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## **Clinical-Economic Analysis of Drugs for the Treatment of COVID-19 at the Stationary Level of Medical Care**

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### **Introduction**

The problems of managing the quality of medical care, the effective use of drugs, the development and improvement of the pharmacotherapeutic service have been and remain relevant in the Republic of Armenia. During the coronavirus epidemic, the problems of effective management of the activities of medical institutions of the republic and the organization of drug supply have become more acute. There was a need to change the order of procurement planning for drug supply of new departments [2]. The urgent formation of outpatient computed tomography centers and mobile teams, the deployment of infectious diseases departments, and the cancellation of planned hospitalization required significant efforts on the part of the staff for the prompt selection of drugs for patients with varying degrees of severity of COVID-19 disease [1]. Doctors, pharmacists and other professionals faced a number of problems in the selection of drugs; there were irregular and unplanned purchases of drugs, which in turn led to inefficient cost planning.

The aim of the study is to conduct a clinical-economic analysis of drugs used in the COVID-19 department of a multidisciplinary hospital in Yerevan.

### **Materials and Methods**

The materials for the study were data on the use of drugs for 1 year (2021) in the COVID-19 department of one of the multidisciplinary hospitals of the Republic of Armenia, the ATC Indices of the World Health Organization and clinical recommendations for the treatment of COVID-19 [4].

The study used ABC/VEN analysis, ATC/DDD methodology, and DU 90% analysis method.

ABC-analysis is a retrospective analysis aimed at assessing the rationality of spending financial resources by dividing drugs into three groups (A, B, C) according to their actual consumption in a certain period of time. Class A includes drugs for which 80% of all funds were spent, class B - 15%, class C - 5%. The implementation of ABC analysis includes a number of sequential actions:

- 1) compiling a list of drugs purchased during the year,
- 2) calculation of the percent of each drug in the total cost of drugs purchased during the year,
- 3) compiling a list of drugs in descending order of purchase price,
- 4) cumulative calculation of percent, which is calculated by sequentially adding up the percent of costs for each drug on the list, up to 80%, then up to 15% and 5%,
- 5) distribution of drugs by classes A, B, C [3,5,6,8,9].

VEN analysis is performed to assess the effectiveness of pharmacotherapy. The essence of the analysis is the distribution of drugs used for certain diseases or in one of the departments of a hospital during the period selected for analysis according to vital needs. This makes it possible to evaluate the effectiveness of the use of financial resources and the dominance in the use of a certain group of drugs. To do this, all drugs prescribed to patients are divided into 3 categories.

- V (Vital). These are the drugs that are needed to save a life, are constantly required to maintain quality of life, or that cause withdrawal symptoms after they stop taking them.
- E (Essential). Essential drugs are most effective against less serious but important diseases, but are not absolutely necessary for basic health care.
- N (Non-essential). These are drugs that are used for a secondary (mild) disease or self-treatment, have questionable efficacy or have a relatively high cost compared to a negligible therapeutic effect [3,5,6,8,9].

Of the two approaches (expert and formal) to the categorization of drugs used in the analysis of VEN, the expert method was implemented. When classifying drugs, consultations were held with the hospital's pharmacist and experienced specialists in the relevant field of medicine, including literature data. Then we summarized the information received and made the final classification.

Using the ATC/DDD methodology, the analysis of used drugs according to the ATC (anatomical-therapeutic-chemical) classification was carried out by searching for the ATC codes of drugs in the "ATC-index" and as well as the defined daily dose (DDD) (determined for each drug as a unit of measurement of drug intake) [3,9,10,11].

Using the DU90% (drug utilization) analysis method, the quantitative analysis of drug use was carried out in the following steps:

- calculation of the number of DDDs (NDDD) for each drug for the study period,

$$NDDD = \frac{\text{amount of drug}}{DDD},$$

- calculation of the percent of each drug in the total NDDD,
- listing drugs in descending order of NDDD value, from highest to lowest, up to 90% and then down to 10%,
- creation of two groups of drugs, the first of which includes drugs with high NDDD, which account for up to 90% of the total number of NDDD (frequently used drugs), and the second group includes drugs with low NDDD, which make up the rest of the total NDDD of 10% (rarely used drugs ),
- calculation of the cost of one DDD in two segments: DU90% and DU10%, which will allow comparing the costs of frequently and rarely used drugs [3].

The cost of 1DDD of a drug is calculated by dividing the amount spent on the drug by its number of DDDs (NDDD).

A combined analysis of DU 90% and ABC/VEN was also performed [7].

## Results and Discussion

The conducted studies showed that in the database of the hospital, the drugs used in the COVID-19 department were presented by trade names, dosing units, quantities and unit monetary terms. The list has been revised and edited, international non-proprietary names (INN) of drugs have been added.

Studies have shown that the number of drugs used in the COVID-19 department of the hospital is 59 INN, of which the majority are drugs affecting the gastrointestinal tract (20,3%), antimicrobial drugs (16,9%) and cardiovascular drugs (13,5%). Among the drugs that affect the gastrointestinal system (A), the COVID-19 department mainly used A02 - antiulcer drugs, A11 - vitamins, A12 - mineral supplements (minerals). Among antimicrobials (J), J01-antibacterial drugs for systemic use were mainly used. Among the drugs that affect the cardiovascular system (C), CO1 - drugs for the treatment of heart diseases and CO3 - diuretics were mainly used.

The next step was an integrated ABC/VEN analysis. First, drugs were sorted by ABC analysis in descending order of financial resources spent on them, and the percent of costs was calculated for each drug. Then, in the created list, drugs were assigned to classes A, B, C. Of the 59 INN drugs used, 22% belonged to group A, 27% to group B and 51% to group C.

According to the VEN analysis, drugs were grouped into classes V, E, N in agreement with doctors and pharmacists and using literature data, namely clinical guidelines for the treatment of COVID-19. The results of the VEN

analysis showed that in the list of used drugs, class V is 18.6%, class E - 66.1%, class N - 15.3% (Table 1).

Table 1

Results of ABC/VEN analysis of drugs

ATC code	INN	Costs: absolute value (Armenian dram)	Costs: %	ABC	VEN
J01CR02	Amoxicillin + clavulanic acid	561,234,70	34,52%	A	V
J01MA14	Moxifloxacinum	133,297,10	8,20%	A	V
A12CA01	Sodium chloride	131,226,19	8,07%	A	V
J01DD04	Ceftriaxone	112,500,00	6,92%	A	V
B01AF01	Rivaroxaban	96,723,46	5,95%	A	E
A11CC05	Cholecalciferol	64,357,10	3,96%	A	E
R01AA05	Oxymetazoline	38,060,00	2,34%	A	E
A12CB	Zinc	35,892,00	2,21%	A	E
B02BA01	Phytomenadione	29,969,52	1,84%	A	E
A07FA51	Lactic acid producing organisms, combinations	27650,72	1,70%	A	E
A02BA03	Famotidine	27406,80	1,69%	A	E
J01FA10	Azithromycin	26763,53	1,65%	A	E
R03CC02	Salbutamol	26520,00	1,63%	A	E
H02AB02	Dexamethason	24,158,00	1,49%	B	V
A06AX01	Glycerol	22,387,00	1,38%	B	N
B05BB01	Compound solution of sodium chloride	20,502,00	1,26%	B	E
D04AA13	Dimetindenum	20056,00	1,23%	B	N
M01AE01	Ibuprofen	18,648,40	1,15%	B	E
A11GA01	Acidum Ascorbinicum	18,360,00	1,13%	B	E
B05CX01	Glucose	17,394,00	1,07%	B	E
N02BE01	Paracetamolum	15,893,59	0,98%	B	E
D02AC	Vazelin	15,473,28	0,95%	B	N
J01CA01	Ampicillin	15,388,00	0,95%	B	E
J01XA01	Vancomycin	14,250,00	0,88%	B	V
A03AX13	Simeticone	10,620,57	0,65%	B	E
A11GB	Acidum Ascorbinicum + Zn	9,854,32	0,61%	B	E
A02BC02	Pantoprazole	9,547,85	0,59%	B	E
M01AB05	Diclofenac	7,488,00	0,46%	B	E
J01DD08	Cefixime	7,003,20	0,43%	B	E
J01XD01	Metronidasole	6,249,60	0,38%	C	E
H01BA02	Desmopressin	6,048,90	0,37%	C	E
S03CA01	Ciprofloxacinum+ Dexamethasonum	5,640,00	0,35%	C	E
C07AB12	Nebivolol	5,374,50	0,33%	C	E
J01CA04	Amoxicillin	4,831,20	0,30%	C	V
S02DA30	Lidocaine + phenazone	4,502,40	0,28%	C	E
A11AA03	Vitamines, minerales	3,267,90	0,20%	C	N
R06AE09	Levocetirizine	3,204,80	0,20%	C	E
J01XE03	Furazidin	2,896,00	0,18%	C	E
N03AX14	Levetiracetamum	2,786,00	0,17%	C	E
D03AX03	Dexpanthenol	2,524,00	0,16%	C	N
B02BX01	Etamsylate	2,293,60	0,14%	C	E

R03BA02	Budesonide	2,125,00	0,13%	C	E
C05AX03	Oleum Hippophea	2,105,60	0,13%	C	N
S01AA12	Tobramycin	2,034,40	0,13%	C	E
R01AA07	Xylometazoline	2,027,39	0,12%	C	E
R06AE07	Cetirizine	1,917,70	0,12%	C	E
A12CX	Potassium aspartate & magnesium aspartate	1,521,54	0,09%	C	E
S01AA17	Erythromicin	1,138,40	0,07%	C	E
M04AC01	Colchicin	902,70	0,06%	C	V
C01CA24	Epinephrine	700,00	0,04%	C	V
H02AB06	Prednisolon	570,40	0,03%	C	V
N05CM09	Valerianae	508,77	0,03%	C	N
C01EB02	Camphora	409,60	0,02%	C	N
C03DA01	Spirolactone	389,80	0,02%	C	E
B01AC06	Acidum acetylsalicylicum	357,10	0,02%	C	E
V07AB	Aqua destillata	320,40	0,01%	C	N
C09AA01	Captopril	318,80	0,01%	C	E
C03CA01	Furosemide	287,20	0,01%	C	E
H03AA01	Levothyroxine sodium	108,90	0,01%	C	V
Total	-	1,625,987,93	100%	-	-

According to the results of the ABC/VEN analysis, it became clear that in group A there are not, but in group B there are drugs of class N (vazelin, dimethindenum and glycerol), which are not so many (18,75%), and in group C - drugs of class V (amoxicillin, colchicin, epinephrine, prednisolon and levothyroxine), which are also few (16,67%) (Table 2).

Table 2

## Results of ABC/VEN analysis of drugs in percent

ABC group	Quantity of INNs	V	E	N
A	13	30,77%	69,23%	0
B	16	12,5%	68,75%	18,75%
C	30	16,67%	63,33%	20%

In order to perform a quantitative analysis of drug use (DU90% analysis), the drug DDD search showed that 39 out of 59 INNs had DDD. For each drug, the number of DDDs (NDDD) was calculated, and then the percent of each drug in the total NDDD. The resulting list was edited in descending order, from the largest NDDD to the smallest, and 2 groups were created: DU 90% and DU 10% (Table 3).

Table 3

Results of DU90% analysis of drugs

INN	ATC code	DDD	NDDD	% in total NDDD	Cost of 1DDD (Armenian dram)	DU90% / DU10%
Cholecalciferol	A11CC05	0,02mg	2587,5	44,38%	24,87	DU90% (total cost of 1DDD in the segment - 6435.18 Armenian dram)
Acidum Ascorbinicum	A11GA01	200mg	850	14,58%	21,60	
Dexamethason	H02AB02	1,5mg	666,6	11,43%	36,24	
Sodium chloride	A12CA01	1000mg	558	9,57%	235,17	
Oxymetazoline	R01AA05	0,4mg	218,75	3,75%	173,98	
Amoxicillin + clavulanic acid	J01CR02	1500mg	142,5	2,44%	3938,5	
Ceftriaxone	J01DD04	2000mg	75	1,29%	1500,00	
Ibuprofen	M01AE01	1200mg	70,8	1,21%	263,39	
Paracetamololum	N02BE01	3000mg	65,83	1,13%	241,43	
Pantoprazole	A02BC02	40mg	65	1,11%	146,89	DU10% (total cost of 1DDD in the segment - 26247.65 Armenian dram)
Rivaroxaban	B01AF01	20mg	63,75	1,09%	1517,23	
Moxifloxacinum	J01MA14	400mg	51	0,87%	2613,67	
Azithromycin	J01FA10	300mg	50	0,86%	535,27	
Nebivolol	C07AB12	5mg	50	0,86%	107,49	
Camphora	C01EB02	150mg	40	0,69%	10,24	
Prednisolon	H02AB06	10mg	40	0,69%	14,26	
Colchicin	M04AC01	1mg	30	0,51%	30,09	
Salbutamol	R03CC02	12mg	25	0,43%	1060,8	
Desmopressin	H01BA02	0,025mg	20	0,34%	302,445	
Levocetirizine	R06AE09	5mg	20	0,34%	160,24	
Famotidine	A02BA03	40mg	15	0,26%	1827,12	
Ampicillin	J01CA01	6000mg	15	0,26%	1025,87	
Simeticone	A03AX13	500mg	14,4	0,25%	737,54	
Phytomenadione	B02BA01	20mg	14	0,24%	2140,68	
Xylonmetazoline	R01AA07	0,8mg	12,5	0,21%	162,19	
Diclofenac	M01AB05	100mg	10	0,17%	748,8	
Cetirizine	R06AE07	10mg	10	0,17%	191,77	
Furazidin	J01XE03	300mg	8,3	0,14%	348,91	
Metronidasole	J01XD01	1500mg	6,67	0,11%	937,44	
Captopril	C09AA01	50mg	5	0,09%	63,76	
Furosemide	C03CA01	40mg	5	0,09%	57,44	
Cefixime	J01DD08	400mg	5	0,09%	1,400,64	

Epinephrine	C01CA24	0,5mg	3,6	0,06%	194,44	
Spironolactone	C03DA01	75mg	3,34	0,06%	116,70	
Levetiracetamum	N03AX14	1500mg	3,34	0,06%	834,13	
Budesonide	R03BA02	0,8mg	3,125	0,05%	680,00	
Vancomycin	J01XA01	2000mg	2,5	0,04%	5700,00	
Amoxicillin	J01CA04	3000mg	1,92	0,03%	2516,25	
Levothyroxine sodium	H03AA01	0,15mg	1,67	0,03%	65,34	
Total	-	-	5830,095	100%	-	-

Only 9 INN drugs were included in DU90% segment. The calculation of the cost of 1 DDD for each drug was carried out, and on its basis, the calculation was also made in the groups DU90% and DU10%. As a result, it was found that the cost of 1 DDD in DU10% is approximately 4 times higher than the cost of 1 DDD in DU90%, which indicates the predominance of the use of inexpensive drugs.

A combined analysis of DU90% and ABC/VEN was also carried out, which made it possible to find out which class of drugs (VEN) belong to the most commonly used (DU90%) group of 9 drugs (Table 4).

As can be seen from the data in the table, in the segment of the most commonly used drugs (DU90%) there were only drugs of class V and E, which are included in groups A and B.

Table 4

*Results of combined analysis of ABC/VEN and DU90%*

Drugs is the DU 90% segment		ABC	VEN
ATC code	INN		
A11CC05	Cholecalciferol	A	E
A11GA01	Acidum Ascorbinicum	B	E
H02AB02	Dexamethason	B	V
A12CA01	Sodium chloride	A	V
R01AA05	Oxymetazoline	A	E
J01CR02	Amoxicillin + clavulanic acid	A	V
J01DD04	Ceftriaxone	A	V
M01AE01	Ibuprofen	B	E
N02BE01	Paracetamolum	B	E

### Conclusion

A clinical-economic analysis of the annual purchase of drugs for the COVID-19 department by a multidisciplinary medical institution in Yerevan showed that the results of ABC/VEN analysis alone are not enough for a final assessment of the effectiveness of the purchase. It turns out that significant

amounts (group B - in the amount of 15% of the total amount of funds) were spent on the purchase of some drugs of the non-essential group (class N), as well as on the purchase of some vital drugs (class V), on the contrary, were spent in smaller amounts (group C - in the amount of 5% of the total amount of funds), although the percent of those drugs in groups B and C is small.

For the final assessment of the effectiveness of procurement, a combined ABC/VEN and DU90% analysis was carried out, according to the results of which it was found that financial resources were mainly spent on the purchase of vital and essential drugs, that is, the procurement was carried out efficiently.

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### **Клинико-экономический анализ препаратов для лечения COVID-19 на стационарном уровне оказания помощи**

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Цель исследования – провести клинико-экономический анализ лекарственных средств, применяемых в отделении COVID-19 многопрофильного медицинского учреждения.

Материалом для проведения исследования послужили данные о применении лекарственных средств за 1 год (2021 г.) в отделении COVID-19 одной из многопрофильных больниц РА, «индексы АТС» Всемирной Организации Здравоохранения и клинические рекомендации по лечению COVID-19. В ходе исследования использовали анализ ABC/VEN, методологию АТС/DDD и метод анализа DU90%.

Клинико-экономический анализ годичных закупок лекарственных препаратов для отделения COVID-19 многопрофильным медицинским учреждением г. Еревана показал, что значительные суммы (15% от общих средств) были потрачены на приобретение некоторых неосновных (второстепенных или вспомогательных) лекарств, а на приобретение жизненно необходимых лекарств, наоборот, были потрачены меньшие суммы (в размере 5% от общей суммы средств).

По результатам комбинированного анализа, проведенного для итоговой оценки эффективности закупок, выявлено, что финансовые ресурсы в основном расходовались на приобретение жизненно необходимых и важнейших лекарств, то есть закупка осуществлялась эффективно.

### **COVID-19-ի բուժման դեղերի կլինիկատնտեսագիտական վերլուծությունը բուժօգնության ստացիոնար մակարդակում**

**Ա.Ա. Չախոյան, Ա.Ե. Սահակյան**

Հետազոտության նպատակն է իրականացնել բազմապրոֆիլ բուժաստատության COVID-19-ի բաժանմունքում կիրառված դեղերի կլինիկատնտեսագիտական վերլուծություն:



Հետազոտությունների իրականացման համար նյութեր են հանդիսացել Հայաստանի Հանրապետության բազմապրոֆիլ հիվանդանոցներից մեկի COVID-19-ի բաժանմունքում դեղերի 1 տարվա (2021թ.) կիրառման տվյալները, Առողջապահության համաշխարհային կազմակերպության «ATC ինդեքս»-ները և COVID-19-ի բուժման կլինիկական ուղեցույցները: Հետազոտության ընթացքում կիրառվել են կլինիկատեսաագիտական մեթոդներից ABC/VEN վերլուծությունը, ATC/DDD մեթոդաբանությունը և DU90% վերլուծության մեթոդը:

Երևան քաղաքի բազմապրոֆիլ բուժհաստատության կողմից COVID-19 բաժանմունքի համար դեղերի մեկ տարվա գնումների կլինիկատեսագիտական վերլուծությունները ցույց են տվել, որ ոչ հիմնական (երկրորդային կամ օժանդակ) խմբի որոշ դեղերի ձեռքբերման վրա ծախսվել են զգալի գումարներ (ընդհանուր դրամական միջոցների 15%-ի չափով), իսկ կենսականորեն անհրաժեշտ որոշ դեղերի գնման համար, ընդհակառակը՝ ծախսվել են ավելի փոքր գումարներ (ընդհանուր դրամական միջոցների 5%-ի չափով):

Գնման արդյունավետության վերջնական գնահատման համար իրականացված վերլուծությունների համակցման արդյունքներով պարզվել է, որ ֆինանսական ռեսուրսները ծախսվել են առավելապես կենսական կարևոր և հիմնական դեղերի ձեռքբերման վրա, այսինքն՝ գնումներն իրականացվել են արդյունավետ:

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