



Costs and outcomes for individuals with psychosis prior to hospital admission and following discharge in Bulgaria

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Abstract

Purpose To examine the cost of psychotic disorders in Bulgaria prior to hospital admission and following discharge from two perspectives: healthcare and societal; and to evaluate the association between the costs and the patient's characteristics.

Methods 96 individuals with psychosis experiencing psychotic exacerbation and their primary caregivers were evaluated upon the patients' hospital admission. The participants were followed up after 12 months. The costs were evaluated from healthcare and societal perspective using the Client's Sociodemographic and Service Receipt Inventory (CSSRI-EU). The psychopathology, functioning, quality of life and caregiver's burden were measured using standardized instruments. The mean differences in the costs and the associations with the clinical and socio-demographic characteristics of the patients were evaluated.

Results The healthcare costs increase from EUR 120.66 (SD = 163.85) at baseline to EUR 177.54 (SD = 136.98) at follow-up. The total cost from societal perspective are up to sixfold higher than the healthcare costs at both assessments [EUR 717.41 (SD = 402.33) and 880.40 (SD = 1592.00), respectively] and do not change significantly. A major shift in the subtypes of costs, and significant associations of the costs with the socio-demographic and clinical characteristics, were found.

Conclusions Psychotic disorders and psychotic exacerbations have high societal costs. The underfunding of mental healthcare in Bulgaria is at the expense of high caregivers' and societal cost. The treatment of psychotic exacerbation is effective and investment in mental healthcare for the improvement of the psychopathology, social functioning, quality of life and the burden of informal care should be viewed as a sustainable investment.

Keywords Cost · Healthcare · Societal · Psychosis · Psychotic exacerbation · Admission

Introduction

Psychosis is disabling mental syndrome with psychotic symptoms (delusions, hallucinations, perceptual disturbances and severe disruption of ordinary behavior) as predominant feature. The term encompasses a range of mental disorders including schizophrenia, schizoaffective disorder, acute and transient psychotic disorders, delusional disorder, bipolar disorder and depression with psychotic symptoms, substance-induced psychosis [1]. Relapses characterized by

return or exacerbation of psychotic symptoms are typical and have a range of negative consequences: increased risk of harm and self-harm, jeopardized relationships and employment, risk of progressive deterioration in functioning, worsening of treatment response and prognosis [2].

Psychotic exacerbations significantly increase the caregiver's burden and typically require hospital admission, increasing both healthcare and societal costs [3, 4]. On average, the estimate for the total annual costs per patient with a psychotic disorder in Europe is EUR 18,796 for 2010, of which only EUR 5805 € (30%) are direct healthcare costs [5]. While the costs vary across countries with different healthcare systems and socioeconomic development, [5] studies consistently report excess costs associated with relapse, estimated in European studies to be between USD 8665 and USD 18,676 for 2015 over periods of 6–12 months [6]. Patients who experience relapses have approximately four-times higher costs compared to patients without

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relapses [4]. A limited number of studies evaluate the course of the cost prior to hospital admission and following discharge [7]. In many Eastern European countries including Bulgaria economic analyses are scarce and insufficient, typically restricted to hospital-based statistical data [8–10].

The aim of the study was to examine the course of the cost of psychotic disorders in Bulgaria prior to hospital admission and 12 months following discharge from two perspectives: healthcare and societal; and to examine the socio-demographic and clinical determinants of higher costs.

Methods

The participants were individuals with psychotic disorders who were admitted to inpatient psychiatric treatment in the Clinic of Psychiatry, University Hospital Alexandrovska, in Sofia, Bulgaria, and their primary caregivers. The inclusion criteria were patients with non-affective or affective psychosis (F2 or F3 according to International Classification of Diseases ICD-10 [1]; psychotic exacerbation defined as a total score on the Positive and Negative Syndrome Scale (PANSS) ≥ 60 , with score ≥ 4 on at least two items from the positive subscale; caregiver willing to participate; and informed consent for participation. Exclusion criteria were substance-induced psychosis and severe comorbid somatic illness or severe cognitive impairment that could impede the adequate participation in the study. The recruitment period was between January 2015 and January 2016. For each month, the first ten consecutively admitted patients meeting the inclusion criteria were considered for participation.

The economic analysis had a pre- and post-study design, which includes evaluation of the participants twice: baseline assessment upon patient's admission to psychiatric hospital and prospective evaluation after 12 months (follow-up assessment). All outcome measures were gathered upon interviewing the participants and were based on standardized instruments, giving a cross-sectional evaluation of the clinical characteristics of the participants and a retrospective evaluation of the costs.

The psychopathology of the patients was measured with the Positive And Negative Syndrome Scale (PANSS) [11] which consists of 30 items, each rated on a 7-point scale from 1 (absence of symptom) to 7 (extremely severe symptom), aggregated in three subscales: positive, negative and general psychopathology. The psychosocial functioning of the patients was measured with the Personal and Social Performance Scale (PSP) [12] which evaluates the patient's functioning from 1 to 100, with a higher score indicative of better psychosocial functioning. The quality of life of the patients was measured with the Manchester Short Assessment of Quality of Life (MANSA) [13] which rates the satisfaction with life and its domains (12 items) on a scale from

1 (couldn't be worse) to 7 (could not be better). The burden of informal care for the caregivers of the individuals with schizophrenia was measured with the Burden Assessment Scale (BAS) [14] which consists of 19 objective and subjective aspect of providing care for the mentally ill family member, rated on a 4-point scale from 1 (not at all) to 4 (a lot).

The evaluation of costs was performed from two perspectives: healthcare and societal. We used an adapted version of the Client Socio-Demographic and Service Receipt Inventory—European version (CSSRI-EU) [15] to gather data on the resource utilization. The participants were asked to recall the number of resources used or lost due to the disorder for predefined periods prior to both assessments.

The invested categories of costs from healthcare perspective included hospital-based, community-based, outpatient treatment, and pharmacotherapy. Healthcare services were subdivided into psychiatric-related and somatic-related services to reflect the contrast in mental and somatic healthcare funding in the country. The costs for the hospital admission during the baseline assessment were included in the follow-up period. The societal perspective included the following categories: healthcare services, contacts with the criminal justice system, informal care, and productivity losses. The lost productivity was evaluated in terms of absence from work, unemployment and premature death due to the disorder. Transfer payments were excluded to avoid double counting [16].

The resource utilization was quantified using a bottom-up (micro-costing) approach. The number of resources used or lost for the specified recall period for each resource was combined with its corresponding unit cost. Then it was divided by the length of the recall period to obtain the cost per month for each resource so that all costs are presented as average monthly cost (EUR per month), adjusted for the purchasing power parity (PPP) for 2015.

$$\begin{aligned} \text{Total monthly costs (resource } X) \\ &= \frac{\text{resources } X \times \text{unit price of the resource } X}{\text{recall period (resource } X)}, \end{aligned}$$

where resource X is a particular type of resource used, recall period is presented in months.

The unit cost, the recall periods for each type of resource and the source of date for the unit costs are presented in Table 1. The unit costs were primarily obtained by nationally recognized sources provided by the Ministry of Health, the Ministry of Finance and the National Statistical Institute of Republic of Bulgaria. The costs per patient day for each type of hospital were gathered from the annually published bulletins by The National Center of Public Health and Analyses [17, 18]. The data on drug prices is available from the Positive Drug List (National Council on Prices and Reimbursement of Medical Products, <http://portal.ncpr.bg/registers/pages/register/list-medicament.xhtml>). The cost

Table 1 Evaluated resources: recall periods, unit costs and the source of data

Type of resources	Recall periods (months)	Units	Unit cost (PPP EUR 2015)	Sources of data for unit cost
Psychiatric-related services				
Psychiatric inpatient treatment	12	Days	19.84–34.85	Ministry of Health [17, 18]
Psychiatric emergency	12	Visits	28.34	Ministry of Health ^a
Day-patient treatment	12	Visits	22.11–34.58	Ministry of Health [17, 18]
Day care center	12	Visits	13.97	Ministry of Finance ^b
Community group therapy	12	Visits	19.84	CSSRI-EU ^c
Psychiatrist	3	Visits	10.77	NHIF ^d
Psychotherapist	3	Visits	22.67	CSSRI-EU ^c
Nurse	3	Visits	5.67–10.20	NHIF ^d
Laboratory tests	3	Test	5.50–127.53	NHIF ^d
Psychopharmacotherapy	1	100 mg	0.03–37.85	Positive Drug List ^e
Somatic-related services				
Somatic inpatient days	12	Days	61.78–307.78	Ministry of Health [17, 18]
Somatic emergency	12	Visits	29.47	Ministry of Health [17, 18]
Somatic specialist	3	Visits	10.77–18.36	NHIF ^d
General practitioner	3	Visits	0.60–1.40	NHIF ^d
Somatic pharmacotherapy	1	100 mg	0.13–82.38	Positive Drug List ^e
Justice system				
Police officers	6	Contacts	11.34	NSI ^f
Police cell	6	Nights	3.51	Council of Europe [20]
Court	6	Appearances	357.09	NSI ^f
Informal care	3	Hours per day	2.86	NSI ^f
Productivity losses				
Absence from work	3	Days	5.75–77.29	NSI ^f , CSSRI-EU ^c
Unemployment	3	Days	22.85	NSI ^f
Premature death	12	Months	502.76	NSI ^f

^aMethodology for financing of medical establishments for 2016 (Ministry of Health, https://www.mh.government.bg/media/filer_public/2016/04/01/metodika_2016.pdf)

^bStandards for financing of activities delegated by the state, Ministry of finance, Republic of Bulgaria (<http://www.minfin.bg/upload/17188/RMS+276.pdf>)

^cCSSRI-EU Client's Sociodemographic and Service Receipt Inventory—European version

^dNHIF National Health Insurance Fund, National Framework for accepting volumes and prices of medical aid for 2015; <http://dv.parliament.bg/DVWeb/showMaterialDV.jsp?sessionId=30845D08DF149A4C7AF78325A5ECD7F8?idMat=91297>

^ePositive Drug List. National Council on Prices and Reimbursement of Medical Products. <http://portal.ncpr.bg/registers/pages/register/list-medicament.xhtml>

^fNSI National Statistical Institute, data on labour market and gross wage, <http://www.nsi.bg>

for emergency department and outpatient visits were collected from the data provided by National Health Insurance Fund (National Framework for accepting volumes and prices of medical aid for 2015, <http://dv.parliament.bg/DVWeb/showMaterialDV.jsp?sessionId=30845D08DF149A4C7AF78325A5ECD7F8?idMat=91297>). Psychiatric emergency costs are available from the methodology for financing of medical establishments for 2016 (Ministry of Health, https://www.mh.government.bg/media/filer_public/2016/04/01/metodika_2016.pdf). Unit costs for community-based social services such as day centers are available

from the standards for financing of activities delegated by the state, Ministry of finance, Republic of Bulgaria (<http://www.minfin.bg/upload/17188/RMS+276.pdf>).

As in other studies [19], the data on the cost of detention in police cell were absent, so we used the data on the average amount spent per day for the detention of one person in prison from the Council of Europe, Annual Penal Statistics—SPACE-I—2012, adjusting for inflation for 2015 [20]. In the absence of other data, the costs associated with contacts with police officers and court appearances were calculated as the mean salary per hour of the

involved professionals, multiplied by the duration of the contact.

The productivity losses were quantified using the human capital approach. The cost of lost productivity due to missed days at work was calculated as the number of missed days in the recall period (3 months) were multiplied by the monthly gross wage of the participant, divided by the working days in the evaluated period (22 working days per month were assumed).

$$LP = \frac{\text{missed days at work} \times \text{monthly gross wage}}{\text{working days in the recall period}}.$$

The costs of productivity losses associated with unemployment were assumed to be the amount of the average gross wage in the country for the year 2015 (EUR 503). The cost due to premature death was calculated as the present value of lifetime earnings in the year of their death [21]. The present value of the lifetime earnings was calculated using the average gross wage, assuming that the current retirement age (63 years for males, 61 years for females) and gross domestic product (GDP) growth (3.4%) will remain the same (the information regarding the national gross wage, the GDP growth and the retirement age for 2015 are available from the National Statistical Institute (NSI) of Republic of Bulgaria at <http://www.nsi.bg/>). A 3% discount rate was used [21].

The present value of the lifetime earnings is calculated using the following formula:

$$P = \sum_{n=1}^n \frac{Fn}{(1+r)^n} = \frac{F1}{(1+r)} + \frac{F2}{(1+r)^2} + \dots + \frac{Fn}{(1+r)^n},$$

P present value of lifetime earnings;

n number of years from the age of death to the retirement age.

Fn estimated income for the n th year (estimation is based on the value of the yearly gross net income for 2015 (F1), with assumed 3.4% increase per year according to the GDP growth).

r discount level (3%) [21].

All costs are presented as average monthly cost EUR per month adjusted for the purchasing power parity (PPP) for 2015. The national currency (Bulgarian Lev, BGN) was converted to nominal EUR using the nominal exchange rate from the European Central bank (https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-bgn.en.html). Then the values were adjusted for the difference in price levels for 2015, using the purchasing power parities based on GDP from Eurostat (<http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>).

1 Bulgarian Lev = 0.57 PPP-adjusted EUR for 2015.

The total costs from the healthcare perspective were calculated as the sum of the cost of psychiatric and somatic-related services. The total cost from societal perspective was the sum of the healthcare costs, the cost associated with criminal justice system, the cost of informal care and the cost of lost productivity. Participants that have died in the follow-up were included in the analysis and are present in the denominator for the calculation of the costs.

The statistical analyses used in the study are paired samples t test, Wilcoxon test, Chi-square test, McNemar test, Spearman correlation, dispersion analysis. Non-parametric bootstrap test based on 1000 bootstrap replications is used for the comparison of the mean differences in the costs [16]. The results are presented as the mean difference between the cost and the 95% confidence interval (CI), where the CI of a significant difference does not contain zero. Univariate analyses and generalized linear models were used to evaluate the determinants of costs [16, 22, 23].

Results

Sample characteristics

One hundred and thirty-six individuals with mental disorders were requested to participate, of which 96 met the inclusion criteria and were recruited for the study. Fifty-six (58%) patients had non-affective psychosis and 40 (42%) had affective psychosis. In total, information for the follow-up after 12 months was available for 88 (92%) of the recruited patients, while 8 (8%) dropped out. Three (3%) patients were deceased at follow-up and their count is included in the denominator for the costs at follow-up. The clinical characteristics were gathered for all participants at baseline ($n=96$). At follow-up, data for the mean scores on PANSS and PSP were available for 85 participants; MANSAs for 69 participants and BAS for 83 participants.

The patients had mean age 39 (SD = 15) years; 45 (47%) of them were female and 42 (44%) were diagnosed with schizophrenia (F20). The mean duration of the illness was 12 (SD = 13) years. Fifty-nine (62%) of the patients at baseline were single, 62 (65%) had no children and 44 (46%) were living with their parents. Twenty-three (24%) of the patients at baseline were in paid employment and seven (7%) did voluntary work. At follow-up the number of paid employment rose to 33 (39%) patients ($p=0.021$). Eleven (13%) were voluntary workers ($p>0.05$) at follow-up. The caregivers had mean age 52 years (SD = 15); 56 (58%) were female and 49 (51%) were parents of the patient.

The mean duration of the baseline hospital admission of the patients was 24 (SD = 11) days. The mean PANSS score measured at baseline was 81 (SD = 16) points and decreased

to 51 (SD = 16) at follow-up ($z = -7.931, p < 0.001$). The psychosocial functioning as measured by the mean PSP score improved from 35 (SD = 16) to 70 (SD = 19), $z = -7.694, p < 0.001$. MANSA scores increased from 51 (SD = 12) points at baseline to 60 (SD = 9) points at follow-up, $t = -4.313, df = 67, p < 0.001$, while the caregiver's burden significantly decreased from 44 (SD = 12) mean score on BAS to 35 (SD = 11) point at follow-up ($t = 7.679, df = 82, p < 0.001$).

Service use

The number of participants using the evaluated resources and the mean amount of resources used in the predefined periods at baseline and follow-up are presented in Table 2. These were used to calculate the costs according to the study methodology. On average, the number of resources used (only for the individuals who used such resources) did not differ significantly in both assessments. Therefore, only the significance of the change in the number (%) of individuals using resourced is provided in the table.

Table 2 Number (%) of participants using resources and mean (mean, SD) number of resources used in the predefined recall periods at baseline and follow-up

Resources	Baseline ($n = 96$)		Follow-up ($n = 88$)		Change in N (%) p
	N (%)	Mean (SD) ^a	N (%)	Mean (SD) ^a	
Psychiatric-related services					
Inpatient days	40 (42)	39 (32)	88 (100)	28 (19)	< 0.001
Emergency department visits	12 (13)	1 (0)	2 (2)	1 (0)	0.021
Day-patient visits	5 (5)	26 (7)	12 (14)	23 (8)	0.046
Day care visits	1 (1)	60 (0)	1 (1)	60 (0)	0.307
Community group therapy	0 (0)		1 (1)	30 (0)	0.818
Psychiatrist visits	64 (67)	3 (2)	67 (76)	2 (1)	0.671
Psychotherapist visits	8 (8)	4 (6)	3 (3)	4 (4)	0.206
Nurse visits	11 (12)	4 (2)	14 (16)	4 (2)	0.242
Laboratory tests	4 (4)		5 (6)		0.128
Psychopharmacotherapy	73 (76)		77 (88)		0.462
Somatic-related services					
Inpatient days	17 (18)	9 (11)	5 (6)	6 (4)	0.029
Emergency department visits	7 (7)	2 (1)	2 (2)	1 (1)	0.381
Somatic specialist visits	29 (30)	2 (2)	21 (24)	1 (1)	0.523
General practitioner visits	53 (55)	2 (1)	37 (42)	1 (1)	0.128
Pharmacotherapy	33 (35)		25 (28)		0.134
Justice system					
Contacts with police officers	26 (27)	1 (0)	1 (1)	1 (0)	< 0.001
Nights in police cell	1 (1)	1 (0)	0 (0)		0.273
Court appearances	4 (4)	1 (0)	1 (1)	1 (0)	0.245
Informal care (hours per day)	91 (95)	4.9 (3.0)	61 (69)	3.5 (3.3)	< 0.001
Productivity losses					
Days absence from work	19 (20)	22 (22)	4 (5)	24 (29)	< 0.001
Days unemployment	26 (27)	66 (0)	35 (40)	66 (0)	0.096
Premature death	0 (0.0)		3 (3)		0.143

The change in the number (%) of participants using resources is evaluated with McNemar's test. The statistically significant differences are presented in bold

^aMean (SD) number of resources used only for individuals who used such resources

The number (%) of participants using psychiatric emergency, somatic inpatient treatment and contacts with police showed statistically significant reduction the follow-up. The use of informal care and the absence from work also showed a statistically significant decline, while the psychiatric day-patient visits showed a statistically significant increase. The table shows a 100% use of inpatient psychiatric treatment in the follow-up which is due to the study methodology. After discharge only 13 (15%) of the followed up patients had psychiatric re-admission with a mean stay of 28 (SD = 17) days, compared to patients hospitalized in the year prior to the baseline assessment [40 (42%), $p < 0.001$].

Costs

The comparisons of the cost at baseline and follow-up are presented in Table 3. While healthcare cost show a statistically significant increase from EUR 120.66 (SD = 163.85) at baseline to EUR 177.54 (SD = 136.98) at follow-up (95% CI -94.75; -12.21), the total cost from societal

Table 3 Comparison of the cost (in PPP EUR for 2015) at baseline and follow-up

Costs	Baseline (<i>n</i> = 96)	Follow-up (<i>n</i> = 88)	Mean difference	95% Confidence interval	
				Lower	Upper
Psychiatric costs	88.44 (118.76)	166.44 (135.68)	− 74.03	− 107.57	− 39.41
Inpatient days	36.33 (58.14)	78.35 (49.59)	− 38.71	− 50.62	− 24.99
Emergency	0.32 (0.88)	0.05 (0.35)	0.24	0.06	0.47
Day-patient visits	3.33 (15.00)	8.04 (21.60)	− 5.30	− 11.10	0.18
Day care	3.06 (29.94)	3.33 (31.27)	0.00		
Community group therapy	0.00 (0.00)	3.38 (31.72)	− 3.38	− 13.18	− 3.13
Psychiatrist	6.02 (7.82)	5.10 (4.70)	0.69	− 1.01	2.37
Psychotherapist	2.76 (16.12)	0.94 (6.66)	1.98	− 1.03	6.32
Nurse	1.36 (3.73)	3.26 (5.37)	− 1.78	− 3.03	− 0.56
Laboratory tests	0.58 (2.81)	1.11 (5.49)	− 0.63	− 1.73	0.38
Psychopharmacotherapy	34.70 (82.04)	62.86 (113.51)	− 27.13	− 53.78	− 1.16
Somatic costs	32.23 (96.83)	11.10 (24.65)	21.88	3.86	43.21
Inpatient days	18.48 (78.67)	3.47 (16.95)	14.94	0.59	35.55
Emergency visits	0.31 (1.20)	0.06 (0.37)	0.20	0.01	0.45
Somatic specialist	2.31 (5.65)	1.39 (3.67)	1.05	− 0.31	2.66
General practitioner	0.22 (0.28)	0.12 (0.17)	0.09	0.03	0.16
Pharmacotherapy	10.91 (50.15)	6.07 (15.37)	5.60	− 1.53	17.49
Justice system	3.62 (13.64)	0.57 (5.16)	3.38	0.28	6.42
Police	0.52 (0.86)	0.02 (0.20)	0.55	0.37	0.73
Court	3.10 (13.29)	0.55 (5.16)	2.83	− 0.29	5.80
Informal care	300.02 (191.47)	218.56 (265.74)	86.83	26.79	140.36
Productivity losses	293.11 (236.76)	482.73 (1602.27)	− 192.98	− 548.49	81.34
Absence from work	33.91 (106.58)	8.93 (58.82)	28.06	2.04	56.19
Unemployment	259.20 (249.92)	197.93 (244.97)	56.55	5.59	103.16
Premature death	0.00 (0.00)	276.87 (1619.65)	− 276.87	− 664.65	− 48.34
Total costs from					
Healthcare perspective	120.66 (163.85)	177.54 (136.98)	− 52.14	− 94.75	− 12.21
Societal perspective	717.41 (402.33)	880.40 (1592.00)	− 154.19	− 586.78	109.56

The comparisons are made using non-parametric bootstrap test with 1000 replications. The significance of the difference is represented with a 95% CI. Significant results are in bold

perspective do not change significantly. Societal costs are six times higher than the healthcare cost at baseline and five times higher than the healthcare costs at follow-up.

Individuals with non-affective psychosis had higher societal costs at baseline ($M = 840$, $SD = 403$) compared to individuals with affective psychosis $M = 546$, $SD = 336$, 95% CI (141; 436). The participants with non-affective and affective psychosis did not differ significantly in healthcare costs either at baseline ($M = 138$, $SD = 194$ and $M = 96$, $SD = 105$, respectively, 95% CI − 14; 108) or at follow-up ($M = 118$, $SD = 126$ and $M = 116$, $SD = 152$, respectively, 95% CI − 40; 79). Younger patients (< 35 years old) had twofold higher healthcare costs at baseline ($M = 159$, $SD = 224$) than patients aged ≥ 35 years ($M = 88$, $SD = 73$), 95% CI − 6; 140). Also, the healthcare costs of patients living with their parents ($M = 160$, $SD = 205$) were found to be approximately twofold higher than the healthcare

costs of patients with other living situation prior to the admission ($M = 87$, $SD = 110$; 95% CI 10; 142).

In univariate analysis, previous psychiatric hospital admissions in the 12-month period prior to the baseline assessment were the major contributor to the healthcare cost, explaining 31% of the variance of the data ($F = 41.162$, $p < 0.001$). Patients with psychiatric admissions had five-fold higher healthcare cost ($M = 228$ EUR, $SD = 206$) than patients without psychiatric admission ($M = 44$ EUR, $SD = 43$), 95% CI: 124; 248. Societal costs at baseline were found to be significantly higher for individuals with non-affective psychosis ($M = 840$; $SD = 402$) than for individuals with affective psychosis ($M = 546$, $SD = 382$), 95% CI: 132; 430. The diagnosis of the patients explained 11% of the variance in the total cost from societal perspective in T1 ($F = 11.180$, $p = 0.001$). The employment status of the patients was the major contributor for the societal costs in

both assessments, explaining 42% ($F = 69.176, p < 0.001$) and 53% ($F = 88.176, p < 0.001$) of the variance of the total cost in each assessment. Patient with psychiatric admissions in the year prior to the baseline assessment had higher societal cost in the follow-up ($M = 1276, SD = 1882$ compared to $M = 499, SD = 611$ for patients without admissions, 95% CI 28; 1015).

Determinants of cost at baseline and follow-up from both perspectives were further analyzed using a generalized linear model to evaluate the combined effect of some of the

socio-demographic characteristics (model 1) and resource utilization characteristics (model 2) in the costs Table 4.

Psychiatric hospital admission in the year prior to the assessment was a significant determinant of the healthcare costs and societal costs at baseline, but also predicted high societal costs at the follow-up. Less favorable socio-demographic characteristics were determinants of high societal costs. History of involuntary treatment is a predictor of higher healthcare costs in the follow-up. However, the diagnosis, age, gender and duration of illness did not have a predictive value on the costs in the combined models.

Table 4 Generalized linear models evaluating the determinants of costs

	Healthcare costs baseline		Societal costs baseline		Healthcare costs follow-up		Societal costs follow-up	
	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>
Model 1								
Diagnosis (non-affective)	0.157	0.578	0.173	0.157	0.025	0.877	0.066	0.788
Gender (female)	- 0.120	0.626	0.233	0.110	- 0.247	0.148	- 0.374	0.115
Age (years)	- 0.009	0.328	- 0.008	0.107	0.009	0.189	0.006	0.617
Family status (not married)	- 0.051	0.877	- 0.393	0.017	0.346	0.150	- 0.626	0.065
Children (no)	- 0.478	0.100	- 0.099	0.518	0.113	0.614	0.844	0.011
Lives with parents (yes)	- 0.720	0.015	- 0.324	0.036	- 0.396	0.052	- 0.329	0.343
Unemployed (yes)	- 0.265	0.309	- 0.836	0.000	0.132	0.433	- 0.510	0.039
Education (< higher)	- 0.020	0.938	0.090	0.447	0.080	0.632	0.535	0.026
Model 2								
Psychiatric inpatient treatment last year (yes)	- 1.591	0.000	- 0.394	0.005	- 0.115	0.442	- 0.678	0.003
Duration of illness (years)	0.003	0.697	0.002	0.783	- 0.004	0.557	0.001	0.904
Ward (acute)	0.218	0.231	- 0.023	0.875	0.073	0.668	- 0.027	0.912
Involuntary treatment (yes)	- 0.144	0.450	- 0.025	0.875	- 0.350	0.036	- 0.248	0.324
Comorbidity (yes)	- 0.352	0.074	- 0.093	0.526	- 0.157	0.335	- 0.229	0.387
Current hospital stay (days)	0.024	0.053	0.003	0.568	0.016	0.019	0.000	0.984

Statistically significant determinants of costs are presented in bold

Table 5 Correlations (Spearman) between the healthcare and societal costs and clinical characteristics at baseline (T1) and follow-up

	Cost at baseline (T1)		Cost at follow-up (T2)	
	Healthcare	Societal	Healthcare	Societal
Healthcare costs in T1	1.000	0.567**	0.246*	0.267*
Societal costs in T1	0.567**	1.000	0.154	0.375**
Healthcare costs in T2	0.246*	0.154	1.000	0.427**
Societal costs in T2	0.267*	0.375**	0.427**	1.000
Psychopathology (PANSS) in T1	0.082	0.289**	0.346**	0.337**
Psychopathology (PANSS) in T2	0.207	0.404**	0.314**	0.586**
Functioning (PSP) in T1	- 0.131	- 0.101	- 0.210*	- 0.139
Functioning (PSP) in T2	- 0.266*	- 0.433**	- 0.371**	- 0.623**
Quality of life (MANSA) in T1	- 0.117	- 0.150	- 0.070	- 0.027
Quality of life (MANSA) in T2	- 0.162	- 0.112	- 0.258*	- 0.293*
Caregiver's burden (BAS) in T1	0.124	0.235*	0.076	0.237*
Caregiver's burden (BAS) in T2	0.348**	0.297**	0.204	0.527**

Statistically significant results are in bold (* $p < 0.05$, ** $p < 0.001$)

The healthcare and societal costs have significant correlations with the clinical characteristics of the participants as presented in Table 5. Higher healthcare costs at baseline are associated with higher healthcare and societal costs, as well as lower psychosocial functioning and higher caregiver's burden at follow-up. The societal cost prior to hospital admission are correlated with the societal cost at following discharge and are as well associated with poor psychosocial functioning, more severe psychopathology and higher caregiver's burden at both assessments. The healthcare costs at the follow-up have positive correlation with the level of psychopathology and a negative correlation with the functioning at both assessment points. Poorer quality of life at the follow-up is also associated with higher healthcare costs. More severe psychopathology, poorer quality of life and higher caregiver's burden are correlated with higher societal cost at the follow-up. The coefficients and the significance of the correlations are presented in Table 5.

Discussion

This is the first Bulgarian micro-costing study to evaluate the cost of psychosis prior to admission and following discharge from two perspectives: healthcare and societal. The results of this observational study not only demonstrate the positive outcomes for the individuals with psychosis in the real clinical practice but also highlight the high societal cost of psychosis and psychotic exacerbations. Similar to other studies, up to 50% of the societal costs are due to lost productivity. The healthcare costs are found to be two-to-three times lower compared to a similarly conducted study in Germany [7]; and this finding is in line with the discrepancy in costs between Bulgaria and other European countries elucidated in the Cost of disorders of the brain 2010 study [5]. The healthcare costs are only up to 20% of total cost at both assessments, compared to up 30 or 40% in other studies [5]. The smaller proportion of healthcare cost and higher proportion of the cost of informal care are indicative of the low funding of mental health care in the country and the high involvement of the informal caregivers as a substitute for the lack of community-based services [24].

While the hospital admission increases the psychiatric inpatient costs in the follow-up, a major shift in the type of costs following discharge is present indicating the use of more community-based services, less emergency department presentations, less somatic healthcare services and contacts with police, as well as less informal care and the absence from work. The increased mortality costs following discharge are a notorious reminder of the high societal cost to of psychotic exacerbations and the need for follow-up of patients in risk: approximately one-third of all suicides among mentally ill patients occur within 3 months of

discharge [25]. The increase in psychiatric costs combined with a major shift in the type of costs following discharge is raising the question whether investment in mental health care and better resource utilization and cost allocation prior to hospital admission could have prevented the negative consequences of the psychotic exacerbations [7].

Less favorable socio-demographic characteristics of the patients are correlated with higher societal costs, which is typical for the course of psychosis [26]. All of the outcome measures (psychopathology, social functioning, quality of life and caregivers' burden) were found to be significant determinants of higher costs, indicating that a broad spectrum of measures including the affected individuals and their caregivers, and not only symptom-oriented measures, should be considered for the evaluation of the effectiveness and cost-effectiveness of the psychiatric treatment [27]. The individuals with psychosis are among the high-cost patients in the health care systems with a small proportion of the individuals having disproportionately large economic burden. Since high healthcare costs prior to admission are correlated with high societal costs following discharge, the individuals incurring higher healthcare costs should be identified to receive the necessary treatment, so that further investment in mental healthcare could prevent high societal costs in future [28, 29]. As the quality of life [3] and the relationship between caregiver and patient [30, 31] are found to be predictive of relapse, the current finding that poor quality of life and high caregiver's burden are correlated with higher societal costs suggests that a focus on the improvement of the subjective outcome measures for patients and caregivers should be considered to reduce future societal costs.

The main limitations of the study are the recruitment of participants from one university hospital, the pre-/post-study design and the non-representative sample which prevents generalization of the results for the whole population of psychotic patients. University hospitals in Bulgaria have the highest levels of competence in the country, providing better standard of care and having higher costs compared to other facilities. Also, they are primarily concerned with short- or medium-term treatment of acute or exacerbated patients, and typically do not provide long-term stay for chronic patients [32]. This can influence on both costs and effectiveness. It can also explain the relatively high percentage of individuals with paid employment in the study, compared to 12–39% in other studies in Europe [33]. However, in the absence of country-specific data in the international literature [34], this is the first study to examine the costs from both healthcare and societal perspective in Bulgaria. The pre-/post-study design provides more insight into the course of the costs in one of the most extreme phases of the illness: psychotic exacerbation. Although costs are typically presented in costs per year in economic analysis, we have presented the cost per month to limit bias with regard to measuring the costs in a specific period

(psychotic exacerbation) associated with intense resource utilization which cannot be generalized for the whole year. Further study should be performed to collect and analyze data from representative sample of Bulgarian patients with psychosis.

The hospitalization at baseline was included in the follow-up period which by default increases the psychiatric costs at follow-up. However, this was considered the most appropriate method because the recruitment of participants was made in the first 2 weeks of admission, without controlling for the duration of the subsequent inpatient stay and treatment, and the data for the cost were collected retrospectively. Also, this allows for adequate comparison with similar studies [7]. The study includes the mortality costs, which in other studies are frequently subjected to death censoring and excluded from economic evaluations due to distortions in the distribution of the data which complicates statistical analyses [22, 35]. While the loss of human life is invaluable, premature death is one of the negative impacts of psychotic disorders and psychotic exacerbations [25]. The exclusion of the deceased participants in a study leads to underestimation of the cost of the disorders and fail to encompass all cost from societal perspective. We assumed societal perspective to illustrate the negative impact of the psychotic exacerbation.

Conclusion

Psychotic disorders have high societal costs and the underfunding of mental healthcare is at the expense of higher caregivers' and societal cost. The treatment of psychotic exacerbation is effective and leads to a shift in the types of costs, indicating that investment in mental healthcare for the improvement of the social functioning and quality of life of the patients and the alleviation of the psychopathology and the burden of informal care should be viewed as a sustainable investment.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical standards The study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The study protocol was approved by the ethics committee of the Medical University of Sofia. All participants gave written informed consent prior to their inclusion in the study and their anonymity was guaranteed.

References

- World Health Organization (WHO) (1992) The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines. World Health Organization, Geneva
- Emsley R, Chiliza B, Asmal L, Harvey BH (2013) The nature of relapse in schizophrenia. *BMC Psychiatry* 13:50. <https://doi.org/10.1186/1471-244X-13-50>
- Boyer L, Millier A, Perthame E et al (2013) Quality of life is predictive of relapse in schizophrenia. *BMC Psychiatry* 13:15. <https://doi.org/10.1186/1471-244X-13-15>
- Almond S, Knapp M, Francois C et al (2004) Relapse in schizophrenia: costs, clinical outcomes and quality of life. *Br J Psychiatry* 184:346–351. <https://doi.org/10.1192/bjp.184.4.346>
- Gustavsson A, Svensson M, Jacobi F et al (2011) Cost of disorders of the brain in Europe 2010. *Eur Neuropsychopharmacol* 21:718–779. <https://doi.org/10.1016/j.euroneuro.2011.08.008>
- Pennington M, McCrone P (2017) The cost of relapse in schizophrenia. *Pharmacoeconomics* 35:921–936. <https://doi.org/10.1007/s40273-017-0515-3>
- Zentner N, Baumgartner I, Becker T, Puschner B (2015) Course of health care costs before and after psychiatric inpatient treatment: patient-reported vs. administrative records. *Int J Health Policy Manag* 4:153–160. <https://doi.org/10.15171/ijhpm.2015.16>
- Bedrozova A, Gerdjikov I (2005) Economical aspects of the inpatient psychiatric help in the Republic of Bulgaria. *Retseptor Bulg Psikhiatr Zhurnal* 2:9–21 (in Bulgarian)
- Knapp M, Patel A, Curran C et al (2013) Supported employment: cost-effectiveness across six European sites. *World Psychiatry* 12:60–68. <https://doi.org/10.1002/wps.20017>
- Alonso J, Petukhova M, Vilagut G et al (2011) Days out of role due to common physical and mental conditions: results from the WHO World Mental Health surveys. *Mol Psychiatry* 16:1234–1246. <https://doi.org/10.1038/mp.2010.101>
- Kay SR, Fiszbein A, Opler LA (1987) The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophr Bull* 13:261–276
- Morosini PL, Magliano L, Brambilla L et al (2000) Development, reliability and acceptability of a new version of the DSM-IV Social and Occupational Functioning Assessment Scale (SOFAS) to assess routine social functioning. *Acta Psychiatr Scand* 101:323–329
- Priebe S, Huxley P, Knight S, Evans S (1999) Application and results of the Manchester Short Assessment of Quality of Life (MansA). *Int J Soc Psychiatry* 45:7–12. <https://doi.org/10.1177/002076409904500102>
- Reinhard SC, Gubman GD, Horwitz AV, Minsky S (1994) Burden assessment scale for families of the seriously mentally ill. *Eval Program Plann* 17:261–269. [https://doi.org/10.1016/0149-7189\(94\)90004-3](https://doi.org/10.1016/0149-7189(94)90004-3)
- Chisholm D, Knapp MRJ, Knudsen HC et al (2000) Client Socio-Demographic and Service Receipt Inventory—European Version : development of an instrument for international research. *Br J Psychiatry* 177:s28–s33
- Husereau D, Drummond M, Petrou S, et al (2013) Consolidated Health Economic Evaluation Reporting Standards (CHEERS) Statement. <https://doi.org/10.1016/j.jval.2013.02.010>
- National Center of Public Health and Analyses (NCPHA) (2017) Bulletin “Economic analysis of wards in multi-profile hospitals for active treatment for the period 2005–2016”. National Center of Public Health and Analyses (NCPHA). <http://ncphp.government.bg>
- National Center of Public Health and Analyses (NCPHA). Bulletin “Economic analysis of the activities of the medical institutions for hospital care in the public health system in the Republic of Bulgaria for the period 2010–2016”. National Center of Public Health and Analyses (NCPHA).
- McCrone P, Craig TKJ, Power P, Garety PA (2010) Cost-effectiveness of an early intervention service for people with psychosis. *Br J Psychiatry* 196:377–382. <https://doi.org/10.1192/bjp.bp.109.065896>

20. Aebi MF, Delgrande N (2014) SPACE I—Council of Europe Annual Penal Statistics: Prison populations. Survey 2012. Strasbourg: Council of Europe
21. Max W, Rice DPD, Sung H-Y, Michel M (2000) Valuing human life: estimating the present value of lifetime earnings
22. Gregori D, Petrinco M, Bo S et al (2011) Regression models for analyzing costs and their determinants in health care: an introductory review. *Int J Qual Heal Care* 23:331–341. <https://doi.org/10.1093/intqhc/mzr010>
23. Pagano E, Petrelli A, Picariello R et al (2015) Is the choice of the statistical model relevant in the cost estimation of patients with chronic diseases? An empirical approach by the Piedmont Diabetes Registry. *BMC Health Serv Res* 15:582. <https://doi.org/10.1186/s12913-015-1241-1>
24. Ganey K, Onchev G, Ivanov P (1998) A 16-year follow-up study of schizophrenia and related disorders in Sofia, Bulgaria. *Acta Psychiatr Scand* 98:200–207
25. Olfson M, Wall M, Wang S et al (2016) Short-term Suicide Risk After Psychiatric Hospital Discharge. *JAMA Psychiatry* 73:1119. <https://doi.org/10.1001/jamapsychiatry.2016.2035>
26. Siskind D, Harris M, Diminic S et al (2014) Predictors of mental health-related acute service utilisation and treatment costs in the 12 months following an acute psychiatric admission. *Aust New Zeal J Psychiatry* 48:1048–1058. <https://doi.org/10.1177/0004867414543566>
27. Stant AD, Buskens E, Jenner JA et al (2007) Cost-effectiveness analysis in severe mental illness: outcome measures selection. *J Ment Health Policy Econ* 10:101–108
28. Jablensky A (2009) Worldwide burden of schizophrenia. In: Sadock BJ, Sadock VA, Ruiz P (eds) *Kaplan&Sadock's Comprehensive textbook of psychiatry*, 9th edn. Lippincott Williams & Wilkins, Philadelphia, pp 1451–1462
29. Knapp M, Mangalore R, Simon J (2004) The global costs of schizophrenia. *Schizophr Bull* 30:279–293
30. Lauber C, Eichenberger A, Luginbühl P et al (2003) Determinants of burden in caregivers of patients with exacerbating schizophrenia. *Eur Psychiatry* 18:285–289
31. Ogilvie AD, Morant N, Goodwin GM (2005) The burden on informal caregivers of people with bipolar disorder. *Bipolar Disord* 7:25–32. <https://doi.org/10.1111/j.1399-5618.2005.00191.x>
32. European Psychiatric Association (EPA) Report on Bulgarian Mental Health Care and Reform Process 2018
33. Evensen S, Wisløff T, Lystad JU et al (2016) Prevalence, employment rate, and cost of schizophrenia in a high-income welfare society: a population-based study using comprehensive health and welfare registers. *Schizophr Bull* 42:476–483. <https://doi.org/10.1093/schbul/sbv141>
34. Levin C, Chisholm D (2016) Cost-effectiveness and affordability of interventions, policies, and platforms for the prevention and treatment of mental, neurological, and substance use disorders. The International Bank for Reconstruction and Development/The World Bank
35. Goeree R, Blackhouse G, Agro K et al (1999) The valuation of productivity costs due to premature mortality: a comparison of the human-capital and friction-cost methods for schizophrenia