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ESTIMATES OF POTENTIALLY PREVENTABLE HOSPITALIZATIONS IN DISEASES AMBULATORY CARE SUBJECTED TO IN UKRAINE

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Key words: Ambulatory care sensitive conditions (ACSCs), Ambulatory Care Sensitive Hospitalizations (ACSHs), potentially preventable hospitalizations (PPHs), Primary Health Care, Ukraine.

Ключові слова: захворювання, що піддаються амбулаторному лікуванню (ЗПАЛ), госпіталізації, пов'язані із ЗПАЛ, потенційно запобіжні госпіталізації, первинна медична допомога, Україна

Ключевые слова: заболевания, поддающиеся амбулаторному лечению (ЗПАЛ), госпитализации, связанные с ЗПАЛ, потенциально предотвратимые госпитализации, первичная медико-санитарная помощь, Украина

Abstract. Estimates of potentially preventable hospitalizations for ambulatory care sensitive conditions in Ukraine. Lekhan V.N., Kriachkova L.V., Doroshenko O.O., Gritsenko L.O. The purpose: this study aims to identify the most relevant diseases that can be treated outpatient (Ambulatory Care Sensitive Conditions, or ACSCs) and to define the scope of potentially preventable hospitalizations (PPHs) for such conditions (Ambulatory Care Sensitive Hospitalizations, or ACSH), for Ukrainian adults (above 18 years old), subject to improvement of primary care efficiency. The study has been carried out in four phases, using the World Health Organization's (WHO) guidance on ACSCs for the European Region, which was adapted to the national context. The data was taken from the official statistical reporting and analyzed by 104 reviewers. The assessment of the PPHs is conducted based on responses of the subgroup of reviewers – 6 experts and 61 primary care physicians, which confirmed the levels of competencies. The most significant rates of potentially preventable hospitalizations (PPHs) are registered for hypertension, pneumonia, angina, chronic obstructive pulmonary disease (COPD), and diabetes, which coincide with ACSCs that are most prevalent for Ukrainian adults. The overall rate of PPHs for adult population of Ukraine with ACSCs is 28.2% as defined by physicians and 32.9% as defined by experts, which may reduce the hospitalization rate for all ACSCs (as percent of all patients with ACSCs) from 8.2% to 6.1% (according to reviews of physicians) or to 5.7% (according to experts' reviews). The study has shown an important scope for better managing of ACSCs in Ukrainian adults. The results of the study can be used to inform the continued health system transformation, specifically for the development of interventions to prevent avoidable hospitalizations for ACSCs in Ukraine, which can lead to more efficient use of resources in the health system and further strengthening of the primary care.

Реферат. Оцінка потенційно запобіжних госпіталізацій при захворюваннях, що піддаються амбулаторному лікуванню в Україні. Лехан В.М., Крячкова Л.В., Дорошенко О.О., Гриценко Л.О. Мета – виявлення найбільш релевантних захворювань, що піддаються амбулаторному лікуванню (ЗПАЛ), та визначення потенційних обсягів запобіжних госпіталізацій, пов'язаних зі ЗПАЛ, для дорослого населення (старше 18-ти років) України при підвищенні ефективності первинної медичної допомоги (ПМД). Дослідження проведено в 4 етапи на підставі адаптованого до національного контексту керівництва ВООЗ щодо оцінки

ЗПАЛ та обсягів запобіжності їх госпіталізацій в Європейському регіоні із використанням офіційної статистичної інформації, із залученням 104 стейкхолдерів, серед яких виділялася група найбільш обізнаних респондентів – 6 експертів та 61 лікар загальної практики-сімейної медицини (ЛЗП). Найбільші популяційні показники обсягів ймовірного попередження госпіталізацій реєструються при артеріальній гіпертензії, пневмонії, стенокардії, ХОЗЛ і діабеті, що збігається зі списком найбільш значущих для дорослого населення України ЗПАЛ. Загальний рівень потенційної запобіжності госпіталізації дорослого населення від ЗПАЛ, визначений для популяції, в Україні становить за оцінками лікарів – 28,2 %, за експертними оцінками – 32,9 %, що може дозволити зменшити загальний обсяг госпіталізації при амбулаторно-чутливих станах (у % від числа хворих із ЗПАЛ) з 8,2 % до 6,1 % (за оцінками ЛЗП) або до 5,7 % (за оцінками експертів). Дослідження показало важливість поліпшення управління ЗПАЛ у дорослих українців. Отримані результати можуть бути використані для обґрунтування продовження трансформації системи охорони здоров'я, зокрема при розробці заходів щодо попередження госпіталізації при амбулаторно чутливих станах в Україні, що сприятиме оптимізації використання ресурсів та подальшому зміцненню систем ПМД.

In settings with limited resources available for financing health care, the concept of ambulatory care sensitive conditions, or ACSCs becomes important. ACSCs are health conditions for which hospitalizations can be avoided by timely and effective care in ambulatory settings, specifically in primary health care [9].

An approach first described by J. Billings et al. [12] almost thirty years ago offered the evaluation of effects of financial accessibility of outpatient care on hospitalization rates in New York, USA, and its application was broadened in numerous international studies. Presently, ACSCs indicators are not only used to define accessibility of care, but also to measure potentially preventable hospitalizations, quality and efficiency of primary health care [3]. The accumulated research from different countries justifies the possibility to better control hospitalizations of patients with ACSCs [14].

The base list of ACSCs, developed by J. Billings et al. [12] and categorized by M. Bardsley et al. [11] to include three groups (acute, chronic, and vaccine-preventable conditions), has been continuously refined [15]. At the present stage of applying the ACSC concept, each country that studies this field using WHO guidance [9], develops a country-specific list of ACSCs, which usually includes diabetes, hypertension, heart failure, angina, kidney and urinary tract infections, chronic obstructive pulmonary disease (COPD), tuberculosis, and influenza [4-8].

Hospitalizations related to ACSCs is one of key indicators for equity and effectiveness of the health care system as a whole, especially for countries with lower levels of socioeconomic development [17]. In Ukraine, despite the interest to decrease the level of unnecessary hospitalizations [10], the ACSC concept is not yet popular, which provided for our interest to the present study.

MATERIALS AND METHODS OF RESEARCH

The purpose of this study is to identify the most relevant diseases that can be treated outpatient (Ambulatory Care Sensitive Conditions, or ACSCs)

and to define the scope of potentially preventable hospitalizations for such conditions (Ambulatory Care Sensitive Hospitalizations, or ACSH), for Ukrainian adults (above 18 years old), subject to improvement of primary care efficiency.

The study was conducted using the WHO guidance on ACSCs for the European Region [9], which was adapted to the national context. It comprised four phases to: (1) define preliminary list of ACSCs using literature review; (2) analyze hospitalization rates of Ukrainian adult population according to the preliminary list of ACSCs; (3) assess relevance of specific ACSCs for Ukraine adults; and (4) evaluate potentially preventable hospitalizations (PPH) or the rate of ambulatory care sensitive hospitalizations (ACSH) according to the comprehensive list of the ACSCs.

The list of ACSCs for the analysis (1st phase of the study), similarly to other relevant studies, was based on the research of Bardsley M. et al. [11] and a synthesis of key international studies of the conditions that were defined as most sensitive to ambulatory interventions [4-8].

The analysis of hospitalization rates of Ukrainian adult population according to the preliminary list of ACSCs (2nd phase) was conducted using statistical information and results of expert reviews on hospitalization rates for specific diseases that was not fully enough presented in the statistical data or missing. The concordance of expert reviews was evaluated using the concordance coefficient (W). The reviews were considered consistent if the coefficient was approaching 1.0 at $W > 0,70$ ($p < 0,05$).

For the analysis of ACSCs, statistical data on hospitalization of adults in 2017 was used. This information is publicly available at the web-sites of the Center of Medical Statistics of the Ministry of Health (MoH) Ukraine (<http://medstat.gov.ua/ukr/statdan.html>), at the Center of Public Health of the MoH Ukraine on infectious diseases incidence ([190](https://phc.org.ua/kontrol-zakhvoryuvan/inshi-infekciyni-zakhvoryuvannya/-monitoring-i-ocinka/infekciyna-zakhvoryuvanist-</p></div><div data-bbox=)

naselennya-ukraini), and on patients with tuberculosis (<https://phc.org.ua/kontrol-zakhvoryuvan/tuberkuloz/robotaz-reestrom-pacientiv-z-tb>).

To study ACSHs, we analyzed 59,379,593 cases of diseases registered in Ukraine in 2017, and 6,601,495 cases of hospital discharges from the same year. For each of the ACSCs defined during the first phase, we analyzed its prevalence, hospitalizations rates (total number of hospitalizations and per 100,000 people), and rate of hospitalizations among patients with ACSCs.

Data for the third and fourth stage of the analysis was received from the responses to the survey based on the standardized questionnaire offered and tested by the WHO in differed countries of the European region [4-8]. Questionnaires were distributed through the association of family doctors of Dnipropetrovsk region that includes 1,406 physicians working in 468 primary care ambulatories of the region (including 56.6% ambulatories located in urban and 43.4% in rural settings) to its most active members: 130 physicians working in 29 ambulatories (including 17 urban and 12 rural ambulatories).

At the third and fourth phase of the analysis, to define the list of ACSCs relevant for Ukraine and estimate PPHs, we received 104 responses from 130 physicians (response rate 80%). All respondents were also filling a questionnaire to assess their qualification levels, knowledge and competencies to evaluate ACSCs. Only those respondents that received a threshold score of 0.8 were confirmed as those who demonstrated a high compliance with the requirements of the survey (67 respondents, including 61 primary care physicians and 6 experts). The final group of 61 surveyed primary care physicians had on average 14.0 years of practicing experience (95% CI 11.0 – 17.47), 83.7% of them had first or highest degree of professional accreditation in general or family medicine, 39.4% of them were working in urban and 60.6% in rural settings. The group of 6 experts had an average 22.5 years of work experience (95% CI 19.9-25.4), all with the highest degree of professional accreditation in organization and management of health care and practical experience of working at the primary care level.

Statistical processing of data was performed with STATISTICA 6.1 (StatSoftInc., serial number AGAR909E415822FA). To describe the normal distribution of the sample data we used the arithmetic mean (M) with a 95% confidence interval (95% CI); for asymmetric distribution we used median (Me) with interquartile range (25%; 75%). For relative values, 95% CI was calculated using adjusted Wald method. Methods of statistical analysis included estimating the statistical significance

discrepancies by Mann-Whitney test for unrelated samples; and by applying Wilcoxon test for related samples, and Pearson's Chi-square (χ^2) test. For multiple comparisons of variables, we used the Bonferroni and Holm corrections and performed a nonparametric Kruskal-Wallis analysis of variance with subsequent a posteriori tests according to the Dann criteria.

The relationships between the variables were evaluated using rank correlation analysis with Spearman correlation coefficients (r_s). The concordance coefficient (W) and the weighted square Cohen's kappa (κ) with 95% CI were used as statistics of agreement of opinions and assessments. The critical value of statistical significance for all types of analysis was taken at the level of $p < 0.05$ [1].

The study has a positive response on the use of research methods from the commission on bioethics (minutes of the meeting of the commission on biomedical ethics of the Dnipropetrovsk Medical Academy of the MoH Ukraine №4 from 06.02.2019).

RESULTS AND DISCUSSION

Hospitalization rates in Ukraine during the last 5 years (2014-2018) remain stable at 189.3 – 193.8 per 100,000 people. More than 16% of total hospitalizations are registered for ACSCs (see table 1).

The highest hospitalization rates per 100,000 is observed for the most prevalent ACSCs: angina, hypertension, diabetes, pneumonia, COPD. In 2017, 1,108,477 people in Ukraine were hospitalized with ACSCs, which makes the hospitalization rate for these conditions at 8.2%. Hospitalizations are administered in more than 50% of such ACSCs as pneumonia, respiratory tuberculosis, perforated ulcers of stomach and duodenum and gastrointestinal bleeding; and for more than 20% of cases for vaccine-preventable diseases, bronchial asthma and epilepsy.

Some of the highly prevalent ACSCs can have a relatively low hospitalization rate (e.g., 11.9% for diabetes and 10.3% for angina), while other less prevalent ACSCs can lead to frequent hospitalizations. Therefore, for the analysis of ACSCs relevant for Ukraine, the combination of hospitalization rates per 100,000 and number of hospitalizations.

In the result, the ACSC list for Ukraine includes pneumonia, angina, respiratory tuberculosis, diabetes mellitus, hypertension, vaccine-preventable diseases, bronchial asthma, gastric and duodenal ulcers and gastrointestinal bleeding, skin and subcutaneous tissue infections, and COPD.

We also defined the relevance of ACSCs on the results of respondents' survey. A combination of statistical relevance and respondents' opinion using two-dimensional graphical analysis (fig. 1) showed that the priority list of ACSCs includes pneumonia,

hypertension, diabetes mellitus, lung tuberculosis, angina, bronchial asthma, and vaccine-preventable diseases. The level of consistency of responses for

marked ACSCs is substantial in terms of weighted squared Cohen's kappa coefficient ($\kappa=0.771\%$ 95% CI 0.554-0.989).

Table 1

Hospitalizations of adults (above 18 years old) with ACSCs in Ukraine

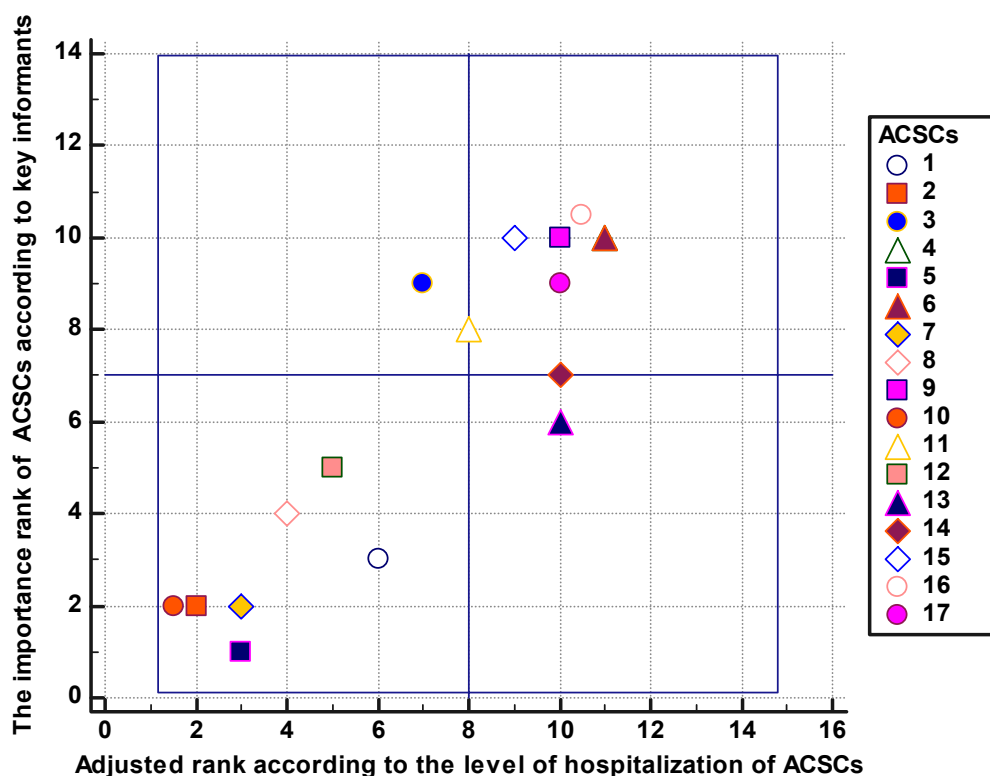
ACSCs	ICD 10 code	Registered cases		Patients hospitalized			
		number	per 100,000 people	number	per 100,000 people	share of hospitalized of total registered cases, %	share of total hospitalizations in Ukraine (total = 6,706,250), %
Vaccine-preventable conditions **, including:	A15-16, A19, A35-A37, A80, B05, B06, B26, B16.1, B16.9, B18.0, B18.1, G00.0, J10, J11, M014	111,734	263.4	29,709	85.4	26.6	0.44
Tuberculosis	A15, A16, A19	32,492	76.6	23,979	68.9	73.8	0.36
Influenza	J10, J11	15,895	37.6	1,590	4.6	10	0.024
Iron deficiency anemia	D50	346,936	997.0	10,408	29.9*	3	0.16
Diabetes	E10-E14	1,261,391	3,624.8	150,554	432.6	11.9	2.24
Epilepsy	G40-41	28,899	83.0	6069	17.4*	21	0.09
Hypertension (without ischemia)	I10-I13	3,704,649	10,645.8	169,198	486.2	4.6	2.52
Angina pectoris	I20	2,606,040	7,488.8	268,164	770.6	10.3	4.00
Pneumonia	J12-J16, J18	133,621	384.0	119,322	342.9	89.3	1.78
Congestive heart failure	I50	2,000,000	5,813.5	20,000 – 30,000	71.8*	1-1.5	0.3-0.45
COPD	J40-J42, J44	1,235,662	2,554.4	85,450	245.6	6.9	1.28
Bronchial asthma	J45-J46	175,447	504.2	45,100	129.6	25.7	0.67
Ulcer of stomach and duodenum	K25-27	827,746	2,378.6	56,119	161.3	6.8	0.84
Including perforated ulcer *	K25.1,2,5,6 K26.1,2,5,6	35,013*	100.6	6,145	17.6*	69	0.09
Infections of the skin and subcutaneous tissue	L00-L08	329,714	947.5	49,457	142.1*	15	0.74
Renal infection	N10-N12	588,769	1,691.9	52,782	151.7	9	0.79
Salpingitis and oophoritis	N70	185,115	970.4 (per 100,000 females)	35,000*	100.6*	18.9*	0.52
Total ACSCs		13,535,723		1,108,477		8.2	16.37-16.52

Notes: Sources of data is the Center of Medical Statistics of the MoH Ukraine <http://medstat.gov.ua/ukr/statdan.html>; * – expert estimates, ** – hospitalizations of vaccine-preventable diseases (tetanus, diphtheria, pertussis, acute polio, measles, rubella, acute hepatitis B, chronic hepatitis B, mumps, hemophilic infection, bacterial meningitis) were considered jointly as hospitalizations of at least 10 per 100,000 people are considered significant (and for some of the mentioned diseases it was significantly lower).

At the fourth and final phase of the study we evaluated volumes of hospitalizations for ACSCs that can be avoided subject to strengthening primary care in the country. The estimated rates of ACSH under the condition of an effective primary care was in many cases significantly lower ($p < 0.05$) than the statistically registered in 2017 hospitalizations for ACSCs (table 2). The group of experts has seen a much broader potential effects of preventive care for ACSCs than primary care physicians.

Significant differences were recorded between estimates of potential levels of hospitalizations for

urban and rural populations. For majority of ACSCs respondents estimated higher rates of PPHs for residents of urban settings compared with rural settings; such differences are statistically significant ($p < 0.05$) for all chronic conditions (specifically for diabetes, epilepsy, hypertension, COPD, and bronchial asthma) and in total for ACSCs. Thus, the levels of PPHs, according to respondents, are 12.6% (7.1; 16.2) for patients from urban settings versus 6.2% (4.7; 9.2) in rural settings ($p = 0.034$).



Notes: 1 - Vaccine-preventable conditions; 2 - Lung tuberculosis; 3 - Influenza; 4 - Iron deficiency anemia; 5 - Epilepsy; 6 - Diabetes; 7 - Hypertension (without ischemia); 8 - Angina pectoris; 9 - Congestive heart failure; 10 - Pneumonia; 11 - COPD; 12 - Bronchial asthma; 13 - Ulcers of stomach and duodenum; 14 - Perforated or bleeding ulcer; 15 - Infections of the skin and subcutaneous tissue; 16 - Renal infection; 17 - Salpingitis and oophoritis.

Fig. 1. Two-dimensional analysis of relevance of ACSCs for adult population of Ukraine based on analysis of statistics and respondents' opinions (ranges from 1 – most important to 17 – least important)

According to the analysis of correlation, better prevention of hospitalizations for ACSCs can be expected for pneumonia ($r_s = 0.30$; $p = 0.012$), perforated or bleeding gastric ulcer and duodenal ulcer ($r_s = 0.34$; $p = 0.008$), acute ACSCs ($r_s = 0.34$; $p = 0.007$) if primary care has sufficient equipment; for pneumonia ($r_s = 0.28$; $p = 0.035$) and kidney infection ($r_s = 0.37$; $p = 0.004$) if primary care physicians received appropriate training; for anemia ($r_s = 0.28$; $p = 0.024$) and vaccine-controlled conditions ($r_s = 0.23$; $p = 0.038$) if patients have sufficient access to medication at the primary care level.

By applying estimated shares of preventable hospitalizations, provided by primary care physicians, to hospitalization rates of ACSCs per 100,000 adult population of Ukraine (from table 1), we calculated PPHs per 100,000 people for the following conditions, in descending order: angina pectoris (172.1), hypertension (169.1) pneumonia (150.3) diabetes (69.1), COPD (67.6), and bronchial asthma (54.0). The share of PPHs in the total hospitalizations of particular ACSCs varies from 16% for diabetes to 43.8% for pneumonia (fig. 2).

Table 2

**Estimated level of hospitalizations for ACSCs (as % of total ACSC cases)
by primary care physician and experts (Me (25%; 75%))**

ACSCs	Primary care physicians n=61	Experts n=6	Total n=67	Difference with actual hospitalization rate	p between groups
	Me (25%; 75%)				
Pneumonia	50.0 (30.0; 53.6)*	35.0 (30.0; 40.0)*	47.0 (30.0; 53.6)*	(42.3)	0.134
Perforated or bleeding ulcer*	57.0 (49.0; 70.0)*	50.0 (40.0; 50.0)*	50.0 (48.3; 69.0)*	(19.0)	0.125
Infections of the skin and subcutaneous tissue	10.0 (5.0; 10.0)*	10.0 (5.0; 10.0)*	10.0 (5.0; 10.0)*	(5.0)	0.974
Renal infection	7.0 (5.0; 9.0)*	5.0 (5.0; 6.0)*	7.0 (5.0; 8.0)*	(2.0)	0.059
Salpingitis and oophoritis	11.5 (10.0; 15.0)*	8.5 (7.0; 12.0)*	10.5 (9.0; 15.0)*	(8.4)	0.070
Iron deficiency anemia	2.0 (1.5; 2.1)*	3.0 (3.0; 3.0)	2.0 (1.5; 3.0)*	(1.0)	0.006
Diabetes	9.5 (8.0; 10.0)*	11.0 (10.0; 12.0)	10.0 (8.0; 10.0)*	(1.9)	0.010
Epilepsy	15.0 (10.0; 18.0)*	15.0 (10.0; 19.5)*	13.0 (10.0; 17.0)*	(8.0)	0.010
Hypertension (without ischemia)	3.0 (2.0; 4.0)*	3.0 (2.0; 4.0)*	3.0 (2.0; 4.0)*	(1.6)	0.016
Angina pectoris	8.0 (7.0; 10.0)*	9.5 (9.0; 10.0)*	8.0 (7.0; 10.0)*	(2.3)	0.049
Congestive heart failure	1.0 (1.0; 1.0)*	1.0 (1.0; 1.0)*	1.0 (1.0; 1.0)*	(0.5)	0.684
COPD	4.0 (3.0; 5.0)*	2.5 (2.0; 3.0)*	4.0 (3.0; 5.0)*	(2.9)	0.022
Bronchial asthma	15.0 (10.0; 20.0)*	7.5 (5.0; 10.0)*	11.2 (5.7; 15.7)*	(14.5)	0.019
Ulcer of stomach and duodenum	5.0 (4.0; 5.5)*	5.0 (4.0; 6.0)*	5.0 (4.0; 5.0)*	(1.8)	0.429
Tuberculosis	66.4 (50.0; 70.0)*	50.0 (50.0; 50.0)*	65.0 (50.0; 70.0)*	(8.8)	0.048
Influenza	8.0 (5.0; 10.0)	5.0 (5.0; 5.0)	8.0 (5.0; 10.0)	(2.0)	0.063

Notes: p – differences between estimates of experts and primary care physicians by Mann-Whitney criteria; * – p<0.05 compared with actual hospitalization rate by Wilcoxon criteria.

The group of experts had different estimates for certain ACSCs regarding the scope of preventable hospitalization. For angina pectoris, salpingitis and oophoritis they estimated lower PPHs than primary care physicians, for ulcers of stomach and duodenum and congestive heart failure at the same level, and higher for other ACSCs. In result, according to experts, list of ACSCs with highest PPHs per 100,000 people looks as follows: hypertension (274.8), pneumonia (208.1), COPD (156.6), bronchial asthma (91.8), renal infection (67.4), and angina pectoris (59.9). The rate of PPHs in the total number of patients hospitalized with a particular ACSC varied from 7.8% for angina pectoris to 60.7% for pneumonia. We however need to emphasize that the PPHs for pneumonia should be treated with extreme caution, given the ongoing in 2020 pandemic outbreak of COVID-19.

In total, the rate of PPHs for Ukrainian adults for ACSCs from the comprehensive list constitute 28.2% (95% CI 18.1 – 39.5) according to estimates of primary care physicians, and 32.9% (95% CI 21.3 – 40.0) according to experts. These estimates translate to the potential to prevent ACSs from the current 8.2% to 6.1% (according to primary care doctors) or to 5.7% (according to experts), totaling annual preventable hospitalizations of 284,000-340,000 cases, or 4.2-5.1% of all hospitalization in Ukraine.

During adaptation of the comprehensive list of ACSCs recommended by WHO [9] for Ukraine, we made few adjustments: we excluded dental conditions as hospitalizations for such cases is extremely rare, and noninfectious gastroenteritis and colitis as statistical data does not register such conditions. We did not include any additional ACSC to the WHO comprehensive list.

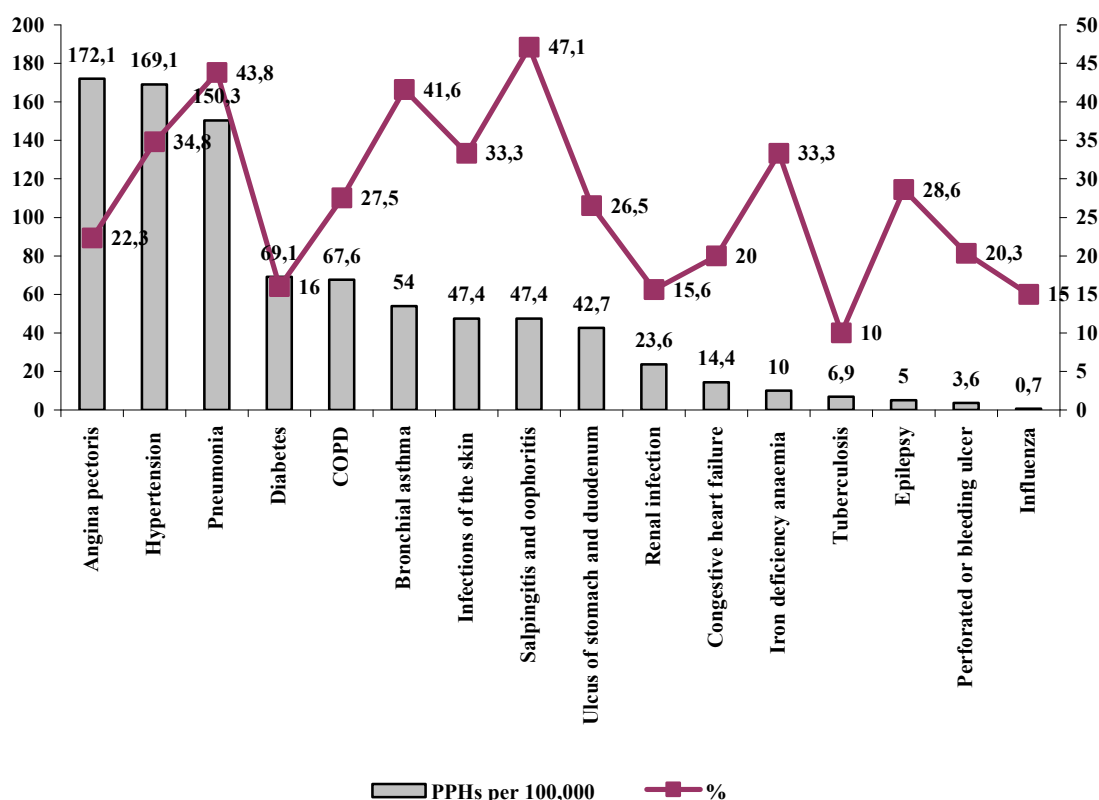


Fig. 2. Scope of PPHs for specific ACSCs (per 100,000 population and as percent of current hospitalization rate) according to the estimates of primary care physicians

Our results differ from the results reported in the other studies of the European region [4-8] as to most relevant ACSCs and PPHs. In those studies, the most prevalent ACSCs were defined as diabetes, hypertension, kidney disease and urinary tract infections, and heart failure [4-8], compared to Ukraine, where most relevant ACSCs included pneumonia, hypertension, diabetes, angina, COPD, and tuberculosis.

The maximum level of PPHs subject to effective interventions at the primary care level for specific ACSCs was estimated at 35-47% by primary care physicians, and 44-70% by experts, whereas in the countries of the European region this estimate reached 80% [4-8], which can possibly be explained by lower existing and forecasted capacity of the national primary care level. We explain the difference of the PPHs for the urban and rural settings by the similar reason, as urban settings traditionally have a stronger primary care system and are better integrated with secondary care level. This difference in PPHs for urban and rural settings is also potentially influenced by the lower socio-economic status of rural residents, which proved to be a significant factor in the first studies on ACSCs [12].

The levels of PPHs may be overestimated, as evidence for effectiveness of interventions aimed at

reducing hospitalization of ACSCs is still limited [3]. In Germany, therefore, the level of PPHs was estimated at 27%, and realistic prevention of hospital admission at 20% [18].

In Ukraine, respondents explain the choice of the most relevant ACSCs and estimated volumes of PPHs primarily by the existing organizational, human and technological capacities of primary care (28.7% (95% CI 23.7-33.7) and 37.8% (95% CI 33.2-42.4) respectively), or those factors that influence accessibility and quality of primary care. The main priority is therefore a further strengthening of the primary care as its existing capacity in Ukraine is insufficient, despite the ongoing reforms. The number of primary care facilities is almost twice lower, and the number of primary care physicians is 16-32% lower in Ukraine than on average for the European region or for the EU countries, in particular: 15.5 primary care facilities compared to 31 and 44 per 100,000 people; 54.3 primary care physicians compared to 64.6 and 79.5 per 100,000 people respectively. At the same time, the association between medical workforce numbers and ACSC hospitalizations was not confirmed. Coordination between primary and secondary care levels is also an important factor for PPH of ACSCs, according to

respondents (18.6% (95% CI 13.3-23.9)). Similarly, researchers from different countries also identified availability and integration of medical care as predictors of ACSHs [15]. An additional factor hindering the reduction ACSHs, according to the results of South Korean researchers [13], is possibly existing overcapacities of hospital sector, which in Ukraine are considerably higher than in the European region and EU countries (4 hospitals compared to 3.1 and 2.9; 730.1 beds compared to 566.6 and 527.4 per 100,000 respectively), and the ease of admissions to hospitals, as a more restrictive order of referring patients to hospitals in non-emergency cases in Ukraine is still under implementation.

In general, introduction of the concept of ACSCs in Ukraine can be considered one of the main elements of the global transition from hospital-centered health care system to a multilevel health care system, based on community-level primary health care, which allows to sort out those health conditions that can be treated only in hospital. However, this transition has not yet gained full momentum and our results confirm that the priority of strengthening primary care in health policy can prevent a significant number of hospitalizations. At the same time, we ask to exercise caution in estimating the volume of PPHs, as the reform of primary care requires complex interventions, as well as development of clear criteria for avoiding ACSHs [17].

Our study has a number of principle limitations, including the following:

1. As our study is mainly based on survey of respondents from one region of Ukraine, our analysis may have an ecological error.

2. The results are representing data obtained from a survey of a relatively small number of respondents.

3. The PPHs of patients with ACSCs are estimated without a detailed analysis of factors that may influence it.

4. The national statistical data used in the study identifies diseases using a three-digit code, while some international studies use a more detailed four-digit coding of ACSCs, which allow to specify different localizations or categories of a disease.

CONCLUSIONS

1. The study proposes a comprehensive list of ACSCs that can be used for the further analysis of PPHs and a list of indicative ACSCs that can be applied in the evaluation of effectiveness of primary care in Ukraine: pneumonia, diabetes mellitus, hypertension, angina, and lung tuberculosis. The received data indicate that the scope of PPHs in adult population is significant subject to improvement of outpatient care, in particular at the primary care level.

2. The study has shown a potential important contribution of better managing of ACSCs in Ukrainian adults in reduction of hospitalizations rates. The results of the study can be used to inform the continued health system transformation, specifically for the development of interventions to prevent avoidable hospitalizations for ACSCs in Ukraine.

Conflict of interests. The authors declare no conflict of interest.

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