

## Gender and Age Features of DALY of Prisoners in Russia

Tulenkov Alexey Mihailovich  
Federal State Institution “Research Institute of Federal Penitentiary Service”,  
14 Zhitnyaya Street, Moscow, Russia

**Abstract:** The problem of assessment of the state of health of prisoners has great social value for society. The correct assessment of the importance of this or that pathology in population of prisoners is a key element, the defining volume of necessary interventions directed to preservation and promotion of health of prisoners. Objective of this research was identification of gender and age features of the Disability Adjusted Life Years (DALY) owing to disturbances of health of prisoners of Russia on the example of the Volga Federal District during 2006-2016. The obtained data confirms existence of a tendency to an aggravation of symptoms of health of prisoners of Russia during 2006-2016. The leading reasons of loss of years of life as a result of disturbance of health became: HIV infection, tuberculosis, acute respiratory infections and complete suicides.

**Key words:** The lost years of life, DALY, prisoners, health assessment, promotion, Russia

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### INTRODUCTION

The necessity of comprehensive assessment of the indicators characterizing health of various segments of the population including quality and quantitative indices is the main reason for search of the ways of increase in level of knowledge, commensurability and comparability, used methodologies. One of such methodologies is definition of the Disability Adjusted Life Years (DALY), used by world health organization in researches on definition of a global burden of diseases (Homedes, 1996; Anonymous, 2015).

DALY is the universal measuring tool allowing to carry out quantitative estimate of loss of health of the population, population effect of results of impact on the population of various factors and to solve at the same time both a problem of reduction of medico-social losses and optimization of economic planning in health care (Zukov *et al.*, 2013; Rao *et al.*, 2013; Yang *et al.*, 2013; Tabakaev *et al.*, 2014; Kobjakova *et al.*, 2015; Murray *et al.*, 2015).

However, it should be noted that the conducted researches concerned studying of indicators in global or regional scale, they are without considering of the isolated groups of the population in particular prisoners.

Objective of this research was detection of gender and age features of the DALY owing to disturbances of health of prisoners of Russia on the example of the Volga Federal District for 2006-2016.

### MATERIALS AND METHODS

The number of the studied contingent, level and structure of prevalence of diseases and mortality are received from the departmental database. The choice of the Volga Federal District is caused by its contribution to structures of criminally executive system in it 27.6% of prisons and 23.8% of prisoners of Russia.

The indicator of DALY and its components were calculated on 1000 prisoners (%) by the adapted technique recommended by World Health Organization (WHO, 2017). Regularity of age groups was defined by information filling of the formalized departmental forms of account: 14-19, 20-34, 35-59, 60 years and older.

The Odds Ratio (OR) of DALY of men, concerning women was calculated for the main reasons for diseases from their 95% of Confidence Intervals (CI 95%) and a standard error of an indicator of the Odds Ratio ( $S_{OR}$ ).

The statistical data were obtained from departmental bases of 2006-2016 and analyzed by using Microsoft Excel program.

### RESULTS AND DISCUSSION

In 2016, DALY indicator in prisons of the Volga Federal District made 414.5 lost years of life on 1000 prisoners (%) (men-406.1%; women-481.3%; OR = 0.737; CI 95% = 0.617-0.880;  $S_{OR}$  = 0.090) that is 21.0% higher than an indicator of 2006 (348.0%). DALY value of prisoners was 26.8% higher than a similar indicator of the population (332.1%) (Anonymous, 2015).

Table 1: Structure of DALY of various gender and age groups of prisoners in 2016

The studied indicators (%)	Value of indicators in various age groups				Total
	14-19 years	20-34 years	35-59 years	60 years and older	
<b>Men</b>					
YLL	14.5	102.6	188.7	301.7	148.6
YLD	65.7	226.3	310.3	255.6	257.5
DALY	80.2	328.9	499.0	557.3	406.1
<b>Women</b>					
YLL	0.0	61.8	151.2	326.2	104.6
YLD	20.3	368.1	413.5	270.8	376.7
DALY	20.3	429.9	564.7	597.0	481.3
<b>Total</b>					
YLL	14.0	98.5	184.1	300.9	145.3
YLD	64.2	239.8	320.9	257.2	269.2
DALY	78.2	338.3	505.0	558.1	414.5

The indicator of Years of Life Lost (YLL) among all studied contingent for the studied period grew by 47.4% and in 2016 made 145.3% (men-148.6%; women-104.6%; OR = 1.494; CI 95% = 1.144-1.952;  $S_{OR} = 0.136$ ). Also the share contribution of YLL to structure of DALY for the studied period from 28.3% 2006 (men-29.7%; women-13.2%) grew to 35.1% in 2016 (men-36.6%; women-21.7%) that is nearly 3 times higher than a similar indicator of the population of the country (12.0%) (Bojcov and Samorodskaja, 2014).

Despite decrease in a share contribution to structure of DALY, an indicator Years Lost due to Disability (YLD) for the studied period grew by 8.0% and in 2016 made 269.2% (men-257.5%; women-376.7%; OR = 0.574; CI 95% = 0.474-0.695;  $S_{OR} = 0.097$ ).

The carried-out analysis of a contribution of indicators of YLL and YLD to structure of DALY of various age groups showed their essential distinction of men and women in 2016 (Table 1).

So, the greatest values of an indicator of DALY also more, made 558.1% in 2016 is registered in an age group of 60 years (men-557.3%; women-597.0%; OR = 0.850; CI 95% = 0.712-1.015;  $S_{OR} = 0.091$ ). In the same age group the indicator of YLL makes the greatest contribution to structure of DALY of 54.1% (men-54.1%; women-54.6%).

In an age group of 60 years and older the circulatory system diseases occupy the maximum share (58.2%) of structure of DALY (Table 2).

On YLL indicator contribution to structure of DALY the importance of neoplasms for 100% presented by malignant forms at men increases in this age group.

The second rating place on the maximum DALY value is taken by an age group of 35-59 years; 505.0% (men-499.0%; women-564.7%; OR = 0.768; CI 95% = 0.644-0.916;  $S_{OR} = 0.090$ ). The share contribution of

an indicator of YLL in structure of DALY in an age group of 35-59 years made 36.5% (men-37.8%, women-26.8%).

In an age group of 35-59 years, certain infectious and parasitic diseases take the leading positions in structure of DALY (Table 3).

Besides, value of diseases of the circulatory system DALY of this age group that made the second place on YLL indicator contribution to structure increases.

On the third rating place there is an age group of 20-34 years with an indicator of DALY of 338.3% (men-328.9%; women-429.9%; OR = 0.650; CI 95% = 0.542-0.780;  $S_{OR} = 0.093$ ). The share contribution of an indicator of YLL in an age group of 20-34 years made 29.1% (men-31.2%; women-14.4%).

In an age group of 20-34 years of 62.0% in structure of DALY occupy certain infectious and parasitic diseases and mental and behavioral disorders (Table 4).

Besides, it should be noted a big contribution to structure of DALY of an indicator of YLL on injury, poisoning and certain other consequences of external causes reasons for 100.0% presented by complete cases of an intentional self-harm at men.

The age group of 14-19 years closes the rating four with the smallest value of an indicator of DALY (78.2%), at the same time the main contribution was made by the young men who are contained in educational colonies that, first of all is caused insignificant (0.2%) by the number of girls of this age group in structure of the prison population (Tulenkov *et al.*, 2016). In 2016 for the first time for all studied period death case in this age group was registered and the share contribution of an indicator of YLL made 17.9% (men-18.1%; women-0.0%).

In an age group of 14-19 years the greatest contribution was made by the diseases of a respiratory organs which made 42.6% of DALY of this age (Table 5).

Table 2: The structure of DALY of 60 years and older in 2016 (%)

Indicators (%)	Men	Women	Total	OR	CI (95%)	S <sub>OR</sub>
<b>Diseases of the circulatory system (I00-I99 on ICD-10)</b>						
YLL	167.7	195.7	168.5	0.828	0.659-1.040	0.116
YLD	164.7	81.2	156.1	2.231	1.683-2.957	0.144
DALY	332.4	276.9	324.6	1.300	1.074-1.574	0.097
<b>Neoplasms (C00-D48 on ICD-10)</b>						
YLL	80.4	0.0	72.2	-	-	-
YLD	5.6	6.0	5.6	0.933	0.294-2.961	0.589
DALY	86.0	6.0	77.8	15.588	6.780-35.836	0.425
<b>Diseases of the respiratory system (J00-J98 on ICD-10)</b>						
YLL	6.7	0.0	6.0	-	-	-
YLD	38.8	117.7	46.9	0.303	0.208-0.404	0.191
DALY	45.5	117.7	52.9	0.357	0.251-0.509	0.181
<b>Diseases of digestive system (K00-K92 on ICD-10)</b>						
YLL	6.7	130.5	18.1	0.045	0.021-0.098	0.399
YLD	10.1	7.0	9.8	1.447	0.550-3.810	0.494
DALY	16.8	137.5	27.9	0.107	0.064-0.179	0.263
<b>Certain infectious and parasitic diseases (A00-B99 on ICD-10)</b>						
YLL	6.7	0.0	6.0	-	-	-
YLD	5.4	2.4	5.1	2.257	0.492-10.350	0.777
DALY	12.1	2.4	11.1	5.091	1.271-20.395	0.708
<b>Injury, poisoning and certain other consequences of external causes (S00-T98, X0-X84 on ICD-10)</b>						
YLL	6.7	0.0	6.0	-	-	-
YLD	0.7	0.8	0.7	0.875	0.035-21.658	1.637
DALY	7.4	0.8	6.7	9.312	0.626-93.661	1.178
<b>Mental and behavioral disorders (F00-F99 on ICD-10)</b>						
YLL	0.0	0.0	0.0	-	-	-
YLD	6.5	37.5	9.5	0.168	0.073-0.388	0.427
DALY	6.5	37.5	9.5	0.168	0.073-0.388	0.427
<b>Other diseases</b>						
YLL	26.8	0.0	24.1	-	-	-
YLD	23.8	18.2	23.5	1.315	0.710-2.437	0.315
DALY	50.6	18.2	47.6	2.875	1.670-4.949	0.277

Table 3: Structure of DALY of prisoners of an age group of 35-59 years in 2016 (%)

Indicators (%)	Men	Women	Total	OR	CI (95%)	S <sub>OR</sub>
<b>Certain infectious and parasitic diseases (A00-B99 on ICD-10)</b>						
YLL	56.0	65.3	56.6	0.849	0.588-1.227	0.188
YLD	69.2	97.3	72.1	0.690	0.500-0.951	0.164
DALY	125.2	162.6	127.8	0.737	0.573-0.948	0.128
<b>Diseases of the respiratory system (J00-J98 on ICD-10)</b>						
YLL	7.9	3.4	7.4	2.334	0.653-8.347	0.650
YLD	102.0	105.5	102.4	0.963	0.722-1.284	0.147
DALY	109.9	108.9	109.8	1.010	0.763-1.338	0.143
<b>Diseases of the circulatory system (I00-I99 on ICD-10)</b>						
YLL	53.7	34.4	51.6	1.593	1.029-2.467	0.223
YLD	38.9	48.0	39.9	0.803	0.521-1.237	0.331
DALY	92.6	82.4	91.5	1.136	0.833-1.550	0.159
<b>Mental and behavioral disorders (F00-F99 on ICD-10)</b>						
YLL	0.0	0.0	0.0	-	-	-
YLD	50.9	93.9	55.3	0.518	0.364-0.737	0.180
DALY	50.9	93.9	55.3	0.518	0.364-0.737	0.180
<b>Diseases of digestive system (K00-K92 on ICD-10)</b>						
YLL	24.4	13.7	23.3	1.801	0.924-3.510	0.341
YLD	20.3	23.7	20.6	0.854	0.469-1.554	0.306
DALY	44.7	37.4	43.9	1.204	0.773-1.876	0.226
<b>Neoplasms (C00-D48 on ICD-10)</b>						
YLL	22.5	30.9	23.3	0.722	0.416-1.252	0.281
YLD	2.7	10.0	3.4	0.268	0.070-1.031	0.687
DALY	25.2	40.9	26.7	0.606	0.366-1.004	0.257
<b>Injury, poisoning and certain other consequences of external causes (S00-T98, X60-X84 on ICD-10)</b>						
YLL	15.0	3.4	13.8	4.464	1.371-14.535	0.602
YLD	5.2	3.1	5.0	1.681	0.411-6.879	0.719
DALY	20.2	6.5	18.8	3.151	1.296-7.660	0.453
<b>Other diseases</b>						
YLL	9.2	0.1	8.1	92.845	0.182-47250.0	3.180
YLD	21.1	32.0	22.2	0.652	0.374-1.138	0.284
DALY	30.3	32.1	30.3	0.942	0.569-1.560	0.257

Table 4: Structure of DALY of prisoners of an age group of 20-34 years in 2016 (%)

Indicators (%)	Men	Women	Total	OR	CI (95%)	S <sub>OR</sub>
<b>Certain infectious and parasitic diseases (A00-B99 on ICD-10)</b>						
YLL	68.0	58.1	66.9	1.183	0.824-1.698	0.185
YLD	55.4	117.6	61.4	0.440	0.316-0.614	0.170
DALY	123.4	175.7	128.3	0.660	0.515-0.847	0.127
<b>Mental and behavioral disorders (F00-F99 on ICD-10)</b>						
YLL	0.0	0.0	0.0	-	-	-
YLD	77.5	118.6	81.4	0.624	0.462-0.843	0.127
DALY	77.5	118.6	81.4	0.624	0.462-0.843	0.127
<b>Diseases of the respiratory system (J00-J98 on ICD-10)</b>						
YLL	1.5	0.0	1.4	-	-	-
YLD	57.7	76.9	59.5	0.735	0.516-1.046	0.180
DALY	59.2	76.9	60.9	0.755	0.532-1.073	0.179
<b>Injury, poisoning and certain other consequences of external causes (S00-T98, X60-X84 on ICD-10)</b>						
YLL	25.9	0.0	23.4	-	-	-
YLD	4.4	3.2	4.3	1.377	0.325-5.826	0.736
DALY	30.3	3.2	27.7	9.733	3.065-30.908	0.590
<b>Diseases of digestive system (K00-K92 on ICD-10)</b>						
YLL	1.5	0.0	1.4	-	-	-
YLD	11.6	18.6	12.2	0.619	0.296-1.296	0.377
DALY	13.1	18.6	13.6	0.700	0.343-1.428	0.363
<b>Diseases of the circulatory system (I00-I99 on ICD-10)</b>						
YLL	3.4	3.6	3.4	0.944	0.214-4.168	0.758
YLD	9.2	15.6	9.8	0.586	0.258-1.330	0.418
DALY	12.6	19.2	13.2	0.652	0.319-1.334	0.365
<b>Neoplasms (C00-D48 on ICD-10)</b>						
YLL	1.5	0.0	1.4	-	-	-
YLD	0.5	1.2	0.6	0.416	0.015-11.293	1.684
DALY	2.0	1.2	2.0	1.668	0.173-16.063	1.156
<b>Other diseases</b>						
YLL	0.8	0.1	0.6	8.006	0.011-5737.4	3.354
YLD	10.0	16.4	10.6	0.606	0.275-1.337	0.404
DALY	10.8	16.5	11.2	0.651	0.301-1.409	0.394

Table 5: Structure of DALY of prisoners of an age group of 14-19 years in 2016 (%)

Indicators (%)	Men	Women	Total	OR	CI (95%)	S <sub>OR</sub>
<b>Diseases of the respiratory system (J00-J98 on ICD-10)</b>						
YLL	0.0	0.0	0.0	-	-	-
YLD	34.5	0.0	0.0	-	-	-
DALY	33.3	0.0	0.0	-	-	-
<b>Mental and behavioural disorders (F00-F99 on ICD-10)</b>						
YLL	0.0	0.0	0.0	-	-	-
YLD	23.4	20.3	23.3	1.156	0.634-2.109	0.307
DALY	23.4	20.3	23.3	1.156	0.634-2.109	0.307
<b>Diseases of the circulatory system (I00-I99 on ICD-10)</b>						
YLL	14.5	0.0	14.0	-	-	-
YLD	1.1	0.0	1.0	-	-	-
DALY	15.6	0.0	15.0	-	-	-
<b>Diseases of digestive system (K00-K92 on ICD-10)</b>						
YLL	0.0	0.0	0.0	-	-	-
YLD	2.3	0.0	2.2	-	-	-
DALY	2.2	0.0	2.2	-	-	-
<b>Certain infectious and parasitic diseases (A00-B99 on ICD-10)</b>						
YLL	0.0	0.0	0.0	-	-	-
YLD	1.6	0.0	1.5	-	-	-
DALY	1.6	0.0	1.5	-	-	-
<b>Other diseases</b>						
YLL	0.0	0.0	0.0	-	-	-
YLD	2.8	0.0	2.8	-	-	-
DALY	2.8	0.0	2.8	-	-	-

As features it is possible to allocate the diseases of bodies of blood circulation which are the only class of this age group in which structure of DALY there is YLL contribution (14.0%).

Besides, mental disorders and disorders of behavior is the only class in which the girls of this age group who are contained in places of detention contributed.

## CONCLUSION

The carried-out analysis allowed revealing the general a tendency to an aggravation of symptoms of health of prisoners of Russia during 2006-2016 what confirm: growth of value of an indicator of DALY for the studied period for 21.0% (from 348.0-414.5% in 2016); growth of value of an indicator of YLL (from 98.6-145.3% in 2016) and also increase in its specific weight (from 28.3-35.1% in 2016) in structure of DALY; growth of value of an indicator of YLD (from 249.4-269.2% in 2016).

The carried-out analysis allowed revealing relevance of these or those diseases in various age groups. Therefore, certain infectious and parasitic diseases which are generally presented by HIV and tuberculosis hold an upper place of rating in age groups of 20-34 and 35-59 years. Diseases of the circulatory system are the main reason for losses of years of life in an age group of 60 years and more. In an age group of 14-19 years the most actual class of diseases is respiratory.

Besides, on the general contribution to various age groups, the mental and behavioral disorders holding the second rating place in age groups 14-19 and 20-34 of years confirmed high relevance, at the same time women relevance of this class is much higher. In too time at men the high wastage rate of years of life from injuries, poisonings and some other effects of influence of the external reasons most of which of cases is presented by the intentional self-harm cases in age groups of 20-34 and 35-59 years is observed.

## REFERENCES

- Anonymous, 2015. Global burden of disease study 2013: Disability adjusted life years 1990-2013. University of Washington Institute for Health Metrics and Evaluation, Seattle, Washington, USA. <http://ghdx.healthdata.org/record/global-burden-disease-study-2013-gbd-2013-disability-adjusted-life-years-1990-2013>.
- Bojcov, S.A. and I.V. Samorodskaja, 2014. [The gender and age indicators of mortality of the population and years of life lost as a result of premature mortality in the Russian Federation in 2012 (In Russia)]. Prob. Soc. Hyg. Health Care Hist. Med., 2: 20-25.
- Homedes, N., 1996. The Disability-Adjusted Life Year (DALY) Definition, Measurement and Potential use. World Bank, Washington, USA.,.
- IHME., 2013. The global burden of disease: Generating evidence, guiding policy. University of Washington Institute for Health Metrics and Evaluation, Seattle, Washington, USA.
- Kobjakova, O.S., I.A. Deev, V.A. Bojkov, M.N. Mil'kevich and E.S. Kulikov *et al.*, 2015. [Possible application of daly to health asseessment of population in Russia (In Russia)]. Soc. Aspects Health Popul., Vol. 42,
- Murray, C.J., R.M. Barber, K.J. Foreman, A.A. Ozgoren and F. Abd-Allah *et al.*, 2015. Global, regional and national Disability-Adjusted Life Years (DALYs) for 306 diseases and injuries and Healthy Life Expectancy (HALE) for 188 countries, 1990-2013: Quantifying the epidemiological transition. Lancet, 386: 2145-2191.
- Rao, P.S.S., F. Darlong, M. Timothy, S. Kumar and S. Abraham *et al.*, 2013. Disability Adjusted Working Life Years (DAWL Ys) of leprosy affected persons in India. Indian J. Med. Res., 137: 907-910.
- Tabakaev, M.V., E.B. Shapovalova, S.A. Maksimov and G.V. Artamonova, 2014. Population health losses from myocardial infarction estimated with index DALY in 2006-2012 years. Complex Issues Cardiovasc. Dis., 1: 21-26.
- Tulenkov, A.M., E.V. Dyuzheva and K.A. Romanov, 2016. Medico-demographic situation in prisons of Volga federal district in the period of the penal system reforming. Kazan Med. J., 97: 124-130.
- WHO., 2017. Health statistics and information systems. World Health Organization, Geneva, Switzerland.
- Yang, G., Y. Wang, Y. Zeng, G.F. Gao and X. Liang *et al.*, 2013. Rapid health transition in China, 1990-2010: Findings from the global burden of disease study 2010. Lancet, 381: 1987-2015.
- Zukov, R.A., J.A. Dyhno, A.V. Shul'min and V.V. Kozlov, 2013. [Assessment of medico-demographic losses of the population of Krasnoyarsk region from the mortality caused by kidney cancer (In Russia)]. Siberian Oncological J., 6: 20-25.