



RESEARCH ARTICLE

Results of the Comparative Analysis of the Willingness-To-Pay Threshold Indicators for Introduction of Innovative Technologies in Healthcare Calculated on the Basis of the Purchasing Power Parity of the Population in Ukraine, Azerbaijan, Armenia, and Georgia

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Abstract

Objective: To conduct a comparative analysis of the dynamics of changes in the willingness-to-pay indicators concerning introduction of the innovative technology in the national healthcare systems of Azerbaijan, Armenia, Georgia and Ukraine. **Methods:** The studies used the “Willingness-to-pay” calculation method proposed by the WHO Commission on Health Macroeconomics and Economics. Calculation and comparison of willingness-to-pay indicators in the reference countries was carried out on the basis of the purchasing power parity (PPP) of the population. **Results:** It was found that during 2010-2017 Azerbaijan consistently held the leading position when introducing the innovative technology in healthcare by the willingness-to-pay value. By the average value of willingness-to-pay indicators (in 2010-2017) the reference countries were distributed in ascending order of indicators in the following way: Armenia (24, 28 USD Thousand); Ukraine (25,02 USD Thousand); Georgia (26,30 USD Thousand); Azerbaijan (50,61 USD Thousand). Therefore, the average value of the willingness-to-pay indicator in Azerbaijan was approximately twice as much as in other reference countries. In ascending order of the average growth rate values (%) of the willingness-to-pay indicator the countries were distributed as follows: Azerbaijan (101.69%); Ukraine (102.02%); Armenia (105.4%); Georgia (107.2%). Azerbaijan demonstrated the highest willingness-to-pay indicators, but it showed the lowest average growth rates (%) within 2010-2017. The highest growth rate (%) of the willingness-to-pay indicator was observed in Georgia. **Conclusion:** The results of the studies conducted can be used to form an objective assessment of the threshold values of national healthcare systems in Azerbaijan, Armenia, Georgia and Ukraine.

Keywords: *Innovative drug, Innovative health technology, Health technology assessment, Pharmaceutical provision of the population, Willingness-to-pay indicator.*

Introduction

Modern medicine can not be imagined without innovative technologies that are used in the treatment of a number of diseases. Innovative technologies in healthcare, namely innovative drugs, are of special relevance when organizing the effective therapeutic and preventive process of chronic diseases, orphan pathologies, as well as diseases that are of socio-economic

importance for the normal development of the state and society as a whole [1-3]. The modern market of innovative drugs is a macroeconomic structure developing most actively at the moment [4-5]. It should be noted that this segment of the global pharmaceutical market is characterized by high growth rates over the past ten years.

Its most important characteristic is the dominance of high-cost drugs. This is reasonable taking into account the fact that most of these drugs appear at the pharmaceutical market due to the active development of genetic engineering and biotechnology [6-8]. Therefore, for the majority of patients with cancer, orphan pathologies, as well as previously incurable diseases, the availability of innovative treatment technologies remains doubtful [1, 9-11].

In conditions of low efficiency of functioning of regulation mechanisms of the innovative drugs availability for patients from the state or the corresponding public institutions the problem of preservation of the quality life year gains more and more important social value with each passing year [1,12-15]. This problem is actively discussed not only in countries with low levels of financing of healthcare systems, as well as those that are in the process of reforming their national healthcare systems [1, 4, 10, 15-20].

In conditions of the ever-increasing needs of the population of economically developed countries in the preservation of the quality life year the problem of adequate resource provision for introduction of innovative drugs in practical medicine is becoming increasingly important every year [8, 12, 16, 21-24].

As it follows from the data of special literature, the most important management decisions that determine the possibility of using new drugs in practical medicine and pharmaceutical provision of the population are taken on the basis of the research results using modern methodology of Health Technology Assessment (HTA) [25-28]. Currently, the literature describes the results of pharmacoeconomical studies in assessing the use of innovative drugs in the treatment of hematological pathologies, Parkinson's disease, orphan pathologies, etc [6, 8, 11, 29].

HTA uses a range of methods to form an objective socio-economic and health assessment of the possibility of using certain innovative technologies or drugs used in the treatment of a number of diseases, including previously incurable ones [16, 28, 30, 31]. One of these methods is determination of the willingness-to-pay indicator (willingness-to-pay analysis -WTP) of the state and society as a whole for the use of innovative drugs in various fields of practical medicine [3, 32-34].

This indicator was first proposed and calculated in the 80s of the last century in the United States and Canada (Kaplan RM, Bush JW) [34]. Its initial value was 50 000 USD and was calculated on the model of a patient with chronic renal failure [34, 35]. The indicator determines all costs of the society in monetary form in preservation of one year of additional quality life (quality adjusted life years-QALY) of a nephrological patient who is on hemodialysis [34].

The application of the WTP assessment results is of socio-economic importance when developing a rational model for financing of pharmaceutical provision of the population by the programs of complete or partial reimbursement of the cost of drugs [4, 10, 20, 36, 37]. Implementing in practice the declared principles of humanistic development of the society many post-Soviet countries began to develop and introduce programs of the state regulation of availability of medicines [20].

Taking into account the above we think that the results of the study of the WTP indicators for using innovative drugs in the national healthcare systems of the post-Soviet countries are relevant. The aim of our studies was to analyze the WTP indicators in the dynamics of years in Azerbaijan, Armenia, Georgia and Ukraine.

Materials and Methods

One of the most important stages of our research was formation of a group of reference countries. It should be noted that the foreign literature has already presented the results of the analysis of the WTP indicators calculated by the indicators of the nominal gross domestic product (GDP) and the purchasing power parity (PPP) of countries of the former Soviet Union [20]. At the same time, the analysis of these indicators was carried out in all countries regardless of the type of functioning of national healthcare systems and the nature of the modern development of pharmaceutical provision.

Therefore, an important stage of our research was the substantiation of the group of reference countries. It was decided to include those countries that in recent years demonstrated significant progress in the process of reforming national healthcare

systems in the group of reference countries in order to increase the availability of medicines for different categories of the population or groups of countries. The data of the information search conducted on the official websites of the Ministries of Health of the post-Soviet countries, as well as their subordinate bodies that regulate pharmaceutical activities in the country were systematized.

The information search was conducted for the period from 01.01.2014 to 01.01.2009 using such keywords as “availability of drugs”, “HTA”, “WTP”, “innovative drugs”, “innovative technologies in healthcare”, “criteria for assessing the availability of drugs”, “state programs in the pharmaceutical sector”. After analyzing the data the group of reference countries, which included Ukraine, Georgia, Azerbaijan and Armenia, was formed.

As evidenced by the data of the WHO European information portal, these countries over the past five years demonstrated a positive trend in increase of the amount of spending on healthcare. Currently, various methods of assessing the financial feasibility of innovative drugs in national healthcare systems are used [15, 16, 26, 32].

Thus, methods based on the results of pharmacoeconomical studies of the indicators of “cost-effectiveness analysis” (CEA) and “cost-benefit analysis” (CUA) are used [32, 36, 38, 39]. The additional amount of money that must be spent to save one year - “Life Years Gained” (LYG, cost-benefit analysis) or “Quality adjusted life years” (QALY, cost-benefit analysis) is calculated [13, 26, 32, 33, 40].

These methods are rather time-consuming and high-cost for assessing the socio-economic feasibility of using innovative drugs [15, 20, 25]. Obviously, these methods are important for solving specific problems in providing certain categories of the population or groups of patients with high cost drugs for a long period, sometimes for life [9, 33, 38]. In the absence of the evidence-based research on the pharmacoeconomical assessment of the new names of innovative drugs it is necessary, in our opinion, to use less expensive and time-consuming methods of the preliminary assessment of the innovative technology for making operational

management decisions concerning organization of their public procurement.

The WTP determination proposed by the WHO Commission on Health Macroeconomics and Economics for macroeconomic calculations and appropriate analysis of indicators can be referred to such a method [15, 20, 26, 39]. This method was proposed by the WHO back in 2002, and it was used in the further analysis of the assessment of the investment level when using innovative technologies in healthcare in different countries.

In addition, this method was used when forming statistical materials on the WHO program “WHO-CHOICE” (“The choice of activities that are cost-effective”) [20, 39]. The essence of this method is to determine the indicators of the gross domestic product of the country calculated per capita and multiplied by three. Figuratively speaking, if the amount of costs associated with introduction of the innovative technology in practical medicine or pharmaceutical provision of the population exceeds the specified WTP indicator, its application is considered irrational taking into account the real resource provision of the healthcare system of a country.

This method has a number of limitations within the application of a particular health technology [20, 26, 28, 39]. However, these restrictions, in our opinion, are leveled in the conditions of shortage of funds and active reforming of the national healthcare systems of the post-Soviet countries in the direction of a significant increase in the availability of drugs for socially vulnerable categories of the population.

The basis of the methodology in the WTP determination is the so-called “welfare economics”, which uses a set of value judgments applied to identify and evaluate the need for the production of a product (service) in the state with the aim of obtaining the maximum income and wealth currently and in the future [41, 42].

The WTP indicator expresses the amount that the society is ready to spend in order to achieve a stable and reliable clinical and therapeutic effect or surrogate points for a definite category of patients or groups of the population [10, 13, 32, 34].

To determine the WTP indicator based on the analysis of the gross domestic product of some countries the data of the World Bank for reconstruction and development were used.

In addition, the statistic data provided on the official websites of the relevant ministries and agencies of the reference country group were used. The GDP was calculated by PPP and expressed in international dollars. The main macroeconomic indicators calculated by PPP allow comparing and evaluating definite processes occurring in different countries [41, 42].

In the studies such methods of scientific research as historical, system, logical, comparative, graphic, mathematical and statistical, content analysis, as well as methods of logical modeling were used. Both a comparative analysis of the average values of WTP calculated by PPP in the reference countries, and the analysis of changes in the WTP indicators in the dynamics of years (2010-2017) were conducted. For example, in the analysis of the dynamics of indicators used in our studies the growth rate (%) of indicators, as well as the coefficients (k) of the growth/decline rate, was applied.

The year of 2010 was chosen as the reference year in the analysis of the dynamics of indicators. Therefore, the calculation of the basic values of the growth/decline rate coefficients (k_{bas}) was performed by assigning the data of 2017 to the corresponding figures in 2010 and the chain growth/decline rate indicators (k_{chain}) by referring the data of the following year to the corresponding data of the previous year. The statistical data processing was carried out using the statistical package StatSoft. Inc. (2014). STATISTICA version 12.0 and Excel spreadsheet. After the preliminary assessment of the data all indicators were

imported into a Statistica 6.0 standard program for the applied statistical analysis. The p-value <0.05 was considered statistically significant.

Results and Discussion

Our studies demonstrated the following results. In the group of reference countries Azerbaijan demonstrated the highest value of the WTP indicators, but Armenia showed the lowest value (Table 1). The indicator of the variation range (%) of the WTP indicators calculated by PPP for the period from 2010 to 2017 for the countries was equal to: Azerbaijan – 12.16%; Armenia – 44.29%, Georgia-51.83%, Ukraine-14.08%. As can be seen, the greatest fluctuations of the WTP indicators calculated by PPP were observed in Georgia.

The k_{bas} indicator in Armenia was equal to 1.44, in Azerbaijan -1.12, in Georgia-1.52, while in Ukraine it was 1.14. The relatively low WTP indicators calculated by PPP in Ukraine raise many questions taking into account the fact that after the collapse of the Soviet Union Ukraine ranked second after the Russian Federation by the GDP indicators per capita. The lack of systemic changes in the Ukrainian economy and healthcare system, the low level of efficiency of the state regulation of the pharmaceutical market led to a sharp decline in the availability of medical and pharmaceutical care to the population.

Chronic patients were provided with innovative drugs exclusively at the expense of charitable and humanitarian funds, as well as public procurement of drugs. All this was implemented in the context of growing corruption risks in the public health sector. Among the reference countries Georgia showed the highest growth rate of the WTP indicator calculated by PPP.

Table 1: Analysis of the dynamics of change in the GDP and WTP indicators calculated by PPP in the group of reference countries

CIS country	2010	2011	2012	2013	2014	2015	2016	2017	Average value
GDP calculated by PPP, USD Thousand									
Azerbaijan	15.63	15.75	16.18	17.17	17.61	17.82	17.28	17.53	16.87
Armenia	6.57	7.02	7.65	8.00	8.40	8.74	8.85	9.48	8.09
Georgia	6.60	7.32	8.03	8.54	9.22	9.63	10.02	10.74	8.76
Ukraine	7.67	8.28	8.48	8.63	8.68	7.95	8.27	8.75	8.33
WTP of the population calculated by PPP, USD Thousand									
Azerbaijan	46.86	47.25	48.54	51.51	52.83	53.46	51.84	52.59	50.61
Armenia	19.70	21.07	22.95	23.99	25.19	26.23	26.55	28.44	24.27
Georgia	19.80	21.95	24.08	25.63	27.65	28.89	30.07	32.22	26.29
Ukraine	23.00	24.85	25.43	25.89	26.05	23.84	24.82	26.25	25.02

In 2017, compared to the data of the basic 2010, this indicator increased 1.5 times. It characterizes the national healthcare system in Georgia as the most attractive for introduction of new innovative drugs among the group of reference countries. In our opinion, it is interesting to compare the reference countries by the average value of the WTP indicator calculated by PPP. As you can see from Fig. 1, by the average value of

the WTP indicators (in 2010-2017) the reference countries were distributed in ascending order of indicators in the following way: Armenia (24,28 USD Thousand); Georgia (26,30 USD Thousand); Azerbaijan (50,61 USD Thousand). As can be seen, Azerbaijan has the leading position by the WTP average value calculated by PPP for the period from 2010 to 2017.

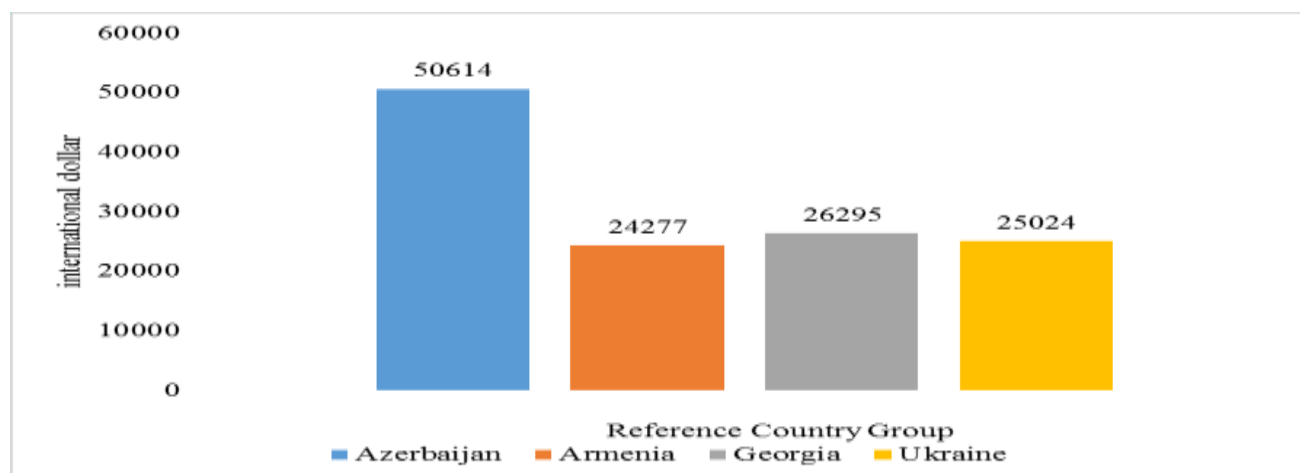


Figure 1: Distribution of the reference countries by the average value of the WTP indicator calculated by PPP (within 2010-2017)

According to the World Bank classification Azerbaijan entered the category of countries with “High average incomes” by the total national income per capita by the end of 2017. It should be noted that Azerbaijan was referred to this category of countries earlier than many countries of the former Soviet Union. At the same time, according to the report of the United Nations (UN) development Program on human development for 2010, Azerbaijan left the group of countries with “Average human development” and entered the group of countries with “High human development”.

With the growth of the economic potential of Azerbaijan the favorable conditions for the healthcare system development have appeared, the country has consistently addressed the problems of public health. The budget allocated for healthcare has increased more than 10 times since 2010. When comparing the WTP indicators calculated by

PPP in economically developed countries of the world it can be argued about the relatively low possibility of introducing innovative technologies in healthcare in the reference countries. For example, the WTP indicator in Australia is equal to 183402,0 USD, in the USA it is 162972,0 USD, in Canada it is more than 150130,0 USD, and in the Russian Federation it is about 22000,0 USD [20].

Therefore, it seems logical that the primary focus of the world pharmaceutical manufacturers in distributing innovative drugs is on the American pharmaceutical market, which is characterized by more liberal approaches to the regulation of drug circulation than, for example, the European pharmaceutical market. The next stage of our research was the analysis of the WTP indicators calculated by PPP in the dynamics of years. The analysis of growth rates (%) of these indicators for the reference countries is presented in Table 2.

Table 2: Analysis of the WTP indicators calculated by PPP in the group of reference countries

Reference Country Group	The growth rates of the WTP indicators calculated by PPP (%) within the research years							
	2011	2012	2013	2014	2015	2016	2017	Average value
Azerbaijan	100.8	102.7	106.1	102.6	101.2	97.0	101.4	101.69
Armenia	107	108.9	104.5	105	104.1	101.2	107.1	105.4
Georgia	110.9	109.7	106.4	107.9	104.5	104.1	107.2	107.2
Ukraine	108.0	102.33	101.8	100.6	91.5	104.1	105.8	102.02

There was a positive dynamics of change in the WTP indicators calculated by PPP in all countries. The WTP indicator calculated by PPP increased annually. The only exceptions were the WTP indicators calculated by PPP in Azerbaijan in 2016 (the value of the chain growth rate indicator was -3.0%), and in Ukraine in 2015 (the growth by -9.5%).

The value of WTP calculated by PPP in Armenia and Georgia increased permanently, but with different growth rates (%). It should be noted that the highest value of the growth rate for the group of reference prices was typical for Georgia in 2011 (the growth by +10.8%), while the lowest value was for Ukraine according to the data of 2015 (-9.5%). The value of this indicator in Ukraine in 2015 was associated with the consequences of the systemic crisis, which affected almost all areas and spheres of the public activity in the country.

In ascending order of the average growth rate values the countries were distributed as follows: Azerbaijan (101.69%); Ukraine (102.02%); Armenia (105.4%); Georgia (107.2%). Therefore, it can be argued that despite the fact that Azerbaijan has the leading position by the WTP average value calculated by PPP in this country there is the lowest growth rate of this indicator among

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the reference countries. At the same time, it should be noted that the WTP data calculated by PPP seem more optimistic in the dynamics of years in Georgia.

Conclusion

Based on the results of the studies conducted the following conclusions can be made. Against the background of systemic changes in the reference countries the issues of development of free market relations and promotion of social responsibility of business in the organization of medical and pharmaceutical services to the population should occupy a special place in formation of the public health policy and the system of pharmaceutical provision of the population.

In conditions of the decline in real income of the population and the unstable political and financial situation in the country it is necessary to elaborate and effectively implement the state support programs for developing the national pharmaceutical industry and increasing the level of staff training for national healthcare systems. A promising stage of our further research will be the analysis of the impact of various factors on the dynamics of changes in the threshold values of the capabilities of the state and public institutions to introduce innovative technologies in healthcare.

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