



Determinants of costs of care for patients attending primary care

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Abstract

Aims: We aimed to evaluate determinants of costs of somatic and psychiatric care for patients attending primary care (PrC).

Methods: 495 PrC patients filled in a questionnaire including questions on background, health behaviour, social contacts, perceived health and depressive symptoms. Costs of somatic and psychiatric care were obtained from the local healthcare register.

Results: During 5 years' follow-up, total inflation-adjusted costs of care were 8145 Euros per capita in 2010 prices: 87.2% was due to somatic and 12.8% to psychiatric care. Age associated positively, but being single and working associated negatively with costs of somatic care. Costs of psychiatric care were high in young adults, single, divorced, unemployed, smokers, and those with few social contacts. In zero-inflated multivariate modelling, poor perceived health and being retired increased probability of seeking somatic care. Depressive symptoms and being unemployed increased, and old age decreased probability of seeking psychiatric care.

Concerning both services together, poor perceived health and being retired associated with increased, but depressive symptoms with decreased likelihood of being a service user. Among service users, age group 25-44 and having poor perceived health associated with higher costs of care. Female gender, being single, employed, having low education level, regular user of alcohol and regular physical exercise associated with lower costs of care.

Conclusions: In patients attending PrC, more than a tenth of total costs of care were due to psychiatric care. Patients' perceived health associated with costs of somatic, and depressive symptoms with costs of psychiatric care. Sociodemographic background also associated with costs of care.

Introduction

The majority of people with health problems seek treatment from primary care (PrC). In Finland, 64% of the population over 15 years old attended a PrC physician in 2006 [1]. PrC patients often suffer from mental health problems: a majority from depression or depressive symptoms [2,3]. When evaluating costs of care of PrC patients, it is reasonable to also consider possible costs of psychiatric care.

As commensurable factors, costs of care are suitable for comparative (out- vs. inpatient care and somatic vs. psychiatric care) as well as for predictive research, rather than number of outpatient visits and hospital days. Costs of care describe precisely the treatment services that society provides for its members. Prospective predictive studies are needed to give insight into the factors that may influence service utilization costs [4].

Costs of care are divided into direct and indirect costs. Direct costs include all healthcare and also non-healthcare costs. Indirect costs include lower work productivity or inability to carry out household tasks [5]. In the present study, we concentrate on direct healthcare costs.

First, we aimed to estimate annual costs of somatic and psychiatric care in patients attending primary care during a 5-year follow-up period. Secondly, we aimed to predict costs of care by baseline characteristics. Perceived health was used as a clinical predictor for use of somatic services and depressive symptoms for use of psychiatric services. Non-clinical predictors comprised sociodemographic background, health behaviour and social contacts.

Methods

The study protocol was approved by the Ethics Committee of the University of Turku and the Turku University Central Hospital. The research permits were given by the chief doctors of the two healthcare centres participating in the study, and financially the study was funded (EVO funding) by Turku University Central Hospital.

Study patients

The study was carried out in two small towns belonging to the healthcare district of South West Finland. The study leader (RKRS) first made an agreement with the chief doctors of the healthcare centres for recruiting patients into the study. The study subjects, over 15 years old, were recruited from healthcare centres between April 2005 and September 2005. Consecutive patients attending a PrC physician on randomly selected days during office time were asked by the research assistant, who also selected the study days, to participate in the study. Altogether, 959 PrC patients were invited, 394 refused. No data concerning the patients who refused were recorded. Data on annual costs of care between 2005 and 2010 were obtained from 495 (87.6%) out of 565 eligible participants. The first study visit was not included into the cost analyses. Thus, some of the 70 PrC patients without cost data made only one (study) visit to the study services, some may have attended other services not included in the present study (e.g. private services) and some had, after the study, visit moved away from the study healthcare district.

The PrC patients with cost data were more often women ($p=0.022$), older ($p=0.021$) and retired ($p=0.004$), but less often single ($p=0.021$) than the 70 PrC patients without cost data.

Examinations

Before seeing a doctor, all participants completed a questionnaire comprising questions on demographic background, tobacco smoking, use of alcohol, physical exercise, social contacts, depressive symptoms (DEPS) [3] and perceived health (1. very good, 2. good, 3. average, 4. bad, 5. very bad). Health behaviour and social contact variables were dichotomised as follows: smoking; regular daily smoker vs. temporarily/non-smoker, use of alcohol; weekly vs. rarely/never, physical exercise; breathless at least twice a week vs. non-breathless/not at all, social contacts; >2 vs. 0-2. The DEPS includes 10 rated questions on depressive symptoms, and its sum score (range 0 to 30) indicates severity of non-clinical depression.

Cost of care

Costs of services used in Euros were obtained from the register of the healthcare district and collected annually between 2005-2010 so that after the baseline visit, a full 5-year period was included (the baseline visit was not included in cost analyses). Costs were then adjusted according to the healthcare price index provided by Statistics Finland [6] using 2010 as a reference year. The cost of a visit was estimated by its duration and professional grade of the service provider. Accordingly, the cost of a hospital day was estimated by the resources used for the patient's treatment. Both costs were determined once a year. In Finland, costs of public healthcare are paid by the municipal community where the service user (patient) is living. However, a patient has to pay a small annual payment for visits to primary care, and a separate payment for each visit to polyclinics and for each hospital day. Visits to community mental health centres are free of charge. The present study deals with costs of public care: costs paid by the patients are not included.

Somatic care costs comprise visits to primary care, to somatic polyclinics in general hospital and general hospital days on somatic wards. Psychiatric care costs comprise visits to psychiatric polyclinics in general hospitals, general hospital days on psychiatric wards and mental hospital days. Costs of outpatient visits and hospital days were summed separately for each participant as somatic costs (SomCosts) and psychiatric costs (PsyCost) and finally, all costs were aggregated together (TotCosts).

Statistical methods

Sums of annual costs of care, from 2005 to 2010, were calculated separately for all care categories (SomCosts, PsyCosts and TotCosts). Means (SD) and medians of various cost categories were calculated and median differences were tested by Mann Whitney U or Kruskal-Wallis tests (Table 2). Differences between dependent distributions were tested by Wilcoxon Signed Rank test. Costs of care were correlated (Spearman correlation) with perceived health and DEPS. Two-tailed $p < 0.05$ was considered statistically significant.

Statistical analysis of healthcare cost data involves a number of difficulties. The data are non-negative, often positively skewed and heavy-tailed and include a large number of zeros for non-users [7]. Because of the large number of zeros, the typical count data models with Poisson and negative binomial distributions may not be appropriate: modified models, zero-inflated or the hurdle model, are needed [8]. These models analyse both the extensive and the intensive aspects of individual healthcare consumption separately.

Zero-inflated models allow the zeros to emerge from the binary choice of participation and also from the counting process following the choice of participation [9]. For example, a patient first chooses whether to visit a doctor or not (extensive aspect). If the patient decides to visit the doctor, the amount of treatment and costs (intensive aspect) is jointly determined by the physician and the patient's compliance with treatment. Thus, zeros may also arise from the counting process in addition to the participation decision. The two-part analysis can be alternatively interpreted as modelling separately the "at-risk" and "not at-risk" subgroups [10].

We used zero-inflated models for analysing determinants of healthcare use. The fit statistics, Akaike's Information Criteria [11] and Vuong test [12], for the models with and without the zero-inflation showed that the zero-inflated negative binomial (ZINB) model provided the best fit when a full set of covariates was used in both "at-risk" and "not at-risk" parts (Table 4). The ZINB regression models were used to test which patient characteristics were associated with subsequent costs of care in the study population. These models have recently been used in various medical studies [10,13,14], and in one cost study regarding gastrointestinal disorders [15].

Estimation of the ZINB regression model produces two-part statistics with different interpretations of coefficients. In the negative binomial part, incidence rate ratios (IRRs) estimate the effect for a one unit change in the explanatory variable relative to the reference group within the "at-risk group" [10]. In the zero-inflated part, odds ratios (ORs) estimate a one unit change in the explanatory variable relative to the reference within the "not at-risk group". These IRR and OR coefficients do not correspond with the whole sample population but separately with the "at-risk" and "not-at-risk" populations, respectively. In practice, the IRR coefficient in the negative binomial part indicates how much each predictor increases/decreases costs of care among the patients who have used the service in question, while OR in the zero-inflated part refers to the probability (risk) of not using the service at all. The bivariate analyses were done with Statistical Programme for the Social Sciences (SPSS) v22.0 and multivariate modelling with statistical software Stata version 13. We computed heteroscedasticity-robust standard errors, which are often suggested in the presence of excess zeros and over-dispersion [8]. P-values <0.05 (with Bonferroni correction) were regarded as significant.

Results

Bivariate analyses

Two-thirds of the PrC were women, more than half were married, two-fifths were employed and more than two-fifths were retired. Their mean age was 54 years, and on average they had received schooling for 11 years. About 17% of the PrC patients smoked (daily) and another 17% used alcohol regularly. A great majority exercised weekly and had more than two social contacts (Table 1).

Table 1. Background characteristics, health behaviour, social contacts (%), depressive symptoms and perceived health.	
All	N=495
Gender	
Men	32.3
Women	67.7
Age	
16-24	8.7
25-44	19.8
45-64	36.6
65+	34.9
mean/SD	54.3/17.3
Marital status	
Single	11.5
Married/Cohabiting	68.1
Divorced/Separated	11.5
Widowed	8.9
Work status	
Working	42.6
Unemployed	10.9
Retired	46.5
Years of education	
6-8	26.7
9-11	30.1
12-14	27.1
15+	16.2
mean/SD	11.3/3.3
Regular use of alcohol	17.4
Regular smoking	16.8
Regular physical exercise	67.3
Social contacts >2	86.3
Depressive symptoms (DEPS; 0-30)	
mean/SD	5.7/5.6
Perceived health (1-4)	
mean/SD	2.7/0.7

Proportions of zero costs (no visit or hospitalization after baseline contact during the follow-up) were as follows: 7.9% for SomCosts, 85.3% for PsyCosts and 5.9% for TotCosts. SomCosts increased, while PsyCosts decreased during five years' follow-up. During five years' follow-up, TotCosts was 8,145 Euros per capita in 2011 prices; the majority of costs (7,103 Euros; 87.2%) were due to SomCosts, and 1,042 Euros (12.8%) due to PsyCosts ($p < 0.001$) (Table 2).

Of SomCosts, 66.0% was due to hospital and 34.0% to outpatient care ($p = 0.053$). Corresponding figures for PsyCosts were 35.3% for hospital and 64.7% for outpatient care ($p < 0.001$).

There were no gender differences in costs of care (Table 2). Age, marital status and work status associated significantly with both SomCosts and PsyCosts, and education years with PsyCosts. Pair comparisons showed that SomCosts in the youngest age group (16-24 years) were lower than in the other age groups ($p < 0.001$ for 25-44 years, $p = 0.002$ for 45-64 years and $p < 0.001$ for 65+ years). Additionally, SomCosts in the oldest age group were significantly ($p = 0.001$) higher than in the next younger group. In the youngest age group, TotCosts were lower than in older age groups ($p = 0.006$ for 25-44 years, $p = 0.027$ for 55-64 years and $p < 0.001$ for 65+ years).

For single patients, SomCosts were lower than in other marital status groups ($p = 0.003$ for married/cohabiting, $p = 0.002$ for divorced/separated and $p = 0.003$ for widowed), and their PsyCosts were higher than in married/cohabiting ($p = 0.003$) and widowed ($p = 0.004$). In divorced/separated, PsyCosts were higher than in married/cohabiting ($p = 0.025$) and widowed ($p = 0.011$). For subjects who were working, SomCosts were lower than in those who were unemployed ($p < 0.001$) or retired ($p = 0.001$). For the unemployed, PsyCosts were higher than in those at work ($p = 0.001$) or retired ($p < 0.001$). In the subjects with the fewest education years (6-8), PsyCosts were lower than in other education groups ($p = 0.001$ for 9-11 years, $p < 0.001$ for 12-14 years and $p = 0.019$ for 15+ years).

Smoking associated with higher PsyCosts, while use of alcohol with lower SomCosts. Physical exercise had no association with costs of care. Poor perceived health correlated with high SomCosts, and depressive symptoms with high PsyCosts.

Table 2. Mean (SD) and median of costs (Euros) of care in 2005-2010 by background characteristics, health behaviour, social contacts, perceived health and depressive symptoms.

	SomCost	PsyCost	TotCost	PsyCost/TotCost
All (N=495)				
Mean	7103	1042	8145	12.8
SD	12678	5447	13658	
Median	3069	0	3346	
Gender				
Men (N=160)				
Mean	9371	959	10330	9.3
SD	17517	5709	18110	
Median	3261	0	3602	
Women (N=335)				
Mean	6020	1082	7101	15.2
SD	9381	5326	10788	
Median	2997	0	3332	
p#	0.493	0.701	0.388	
Age				
16-24 (N=43)				
Mean	2066	1404	3470	40.5
SD	2450	5009	5351	
Median	795	0	2025	
25-44 (N=98)				
Mean	6750	2098	8848	23.7
SD	13723	7687	15908	
Median	3147	0	3189	
45-64 (N=181)				
Mean	6564	1004	7568	13.3
SD	12684	5286	13535	
Median	2468	0	2969	
65+ (N=173)				
Mean	9118	394	9512	4.1
SD	13221	3929	13651	
Median	4636	0	4793	
p##	<0.001	<0.001	0.001	
Marital status				
Single (N=57)				
Mean	3977	3128	7105	44.0
SD	6917	9891	11966	
Median	1138	0	2288	
Married/Cohabiting (N=337)				
Mean	7166	466	7632	6.1
SD	13340	2636	13635	
Median	3192	0	3341	
Divorced/Separated (N=57)				
Mean	8751	2278	11029	20.7
SD	14646	8364	16322	
Median	3890	0	4694	
Widowed (N=44)				
Mean	8534	1148	9682	11.9
SD	9784	7594	11828	
Median	4715	0	4843	
p##	0.003	0.001	0.059	

	SomCost	PsyCost	TotCost	PsyCost/TotCost
Work status				
Working (N=211)				
Mean	4382	857	5238	16.4
SD	7664	3899	8735	
Median	1812	0	2414	
Unemployed (N=54)				
Mean	9867	2597	12464	20.8
SD	20776	8054	21677	
Median	4062	0	5604	
Retired (N=230)				
Mean	8951	847	9798	8.6
SD	13450	5867	14448	
Median	4217	0	4515	
p##	<0.001	<0.001	<0.001	
Years of education				
6-8 (N=132)				
Mean	6952	161	7113	2.3
SD	12158	1091	12186	
Median	3332	0	3499	
9-11 (N=149)				
Mean	6894	1598	8492	18.8
SD	11826	7395	13607	
Median	2969	0	3346	
12-14 (N=134)				
Mean	6668	1642	8310	19.8
SD	11543	6424	13178	
Median	2991	0	3506	
15+ (N=80)				
Mean	8469	455	8924	5.1
SD	16472	2967	16682	
Median	3154	0	3196	
p##	0.935	0.002	0.946	
Smoking				
Regularly (N=83)				
Mean	6565	2694	9259	29.1
SD	13729	10259	17008	
Median	2923	0	3179	
Not regularly (N=412)				
Mean	7211	709	7921	9.0
SD	12471	3742	12891	
Median	3084	0	3510	
p#	0.677	0.001	0.916	
Use of alcohol				
Regularly (N=86)				
Mean	5826	1932	7758	24.9
SD	13193	7957	15061	
Median	2095	0	2706	
Not regularly (N=409)				
Mean	7371	855	8226	10.4
SD	12567	4747	13363	
Median	3312	0	3540	
p#	0.063	0.329	0.330	

	SomCost	PsyCost	TotCost	PsyCost/TotCost
Physical exercise				
Regularly (N=333)				
Mean	6432	893	7325	12.2
SD	10743	5066	11786	
Median	2894	0	3115	
Not regularly (N=162)				
Mean	8482	1349	9830	13.7
SD	15886	6163	16783	
Median	3834	0	4249	
p#	0.295	0.065	0.126	
Social contacts				
>2 (N=428)				
Mean	7461	900	8361	10.8
SD	13447	5456	14416	
Median	3179	0	3335	
<=2 (N=68)				
Mean	4853	1934	6787	28.5
SD	5423	5344	7198	
Median	2514	0	4185	
p#	0.506	0.001	0.364	
Perceived health (1-5)	0.237***	0.088	0.248***	
Depressive symptoms (0-30)	0.053	0.204***	0.120**	

PsyCost=Cost of psychiatric care

SomCost=Cost of somatic care

TotCost=Cost of psychiatric and somatic care

PsyCost/TotCost=Proportion of costs psychiatric care from total costs care

p#=Mann-Whitney U test

p##=Kruskal-Wallis test

*** p<0.001. **p<0.01. * p<0.05

Multivariate predictive modelling

In zero-inflated negative binomial analyses (Tables 3 and 4), the estimated coefficients should be interpreted in contrast to the reference group: male, 16-24 years-old, single, employed, <9 years of education, non-regular alcohol users, non-smokers, 0-2 social contacts, low number of depressive symptoms and good perceived health.

Poor perceived health and being retired associated with increased likelihood of receiving somatic care. Among service users, age group 25-44, being unemployed and retired, having 9-11 or over 14 years of education, having 3 or more social contacts and poor perceived health associated with higher, while female gender and single marital status with lower SomCosts. Additionally, regular use of alcohol and physical exercise associated (not significantly) with lower SomCosts. Depressive symptoms and being unemployed increased, while old age decreased the likelihood of receiving psychiatric care. Among service users, female gender, age between 25 and 64 years and regular use of alcohol associated with high, while being married/cohabiting or divorced, and unemployed associated with lower PsyCosts (Table 3).

Costs of total care

Poor perceived health and being retired associated with increased, but depressive symptoms (slightly) with decreased likelihood of being a service user (Table 4). Among service users, age groups 25-44, and having poor perceived health associated with higher, while female gender, being single, employed, having low education level, regular user of alcohol and regular physical exercise with lower TotCosts.

Table 3. Multivariate analyses of costs of somatic and psychiatric care.

	Total costs of somatic care (health index adjustment 2010)							
	Negative binomial part				Zero-inflated part			
	P	IRR	(95% CI)		P	OR	(95% CI)	
Women	0.003	0.659	0.500	0.868	0.472	1.372	0.580	3.244
Age								
25-44	0.003	2.093	1.282	3.417	0.427	0.553	0.128	2.389
45-64	0.165	1.417	0.867	2.316	0.936	1.059	0.265	4.229
65+	0.058	1.744	0.981	3.102	0.822	0.824	0.154	4.416
Marital status								
Married/Cohabi	0.013	1.712	1.122	2.612	0.663	1.359	0.342	5.407
Divorced	0.001	2.548	1.455	4.464	0.546	0.541	0.074	3.971
Widowed	0.019	2.015	1.123	3.616	0.344	2.582	0.361	18.440
Work status								
Retired	0.015	1.586	1.094	2.298	0.005	0.269	0.108	0.670
Unemployed	0.012	1.788	1.138	2.811	0.624	0.717	0.189	2.716
Years of education								
9-11 years	0.035	1.415	1.024	1.956	0.572	1.355	0.473	3.882
12-14 years	0.072	1.404	0.970	2.030	0.802	0.869	0.291	2.597
15+ years	0.020	1.685	1.087	2.613	0.390	1.724	0.498	5.973
Regular use of alcohol	0.019	0.673	0.484	0.937	0.491	0.700	0.253	1.934
Regular smoking	0.299	0.848	0.622	1.157	0.430	0.671	0.249	1.808
Regular exercise	0.052	0.785	0.615	1.002	0.920	0.962	0.455	2.034
Social contacts	0.022	1.440	1.054	1.967	0.341	0.639	0.254	1.607
Depressive symptoms								
Perceived health	0.033	1.227	1.017	1.481	0.003	0.459	0.275	0.768
Constant	<0.001	983.900	462.400	2093.600	0.981	1.237	0.129	8.157

	Total costs of psychiatric care (health index adjustment 2010)							
	Negative binomial part				Zero-inflated part			
	P	IRR	(95% CI)		P	OR	(95% CI)	
Women	0.015	2.346	1.180	4.666	0.690	0.883	0.478	1.630
Age								
25-44	0.024	5.177	1.238	21.650	0.868	1.092	0.388	3.070
45-64	0.032	2.927	1.094	7.832	0.326	1.739	0.576	5.254
65+	0.088	7.703	0.740	80.230	0.003	9.004	2.109	38.450
Marital status								
Married/Cohabi	0.004	0.201	0.067	0.603	0.998	0.999	0.421	2.369
Divorced	0.015	0.268	0.093	0.775	0.916	0.940	0.300	2.943
Widowed	0.875	1.451	0.014	152.500	0.425	2.292	0.299	17.580
Work status								
Retired	0.985	1.016	0.198	5.221	0.096	0.481	0.203	1.139
Unemployed	0.046	0.470	0.224	0.988	0.001	0.253	0.115	0.559
Years of education								
9-11 years	0.876	1.116	0.280	4.446	0.068	0.396	0.146	1.072
12-14 years	0.163	2.054	0.747	5.654	0.026	0.304	0.106	0.869
15+ years	0.622	0.693	0.161	2.979	0.157	0.426	0.131	1.388
Regular use of alcohol	0.040	3.417	1.057	11.040	0.916	0.964	0.486	1.912
Regular smoking	0.849	1.070	0.534	2.141	0.323	0.689	0.329	1.442
Regular exercise	0.487	0.771	0.370	1.604	0.751	1.105	0.595	2.052
Social contacts	0.998	0.998	0.177	5.631	0.231	1.606	0.740	3.487
Depressive symptoms	0.668	1.020	0.933	1.115	<0.001	0.897	0.848	0.948
Perceived health								
Constant	<0.001	1719.400	130.100	22727.600	0.001	15.970	3.232	78.900

Note: Table reports incidence rate ratios for the negative binomial part and odds ratios for the zero-inflated part of Zero-inflated negative binomial regression To account for high dispersion of costs, heteroscedasticity-robust standard errors are computed as suggested by Cameron and Trivedi (2005)

Table 4. Multivariate analyses of total costs of healthcare.

	All healthcare costs (health index adjustment 2010)							
	Negative binomial part				Zero-inflated part			
	P	IRR	(95% CI)		P	OR	(95% CI)	
Women	0.009	0.679	0.508	0.908	0.909	0.944	0.348	2.559
Age								
25-44	0.016	1.885	1.125	3.159	0.457	0.490	0.075	3.203
45-64	0.444	1.234	0.720	2.115	0.965	0.966	0.212	4.399
65+	0.224	1.455	0.795	2.664	0.793	1.246	0.241	6.435
Marital status								
Married/Cohabi	0.640	1.115	0.707	1.758	0.495	1.886	0.305	11.670
Divorced	0.063	1.736	0.972	3.101	0.886	1.193	0.107	13.340
Widowed	0.211	1.479	0.802	2.729	0.216	4.691	0.406	54.180
Work status								
Retired	0.005	1.697	1.178	2.444	0.001	0.198	0.076	0.514
Unemployed	0.008	1.844	1.170	2.906	0.541	0.585	0.105	3.270
Years of education								
9-11 years	0.003	1.636	1.183	2.264	0.708	1.252	0.385	4.068
12-14 years	0.007	1.677	1.155	2.435	0.646	0.747	0.216	2.589
15+ years	0.019	1.682	1.091	2.595	0.691	1.338	0.318	5.622
Regular use of alcohol	0.39	0.855	0.597	1.223	0.654	0.760	0.230	2.514
Regular smoking	0.829	1.039	0.736	1.466	0.663	0.795	0.283	2.233
Regular exercise	0.058	0.782	0.607	1.009	0.646	1.234	0.504	3.021
Social contacts	0.285	1.197	0.861	1.665	0.467	1.840	0.356	9.507
Depressive symptoms	0.956	0.999	0.974	1.025	0.783	0.988	0.906	1.078
Perceived health	0.005	1.307	1.082	1.578	0.046	0.540	0.296	0.988
Constant	<0.001	1382.60	629.700	3035.500	0.179	0.185	0.016	2.160

Note: Table reports incidence rate ratios for the negative binomial part and odds ratios for the zero-inflated part of Zero-inflated negative binomial regression

To account for high dispersion of costs, heteroscedasticity-robust standard errors are computed as suggested by Cameron and Trivedi (2005)

Discussion

Major findings

During six years' follow-up, the total costs of care for the patients attending PrC were about 8,145 Euros per capita in 2011 prices. About 87% of the total costs were due to somatic and about 13% to psychiatric care. A minority (8%) of PrC patients caused no somatic care costs after baseline visit: the reason for their visit was a certificate or a health examination or some other reason. The corresponding figure for psychiatric costs was 85%. During the follow-up, annual costs of somatic care increased, while costs of psychiatric care decreased. Several background factors associated with total costs of somatic and psychiatric care.

Costs of somatic care

Because a great majority of the total costs were caused by somatic care, the predictors of somatic care costs are discussed together with those of the total care costs. It was expected that perceived health would associate with increased care-seeking and with higher costs of total and somatic care. The results suggest that perceived or subjective health is an important predictor for costs of care: more important than diagnostic examinations [16, 17].

There were no gender differences in received somatic or total care but intensity of use of care was lower among women than men. This difference was due to men's higher use of hospital care (not shown). As expected, costs of somatic care increase steeply with age. About two-fifths of costs of somatic care were caused by patients over 64 years of age. Moreover, when the effects of other factors were taken into account, total costs and costs of somatic care were high in young adults (25-44). Possibly, services offered by PrC are suitable for young adults and therefore they use treatment services for a longer time.

Marital status associated consistently with total/somatic care costs: single patients had significantly lower costs than the married/cohabiting. Possibly, close social relationships, spouse and children for the married/cohabiting, and children for the widowed, supported staying in somatic treatment longer. Retired patients were receiving care more often and used care more intensively than others. Unemployed

patients also made great use of care services. It is probable that, at least to some extent, the high care costs of retired and unemployed patients are partly due to the low registered costs of the working patients. In Finland, there is a separate occupational healthcare system only for the employed, and these costs are not included in the present study. However, it is remarkable that unemployed persons had very high total and somatic care costs. In several studies, unemployment is associated with poor physical and mental health [18,19].

Education had no effect on being a service user, but more than the compulsory education years (>8 years) associated with higher costs of care. Education seems to improve adherence to care generally and somatic care specifically because ill health is generally higher in subjects with minimal education [20]. Low costs of care of patients with minimal education raises the question of whether at least part of their illness remains undetected and/or untreated.

It was unexpected that regular use of alcohol associated with low costs of somatic and total care. In a population study, moderate alcohol drinking did not associate with decreased self-rated health and quality of life [21]. Thus, it is possible that although heavy use of alcohol is associated with increased health problems and costs of care [22], the proportion of such use among regular users is so small that the overall effect is to decrease not increase costs of somatic care. However, in line with a previous study [22], regular use of alcohol was associated with increased costs of psychiatric care. Physical activity is an important health-promoting and cost-reducing factor [23]. In the present study, regular physical exercise also associated (not significantly) with lower costs of somatic care.

Costs of psychiatric care

Mental problems are common in PrC patients [2,24], a majority of them being depressive or other affective problems [3,5] and well treatable in PrC. Yet, in Finland only less than 3% of registered PrC visits involve mental health problems [26].

In the present study, about 15% of PrC patients attended psychiatric care, and nearly 13% of all costs were due to psychiatric care, indicating that PrC is an important path to psychiatric care. As expected, depressed patients were more often referred to psychiatric care. However, among those who attended psychiatric care, depressive symptoms did not increase costs of care, indicating that depressed patients recovered relatively soon and did not need psychiatric treatment more than other patients attending psychiatric care.

There were no gender differences in being a psychiatric service user, but women used psychiatric care more intensively than men. On the other hand, elderly patients attended psychiatric care less often, but when they did their costs were relatively high (not significantly, because of low numbers of aged/elderly patients). It seems that men need more intensive psychiatric treatment and the aged patients should have been referred to psychiatric care.

Marital status is an important factor in use of psychiatric care. In single patients, psychiatric symptoms and disorders are frequent [26], thus it is understandable that their costs of psychiatric care and their proportion of total costs were exceptionally high. On the other hand, costs of psychiatric care were exceptionally low in married/cohabiting patients, as well as in those with social contacts, indicating that the social support received from intimate relationships is an important buffer against psychiatric problems [27]. Contrary to most studies [28] and although psychiatric problems are frequent in divorced/separated patients [26], they did not use psychiatric care much. It is possible that among divorced/separated patients, although psychiatric disorders/symptoms are frequent [26], their psychiatric problems were treated in PrC (they stayed longer in somatic care) or they completely dropped out of services.

It is understandable that unemployed patients, who frequently suffer from psychiatric symptoms [18,19], often seek psychiatric care. However, the costs of psychiatric care among the unemployed remained lower than average. They probably did not receive the kind of help they expected and therefore dropped out of psychiatric care.

Advantages and Limitations

To our knowledge, this is the first study to use zero-inflated count regression modelling for estimation of costs of somatic and psychiatric care in patients attending primary care. In the negative binomial part, we were able to estimate the relative costs within the service users, and in the zero-inflated part, odds ratios for not using services. The prospective study design is also a clear advantage of the present study.

The cost data are real costs of visits and hospital days to the service providers. Although the register of costs of care covers the whole population of the healthcare districts, we were not able to estimate the costs of care of the subjects who had moved away from the district, nor the costs of occupational healthcare provided by private services. In 2009, 20% of costs of occupational healthcare was provided by public primary healthcare [29]. The total costs of care for employed people are thus underestimated. Additionally, somatic outpatient care included visits to PrC and to somatic outpatient polyclinics. All PrC visits were regarded as somatic because they could not be separated from PrC visits which were made because of psychiatric problems. However, according to official statistics this proportion is only about 3% [25].

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References

1. Saukkonen S.M., Rintanen H. Terveyskeskuskäynnit vuosina 1985-2006. Official Statistics of Finland. Tilastotiedote 2007; 25. [http://www.stakes.fi/tilastot/tilastotiedotteet/2007/Tt25_07.pdf]
2. Philbrick JT, Connelly JE, Wofford AB. The prevalence of mental disorders in rural office practice. *J Gen Intern Med.* 1996; 11:9-15.
3. Salokangas R. K., Poutanen O., Stengård E. Screening for depression in primary care. Development and validation of the Depression Scale, a screening instrument for depression. *Acta Psychiatr Scand.* 1995; 92:10-16.
4. Jones, J., Amaddeo F., Barbui C., Tansella M. Predicting costs of mental health care: a critical literature review. *Psychol Med.* 2007; 37:467-477.
5. Sloan F.A., Hsieh C.-R. *Health Economics*, MIT Press, Cambridge Massachusetts 2012.
6. Statistics of Finland. http://www.stat.fi/til/khi/2010/12/khi_2010_12_2011-01-14_tau_001_fi.html
7. Mihaylova B., Briggs A., O'Hagan A., Thompson S.G. Review of statistical methods for analysing healthcare resources and costs. *Health Econ.* 2011; 20:897-916.
8. Cameron A.C., Trivedi P.K. *Microeconometrics: Methods and Applications*. Cambridge University Press, New York 2005.

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9. Pohlmeier W., Ulrich V. An econometric model of the two-part decision making process in the demand for health care. *J Hum Res* 1995; 30, 339-361.
 10. Preisser J.S., Stamm J.W., Long D.L., Kincade M.E. Review and recommendations for zero-inflated count regression modeling of dental caries indices in epidemiological studies. *Caries Res*. 2012; 46: 413-23.
 11. Akaike H. Information theory and an extension of the maximum likelihood principle. Pages 610-624. in S. Kotz, and N. L. Johnson (Eds.) *Breakthroughs in statistics*, Vol. 1. Springer-Verlag, London 1992.
 12. Vuong Q.H. Likelihood Ratio Tests for Model Selection and non-nested Hypotheses. *Econometrica* 1989; 57: 307-333.
 13. Lee J.-H., Han G., Fulp W.J., Giuliano A.R. Analysis of overdispersed count data: application to the Human Papillomavirus Infection in Men (HIM) Study. *Epidemiol Infect*. 2012; 140: 1087-1094.
 14. Elha, J.D., Patrick S.L., Anderson S., Simons, J.S., Frueh B.C. Gender- and trauma-related predictors of use of mental health treatment services among primary care patients. *Psychiatric services*. 2006; 57: 1505-1509.
 15. Baghban A.A., Pourhoseingholi A., Zayeri F., Ashtari S., Zali M.R. Zero inflated statistical count models for analysing the costs imposed by GERD and dyspepsia. *Arab J Gastroenterol*. 2013; 14: 165-168.
 16. Smith G.R. Jr, Monson R.A., Ray D.C. Patients with multiple unexplained symptoms. Their characteristics, functional health, and health care utilization. *Arch Intern Med*. 1986; 146:69-72.
 17. Rief W., Mewes R., Martin A., Glaesmer H., Braehler E. Are psychological features useful in classifying patients with somatic symptoms? *Psychosom Med*. 2010; 72: 648-655.
 18. Schwefel D. Unemployment, health and health services in German-speaking countries. *Soc Sci Med*. 1986; 22: 409-430.
 19. Wanberg C.R. The individual experience of unemployment. *Annu Rev Psychol*. 2012; 63: 369-396.
 20. van den Berg T., Schuring M., Avendano M., Mackenbach J., Burdorf A. The impact of ill health on exit from paid employment in Europe among older workers. *Occup Environ Med*. 2010; 67: 845-852.
 21. Saarni S.I., Joutsenniemi K., Koskinen S., Suvisaari J., Pirkola S., Sintonen H., Poikolainen K., Lönnqvist J. Alcohol consumption, abstaining, health utility, and quality of life - a general population survey in Finland. *Alcohol Alcohol*. 2008; 43: 376-386.
 22. Odlaug B.L., Gual A., DeCourcy J., Perry R., Pike J., Heron L., Rehm J. Alcohol Dependence, Co-occurring Conditions and Attributable Burden. *Alcohol Alcohol*. 2015 Aug 4. pii: agv088. [Epub ahead of print]
 23. Oldridge N.B. Economic burden of physical inactivity: healthcare costs associated with cardiovascular disease. *Eur J Cardiovasc Prev Rehabil*. 2008; 15: 130-139.
 24. Lefevre F., Reifler D., Lee P., Sbenge M., Nwadiaro N., Verma S., Yarnold P.R. Screening for undetected mental disorders in high utilizers of primary care services. *Gen Intern Med*. 1999; 14: 425-431.
 25. Rautiainen H., Pelanteri S. *Psykiatrinen erikoissairaanhoito 2010*. Official Statistics of Finland 2012. http://www.stakes.fi/tilastot/tilastotiedotteet/2012/Tr03_12.pdf
 26. Kendler K.S., Gallagher T.J., Abelson J.M., Kessler R.C. Lifetime prevalence, demographic risk factors, and diagnostic validity of nonaffective psychosis as assessed in a US community sample. The National Comorbidity Survey. *Arch Gen Psychiatry*. 1996; 53: 1022-1031.

27. ten Have M., Vollebergh W., Bijl R., Ormel J. Combined effect of mental disorder and low social support on care service use for mental health problems in the Dutch general population. *Psychol Med.* 2002; 32: 311-323.
28. Twomey C.D., Baldwin D.S., Hopfe M., Cieza A. A systematic review of the predictors of health service utilisation by adults with mental disorders in the UK. *BMJ Open.* 2015; 6: 5. doi: 10.1136/bmjopen-2015-007575.
29. Hujanen T., Mikkola H. Työterveyshuollon palvelujen kustannusten alueelliset erot. *Nettityöpapereita 2013*; 42. [<https://helda.helsinki.fi/bitstream/handle/10138/38194/Nettityopapereita42.pdf?sequence=1>]

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