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A comparative analysis of the willingness-to-pay indicators for the use of the innovative health technologies in Jordan, Egypt, Morocco, Sudan and Ethiopia

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Abstract

The article presents the results of the willingness-to-pay analysis for the use of the innovative health technologies in such countries as Jordan, Egypt, Morocco, Sudan and Ethiopia. The willingness-to-pay (WTP) indicator is an important parameter that allows evaluating financial possibilities of the state and society as a whole in implementing innovative technologies in healthcare. It has been found that the average value of the WTP indicator in the countries varies in a wide range of values – from 1,37 thousand US dollars in Ethiopia to 14,37 thousand US dollars in Jordan. In Ukraine, the WTP was 2.8 times less than the similar indicator in Jordan, 1.82 times less than in Morocco and 1.77 times less than in Egypt. In 2016, compared to the data of 2008, the WTP indicator increased in Jordan (the growth rate – 43.46%), Ethiopia (105.1%) and Egypt (65.74%). In Sudan the inverse relationship was observed, i.e. the WTP indicator decreased by 0.21% in 2016 compared to the data of 2008. Within 2008-2016 the WTP indicators had the positive dynamics of growth in Jordan (the average growth rate was 4.63%) and in Egypt (6.64%). In Morocco, Sudan and Ethiopia the dynamics of the WTP indicator had a complex nature of development during 2008-2016. In general, among the reference countries the most stable character of changes in the WTP indicator in the process of introduction of innovative drugs to the pharmaceutical market was characteristic for Jordan.

Keywords: innovative drug, innovative health technology, pharmaceutical providing of the population, willingness-to-pay indicator.

INTRODUCTION

The introduction of innovative health technologies to the pharmaceutical market is a complex process. Most national healthcare systems suffer from a constant scarcity of funds. One of the paramount trends in many countries is the increasing demands of the population to the quality of medical and pharmaceutical services provided. Many diseases that formerly were not even diagnosed or poorly treatable are currently included in the state programs on drug provision. The application of innovative medical technologies in treating, for example, orphan diseases is considered as one of the promising areas in providing effective medical care to these patients.

As it is known, the use of innovative technologies in healthcare requires a lot of material resources [1-3]. In most countries of the world all expenses on innovative health technologies are covered by the state and society as a whole [3-5]. Effective treatment of rare, chronic diseases with the use of innovative drugs is an important indicator of efficiency for functioning of the national health systems [6,7].

The use of innovative technologies in healthcare requires a preliminary scientific assessment. In the conditions of active development of the pharmaceutical market of innovative drugs the assessment of possibilities of the state and society to pay the cost of their application is of particular relevance. The social relevance of these studies is due to the fact that most innovative drugs are used in the treatment of severe diseases. In addition, innovative drugs are expensive. Therefore, patients with genetic abnormalities, as well as patients with multiple sclerosis, cancer, etc., can not pay the cost of their treatment [3,4]. The state and society as a whole cover a significant part of the costs for the treatment of these patients. Therefore, a preliminary assessment of the possibility to use an innovative drug in practical healthcare has an important public and social value [3,4,8]. As is known, such assessment is carried out by the analysis of the willingness-to-pay (WTP) indicator [3,4,9-11].

Every year studies of threshold values in the assessment of financial possibility of the state to pay the cost of the use of innovative medical technologies are of greater social value [3,12,13,15,16]. Abroad, the methods of pharmacoeconomics evaluation of the effectiveness of a new medical technology based on the results of "cost-effectiveness analysis" (CEA) and "cost-utility analysis" (CUA) are used. The results of these analyses reflect the additional sum to be paid per a year for "Life Years Gained" – LYG (cost-effectiveness analysis), as well as for "Quality Adjusted Life Years" – QALY (cost-utility analysis) [3,17-20]. When determining the applicability of a new medical technology the use of these methods of the pharmacoeconomic research is a high-cost and time-consuming process [3,19,20]. For making operative administrative decision under conditions of resource shortage in the national healthcare systems the alternative methods for calculating WTP are used. For example, in the works of the Russian scientists the calculation of WTP using macroeconomic indicators of the countries' development are widely used [3,19].

Currently, this WTP indicator is used to assess the pharmacoeconomics effectiveness ("cost-effectiveness threshold") of a medical technology in the treatment of diseases requiring significant financial support from the state and society as a whole. WTP reflects the sum (in the national monetary units of the country) that the society is willing to spend to achieve a certain therapeutic effect or some surrogate endpoints for this group of patients [4,21,22]. Today WTP is considered to be an important component of Health Technology Assessment (HTA) as a modern methodology in constructing effective models of medical and pharmaceutical provision of the population. In many countries of the European Union the decision on inclusion of a medical technology in practical medicine is made taking into account the results of the studies of the economicotherapeutic and social significance of their use [4,21,23]. These studies are carried out using HTA methods, among them the analysis of the WTP indicator is of great socio-economic importance for the society as a whole [2,14,20,24,25]. Comparison of the WTP indicator in countries that have different approaches to financing and organizing the provision of medical care to the population is of some practical importance. First of all, it is important for such countries as Ukraine, which is at the stage of reforming its healthcare system and pharmaceutical provision of the population. Currently, the Ukrainian healthcare is actively searching for effective ways to solve the problem of increasing the availability

of drugs and medical care for the population. One of the ways to solve this problem is the tender procurement of expensive drugs under the control of the state, as well as involvement of international funds and humanitarian organizations. The preliminary assessment of clinical and economic feasibility of the purchase of any drug should be performed using modern tools, namely HTA methods. The WTP indicator allows to assess the threshold values, which are acceptable from a socio-economic point of view, in financing of drug procurement [3,4,8,10,25].

MATERIALS AND METHODS

When designing our studies one of the important issues was the choice of the reference group of countries. Undoubtedly, with the aim of practical use of the results obtained for the Ukrainian healthcare it would be logical to include those countries that are geographically close to Ukraine or have common historical and political characteristics of development in the reference group. When conducting the preliminary analysis of the special literature data concerning the specified problem it was found that the WTP indicator in countries that were part of the former USSR was studied by a group of the Russian researchers since the early 2000s [13,19]. In their works the results of the comparative analysis of the WTP indicator in the countries of the former USSR, including Ukraine, as well as in the countries of the European Union and some countries in South America, USA, Canada, Japan, China and others were presented. This fact served as an objective substantiation for the choice of reference countries on a different basis than geographical proximity, and common historical and political characteristics of development. The analysis of macroeconomic indicators of development of Ukraine within 2010-2016 has demonstrated the following results. The average value of government expenditures on healthcare and pharmaceutical providing of the population calculated per capita (conditional indicator “A”) was 77 US dollars, while % of these expenditures in relation to GDP (conditional indicator “B”) of the country was 2.6%. Then the similar indicators of government expenditures on health in different countries of the world were analyzed. Thus, we selected countries where the average value of the conditional indicator “A” for 2011-2016 varied in the range of values from 70 to 100 US dollars, while the indicator “B” ranged from 2.5% to 5.0%. It should be noted that those countries, which despite socio-economic challenges of development and political problems managed to maintain relative stability in the state, were of special interest for Ukraine. Therefore, the reference group included such countries as Egypt, Morocco, Sudan, Ethiopia and Jordan. It is also important that in these countries the state plays a significant role in formation of guarantees for providing medical and pharmaceutical services to the population, especially for those categories of citizens who can not pay the cost of medicines or qualified medical care by themselves. As it is known, in Ukraine the role of the state in organizing medical and pharmaceutical services to the population is traditionally essential.

The next important issue in our research was the choice of the method for calculation of the WTP indicator. For the first time the WTP indicator was calculated in the USA and Canada in the mid-80s of the XX century (Kaplan RM, Bush JW) [4,6,10,11,13]. The WTP indicator initially calculated was equal to 50 000 US dollars. This indicator reflected the money equivalent of quality adjusted life year (QALY) of a hemodialysis patient with chronic renal insufficiency. This pathology was chosen as an ideal model from the economic point of view in order to analyze the QALY indicator since the patient died if the treatment was stopped [4,10,11,12].

In our studies the method of determining the recommended by the Commission on Macroeconomics of the World Health Organization (WHO) was used [10,12,26,27]. According to this method WTP is measured by multiplying of the country's GDP calculated per capita by three [10,11,12,27].

As evidenced by the special literature data, this WTP calculation method has a number of significant limitations. In particular, these restrictions are observed when using specific innovative medical technologies in practical healthcare [9,13,19,28]. Scientists working in this area recommend to use indicators based on the results of the pharmacoeconomics research reflecting the sum to be paid per a year for LYG (cost-effectiveness analysis) or for QALY (cost-utility analysis) [3,17-20]. As previously stated, to conduct these studies is a high-cost and time-consuming process. In conditions of extreme shortage of funds needed to conduct the applied research in Ukraine to perform analysis of the WTP indicators using these methods is very problematic. Therefore, taking into account the Ukrainian realities of the domestic pharmaceutical science development, as well as assuming the macroeconomic scale of further use of the results obtained we decided to use the WTP calculation method based on the analysis of GDP data of the reference countries.

To calculate the WTP indicator the macroeconomic data of development of such countries as Egypt, Morocco, Sudan, and Ethiopia for 2008-2016, as well as Jordan for 2005-2016 were used. This combination of countries was called the reference countries. The macroeconomic indicators of development of the reference countries were presented on the official website of the World Bank for Reconstruction and Development. At the preliminary stage of our research the average indices of the nominal gross national product per capita in the countries were calculated according to the analysis of the dynamics of macroeconomic indicators of development of countries in the dynamics of years. At the first stage of our research the average WTP indicator in the reference countries was calculated. Then the dynamics of change in the WTP indicator for 2008-2016 in the reference countries was analyzed. To analyze the dynamics of the WTP indicators the growth rates (%) of the WTP indicators were measured. Both chain and basic values of the growth rate of the WTP indicators in the reference countries were calculated in the studies. Thus, when determining the chain indices of the WTP growth rate (%) the results of the ratio of the WTP indicators in absolute values (US dollars) of the subsequent year to the WTP data in absolute values (US dollars) of the previous year were used. To calculate the basic indices of the growth rates (%) of the WTP indicators in the reference countries the data for 2008 were selected.

The statistical data processing was carried out using a Microsoft Office Excel 2010 standard spreadsheet and standard methods of variation statistics. After a preliminary assessment of the data all indicators were imported into a Statistica 6.0 standard program for the applied statistical analysis (the license of a V.7. English – V.6 Russia K 892818 software product). The significance level for all tests was taken as P-value less than 0.05.

RESULTS

Analysis of the WTP average values and dynamics of their changes in the reference countries

The results of the studies are presented in Figure 1. By the average value the WTP indicators for the use of innovative medical technologies in healthcare systems of the reference countries were distributed as follows. The highest value of WTP was typical for Jordan. The second position was taken by Morocco. The third position was represented by Egypt. Sudan with the WTP indicator of 5,18 thousand US dollars was in the fourth position. The lowest value of the WTP average value was typical for Ethiopia. The range of indicators of the WTP average value in the group of the reference countries was 951.82%. As Figure 1 shows, the WTP average value in Jordan was 1.54 times more than in Morocco, 1.58 times more than in Egypt, 2.78 times more than in

Sudan and 10.52 times more than in Ethiopia. The next stage of our research was the analysis of the dynamics of changing the WTP indicator in Jordan from 2008 to 2016. The system of healthcare and pharmaceutical provision of the population in Jordan is characterized by a high level of guarantees from the state in delivering accessible and qualified care to the population. In addition, the relative low cost of medical and pharmaceutical services in Jordan beyond the scope of state and social support of the population while maintaining their high quality attracts many people from different countries.

***** The method for determining the WTP indicator is recommended by the Macroeconomics Commission of the World Health Organization (WHO) [10,11,12,27].

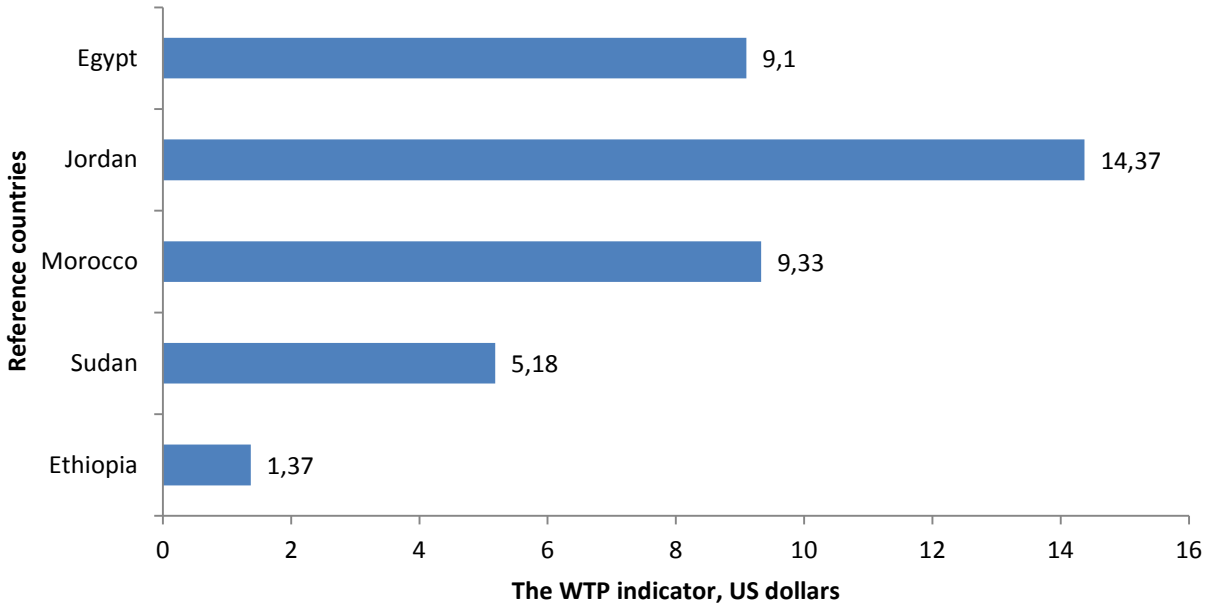

Figure 1: A comparative analysis of the WTP indicator for the use of innovative technologies in healthcare in the reference countries was based on GDP *3 for each country*

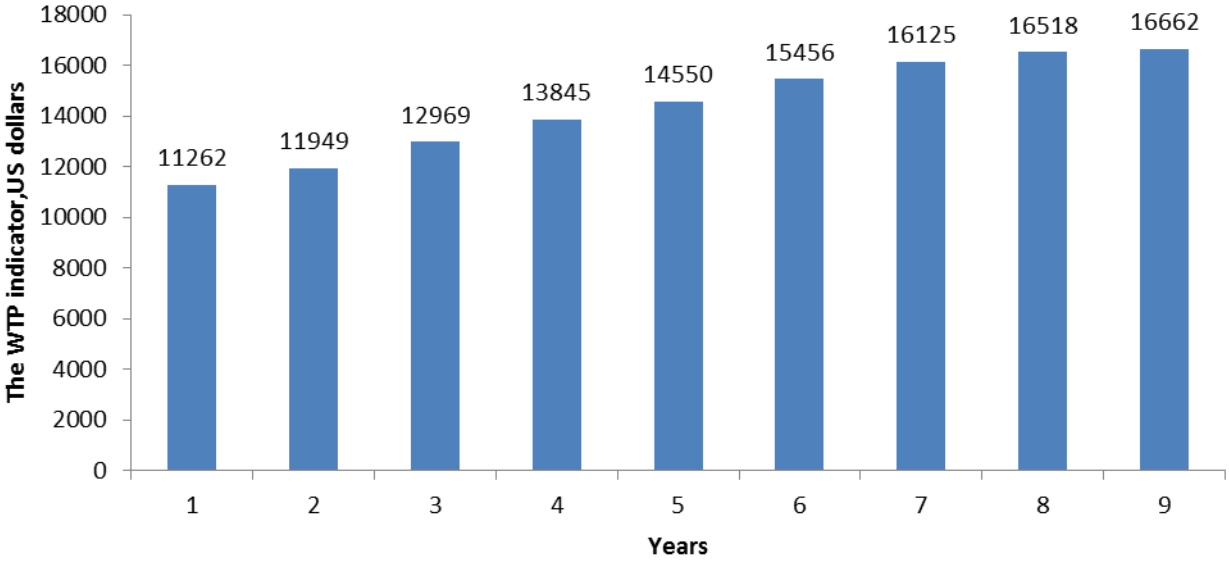

Figure 2: The analysis of the dynamics of the WTP change for the use of innovative technologies in healthcare in Jordan (in 2008-2016)

As a result of the study it was determined that the WTP indicator in Jordan gradually increased from 2008 to 2016 (Figure 2). Moreover, the WTP indicator changed from 11262 US dollars in 2008 to 16662 US dollars in 2016. Thus, the growth rate of the WTP indicator in 2016 was 47.95% compared to the data of 2008. Further the chain values of the growth rates of the WTP indicator were calculated by years. It was found that the highest chain values of the growth rates of WTP in Jordan were observed in 2010 (8.5%). The lowest chain values of the growth rates of the WTP indicator were typical for 2016. For example, the WTP indicator

increased only by 0.9% in 2016 compared to the data of 2015. The average value of the chain growth rates of the WTP indicator for the use of innovative technologies in healthcare of Jordan was 4.63%.

The next stage of our research was a comparative analysis of the dynamics of the WTP indicators in the reference countries within 2008-2016. The results of our study are given in Table. It was found that the positive value of the growth rates of the WTP indicator was observed in two countries: Jordan and Egypt. Thus, the average value of the growth rates of the WTP indicator was 4.63% in Jordan, and 6.64% in Egypt. In these countries there was a positive dynamics of steady increase in the WTP indicator for the use of innovative technologies in healthcare for eight years.

In Morocco, Sudan and Ethiopia the WTP indicator had the complex dynamics of development within 2008-2016. The growth rates of the WTP indicator by the years had both positive and negative values. The lowest value of the growth rates of the WTP indicator based on the entire population of the reference countries (–12.3%) was observed in Sudan in 2012, while the highest value was in Ethiopia (30.6%) in 2012.

When comparing the WTP indicator in 2016 with the baseline of 2008 concerning the group of the reference countries the following data were found. In Jordan the WTP indicator increased by 43.46% in 2016, in Morocco – only by 7.67%, in Ethiopia –by 105.1%, and in Egypt – by 65.74%. Sudan was the only country characterized by a decrease of the WTP indicator in 2016 compared to the data of 2008. Thus, the growth rate of the WTP indicator in Sudan was –0.21%.

DISCUSSION

The study of the WTP indicator in different countries is a universal tool for making effective decisions in the healthcare system and pharmaceutical providing of the population [4,15,16,18]. WTP indicates the additional amount in monetary units that the state and society as a whole is willing to spend in achieving a particular therapeutic effect when providing medical care to patients or surrogate endpoints of the pathological process development [5,11,14,19]. As shown by the results of studies among the reference countries, Jordan is characterized by the most advantageous financial opportunities for implementation of innovative technologies in healthcare. Moreover, in Jordan the positive dynamics of growth the WTP indicator preserved during 2008-2016. However, attention should be paid to significant reduction of the growth rates of the WTP indicator in 2016 (0.9%) compared to the previous year (2.4%). In general, while maintaining the positive tendency it is possible to say with confidence about a stable formation of socially oriented directions of development of the Jordanian healthcare system and pharmaceutical providing of the population. Undoubtedly, uncontrolled processes of immigration of the population from neighboring countries experiencing deep political and social conflicts can objectively have a negative impact on the dynamics of the WTP indicator in Jordan. Based on the data of the UN Agency for refugees only in 2016 there were 635 thousand Syrian refugees officially registered in Jordan. According to unofficial data their number is about 1.5 million people, and it is almost 20% of the total population of Jordan. Thus, in order to maintain the positive trend of the growth rates of the WTP indicators in Jordan it is necessary to develop and adopt a number of programs to restructure the flow of immigrants. Moreover, international organizations and humanitarian funds should be more actively involved in the decision of this problem.

The unstable value of the WTP indicator in such countries as Morocco, Ethiopia and Sudan questioned the possibility of using innovative technologies in healthcare. Attention should be also paid to the fact that since 2011 the growth rates of the WTP indicator significantly decreased in Egypt compared to the data of 2009 and 2008. Moreover, in 2008 and 2009 the growth rates of the WTP indicator in Egypt were 13.9% and 13.8%, respectively. According to the data of 2010 the growth rate of the WTP indicator in Egypt was only 6.1%.

For such a socially significant indicator as WTP the unstable tendency of changes and decrease in values of the WTP indicator in such countries as Ethiopia, Morocco, and Sudan has serious negative consequences for stability in the society [7,17,19]. In addition, the unstable nature of the dynamics of the WTP indicator in these countries is an objective basis for development and introduction of international humanitarian projects and programs related to the financial and humanitarian support of the patients with genetic abnormalities, cancer, and orphan diseases.

If the worldwide statistics is compared, it is possible to make the following conclusion. In some studies the scientists indicate the fact that WTP has a large range in different countries [3,6,13,17,21,25]. This is due to a number of causes, as well as factors of the external and internal development of countries and healthcare systems. For example, the WTP indicator in Australia is 183402 US dollars, in the United States – 162972 US dollars, in Canada – 150128 US dollars, in Russia – 22010 US dollars. On the one hand, these WTP indicators clearly demonstrate the breadth of the range of financial capabilities of national healthcare systems of different countries associated with the process of introduction of modern innovative medical technologies. On the other hand, they indirectly reflect the need for additional pharmacoeconomics studies to assess the rationality of the innovative medical technology use in specific conditions of providing medical and pharmaceutical services to the population.

Table. The results of the analysis of dynamics in changing the WTP indicator in the reference countries within 2008-2016

Reference countries	Unit of measurement	The WTP indicator								
		2008	2009	2010	2011	2012	2013	2014	2015	2016
Egypt,the growth rate	thousand US dollars	6,48	7,38	8,40	8,91	9,78	9,93	10,05	10,26	10,74
	%	–	13.9	13.8	6.1	9.8	1.5	1.2	2.1	4.7
Jordan,the growth rate	thousand US dollars	11,62	11,95	12,97	13,85	14,56	15,46	16,13	16,52	16,67
	%	–	2.8	8.5	6.8	5.1	6.2	4.3	2.4	0.9
Morocco,the growth rate	thousand US dollars	8,88	8,71	8,76	9,42	9,03	9,78	9,90	9,96	9,56
	%	–	–1.9	5.7	7.5	–4.1	8.3	1.2	6.1	–4.2
Sudan,the growth rate	thousand US dollars	4,80	4,59	5,52	6,09	5,34	4,95	5,22	5,28	4,79
	%	–	–4.4	20.3	10.3	–12.3	–7.3	5.5	1.2	–9.3
Ethiopia,the growth rate	thousand US dollars	0,99	1,14	1,02	1,08	1,41	1,53	1,50	1,59	2,03
	%	–	15.2	–10.5	5.9	30.6	8.5	–2.0	6.0	27.7

CONCLUSION

In Morocco, Sudan and Ethiopia the dynamics of the WTP indicator had a complex nature of development during 2008-2016. In general, among the reference countries the most stable character of changes in the willingness-to-pay indicator in the process of introduction of innovative drugs to the pharmaceutical market was characteristic for Jordan. As a result of the studies conducted it should be noted that the WTP indicators obtained demonstrated different available financing of the national healthcare systems and pharmaceutical providing of the population in the reference countries in the process of introduction of innovative drugs to the pharmaceutical market. In our opinion, one of the promising directions of research in this area is determination of the main factors affecting the process of construction of models for affordable and effective medical and pharmaceutical care, which meet the basic requirement of the WHO National policy. Among the reference countries it is Jordan that has the greatest scientific and socio-political potential that allows implementing effectively innovative technologies in the healthcare system and pharmaceutical providing of the population.

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