020

Studied period		DES STMs sales index, thousands of packages					\bar{y}_c	I _{сес.}	P _{сес.}
Month	Year	2016	2017	2018	2019	2020			
January		34.34	72.52	105.12	125.53	208.58	109.22	0.94	-0.06
February		47.57	79.04	104.44	134.10	204.15	113.86	0.98	-0.02
March		57.55	88.55	115.46	155.57	197.13	122.85	1.05	0.05
April		54.04	79.78	107.08	142.35	130.51	102.75	0.88	-0.12
May		54.07	84.17	109.87	135.22	134.10	103.49	0.89	-0.11
June		55.77	81.35	113.21	146.74	143.01	108.02	0.93	-0.07
July		60.50	84.63	119.01	160.71	162.74	117.70	1.01	0.01
August		61.90	85.55	126.08	168.31	168.99	121.98	1.05	0.05
September		61.70	82.94	123.89	163.29	157.57	117.88	1.01	0.01
October		63.96	83.69	114.90	162.50	153.61	115.73	0.99	-0.01
November		79.40	98.97	123.43	184.84	154.73	128.27	1.10	0.10
December		83.77	110.27	125.25	201.46	159.71	136.09	1.17	0.17

To construct the seasonal wave, seasonality peaks were used, which allow to increase the visual clarity of the obtained dependence.

The results of the analysis of the constructed diagrams indicate the similar character of the main tendencies of the time series in 2016, 2017, 2018 and 2019. This is signified by clear peaks in March,

August and December of every year (Fig. 1). However, an additional peak of DES STMs sales in May 2017 should be noted.

This tendency may be explained by the changes in the nature of interaction of indoor and/or outdoor environmental conditions with the visual analyzer.

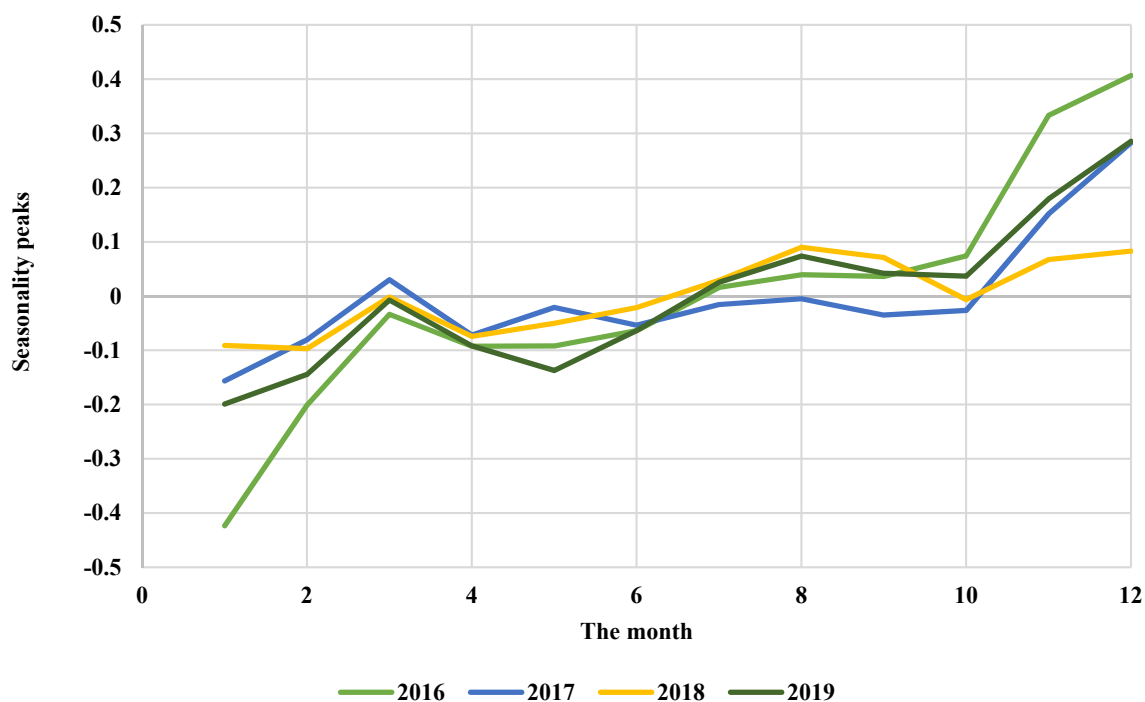


Fig. 1. Seasonal waves of DES STMs sales in 2016, 2017, 2018 and 2019

Quite an atypical picture was observed in 2020 (Fig. 2), when together with a “typical” peak in August, there was an additional considerable growth in sales in January-February, a drastic decrease in spring and an absence of a peak in

December. The probable reason for this is a change of lifestyle that occurred due to the pandemic caused by SARS Cov-2, which led to the start of lockdown in March 2020 and a subsequent adaptive quarantine.

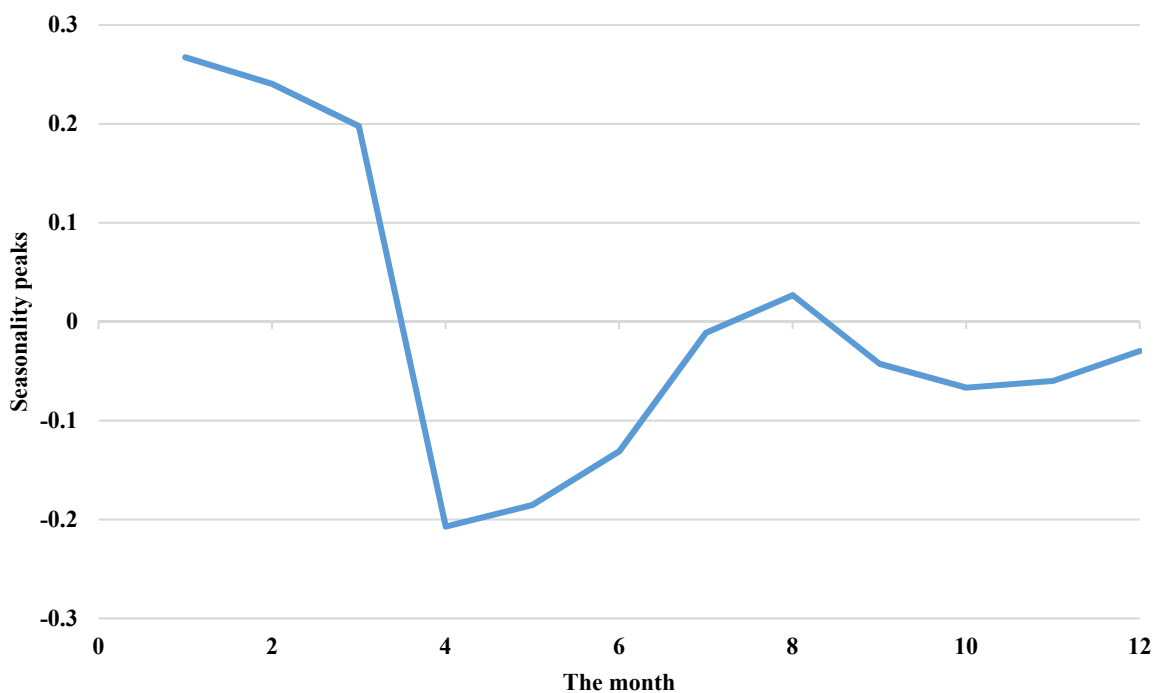


Fig. 2. Seasonal wave of DES STMs sales in 2020

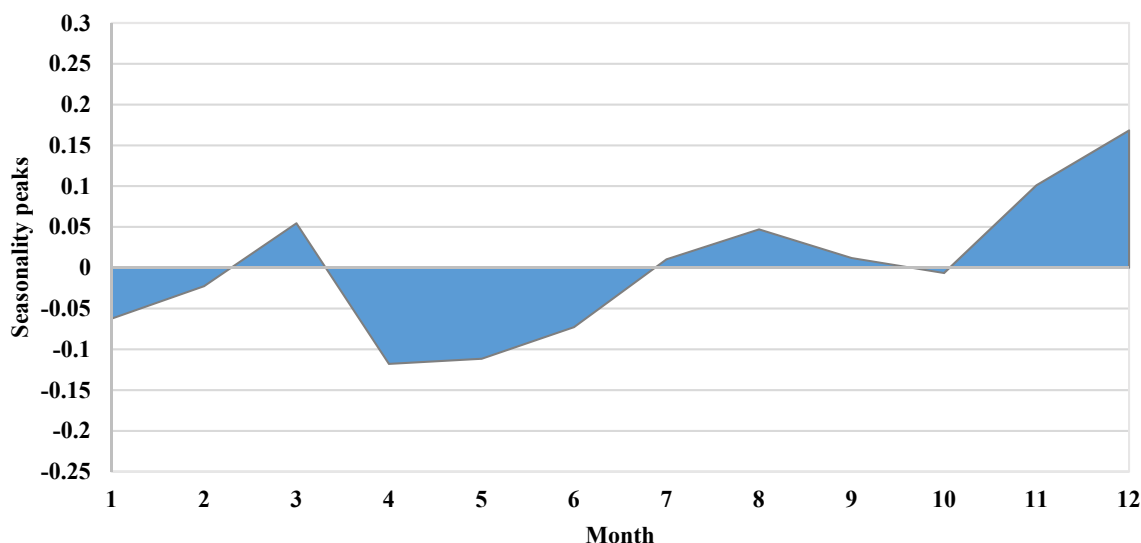
Taking into consideration the identified peculiarity, the next step was to determine indexes and seasonal peaks according to the monthly data over

The shapes of the graphs in Fig.3a and Fig.3b are identical, which, despite the influence of specific circumstances of 2020, indicates tendency preservation.

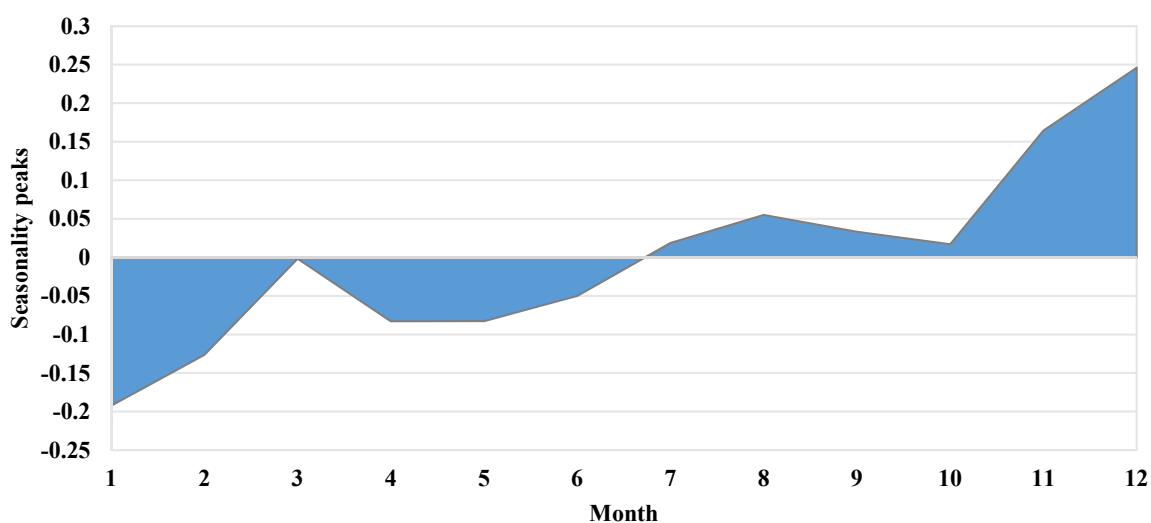
The results indicate uneven demand for DES STMs throughout the year, due to the greater prevalence of the syndrome caused by increased

the 5-year period (Fig. 3a) as well as to compare the data with the similar indexes over the 4-year period (excluding the “atypical” 2020) (Fig. 3b).

impact of certain environmental factors. Similar patterns have been found by a number of researchers; however, it should be noted that their studies were based on the analysis of morbidity, the influence of risk factors (including allergic factors), the frequency of visits to the doctor [6, 12].



a) for 2016-2020 period



b) for 2016-2019 period

Fig. 3. Seasonal peaks of DES STMs sales over the studied period

CONCLUSIONS

1. The analysis of retail sales of dry eye syndrome substitution therapy medicines over the period of 2016-2020 indicates a steady presence of seasonal peaks in March, August and December.

2. The received results may be used by the pharmacies and their branches while forming their stock in order to optimize the pharmaceutical provision of the population with medicines and medical devices for dry eye syndrome treatment.

3. Patients are advised to apply preventative measures in order to limit the influence of a number of studied aggressive factors (take periodic breaks when working with gadgets, use humidifiers indoors, use sunglasses at certain times of the year, equip air conditioners with high quality air filters, etc.).

Contributors:

Tomashevska Yu.O. – conceptualization, methodology, formal analysis, investigation, data curation, writing – original draft, writing – review & editing, visualization, project administration;

Kryvoviaz O.V. – conceptualization, methodology, formal analysis, data curation, writing – review & editing;

Makarenko O.V. – methodology, validation, writing – review & editing, project administration;

Koval V.M. – methodology, validation, formal analysis, visualization.

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