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INFLUENCE OF COGNITIVE AND MOTOR ABILITIES ON THE LEVEL OF CURRENT FUNCTIONING IN PEOPLE WITH MULTIPLE SCLEROSIS

VPLIV KOGNITIVNIH IN MOTORIČNIH SPOSOBNOSTI NA STOPNJI TRENUTNEGA DELOVANJA PRI OSEBAH Z MULTIPLO SKLEROZO

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ABSTRACT

Introduction: Multiple sclerosis (MS) results in a wide range of disabilities. The effects of cognitive and motor dysfunctions are significant and affect level of functioning in people with MS.

Objective: The aim of the research was to determine the common contribution of neurological, motor and cognitive status to the overall functioning of MS patients.

Method: The sample consisted of 108 subjects with RRMS. The instruments used in the research included: The General Questionnaire, the World Health Organization Disability Assessment Schedule, the Audio Recorded Cognitive Screen, Paced Auditory Serial Addition Test, the Nine Hole Peg Test, the 25 Foot Walk Test, and the Expanded Disability Status Scale.

Results: Subjects with a mild neurological deficit had a higher level of current functioning in all domains (a lower WHODAS 2.0 score) than subjects with a moderate neurological deficit ($r=0.43$, $p<0.001$). We found a positive correlation between the level of cognitive impairment and motor deficits of both upper and lower extremities and the level of neurological deficit ($p<0.001$). Subjects with lower neurological deficits had significantly lower WHODAS 2.0. scores, i.e. better motor abilities of both upper and lower extremities than subjects with moderate neurological deficits ($p<0.001$). The greatest contribution to explaining the overall level of current functioning of people with MS had subjects' age, cognitive abilities and motor abilities of the upper extremities.

Conclusion: Inverse relationship of neurological, motor and cognitive status affects the overall daily functioning of people with MS, requiring planning of comprehensive programs in the rehabilitation of people with MS.

Keywords:
multiple sclerosis, motor abilities, cognitive abilities, functional status

IZVLEČEK

Uvod: *Multipla skleroza (MS) se kaže v širokem naboru nezmožnosti. Učinki kognitivnih in motoričnih nezmožnosti so znatni in vplivajo na stopnjo delovanja pri osebah z MS.*

Namen: *Cilj raziskave je določiti pogost doprinos nevrološkega, motoričnega in kognitivnega statusa k splošnemu delovanju bolnikov z MS.*

Metode: *Vzorec je vključeval 108 oseb z RRMS. Orodja, ki so bila uporabljena v raziskavi, so naslednja: Splošni vprašalnik (General Questionnaire), Lestvica ocenjevanja zmanjšanih zmožnosti (WHODAS), presejalni test Audio Recorded Cognitive Screen (ARCS), test Paced Auditory Serial Addition Test (PASAT), Test devetih zatičev (Nine Hole Peg Test), test časovno omejene hoje 25 Foot Walk Test in Razširjena lestvica stopnje prizadetosti (Expanded Disability Status Scale, EDSS).*

Rezultati: *Osebe z blago obliko nevrološke pomanjkljivosti so pokazale višjo stopnjo trenutnega delovanja na vseh področjih (nižji rezultat WHODAS 2.0) kot osebe z zmerno nevrološko pomanjkljivostjo ($r = 0,43$, $p < 0,001$). Med stopnjami kognitivne prizadetosti in motorične pomanjkljivosti obeh zgornjih in spodnjih okončin ter stopnjo nevrološke pomanjkljivosti smo odkrili pozitivno korelacijo ($p < 0,001$). Osebe z nižjo nevrološko pomanjkljivostjo so imele občutno nižje rezultate vprašalnika WHODAS 2.0, tj. boljše motorične sposobnosti obeh zgornjih in spodnjih okončin kot osebe z zmerno nevrološko pomanjkljivostjo ($p < 0,001$). Največji doprinos k pojasnjevanju splošne stopnje trenutnega delovanja oseb z MS so imele starost oseb, njihove kognitivne sposobnosti in motorične sposobnosti zgornjih okončin.*

Zaključek: *Inverzni odnos nevrološkega, motoričnega in kognitivnega statusa splošno vpliva na vsakodnevno delovanje oseb z MS, zahteva načrtovanje celostnih programov pri rehabilitaciji oseb z MS.*

Ključne besede:
multipla skleroza, motorične sposobnosti, kognitivne sposobnosti, status delovanja

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1 INTRODUCTION

Multiple sclerosis (MS) is a chronic, demyelinating, and degenerative disease of the central nervous system (CNS). It can be said that the disease has a "thousand images" because it affects many functions and results in a wide spectrum of disabilities (1). According to Kurtzke's latest global MS prevalence scale, in most of Europe it has a moderate prevalence (38–70/100.000 of the population) (2) occurring in the 20–40-year age group (3). It is a challenge for researchers, doctors and other members of healthcare teams to understand how to treat people with MS.

As a result of the disease, many symptoms can occur that manifest in cognitive and motor impairments, the effects of which are great and affect functioning of people with MS. It is only when they become noticeable that rehabilitation strategies are employed in treating deficits. In the management itself, over 30% of people with MS report the need for a multidisciplinary approach (4). Although most MS symptoms can be objectively evaluated, very often they are based on the patient's subjective sense of illness (5). Problems that are not recognized timely may reduce the overall functioning of the patient and lead to serious consequences. Ten years after the diagnosis, 50–80% of the patients will no longer work (6) or have mood impairments, which will all affect the performance of their daily living activities (7).

Difficulties with cognitive functioning can become a significant problem affecting both the patient and his/her family members (8). Research has shown that the presence of cognitive impairment is a significant source of social disability (9, 10). Cognitive impairment is present in up to 65% of people with MS (1). Severity and type of cognitive impairment are individual. Cognitive dysfunction can develop at any time during the course of MS, regardless of the form of the disease, and may be associated with both mild and severe neurological deficits (11–14). People with MS with cognitive impairment usually less frequently participate in social activities and require more personal support than those with the same level of motor problems who are cognitively preserved (1). People with MS are less physically active compared to the general population (15, 16) and, therefore, a person with low level of physical activity is considered to have a sedentary lifestyle (17). Mobility problems lead to reduced activity (overall participation), while maintained mobility (walking ability) facilitates performance of daily activities and social activities with family and friends (18). Very often, patients themselves notice their reduced capacity for walking (19). Progression of the disease further worsens and reduces speed of gait, as a result of increased spasticity and other indicators of impaired motor control (20). With time, people with MS recognize difficulties in different motor skills involved to perform daily activities, such as, for example, climbing the stairs (19).

Furthermore, manual skills are considered essential for successful performance of daily tasks (21). Having problems in this field, the patient's level of independence in everyday activities, social participation and the overall quality of life are reduced (22).

MS is an unpredictable disease and it is a challenge for patients to cope with unstable and uncertain disease courses and reduced functional ability. Therefore, early recognition of symptoms and early intervention are very important. The primary objective of our research was to determine common contribution of neurological, cognitive and motor status on the overall functioning of MS patients.

2 METHOD

2.1 Participants

The sample consisted of 108 subjects diagnosed with MS aged 20–53 (Mean=39.86 years, SD=8.20 years).

The inclusion criteria were: the diagnosis of MS based on McDonald's criteria (23), relapsing-remitting form of the disease (RR MS), age 18–55 years, and EDSS score (24) 0–5.5.

Time from the diagnosis ranged from 1 to 26 years. A detailed overview of the demographic characteristics of the sample is shown in Table 1.

Table 1. Demographics of the study sample.

		Frequency	%
Gender	Male	38	35.2
	Female	70	64.8
Living arrangement	With parents	19	21.8
	With relatives	1	1.1
	Alone	8	9.2
	With a partner	11	12.6
	With partner and child/ren	46	52.9
	Alone with child/ren	2	2.3
Other's support	No	78	72.2
	Yes	30	27.8
Residence	Urban	70	64.8
	Rural	38	35.2
Marital status	Single	26	24.5
	Married	69	65.1
	Separated	2	1.9
	Divorced	5	4.7
	Nonmarital cohabitation	4	3.8
Work status	Full-time	26	24.3
	Part-time	4	3.7
	Freelance	2	1.9
	Student	3	2.8
	Retired	47	43.9
	Unemployed due to illness	12	11.2
	Unemployed for other reasons	12	11.2

2.2 Instruments

The current functioning was assessed using the 36-item self-reporting version of the World Health Organization Disability Assessment Schedule (WHODAS 2.0) (27), which covers the following six domains: Cognition, Mobility, Self-care, Getting along, Life activities, Participation.
Motor function was evaluated using the 9 Hole Peg Test (9HPT) and the 25 Foot Walk Test (25 FWT). The 9HPT possesses good validity and sensitivity in detection of even the slightest impairments in function of the arm (28, 29) and was, therefore, chosen to assess manual dexterity, and it represents a good measure of defining the degree of dysfunction of upper extremities. The 25 FWT evaluates the function of lower extremities and gait and is a good instrument for the assessment of gait in MS patients (30).

Cognitive abilities were assessed using two instruments. The Audio Recorded Cognitive Screen (ARCS) (31) is a screening instrument used to detect cognitive impairment or dementia. The components of the ARCS statistically significantly correlate with conventional neuropsychological tests. The ARCS has a good validity and reliability (31), as well as excellent sensitivity (92%) and specificity. The other instrument used was the Auditory Serial Addition Test – PASAT (32), which measures cognitive function in the sense of auditory information processing speed, attention, and calculation ability.

Neurological deficit was evaluated using the Expanded Disability Status Scale (EDSS) (24). On the basis of EDSS scores, all subjects were divided into three groups: without neurological deficits (EDSS 0–1.5) – 22 subjects (20.4%); mild neurological deficits (EDSS 2–3.5) – 61 subjects (56.5%); and moderate neurological deficits (EDSS 4–5.5) – 25 subjects (23.1%).

2.3. Statistical Analysis

All statistical data analyses were performed using SPSS Statistics for Windows, Version 21.0. We used descriptive statistics, Pearson correlation coefficient and Hierarchical regression analysis. Also, a multiple regression analysis was used to verify the relationship between EDSS subscales and the results to WHODAS. T-test and one-way ANOVA were used to test group differences. Hierarchical regression analysis was used in order to determine the effect of predictors on functioning of subjects with MS. We used a step-by-step approach; in the first stage, the socio-demographic predictors were entered; then, in each further stage, one pre-correction variable was included in the model. In the second stage, the scores from the PASAT test were used as predictors, in the third ARCS performance scores, in the fourth step the new neurological deficit was included as a predictor variable and, in the last two stages, estimates of the motor status of the upper and lower extremities were consecutively included.
The missing data treatment was performed using k-nearest neighbour model in R, which occurred only among a few examinees. To calculate effect size within the model, we used an effect size calculator for hierarchical multiple regression (25), after which we calculated post-hoc statistical power for HMA (26).

The statistical significance of each independent variable was obtained using beta coefficients and values $p<0.05$ were considered statistically significant.

3 RESULTS

The socio-demographic variables were an important segment in the results. In our sample, most subjects (69.5%) earned their income through salaries and pensions. As regards social activities, the largest number of subjects (86%) did not have a hobby. The WHODAS 2.0 scores showed that our subjects had the most problems in the domains of Participation, Mobility, Life Activities (Domestic) and Cognition (Table 2). The least problems were reported in the domain of Self-Care.

Table 2. WHODAS 2.0 total score and individual domain scores.

Characteristic	N	Min	Max	Mean	SD	Skewness	Kurtosis
Cognition	108	0	100.00	23.90	24.27	0.97	0.02
Mobility	108	0	100.00	26.45	23.14	0.74	0.03
Self-care	108	0	75.00	9.25	16.17	2.16	4.37
Getting along	108	0	75.00	16,03	20.07	1.40	1.11
Life activities - domestic responsibilities	108	0	100.00	25.99	23.71	0.83	0.39
Life activities - leisure, work and school	84	0	68.75	13.20	12.16	1.64	4.68
Life activities	108	0	81.25	22.12	18.44	0.90	0.56
Participation	108	0	84.38	28.12	19.46	0.78	0.17
WHODAS 2.0 score	108	0	65.97	21.19	15.40	0.81	0.04

Age has a low to moderate positive correlation with the total WHODAS 2.0 score (r=0.27, p<0.05) and the domains of Participation (r=0.19, p<0.05), Self-Care (r=0.25, p<0.01), Life Activities (r=0.21, p<0.05) and Getting Along (r=0.35, p<0.01), indicating that older subjects had more difficulties in the specified domains, i.e. they had higher WHODAS 2.0 scores in these domains. The time passed since diagnosis has a low but significant positive correlation with the domains Getting Along (r=0.29, p<0.01), Participation (r=0.21, p<0.05), and the total WHODAS 2.0 score (r=0.28, p<0.01).

The average achievement on the 9HPT, performed with the dominant hand, was 22.69 seconds (SD=9.90), and with the non-dominant hand it was 24.92 (SD=9.48 seconds). On average, male subjects had worse results with the dominant hand compared with the norm for the general population by 7.62 seconds, while the deviation in women was 3.99 seconds. Poorer achievement on the 9HPT was recorded in subjects with longer disease duration (r=0.27, p<0.001) and in older subjects (r=0.31, p=0<0.001), but with very low correlations.

The average value on the 25FWT was 5.49 (SD=2.81 seconds). Again, there was a statistically significant positive but low correlation with disease duration (r=0.36, p<0.001) and age (r =0.24, p<0.001).

The average score for all subjects on the PASAT was 43.52 (SD=19.84); 21 (19.4%) subjects had problems in cognitive functioning. The ARCS showed that 38.3% of subjects fell into the cognitive impairment category, and another 37 (34.6%) had deficits of a single function, i.e. visuospatial abilities. The subjects with cognitive deficits were older (t=-2.91, p<0.001) and/or with longer disease duration (t=-2.82, p<0.001).

We confirmed our assumption that there was a low negative but significant correlation between the level of current functioning as measured by the WHODAS 2.0 and the level of EDSS score in patients with MS (r=0.34, p<0.001). The results showed a significant difference between the three groups of subjects categorized according to neurological deficits in relation to the WHODAS 2.0 attainment test (F=8.92, p<0.001). The findings suggested that subjects without neurological deficits had significantly lower scores (Mean=13.62, SD=12.03) on the WHODAS 2.0 compared to subjects with moderate neurological deficits (Mean=30.85, SD=16.13). In addition, the difference between subjects with mild neurological deficits (Mean=19.96, SD=14.37) and those with moderate neurological deficits was also significant. Subjects with mild neurological deficits had a better functional status than subjects with pronounced neurological deficits.

When we analysed all the EDSS subscales together, we found these subscales to be significant predictors of WHODAS 2.0 scores (R^2=0.233, F=3.297, p<0.01), significant partial contributions to the prediction of the WHODAS 2.0 score for the functions of the pyramidal system (β =0.34, p<0.05) and the bladder and the bowels (β=0.24, p<0.05). The higher scores for these functions were associated with poorer current functioning.

The second assumption of our research was that there was a positive correlation between the level of cognitive impairment and the level of neurological deficits in patients with MS. There was a significant but low negative correlation between the EDSS and PASAT scores (r=-0.25, p<0.001). Higher scores on the EDSS were associated with lower PASAT scores. The same finding was obtained for the ARCS (r=-0.34, p<0.001).

The association between cognitive and motor abilities and the current functioning of our subjects was tested with the Pearson coefficient of linear correlation. The total ARCS, 9HPT and 25FWT scores significantly correlated with all WHODAS 2.0 domains and total score, except for the domain that identifies difficulties in life activities – work/school (Table 3). These correlations range from weak to moderate, indicating that the level of achievement in WHODAS 2.0 scales is negatively correlated with ARCS score and positively correlated with the motor abilities of upper and lower extremities.

Table 3. Correlation between cognitive and motor functioning and WHODAS 2.0 domains and total score.

WHODAS 2.0	ARCS score	9 HPT	25 FWT
Cognition	-0.31**	0.31**	0.27**
Mobility	-0.34**	0.56**	0.51**
Self-care	-0.28**	0.43**	0.30**
Getting along	-0.25**	0.34**	0.32**
Life activities	-0.24*	0.43**	0.32**
Life activities - domestic responsibilities	-0.29**	0.51**	0.36**
Life activities - leisure, work and school	-0.03	0.00	-0.00
Participation	-0.23*	0.35**	0.38**
WHODAS 2.0 score	-0.34**	0.48**	0.42**

** Correlation significant at p<0.01

* Correlation significant at p<0.05

In order to examine the common contribution of all predictor variables in explaining the overall functioning of MS patients, a hierarchical regression analysis was employed (Table 4). Models were constructed by firstly introducing socio-demographic variables and then individual variables of all studied domains (models are explained in method section).

Table 4. Hierarchical regression analysis: dependent variable – functioning of subjects.

Model	R	R^2	F	p	beta	p	95% CI
Step 1.	0.35	0.12	2.82	0.03			
AGE					0.24	0.03	0.51;2.66
Step 2.	0.51	0.26	5.40	0.00			
PASAT					-0.39	0.00	-23.94;-6.13
Step 3.	0.56	0.32	6.05	0.00			
PASAT					-0.32	0.00	-21.02;-3.56
ARCS					-0.26	0.00	-21.41;-4.70
Step 4.	0.57	0.32	5.23	0.00			
PASAT					-0.32	0.00	-19.74;2.77
ARCS					-0.25	0.01	-18.67;-2.06
Step 5.	0.65	0.43	7.09	0.00			
PASAT					-0.29	0.00	-18.09;-1.80
9HPT					0.40	0.00	-26.89;-6.59
Step 6.	0.66	0.43	6.25	0.00			
PASAT					-0.29	0.00	-17.90;-1.62
9HPT					0.39	0.00	-25.38;-3.88

Model 1: sociodemographic variables
Model 2: sociodemographic variables and PASAT
Model 3: sociodemographic variables, PASAT and ARCS
Model 4: sociodemographic variables, PASAT, ARCS and EDSS
Model 5: sociodemographic variables, PASAT, ARCS, EDSS and 9HPT
Model 6: sociodemographic variables, PASAT, ARCS, EDSS, 9HPT and 25FWT

Individual contributions of only statistically significant predictors are shown.

We used hierarchical regression analysis in order to determine the effect of a set of predictor variables on the functionality of people with MS. In the first step, we tested the predictive contribution of socio-demographic variables. The results show that socio-demographic variables explained 12% of the variance in the functioning of our subjects. By analysing the individual contributions of socio-demographic variables, it was found that only age had a significant contribution. With more advanced age, subjects had, i.e. lower level of overall functioning. In the second step, we added the PASAT variable, which led to a significant change in the explanation of the variance of social participation and explained 26% of the variance. When we consider contribution at an individual level within the model in step 2, we can see that the contribution of age is lost, whereas only cognitive abilities measured by the PASAT test have a significant predictor role.

In the third step, the ARCS total score model was included, changing the percentage of explained variance significantly, whereas PASAT and ARCS became the only predictors of the level of overall functioning of our subjects. The scores on both cognitive tests negatively correlated with the WHODAS 2.0 score, i.e. it was confirmed that a lower cognitive status was associated with a lower level of overall functioning of people with MS.

In the fourth step of analysis, we introduced the level of neurological deficit (EDSS score) as a predictor. The observed change in the prediction of the level of

functioning was not significant, and the percentage of the explained variance increased to 32%. Cognitive ability scores remained the only significant predictors.

In the fifth step, the score of motor abilities of the upper extremities was added. The observed change in the prediction of the level of functioning was significant, and the percentage of the explained variance rose to 43%. Significant variables noticed in this model were cognitive abilities, as assessed by the PASAT, and the motor function of upper extremities. The other predictors were not significant.

In the final model, the lower extremity motor function was added – the percentage of the explained variance remained the same, as well as the predictors of functioning.

Cohen's f2 effect size for our model was 0.75. Statistical power was tested post hoc, i.e. after performing analysis. For an effect size of 0.75, with a significance p-level of .05, and 108 participants, observed statistical power for our model was 0.99.

4 DISCUSSION

In our research, it was found that the domains most commonly affected in MS patients are participation, mobility, life activities and cognition. Each of the domains will be discussed separately and then the interdependent relationship between the functioning domains of this population will be compiled.

Social life and social participation are influenced by physical, social, environmental and personal factors (33). Changes that occur within the course of the main disease are dynamic. After they have been diagnosed with MS, people tend to experience fear, uncertainty, social isolation from friends and changes in the quality of life (34, 35). In this context, it is important to discuss a few, in our opinion, most important findings. Given that our subjects did not have severe disabilities and considering the age structure of the sample, it is worrying that only 32 subjects were employed and 47 (43.9%) had already been retired due to MS. Regardless of the severity of neurological deficits, it is necessary to provide a support system for the patients in order for them to maintain active participation in society. Already in the last century it was found that the functional damage that is common in MS included difficulties in independent purchasing, home maintenance, clothing, driving and using public transport (36), which consequently reduced the level of social participation. Nearly 30% of our subjects had support and help in everyday activities.

The total WHODAS 2.0 score in our study was 21.19, which indicates that disability was not a pronounced problem in our subjects. In an Italian study, the total WHODAS 2.0 score was 22.93 for persons with disabilities (37). We can conclude that with disease progression the WHODAS 2.0 score rises.

In our study, on the WHODAS 2.0, subjects had the most difficulties in the domains of Participation, Mobility and Life Activities (domestic responsibilities) and the least difficulties in the domain of Self-Care. Considering that the scores grouped around higher values, we can conclude that our subjects had not yet developed a disability that would have interfered with their overall functioning. Of significance is the finding that less severe neurological deficits were associated with a higher level of functioning, indicating that the dimensions of neurological status are predictors of patients' functioning in different domains of life. This finding is in accordance with current literature data (38). We also confirmed that there were significant differences between subjects without, with mild and moderate neurological deficits with regard to level of functioning, thereby proving the initial hypothesis of our research that with progression of MS the overall functioning of the patients decreases. Previous studies have shown that transition of the EDSS score from 1.0–3.0 to 3.5–5.5 significantly affects all aspects of functioning (39) and that, therefore, the patients require support in these processes.

Manual abilities and gait are significant predictors of perceived difficulties in daily activities in patients with MS who do not have motility problems (40). According to Lamers and associates (41), the general muscular strength of the upper extremities is strongly associated with the 9HPT measures of the capacity of upper extremities, and damage to bodily functions and structures and the level of disability of upper extremities are strongly associated with participation in community. Given that with advanced age and longer disease duration motor abilities worsen, it is necessary to integrate their screening into MS management protocols. Similar findings were reported by the authors of a Swedish study (42). They found that better results on the 9HPT were associated with a higher level of social participation and that gait and manual skills had a better discriminatory and predictive value than cognitive measures.

In our study, we also confirmed that cognitive impairment is registered in older subjects and in subjects with longer disease duration, which points to the importance of screening cognitive abilities after the diagnosis of MS has been established. The overall prevalence of cognitive dysfunction in our subjects was similar to those in other published studies, i.e. up to 70% (1). However, the significant negative correlation we obtained between the total EDSS score and the cognitive function measures should be considered with caution, since it is not always the case.

It has long been established that MS patients with cognitive impairment less frequently participate in social activities compared with those with only motor disability (9). Considering the costs that such monitoring implies, contemporary science offers a potential solution; use of computerized assessment techniques such as ARCS.

In this study, we tested the significant contribution of predictor variables in explaining the degree of current functioning and found that age and performance on cognitive ability tests, the upper extremity ability test and gait test are significant predictor variables, while neurological deficit itself, as measured by the EDSS, is not a significant predictor of the overall functioning in people with MS.

5 CONCLUSION

Since interdependence of neurological, motor and cognitive status of MS patients affects the overall daily functioning, comprehensive rehabilitation program and psychosocial support for patients with MS should be carefully planned.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

FUNDING

The study has received no funding.

ETHICAL APPROVAL

The research was approved by the Ethics Committee of the Clinical Centre of Vojvodina and the Ethics Committee of the University of Novi Sad, Faculty of Medicine.

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PREVALENCE OF AND FACTORS ASSOCIATED WITH HEALTHCARE-ASSOCIATED INFECTIONS IN SLOVENIAN ACUTE CARE HOSPITALS: RESULTS OF THE THIRD NATIONAL SURVEY

PREVALENCA IN DEJAVNIKI, POVEZANI Z BOLNIŠNIČNIMI OKUŽBAMI V SLOVENSKIH BOLNIŠNICAH ZA AKUTNO OSKRBO: REZULTATI TRETJE NACIONALNE PRESEČNE RAZISKAVE

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ABSTRACT

Introduction: In the third Slovenian national healthcare-associated infections (HAIs) prevalence survey, conducted within the European point prevalence survey of HAIs and antimicrobial use in acute care hospitals, we estimated the prevalence of all types of HAIs and identified factors associated with them.

Methods: Patients were enrolled into a one-day cross-sectional study in November 2017. Descriptive analyses were performed to describe the characteristics of patients, their exposure to invasive procedures and the prevalence of different types of HAIs. Univariate and multivariate analyses of association of having at least one HAI with possible risk factors were performed to identify risk factors.

Results: Among 5,743 patients, 4.4% had at least one HAI and an additional 2.2% were still treated for HAIs on the day of the survey, with a prevalence of HAIs of 6.6%. The prevalence of pneumoniae was the highest (1.8%), followed by surgical site infections (1.5%) and urinary tract infections (1.2%). Prevalence of blood stream infections was 0.3%. In intensive care units (ICUs), the prevalence of patients with at least one HAI was 30.6%. Factors associated with HAIs included central vascular catheter (adjusted odds ratio [aOR] 4.1; 95% confidence intervals [CI]: 3.1–5.4), peripheral vascular catheter (aOR 3.0; 95% CI: 2.3–3.9), urinary catheter (aOR 1.8; 95% CI: 1.4–2.3).

Conclusions: The prevalence of HAIs in Slovenian acute care hospitals in 2017 was substantial, especially in ICUs. HAIs prevention and control is an important public health priority. National surveillance of HAIs in ICUs should be developed to support evidence-based prevention and control.

Keywords:
healthcare-associated infections, prevalence, survey, risk factors, Slovenia

IZVLEČEK

Izhodišča: *Tretja slovenska nacionalna presečna raziskava bolnišničnih okužb (BO) je potekala v okviru evropske presečne raziskave okužb, povezanih z zdravstvom in uporabe protimikrobnih zdravil v bolnišnicah za akutno oskrbo. Naši cilji so bili oceniti prevalenco vseh vrst BO in opredeliti dejavnike, ki so povezani z BO.*

Metode: *V enodnevno presečno raziskavo smo vključili vse bolnike, ki so bili na izbrani dan v novembru 2017 zdravljeni v slovenskih bolnišnicah za akutno oskrbo. Z deskriptivnimi analizami smo opisali značilnosti bolnikov, izpostavljenost invazivnim posegom in ocenili prevalenco različnih vrst BO. Z univariatnimi in multivariatnimi analizami povezanosti BO z možnimi dejavniki tveganja smo opredelili dejavnike tveganja.*

Rezultati: *Na dan raziskave je imelo BO 4,4 % (95 % interval zaupanja (IZ): 3,9 %-4,9 %) bolnikov in dodatnih 2,2 % (95% IZ: 1,8 %-2,6 %) bolnikov je bilo še vedno zdravljenih zaradi BO, torej je imelo BO 6,6 % (95% IZ: 6,0 %-7,3 %) bolnikov oziroma je bila prevalenca BO 6,6 %. Na 100 bolnikov je bilo 7,1 epizod BO, ker so nekateri bolniki imeli več kot eno epizodo. Najvišja je bila prevalenca pljučnic (1,8 %), sledile so okužbe kirurške rane (1,5 %) in okužbe sečil (1,2 %). Prevalenca okužb krvi je bila 0,3 %. Delež bolnikov z vsaj eno BO je bil najvišji v enotah za intenzivno zdravljenje (30,6 %). Na 100 bolnikov v enotah za intenzivno zdravljenje je bilo 38,3 epizod BO. V primerjavi z bolniki brez različnih invazivnih posegov so imeli bolniki s centralnim žilnim katetrom 4,1-krat višji obet BO (prilagojeno razmerje obetov (pRO) 4,1; 95 % interval zaupanja (IZ): 3,1-5,4), bolniki s perifernim žilnim katetrom 3,0-krat višji obet BO (pRO 3,0; 95 % IZ: 2,3-3,9), bolniki z urinskim katetrom 1,8-krat višji obet BO (pRO 1,8; 95 % IZ: 1,4-2,3) in bolniki z operacijo v času hospitalizacije 1,6-krat višji obet BO (pRO 1,6; 95% IZ: 1,2-2,0).*

Zaključki: *Prevalenca BO v slovenskih bolnišnicah za akutno oskrbo je bila v letu 2017 precejšnja. Predvsem je bila visoka v enotah za intenzivno zdravljenje. Preprečevanje in obvladovanje BO je pomembna javnozdravstvena prednostna naloga. Za preprečevanje in obvladovanje BO, ki temelji na dokazih, je treba vzpostaviti nacionalno epidemiološko spremljanje BO tudi v enotah za intenzivno zdravljenje.*

Ključne besede:
okužbe, povezane z zdravstvom, prevalenca, presečna raziskava, dejavniki tveganja, Slovenija

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1 INTRODUCTION

Healthcare-associated infections (HAIs) represent a problem for patient safety and their impact implies prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobials, additional financial burdens, an excess of deaths, high costs for healthcare systems and emotional stress for patients and their families (1). More than half of certain types of HAIs are considered preventable with comprehensive evidence-based prevention strategies (2).

In the second Slovenian national HAIs prevalence survey (SNHPS II), conducted in October 2011 in all acute care hospitals, we estimated that on the day of the survey 3.8% (95% confidence interval [CI]: 3.3%–4.4%) of patients had at least one HAI and an additional 2.6% (95% CI: 2.1%–3.0%) were still on treatment because of at least one HAI (not present on the day of the survey), corresponding to overall HAIs prevalence of 6.4% (95% CI: 5.7%–7.0%) (3). As 36 of 358 patients with at least one HAI had more than one HAI, there were 7.0 episodes of HAIs per 100 patients (3).

The third Slovenian national HAIs prevalence survey (SNHPS III) was conducted in 2017 within the second European Point prevalence survey (EU PPS II) of HAIs and antimicrobial use in acute care hospitals of the European Union (EU) and European Economic Area (EEA) under the coordination of the European Centre for Disease Prevention and Control (ECDC).

The objective of this paper is to describe the characteristics of patients, their exposure to invasive procedures and to report the estimated prevalence of different types of HAIs, microorganisms identified and association of potential risk factors with HAIs in Slovenian acute care hospitals in 2017 and compare them to the corresponding estimates in 2011.

2 METHODS

2.1 Survey Design and Data Collection

A cross-sectional study (one-day prevalence survey) was conducted in all Slovenian acute care hospitals. The SNHPS III protocol had been adapted from the EU PPS protocol (version 5.3) (4) to ensure comparability of our results with other EU/EEA countries participating in EU PPS II and with the results of the SNHPS II conducted in 2011. Data was collected during the period from 13th to 30th November 2017 by trained teams led by SNHPS III coordinators for data collection in individual hospitals. One hospital collected data on 10th January 2018. Patients from all wards, including long-term care and acute psychiatric wards, were included, while patients from accident and emergency departments (except, if monitored for >24 hours) were excluded. Patients were included, if they were admitted to the ward before or at 8:00 am and not yet discharged from the ward at the time of the survey and neonates and their mothers were included, if born before or at 8:00 am on the day of the survey. We also excluded patients undergoing same day treatment or surgery, those seen at outpatient departments and outpatient dialysis patients.

Standard information was collected for all eligible patients. It included age, sex, admission date, date of data collection (survey date), and ward specialty. Patients were classified using the McCabe criteria into three categories: non-fatal disease (expected survival >5 years), ultimately fatal disease (expected survival 1–4 years), and rapidly fatal disease (expected death within 1 year) (5). Exposures to indwelling devices (central vascular catheter, peripheral vascular catheter, urinary catheter and intubation) on the day of the survey and surgical procedures during current hospitalisation were recorded. All types of HAIs were identified by reviewing all medical records available at the time of the survey and through consultations with attending physicians and nurses. We used European standard surveillance definitions for different types of HAIs (4). In contrast to the ECDC EU PPS II protocol, we have collected the data so that we were able to distinguish between patients with HAIs present on the day of the survey and those still receiving treatment on the day of the survey for previous HAIs. The onset of the signs and/or symptoms suggestive of a HAI was on day 3 of the current admission or later (day 1 was the day of admission). Infections present at admission or occurring on day 1 or day 2 or still being treated on day 1 or day 2 were also counted as HAIs, if fulfilling the HAIs surveillance definitions and additional criteria. These were: (a) if the patient has been discharged from acute care hospital less than two days before re-admission; (b) when the patient had surgical site infection and surgery within 30 days before the survey (or if deep or organ/space surgical site infection and implant within 90 days before the survey); (c) in case of a *Clostridium difficile* infection, when the patient had been discharged from acute care hospital less than 28 days before the current admission; and (d) if an invasive device was placed on day 1 or day 2 and that resulted in a HAI. We collected data on the microorganisms causing HAIs available at the time of the survey (4).

2.2 Data Management and Analysis

Completed data collection forms were checked for possible errors, missing information and inconsistencies. SNHPS III hospital coordinators were approached for clarifications and to obtain missing information. Data was double entered using inhouse developed web-based (HTML, JavaScript, Apache Tomcat and MySQL) data entry solutions, featuring code range and filter checks. Discrepancies due to entry mistakes were checked against the information on data collection forms and corrected.

Descriptive analyses were performed using the statistical software Stata (Version 11.2, StataCorp, College Station, Texas, USA). Characteristics of patients and their exposure to invasive procedures, including surgery, were described. The prevalence of HAIs was defined as the number of patients with at least one HAI present on the day of the survey (signs and/or symptoms) or still receiving treatment for HAIs on the day of the survey (previously present signs and/or symptoms of HAIs). The proportion of patients with at least one HAI (overall prevalence) and the prevalence of different types of HAIs were computed (overall and according to ward specialties). In addition, since some patients had more than one HAI, the ratio of episodes of HAIs per 100 patients was computed.

Univariate and multivariate analyses of association of any HAI acquired during current hospitalisation with selected risk factors were performed. Univariate analyses were first performed using the classical method for analyses of the 2×k contingency tables and then repeated using logistic regression. Maximum likelihood estimates of odds ratios (ORs) together with 95% CIs and results of likelihood ratio tests for significance were computed. Risk factors that were found to be significantly associated with any HAI ($p<0.05$) were fitted into a series of multivariate models, adding one at a time. They were kept in the multivariate model, if they remained significantly associated with any HAI after adjustment for other risk factors in the model (borderline significance, $p=0.05$). Maximum likelihood estimates of adjusted ORs (aORs) together with 95% CIs and results of likelihood ratio tests for significance were computed for all risk factors remaining in the final model.

3 RESULTS

3.1 Participating Hospitals and Numbers of Patients Surveyed

All 21 Slovenian acute care hospitals participated. 5,743 patients were surveyed. Over half of them (55.7%) were hospitalised in three hospitals with over 650 beds and only 9.7% in nine with fewer than 200 beds.

3.2 Patient Characteristics and Exposure to Invasive Procedures

The mean age of patients was 59 years (range 0 to 102, median 65 years), 27.7% were less than 50 years old, 52.5% were 50 to 79, and 19.8% were aged 80 years or more. There were fewer males (48.6%) than females. Of 5,665 patients (98.6% of all surveyed) who were categorized according to McCabe index, 7.0% had a rapidly fatal disease and 19.9% had an ultimately fatal disease. The average length of hospital stay from admission to the survey day was 12.3 days (median 6 days). The length of stay was one to three days for 32.9% of patients, four to seven days for 25.0%, eight to 14 days for 20.1% and more than 14 days for 22.0% of patients. A total of 31.8% of patients had undergone surgery since admission. On the day of the survey, 48.2% had a peripheral vascular catheter, 9.4% a central vascular catheter, 19.1% a urinary catheter, and 3.1% were intubated. Exposures to indwelling devices were most common in intensive care units (ICUs). The prevalence of exposures to different indwelling devices, overall and according to the ward specialty is shown in Table 1.

3.3 Prevalence of Healthcare-Associated Infections

On the day of the survey, 4.4% (95% CI: 3.9%–4.9%) of patients had at least one HAI and additional 2.2% (95% CI: 1.8%–2.6%) were still on treatment because of a previous HAI (symptoms and signs not present anymore on the day of the survey), corresponding to the overall prevalence of 6.6% (95% CI: 6.0%–7.2%). In different hospitals, the prevalence of HAIs ranged from 0.0% to 28.6%. Among patients hospitalised in large hospitals with more than 650 beds the prevalence was 6.9% (95% CI: 6.1%–7.9%) and among those hospitalised in small hospitals with less than 200 beds 5.5% (95% CI: 3.9%–7.8%).

Overall, the prevalence of pneumoniae was the highest (1.9%; 95% CI: 1.5%–2.2%), followed by surgical site infections (1.5%; 95% CI: 1.2%–1.8%) and urinary tract infections (1.2%; 95% CI: 1.0%–1.5%). Excluding HAIs that were not present on the day of the survey, but patients

Table 1. Prevalence of exposures to indwelling devices on the day of the survey, overall and according to different ward specialties, Slovenian national healthcare-associated infection prevalence survey, 2017.

	Intensive care	General medicine	Surgery	Gynaecology, obstetrics & neonatology	Paediatrics	Other/ mixed	All	(95% CI)
Peripheral vascular catheter	68.9%	56.8%	49.7%	21.7%	57.3%	22.1%	48.2%	(46.9% - 49.5%)
Central vascular catheter	74.0%	6.9%	9.6%	0.2%	7.1%	5.2%	9.4%	(8.6% - 10.1%)
Urinary catheter	81.1%	20.9%	18.5%	6.8%	1.1%	13.7%	19.1%	(18.1% - 20.2%)
Intubation	48.0%	1.0%	2.3%	0.6%	2.1%	1.3%	3.1%	(2.7% - 3.6%)
Number of patients	196	2190	1997	545	281	534	5743	

were still treated for them, the corresponding prevalence estimates were 0.6% (95% CI: 0.4%–0.8%), 0.6% (95% CI: 0.4%–0.8%) and 0.5% (95% CI: 0.3%–0.7%). The proportion of patients with at least one HAI or still treated for at least one HAI was the highest in ICUs (30.6%; 95% CI: 24.6%–37.4%), followed by surgical wards (6.7%; 95% CI: 5.7%–7.9%), general medical (5.8%; 95% CI: 4.9%–6.9%), paediatric (3.2%; 95% CI: 1.7%–6.0%), and gynaecology and obstetrics wards (2.9%; 95% CI: 1.8%–4.7%). Excluding HAIs that were no longer present on the day of the survey, but patients were still treated for them, the corresponding prevalence estimates were 6.9%; 95% CI: 3.8%–12.1%), 2.1% (95% CI: 1.5%–2.8%), 3.0% (95% CI: 2.4–3.8%), 1.1% (95% CI: 0.4%–3.2%), and 0.4% (95% CI: 0.1%–1.4%). Numbers of patients with different types of HAIs and respective prevalence, overall and according to different ward specialties are shown in Table 2.

409 episodes of HAIs occurred in 377 patients (349 had one, 24 had two and four had three episodes). 322 episodes (78.7%) started during the current hospitalisation, of which all were attributed to current hospitalisation. 20.5% of all HAIs were present at admission, of which 70.2% were associated with a previous stay in the same hospital and 40.5% were surgical site infections. The median duration of hospital stay until the onset of HAIs acquired during current hospitalisation was 10 days (mean 20.2 days).

Among 409 episodes of HAIs, pneumoniae was most common (26.7%), followed by surgical site infections (20.5%) and urinary tract infections (16.9%). The highest proportion of healthcare-associated pneumoniae occurred in general medicine wards (35.5% of all), the highest proportion of surgical site infections in surgical wards (77.4% of all) and the highest proportion of urinary tract infections in general medicine wards (59.4% of all).

The mean number of HAI episodes per infected patient was 1.1. There were 7.1 episodes of HAIs per 100 patients. The corresponding ratio was the highest in ICUs (38.3/100), followed by surgery (6.9/100), general medicine (6.3/100), paediatrics (3.6/100), and gynaecology, obstetrics and neonatology (2.9/100).

At least one microorganism was identified in 52.3% episodes of HAIs, one in 36.4% and more than one in 15.9% episodes of HAIs. The numbers of different microorganisms identified in HAIs overall and according to most common types of HAIs are shown in Table 3.

Table 2. Number and prevalence of different types of healthcare-associated infections (HAIs), overall and according to ward specialties, Slovenian national healthcare-associated infections prevalence survey, 2017.

	Intensive care	General medicine	Surgery	Gynaecology, obstetrics & neonatology	Paediatrics	Other	All
	Number (prevalence)	Number (prevalence)	Number (prevalence)	Number (prevalence)	Number (prevalence)	Number (prevalence)	Number (prevalence)
Pneumoniae	35 (17.9%)	38 (1.7%)	19 (1.0%)	1 (0.2%)	3 (1.1%)	11 (2.1%)	107 (1.9%)
Surgical site infections	5 (2.6%)	4 (0.2%)	65 (3.3%)	3 (0.6%)	0 (0.0%)	7 (1.3%)	84 (1.5%)
Urinary tract infections	6 (3.1%)	41 (1.9%)	15 (0.8%)	1 (0.2%)	1 (0.4%)	5 (0.9%)	69 (1.2%)
Systemic infections	3 (1.5%)	22 (1.0%)	13 (0.7%)	0 (0.0%)	0 (0.0%)	2 (0.4%)	40 (0.7%)
Gastro-intestinal system infections	2 (1.0%)	13 (0.6%)	4 (0.2%)	0 (0.0%)	0 (0.0%)	5 (0.9%)	24 (0.4%)
Bloodstream infections with CRI3	6 (3.1%)	10 (0.5%)	3 (0.2%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	20 (0.3%)
Skin and soft tissue infections	0 (0.0%)	4 (0.2%)	4 (0.2%)	0 (0.0%)	0 (0.0%)	2 (0.4%)	10 (0.2%)
Central nervous system infections	1 (0.5%)	3 (0.1%)	3 (0.2%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	8 (0.1%)
Eye, Ear, Nose or Mouth infection	0 (0.0%)	5 (0.2%)	1 (0.1%)	1 (0.2%)	0 (0.0%)	1 (0.2%)	8 (0.1%)
Other lower respiratory tract infections	4 (2.0%)	3 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (0.1%)
Bone and joint infections	0 (0.0%)	0 (0.0%)	5 (0.3%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	6 (0.1%)
Cardiovascular system infections	0 (0.0%)	1 (0.0%)	4 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	5 (0.1%)
Catheter-related infections w/o BSIs	0 (0.0%)	2 (0.1%)	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.1%)
Reproductive tract infections	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (0.4%)	0 (0.0%)	0 (0.0%)	2 (0.0%)
Specific neonatal infections	4 (2.0%)	0 (0.0%)	0 (0.0%)	8 (1.5%)	0 (0.0%)	0 (0.0%)	16 (0.3%)
Patients with at least one HAI[a]	60 (30.6%)	127 (5.8%)	134 (6.7%)	16 (2.9%)	4 (1.4%) 9 (3.2%)	0 (0.0%) 31 (5.8%)	377 (6.6%)

CRI3: catheter-related bloodstream infection with microbiological documentation of the relationship between the vascular catheter and the bloodstream infection.

w/o BSIs: without bloodstream infections.

[a] Patients can have several HAIs, thus the numbers in columns do not necessarily add up to the number of patients with at least one HAI.

Table 3. Microorganisms identified in healthcare-associated infections (HAIs) overall and by most common types of HAIs, Slovenian national healthcare-associated infections prevalence survey, 2017.

	Pneumonia/ lower respiratory tract infections	Surgical site infections	Urinary tract infections	Bloodstream infections	Gastrointestinal tract infections	All HAIs
	Number	Number	Number	Number	Number	Number
Number of all HAIs	116	84	69	33	25	409
Number of HAIs with microorganisms all	50	44	50	25	19	214
Number of microorganisms	83	73	60	27	23	301
Gram-positive cocci	16	34	10	13	3	94
Staphylococcus aureus	9	9	0	4	0	30
***Streptococcus* spp.**	4	12	7	3	2	30
Coagulase-negative staphylococci	1	9	3	5	0	23
Other gram-positive cocci	2	4	0	1	1	11
Gram-negative cocci	0	0	0	0	0	0
Enterobacteriaceae	38	20	39	11	6	123
Escherichia coli	5	6	19	7	2	40
***Enterobacter* spp.**	10	7	4	2	1	28
***Klebsiella* spp.**	11	2	7	1	1	24
***Proteus* spp.**	3	3	5	0	1	13
Other Enterobacteriaceae	9	2	4	1	1	18
Non-fermenting gram-negative bacteria	18	6	7	0	1	33
Pseudomonas aeruginosa	9	4	6	0	1	21
Other non-Enterobacteriaceae	9	2	1	0	0	12
Anaerobic bacilli	0	8	0	1	12	22
Clostridium difficile	0	0	0	0	12	12
Other anaerobes	0	8	0	1	0	10
Other bacteria	0	0	0	0	0	0
Fungi	11	5	4	2	0	27
***Candida* spp.**	9	5	4	2	0	25
Other fungi	2	0	0	0	0	2
Virus	0	0	0	0	1	2
Negative codes	62	40	19	7	6	189
Examination not done	37	24	6	0	2	87
Not yet available/missing	11	11	9	6	2	51
Sterile examination	13	5	3	1	1	48
Microorganism not identified	1	0	1	0	1	3

Most frequently isolated microorganism was *Escherichia coli* (13.3%), followed by *Staphylococcus aureus* (10.0%) and *Streptococcus* spp. (10.0%). Among 19 gastrointestinal infections with identified microorganisms, infection with *Clostridium difficile* was confirmed in 12 cases.

3.4 Factors Associated with HAIs

The results of univariate and multivariate analyses of association of selected patients' characteristics, exposure to indwelling devices on the day of the survey and surgery during current hospitalisation with HAIs acquired during current hospitalisation are shown in Table 4. The presence of at least one HAI acquired during current hospitalisation was independently associated with surgery during current hospitalisation, presence of a central vascular catheter, presence of a peripheral vascular catheter, presence of a urinary catheter and length of hospitalisation.

4 DISCUSSION

We obtained estimates for the distribution of selected characteristics of patients, for the prevalence of exposure to selected invasive procedures and for the prevalence of HAIs in Slovenian acute care hospitals for the year 2017

using standardised European methods and European HAIs surveillance definitions. Our results are well comparable to the results of SNHPS II conducted in 2011 and with overall 2016/2017 EU PPS II results. Our estimated prevalence of HAIs (6.6%) was similar to the overall prevalence of HAIs in the EU PPS II (5.9%; country range: from 2.9% in Lithuania to 10.0% in Greece), and almost identical to the overall validation corrected prevalence of HAIs (6.5%; 95% CI: 5.4%–7.8%) (6). It is of concern that our estimated prevalence of HAIs among patients in ICUs (30.6%) was rather high in comparison to the overall European estimate of 19.2% for patients categorised as ICU specialty patients in 2016/2017 (6).

In comparison to SNHPS II conducted in 2011, in the SNHPS III in 2017, the patients were older, with the average age of 55 years in 2011 and 59 years in 2017 (p<0.01) (3). On average, they were hospitalised longer, 11 days in 2011 and 12 days in 2017 (p<0.01) (3). In addition, exposure of patients to some indwelling devices has increased. In 2017, 9.4% of patients had a central vascular catheter on the day of the survey, while in 2011 7.3% (p<0.01) and in 2017 19.1% of patients had a urinary catheter on the day of the survey and in 2011 16.2% (p<0.01) (3).

Our estimated overall prevalence of HAIs (6.6%) was very similar to the overall estimated prevalence of HAI in 2011 (6.4%) (2). The estimated prevalence of HAIs among patients in ICUs was again rather high (30.6%), although somewhat lower than the corresponding estimate in 2011 (35.7%) (p=0.27) (3).

Table 4. Prevalence of healthcare-associated infections (HAIs) acquired during current hospitalisation according to patients' characteristics, ward specialties, and exposure to extrinsic risks and results of univariate and multivariate analysis of association, Slovenian national healthcare-associated infections prevalence survey, 2017.

	Univariate analyses (whole data)				Univariate analyses (restricted data)		Multivariate analyses (restricted data)	
	Prevalence of HAIs	Number of patients (base)	Odds ratio	p-value (95% CI)	Odds ratio	p-value (95% CI)	Adjusted odds ratio	p-value (95% CI)
Age								
<50 years	3.9%	1588	1	p<0.001	1	p<0.001		
50-79 years	7.7%	3017	2.1	(1.5-2.7)	2.0	(1.5-2.7)		
≥80 years	7.3%	1138	1.9	(1.4-2.7)	1.9	(1.4-2.7)		
McCabe index								
Non-fatal disease	4.7%	4143	1	p<0.001	1	p<0.001		
Ultimately fatal disease	10.3%	1128	2.3	(1.8-2.9)	2.3	(1.8-2.9)		
Rapidly fatal disease	14.5%	394	3.4	(2.5-4.7)	3.3	(2.4-4.6)		
Surgery (during current hospitalisation)								
No	4.9%	3904	1	p<0.001	1	p<0.001	1	p<0.01
Yes	10.2%	1827	2.2	(1.8-2.7)	2.2	(1.8-2.7)	1.6	(1.2-2.0)
Intubation								
No	5.8%	5565	1	p<0.001	1	p<0.001		
Yes	30.3%	178	7.1	(5.0-9.9)	7.1	(5.0-9.9)		
Central vascular catheter								
No	4.7%	5202	1	p<0.001	1	p<0.001	1	p<0.001
Yes	24.8%	537	6.7	(5.3-8.5)	6.7	(5.3-8.5)	4.1	(3.1-5.4)
Peripheral vascular catheter								
No	4.6%	2967	1	p<0.001	1	p<0.001	1	p<0.001
Yes	8.7%	2769	2.0	(1.6-2.5)	2.0	(1.6-2.5)	3.0	(2.3-3.9)
Urinary catheter								
No	4.1%	4640	1	p<0.001	1	p<0.001	1	p<0.001
Yes	16.8%	1099	4.7	(3.8-5.8)	4.7	(3.8-5.8)	1.8	(1.4-2.3)
Length of hospital stay[a]:								
≤3 days	1.1%	1892	1	p<0.001	1	p<0.001	1	p<0.001
4-7 days	3.1%	1434	2.8	(1.7-4.8)	2.8	(1.7-4.8)	2.6	(1.5-4.4)
8-14 days	9.5%	1153	9.3	(5.8-14.9)	9.3	(5.8-14.9)	9.4	(5.8-15.2)
≥15 days	16.1%	1264	17.0	(10.8-26.9)	16.9	(10.7-26.7)	15.5	(9.7-24.8)

5,719 individuals with information on all risk factors included in the final multivariate model were included in multivariate analyses on the restricted data (99.6% of all individuals surveyed).

[a] Length of hospital stay was computed until the day of the survey for patients without HAIs and for those with HAIs until the day of occurrence of HAIs (first HAI, if several).

Similar to 2011, the three most frequently reported HAIs in 2017 were pneumonia (2017: 26.7%; 2011: 18.7%), surgical site infection (2017: 20.5%; 2011: 16.7%), and urinary tract infection (2017: 16.9%; 2011: 19.4%); together accounting for almost two thirds of all HAIs in 2017 (3).

In 2017, factors independently associated with HAIs were central vascular catheter, peripheral vascular catheter, urinary catheter, surgery during current hospitalisation and having a prolonged hospital stay. In 2011, in addition to these, older age, having a fatal disease and intubation with or without ventilation were also associated with HAIs (3). It should be noted that factors associated with higher odds of HAIs do not necessarily precede HAIs. For example, a central or peripheral vascular catheter can be inserted because of antimicrobial parenteral treatment of a HAI.

The strength of our survey was the participation of all Slovenian acute care hospitals ensuring representativeness of our results for Slovenian acute care hospitals and the use of standardised European methods (4) that were comparable to our methods used in SNHPS II in 2011 (3). Nevertheless, we should be cautious with comparisons, as the methods used to ascertain patients' characteristics, exposures to potential risks, and HAIs in both Slovenian surveys may have differed (including the slightly different HAI surveillance definition for pneumonia used in 2011).

The major limitation was the possibility that the sensitivity and specificity of approaches to ascertain HAIs were less than optimal and may have differed substantially between individual hospitals and also between the two surveys. This could have resulted in under- or over-estimation of the different estimates for the prevalence of HAIs (nationally, in individual hospitals, according to wards' specialty, etc.) and misclassification of some HAIs. Similarly, to the SNHPS II, we did not have the resources needed for the concurrent validation of the data collection methods within the European point prevalence survey of HAIs and antimicrobial use, as suggested by ECDC (7).

However, we have assessed the sensitivity and specificity of the methods used for the ascertainment of six selected types of HAIs during the SNHPS II in the largest Slovenian teaching hospital, the University Medical Centre Ljubljana (UMCL) by retrospective medical chart review to be 83% and 99% (8). These estimates were very similar to the corresponding estimates in the 2010/2011 EU PPS validation study, 83% and 98% respectively (9). As the estimated overall sensitivity and specificity of our data collection methods for ascertaining HAIs in the UMCL during SNHPS II were relatively high and the level of agreement between the primary survey data collection and validation results was very good for HAIs overall, this is also reassuring with respect to the validity and reliability of SNHPS III results.

5 CONCLUSIONS

Our results indicate that prevalence of HAIs in Slovenian acute care hospitals in 2017 remained substantial. Slightly higher point estimate of the prevalence of HAIs in 2017 in comparison to 2011 (the difference was not statistically significant), together with the evidence for increased average age of patients, prolonged hospitalisation, increased prevalence of exposure to some indwelling devices associated with HAIs, suggest that overall HAIs prevention and control efforts in Slovenian acute care hospitals have managed to contain the magnitude of the problem, but not to appreciably decrease the occurrence of HAIs. To achieve this, prevention and control efforts should be targeted at preventing pneumonia, surgical site infections and urinary tract infections. Reducing the high prevalence of HAIs in ICUs remains a priority. Appropriate resources for the national coordination of prevention and control of HAIs as well as in individual acute care hospitals should be ensured.

For evidence-based national and individual hospitals' HAIs prevention and control policies and practices, the national HAIs surveillance system, coordinated at the National Institute of Public Health, including the repeated SNHPSs every five years, should be developed further.

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CONFLICT OF INTEREST

No conflicts of interest exist.

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ETHICAL APPROVAL

The Medical Ethics Committee of the Republic Slovenia consented to the development and implementation of the National Network for the Surveillance of HAIs, with one of its components, repeated Slovenian national healthcare-associated infections prevalence surveys (consent number: 68/04/08).

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HEALTH BEHAVIOUR CHANGES OF CUTANEOUS MELANOMA SURVIVORS IN SLOVENIA – A QUALITATIVE STUDY

SPREMEMBE V ZDRAVSTVENEM VEDENJU BOLNIKOV Z MELANOMOM KOŽE V SLOVENIJI - KVALITATIVNA RAZISKAVA

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ABSTRACT

Introduction: Most data related to cutaneous melanoma survivors' health behaviour comes from epidemiological studies and is predominantly concerned with safe-sun behaviour and self-examination. Data regarding other changes of health behaviour are scarce and so are qualitative studies in this realm. The aim of our research is to acquire insight into the experiences of patients with cutaneous melanoma in Slovenia. How did they react to the diagnosis, which changes did they introduce in their health behaviour and how do they assess the role of family doctors?

Methods: Using the qualitative approach of collective case reports, a demographically diverse group of patients with different forms and stages of cutaneous melanoma was selected. Semi-structured interviews conducted by a psychologist were recorded and transcribed verbatim. For data processing, the approach of Qualitative Content Analysis was applied.

Results: We integrated interviewees' experiences after the diagnosis of cutaneous melanoma in several subcategories: either they did not introduce any changes or they mentioned changing their habits when exposed to the sun and performing skin self-examination; they also emphasized their ways of dealing with stress and raising awareness about melanoma among family members and friends. The role of family doctors in the prevention and care appears unclear; even contradictory.

Conclusions: We obtained insight into the experiences of Slovenian patients with cutaneous melanoma. The interviewees prioritised safe behaviour in the sun, strengthening of psychological stability and raising awareness about melanoma. Findings will be used in the creation of a structured questionnaire for national epidemiological survey.

Keywords:
cutaneous melanoma, coping with stress, experiences, health behaviour, qualitative research

IZVLEČEK

Uvod: *Večina podatkov, povezanih z zdravstvenim vedenjem bolnikov z melanomom kože, je pridobljena z epidemiološkimi raziskavami. Raziskave se pretežno ukvarjajo z varnim obnašanjem na soncu in samopregledovanjem kože. Bistveno manj poznamo druge spremembe v zdravstvenem vedenju teh bolnikov, prav tako je - tudi v tuji literaturi - le malo kvalitativnih raziskav na to temo. Namen raziskave je pridobiti vpogled v izkušnje bolnikov v Sloveniji po diagnozi melanoma kože; kako so se odzvali na bolezen, kakšne spremembe so vpeljali v svoje (zdravstveno) vedenje in kako vidijo vlogo osebnih zdravnikov.*

Metode: *Glede na namen raziskave je bil uporabljen pristop študije skupine primerov (angl. collective case report). Psihologinja je opravila poglobljene intervjuje z bolniki obeh spolov, različnih starosti, različne izobrazbe in z različnimi oblikami melanoma kože. Za obdelavo podatkov je bil uporabljen pristop kvalitativne analize vsebine.*

Rezultati: *Izkušnje in odzive bolnikov ob diagnozi melanoma kože smo strnili v več podkategorij: bodisi intervjuvanci sploh niso uvedli sprememb ali pa omenjajo spremembe pri zaščiti pred soncem in samopregledovanju kože; izpostavljajo tudi odziv na stres in osveščanje soljudi glede melanoma. Glede spreminjanja navad pri zaščiti pred soncem poleg uporabe zaščitnih pripravkov izpostavljajo predvsem fizikalno zaščito in pazljivost glede ur v dnevu, ko se izpostavijo soncu. Samoopazovanje kože so le redko omenili spontano, po usmerjenem podvprašanju pa so vsi zatrdili, da ga izvajajo. Stres ob diagnozi premagujejo predvsem s krepitvijo čustvene stabilnosti in povečanjem telesne aktivnosti. Velik del intervjuvancev je ljudi okoli sebe pričel osveščati glede melanoma kože, tveganih vedenj in možnosti preventive. Vloga zdravnikov družinske medicine je nejasna, mestoma celo kontradiktorna.*

Zaključek: *Pridobljen je pričakovani vpogled v izkušnje slovenskih bolnikov z melanomom kože. Intervjuvanci so izpostavili varno obnašanje na soncu, krepitev čustvene stabilnosti in ozaveščanje bližnjih glede melanoma. Izsledki bodo uporabljeni pri oblikovanju strukturiranega vprašalnika za epidemiološko raziskavo, ki bo ovrednotila spremembe v zdravstvenem vedenju bolnikov z melanomom kože in iskala dejavnike, ki ključno vplivajo nanje.*

Ključne besede:
melanom kože, obvladovanje stresa, izkušnje, zdravstveno vedenje, kvalitativna raziskava

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1 INTRODUCTION

Cutaneous melanoma is one of the most common malignancies in the world. Given the possibility of aggressive metastases, it is the most dangerous form of skin cancer (1). Both the incidence (recorded or estimated) and the mortality of cutaneous melanoma are significantly higher in the more developed parts of the world (2).

In IARC estimations for 2018, are among 20 countries most heavily burdened with melanoma, as many as 16 European countries; Slovenia (with estimated ASR 18.6) occupies the 10th place in the world and 8th in Europe (3). In the period 2011 to 2015 an average 124 persons per year died because of cutaneous melanoma in Slovenia, with the average age-standardized mortality rate in this period being 2.85 (3.50 for men and 2.33 for women) (4). 5-year survival rate in Slovenia, which was at the beginning of the 21th century 80.4% and worse than European average (5), has substantially improved to 89.4% in the 2011–2015 period. In the last twenty years much has been said about melanoma, but usually among professionals or in the direction from profession to population. Nowadays, these processes of communication and awareness are well established, either through everyday medical procedures or through prevention campaigns (6). However, when speaking with patients in dermatology clinics in Slovenia, we still notice much fear and little actual knowledge about melanoma (personal communication, 7).

The stage at which melanoma is detected and surgically removed is the most important factor for the prognosis of the disease and survival; prevention on primary and secondary level remains the key factor for the reduction of melanoma-rated mortality (8–12). This is especially important for melanoma survivors, who have a significantly increased (13) risk of acquiring second primary melanoma and should be repetitively counselled about the risk and about the importance of preventive health behaviour. To optimize our messages and interventions regarding preventive behaviour, it is crucial to (i) recognize what has changed in health behaviour after the diagnosis of melanoma and (ii) to understand the triggers to the changes. In the literature there is relatively little data (9–11, 14–16) regarding the heath behaviour of melanoma survivors. For the Slovenian population we have none. The aim of this qualitative part of our research is to understand how melanoma survivors in Slovenia percept the disease, how do they cope with it and how do they assess the role of the family doctor. Its key objective is the identification of changes in health behaviour after obtaining the diagnosis: what they do, what matters to them and whether they mention anything we have not thought about or learned from the literature.

Collected data is going to be used in subsequent epidemiological study (17), results of which shall help in the planning of future public health interventions in Slovenia.

2 METHODS

We performed a qualitative study of patients' experiences before and after the diagnosis of cutaneous melanoma; we used the approach of the collective case report. Among different approaches in qualitative research methodology, case studies are recommended when complex phenomena are to be studied within their contexts (18–20). They are the most powerful when answers on »how« and »why« are sought. Based on the literature, the collective (multiple) case studies enable the researcher to detect and explore the differences through replication of findings across cases (19–21). Regarding this, cases should be selected primarily because of their own intrinsic value (22). However, to better understand the underlying phenomenon, parallel sampling design is often applied: »the selected cases are treated as a set and their voice is compared to all other cases one at a time in order to understand better the underlying phenomenon, assuming that collective voices generated by the set of cases lead to data saturation« (23).

2.1 Participants

Altogether, ten patients from a dermatological outpatient clinic in Ljubljana, Slovenia were included (5 men, 5 women). We invited them to participate in the study during their regular medical check-up as melanoma survivors, however, they came to the interviews on the agreed term in their free time. Inclusion criteria were as follows: (i) diagnosis of cutaneous melanoma in the past (single, multiple, invasive or in situ) (ii) age >18 years and (iii) fluent in Slovenian language. To ensure the anticipated group diversity of parallel purposeful sampling, we invited patients from different geographical regions, educational background, age, gender and different melanoma stages. Parallels were gender and whether an interviewee had had one or multiple melanomas. In terms of time from the diagnosis, patients were limited only to the fact that at least one year had passed since the (first) melanoma. Group characteristics are depicted in Table 1. Patients were gathered in period from January 2015 until April 2015.

Table 1. Characteristics of the participants.

	Total (men/women)
Participants (n)	10 (5/5)
Age, mean (years)	51.8 (62/41.6)
Diagnosis *	
MIS	8 (6/2)
SSM	19 (10/9)
NM	1 (1/0)
LM	1 (1/0)
One MM	4 (2/2)
Two or more MM/MIS	6 (3/3)
Duration from (last) diagnosis to interview, mean (years)	3.7 (2.6/4.8)

*melanoma in situ (MIS), superficial spreading melanoma (SMM), nodular melanoma (NM), lentigo maligna melanoma (LM)

2.2 Data Collection

After patients' written approval, an independent psychologist conducted in depth interviews, their time duration was from 30 to 100 minutes, median being 38.5 minutes. Interviews were recorded and later verbatim transcribed. The guiding questions were followed by uplink sub-questions. Guiding questions were:

- What was your reaction to the diagnosis of melanoma?
- How did the diagnosis impact on your lifestyle changes?

2.3 Data Analysis

Acquired interviews were processed according to Qualitative Content Analysis (QCA) (21). Texts were listened to and read multiple times, based on which open codes were developed to capture emerging themes. After collecting the data, they were classified into meaningful units, which are described in a single word or a short sequence of words. Open coding was introduced as in the initial stage of data analysis in grounded theory studies (19). Unlike the grounded theory, where the ultimate purpose of open coding is to obtain categories that explain, the procedure in QCA (21) tends only to describe. In building the coding frame both approaches, inductive and deductive, were used. Part of the main subcategories were conceptually designed (deductive), based either on our experiences from work with patients or on data from the literature. However, the last two main subcategories as well as all detailed subcategories resulted from an inductive approach; through the analysis of "row data" of interviewees' experiences, the codes and themes emerged. Likewise, the part considering the role of family doctors, which emerged when listening/reading the interviews, is mostly data driven. Only one category, "family doctor is checking patients' skin", was logically driven.

To ensure reliability of the coding, two independent researchers coded the texts. When applied to their coding, the coefficient of agreement was high (97%). Regarding the validity, when a coding frame is mostly "data driven", as it happens in this research, "face" validity is advised (21). Validity is a measure of assessment between concept of the study and its procedure, and face validity displays the "extent to which your instrument gives the impression of measuring what it is supposed to measure" (21). The assessed face validity of the data was high, as there were no abstract or residual categories left.

According to the leading questions of the interview, data were assessed as important/relevant and classified into relevant categories.

3 RESULTS

Data based on interviews with 10 patients were categorized according to leading questions. As our aim was identification of experiences of patients who have been diagnosed with cutaneous melanoma, in the foreground were their reactions on the disease and changes in health behaviour they implemented.

Exploring the responses of the interviewees in terms of changes in their health behaviour led to the main category "impact of being diagnosed with cutaneous melanoma on health behaviour".

Patients' answers are depicted in Table 2.

Table 2. The impact of being diagnosed with cutaneous melanoma on health behaviour.

Main categories	Main subcategories	Detailed subcategories	Codes
Health behaviour management	No changes		living the same way
	Changes in sun behaviour		use of protective creams
			»different« creams
			higher SPF used
			physical protection
			vigilance in hours
			avoiding the sun
	Changes in skin self-examination		checks regularly
			checks occasionally
			checks before the medical check-up
			being more attentive to the skin
	Dealing with the stress	strengthening of mental stability	independently
			with help of an expert
			conversation with family/friends
		physical activity	stroll
			intensive activity
			yoga
	Raising awareness of melanoma		among kinship
			among acquaintances

Several subcategories emerged. Two interviewees reported that they have not changed anything important: "I do not think that I did [change anything]. Maybe I have sorted certain things out, but basically I live exactly the same, because I was already convinced that I did not make any mistakes" (male, 55).

The rest of the subcategories were about changes in different aspects of health behaviour, where the first two, focusing on participants' attitude regarding the UV exposure and their examination of the skin and eventual changes, were expected, and they were distinctly realized in the interviews. The third subcategory is mainly speaking about coping with the stress of malignant disease: trying to (re)gain inner peace, either with work on one's mind/soul or with increased physical activity to alleviate the stress.

The last subcategory is dedicated to the care for (the important) others, raising awareness about melanoma, safe behaviour in the sun and being observant regarding the changes on one's own skin.

As expected, a large part of the interviewees became much more cautious when exposed to the sun. Most of them started practising cautious protection from UV rays, either with SPF products or with clothes: "I also wear a swimming cap, I am strictly protected… the most important is thorough protection from the sun, covered (with clothes), cream applied, this is the most important for sure, so to speak the only one…" (male, 74) or they became vigilant regarding the time of the day, when spending time outside "the most important instruction being that one is not exposed to the sun when it is at its strongest…" (male, 55). Some participants even began to avoid being outside during the day: "the fears about the sun exposure… came subconsciously… now I really go to extremes, I meet with friends at 18.00 only…" (female 29).

They also quite often mentioned the use of protective creams with chemical protection factors; either they started using them or they advanced to a higher SPF; one of interviewees started to use an alternative, "different" cream: "…I actually started using creams without any chemistry; for the face and body… there is no chemistry, everything is on mineral foundation; before (the melanoma) there was nothing of this, I thought it was not important…" (female, 47).

The issue of skin (self) examination (SSE) is somehow controversial. Namely, only three of ten participants mentioned SSE spontaneously but, after being specifically asked, all of them asserted that they perform it either

regularly: “I do the examination myself once a month” (female, 47), occasionally, or they are generally more observant regarding their skin: “…since then [melanoma diagnosis], I have been more attentive to the moles” (female, 33).

Outstanding is the majority, who mentioned the need to alleviate the stress connected to diagnosis of cutaneous melanoma. The subcategory of strengthening of mental/psychical stability was addressed most frequently of all categories. To most of the participants sharing their feelings and worries with relatives and friends was helpful enough: “I talked to my sister… she took a lot of care. Talking to someone who is close to you – at that time there is something gathering inside you – you have to deliver it out of yourself, to talk, to know that you are not alone. That you have somebody you trust” (female, 47). Much more rarely they used different mental techniques or obtained the help of an expert; “…there was so much of everything, I could not sleep...; I started to visit a psychiatrist… I had a feeling that I was insane and I needed a psychiatrist…” (female, 33). Quite a lot of interviewees sought relief in physical activities like yoga, intense strolling and hiking or more strenuous sports: “I am more physically active; I began working out” (female, 47).

The subcategory of raising awareness about melanoma and prevention thereof is represented quite largely – to the same extent as the subcategory about cautiousness towards UV exposure. Most of the participants were focused primarily on family members, while others were even more outspoken: “…in particular I told everybody I knew… in our family the diagnoses were somehow secret until then… so they also started to watch themselves and everybody around me visited a dermatologist” (female, 47).

Table 3. Patients’ experiences regarding the role of family doctors before and after the diagnosis of cutaneous melanoma.

Categories	Codes
Before the diagnosis	does not deal with the skin
	alerts about skin self-examination
	incorrectly assesses specific lesion
After the diagnosis	active
	passive
	relieving
	burdening

In the part of the research where interviewees spoke about the role of their family doctors, we designed two main categories: before and after the diagnosis of cutaneous melanoma. All the subcategories were data driven (Table 3).

A weak half of the interviewees mentioned a role of family doctor before the diagnosis of cutaneous melanoma and after it. They assessed the doctor’s attitude before the diagnosis quite critically; sometimes almost angrily. They felt that she/he was not attentive enough to their skin – nobody mentioned that a check-up of the skin lesions was performed and only one participant, with positive family history of melanoma, mentioned that she was advised to self-examine her skin: »by nature I have many moles and my doctor advised me to check them« (female, 29). However, another participant, phototype 1 and with positive family history of melanoma, felt that total forsaking of skin examination was not appropriate: »for example, I regularly attend medical check-ups, do the electrocardiogram… but nobody ever mentioned skin self-examination to me» (male, 55). Two participants expressed concern and sounded apprehensive because their family doctor’s diagnostic assessment was wrong, even though they themselves alerted her/him about the lesion: »… a strange lesion appeared… I showed it a few times to my doctor, but she always said: ‘oh, it is nothing important’« (female, 58).

Statements regarding the role of family doctors after the diagnosis of cutaneous melanoma strike as being much less passionate; they sound more as a depiction of a relationship that a patient has with her/his family doctor. Interviewees experienced their family physician’s attitude in diverse ways; as active “...he sent me to blood tests, I am under control...” (female, 47) or passive: “...I believe he is warning the patients... but ... I overtook him with the results...” (male, 74), some experienced it as relieving “… my family doctor also told me that the first level is not that dangerous…” (female, 29) and others as burdensome:” The event... which could shake someone a little... she (the doctor) automatically said, if I were visiting oncology department, if I had psychological support... I saw a question mark above her – why I was not going” (male, 55).

4 DISCUSSION

After they received the diagnosis of cutaneous melanoma, the vast majority of our interviewees introduced changes to their health behaviour. In accordance with before-mentioned data from literature (9–11, 15, 16), they were predominantly changing their habits regarding the sun protection. Only a part of interviewees spontaneously mentioned self-examination although, after being asked directly about the subject, everybody claimed that after the diagnosis they watch their skin more carefully. Reasons

that self-examination was not frequently mentioned are not known. We assume that it is still a common occurrence that people connect prevention against skin cancer only with safe sun behaviour. One of the reasons may be that experts emphasize safe sun behaviour over self-examination in the media and in personal communication with patients (24, 25). However, in Slovenia we heed the guidelines for management of patients with melanoma (26). Patients are rigorously monitored and counselling about safe sun behaviour and skin self-examination are regular parts of medical visits. On the other hand, it may be that patients do not trust in their own capability of recognising an atypical lesion and, as Ajzen stated (27), the limiting factor is low perceived behaviour control. This may well be connected with high fear appeal regarding melanoma in the last few decades and not (yet) strong enough efficacy messages (28).

Interviewees very often mentioned the strengthening of their psychical stability (29): usually this was achieved independently of any professional help (most often through conversation with relatives and friends), only rarely with some help from an expert. Even though there is no lack of evidence that melanoma survivors are in need of psychological support (30, 31), we did not find any data about specific approaches to melanoma patients. Researchers who looked into the cancer treatment in the USA in general, found that, despite the fact that the provision of psychosocial support to the cancer patients was identified as part of good medical care, health professionals often do not detect patients' need for it. As mentioned in the literature (32, 33), patients are rarely referred to appropriate specialists or treated according to their psychological needs.

Relatively often, interviewees mentioned the intensification of physical activity after being diagnosed with cutaneous melanoma – either outdoors or in the gym. Although the benefits of regular physical activity for melanoma patients have not been investigated, regarding the results of studies, concerning patients with other cancers (34), the benefits are expected and are emphasized in Cancer Fact Sheets (35). Regular outdoor activity after being diagnosed with melanoma is encouraged but, as Lawler and co-workers suggested (36), physical activity and sun protection should be promoted simultaneously.

More than half of our interviewees are raising awareness on the issues of cutaneous melanoma among their relatives and friends. The result is not in concordance with the report from Oliveria and co-workers (16), where even patients who understood the increased risk for family members rarely raised the issue among them.

Surprisingly, considering reports in the literature (37), not even one interviewee mentioned changes in other aspects of healthy lifestyle, like healthy eating or reducing alcohol intake and smoking.

Patients' experience on the role of family doctors is, strictly speaking, not a component of health behaviour, but already at the first interview the message had such power so that we did not label it as irrelevant; when opinions multiplied, we formed a separate part of the research. Interviewees mentioned the impact of a family doctor in the time before the diagnosis of cutaneous melanoma and, later, after the diagnosis and treatment were performed.

The results are surprising. Almost half of the interviewees think that they belong to a group with a high risk for skin cancer because of their skin type or/and abundance of moles, and two of them are burdened with a family history of melanoma. However, physicians payed no special attention to their skin; the only exception was a warning about the need of skin self-examination to one participant. Moreover, when alerted about a "suspicious" pigmentary lesion (which was later confirmed to be melanoma), the family doctor did not take it seriously.

After the diagnosis of cutaneous melanoma, the situation is somehow fragmented and unconvincing. Half of the interviewees do not even mention a family doctor or her/his response. Others depict different situations; they are experiencing their physician as active, with relieving impact, but also as ignorant and burdening or very passive. Results are consistent with the reporting of Loescher and co-workers (38) who find that communication with people at high risk is inadequate, inconsistent or even inaccurate. Reasons are attributed to (i) the lack of time that a doctor spends with the patient, which is further reduced by all the more extensive administrative requirements, (ii) intensive sub-specialization of doctors and, consequently, lack of knowledge in areas not domiciled and (iii) lack of communication skills. However, as Hajdarević and co-workers (39) stated, healthcare providers should expand the understanding of patients' experiences and the patterns of seeking medical care. By facilitating access to medical care, early diagnostics will also be facilitated.

4.1 Study Limitations

We are aware of two limitations; interviews were conducted in familiar medical surroundings and half of the interviewees were regular patients of the principal investigator. Those circumstances could have influenced patients' responses. In order to diminish that influence, a psychologist who is not a member of the staff and was unknown to interviewees conducted the interviews.

Probably we should also mention the number of participants among limitations. We are aware that many qualitative multiple case studies include 30 or more participants but, on the other side, Creswell (19) advises to use four to five cases. Only if there is a rationale does he advise to expand the group. Our rationale was diversity of interviewees. Thus, in the beginning we included 10 patients, with the intention to include more if we do not achieve saturation. However, saturation was achieved by the seventh patient and we saw no reason to expand the group.

Regarding the time interval from the last melanoma, which is different for men and women, we believe that we cannot consider it as a limitation. All interviewees could be labelled as "mature" survivors, and most probably their responses are not an acute (over)reaction to the diagnosis of melanoma but stable changes in health behaviour.

The strength of our study is its design based on the patients' experience after being diagnosed with cutaneous melanoma and possibility of detailed research of patients' perception and reaction. Moreover, the research framework was not rigid and when new information emerged the framework could be revised.

Implications for practice: findings served as a background for ongoing quantitative epidemiological survey, which is evaluating the extent of changes in health behaviour and factors that trigger those changes. Collected data will facilitate communication with melanoma patients and help to design corresponding public health interventions.

5 CONCLUSION

Presented qualitative research offers an insight into the experience of patients with cutaneous melanoma in Slovenia and into the changes of their health behaviour. The interviewees set in the forefront safe behaviour in the sun, dealing with stress and raising awareness about melanoma among fellow men. They mentioned skin self-examination less often. The specific role of family doctors in the prevention and care of people with high risk for melanoma appears contradictory or is at least not sufficiently defined.

CONFLICTS OF INTERESTS

The authors declare that no conflicts of interest exist.

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ETHICAL APPROVAL

This study conforms to the recognised standards of the Declaration of Helsinki and was approved by the Republic of Slovenia National Medical Ethics Committee on 13th of May 2014 (reference number 139/05/14).

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CLASSIFICATION OF PRIMARY CAESAREAN SECTIONS IN LABOR AND ITS USEFULNESS FOR ANALYSIS OF SLOVENIAN PERINATAL DATA

KLASIFIKACIJA PRIMARNIH CARSKIH REZOV IN NJENA UPORABNOST ZA ANALIZO SLOVENSKIH PERINATALNIH PODATKOV

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ABSTRACT

Objective: To determine the usefulness of a novel classification of indications for caesarean section (CS) in labour in recognizing differences in clinical practice in different maternity units.

Methods: Data from the National Perinatal Information System (NPIS) for 2013 and 2014 were used to classify indications for CS in nulliparous women with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses within 14 Slovenian maternity units into foetal distress and different sub-groups of dystocia according to use and dosage of oxytocin. Chi-square test was used for statistical comparison between units (P≤0.05 significant).

Results: There were 13,572 deliveries and 1,567 (12.0%) CS in nulliparous patients with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses in Slovenia during the study period. Rates of CS in this group of women differed significantly among different maternity units (from 4.1% to 20.9%; P<0.001) suggesting significant differences in clinical practice. The most common indication for CS was cephalopelvic disproportion, which was diagnosed with different frequency in different units (from 11.2% to 45.9%; odds ratio 6.72; 95% confidence interval 3.10– 14.71; P<0.001).

Conclusions: It is possible to use NPIS data to retrospectively classify indications for CS. Such classification reveals significant differences among maternity units and could allow for a meaningful analysis of CS rates in different hospitals leading to evidence-based initiatives to decrease the incidence of primary CS.

Keywords:
caesarean sections, dystocia, cephalopelvic disproportion

IZVLEČEK

***Cilji**: Ugotoviti uporabnost nove klasifikacije indikacij za urgentni carski rez za analizo razlik v klinični praksi v različnih porodnišnicah.*

***Metode**: Podatke iz Nacionalnega perinatalnega informacijskega sistema (NPIS) za leti 2013 in 2014 o urgentnih carskih rezih pri prvorodnicah ob roku po spontanem začetku poroda s plodom v glavični vstavi smo klasificirali glede na indikacijo za carski rez v fetalni distres in podskupine distocije glede na uporabo in odmerek oksitocina. Za statistično primerjavo med porodnišnicami smo uporabili hi kvadrat test (P ≤ 0,05 statistično pomembno).*

***Rezultati**: V vključeni skupini porodnic je bilo v Sloveniji v preučevanem obdobju 13.572 porodov, od tega 1567 (12,0 %) carskih rezov. Delež carskih rezov se je med porodnišnicami pomembno razlikoval (od 4,1 % do 20,9 %, P < 0,001), kar nakazuje na pomembne razlike v klinični praksi med porodnišnicami. Najpogostejša indikacija za urgentni carski rez je bila kefalopelvinska disproporca, delež katere pa se je prav tako pomembno razlikoval med porodnišnicami (od 11,2 % do 45,9 %; razmerje obetov 6,72; 95 % interval zaupanja 3,10-14,71; P < 0,001).*

***Zaključek**: Podatke NPIS lahko uporabimo za retrospektivno analizo indikacij za urgentne carske reze, ki omogoča primerjavo kliničnih praks med porodnišnicami in izdelavo strategij za zmanjšanje naraščanja pojavnosti primarnih carskih rezov.*

***Ključne besede**:*
carski rezi, distocija, kefalopelvinska disproporca

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1 INTRODUCTION

Caesarean section (CS) rates have increased significantly worldwide during the last decades without a concomitant decrease in neonatal morbidity or mortality (1–4). With growing knowledge of short- and long-term complications associated with CS, many efforts have been made to control the rise in CS rates (2, 3). The safest and most effective approach to achieve this is to avoid the first, i.e. primary CS (3).

Variation in rates of CS in nulliparous women with cephalic foetuses presenting in spontaneous labour at term indicate that differences in clinical practice affect the number of CS significantly (5, 6). A classification that would allow transforming crude numbers of primary CS into useful information on differences in clinical practice patterns could be used to design individualized approaches required to safely reduce the rates of primary CS.

In 2013, Robson et al. proposed a classification of CS in labour shown in Table 1 (7). They classified indications for CS in labour into foetal distress and dystocia. Primary CS for foetal distress was defined as a CS in labour for foetal distress when no oxytocin is used. All other CS were classified as a form of dystocia. Sub-groups of dystocia depend on whether progress of labour (cervical dilatation) is less than 1 cm/h (inefficient uterine action) or more than 1 cm/h (efficient uterine action). Inefficient uterine action was then subdivided into poor response (despite maximum treatment with oxytocin), inability to treat adequately (for foetal reasons), inability to treat adequately (because of the uterus over-contracting), or no treatment (oxytocin not given for other reasons).

The aim of our study was to determine whether this classification of indications for CS in labour can be retrospectively applied using data from a national perinatal database and whether this could help recognizing differences in clinical practice in different maternity units that could explain different CS rates.

Adapted from ref. 7: Robson M, Hartigan L, Murphy M. Methods of achieving and maintaining an appropriate caesarean section rate. Best Pract Res Clin Obstet Gynaecol. 2013;27:297–308; * maximum dose of oxytocin refers to individual unit's protocol.

2 METHODS

We evaluated NPIS data for the period 2013 through 2014. Since 1987, NPIS registers all deliveries in Slovenia at ≥22 weeks of pregnancy or when birth weight is equal to 500 g or above. Registration is mandatory by law in the country's 14 maternity units and more than 140 variables are entered into a computerized database by the attending midwife and doctor. Patient demographics, family, medical, gynaecologic and obstetric history, data on current pregnancy, labour and delivery, postpartum period, and neonatal data are collected. The complete list of variables with definitions and methodological guidelines has been published online by the Slovenian Institute of Public Health (8). To assure quality of data collected, controls are built in the computerized system, data is audited periodically, and comparisons are made with international databases, such as the Vermont Oxford network in which Slovenia participates.

A 2-year period was chosen for the present analysis to avoid changes in clinical practice that may occur over a longer time and long enough to provide a meaningful analysis due to small number of deliveries in some units. All nulliparous patients with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses (Group 1 according to the Robson's Ten Group Classification System) were classified into the seven categories according to classification in Table 1 (9). We also compared rates of several maternal outcomes (3rd or 4th perineal tear, postpartum haemorrhage >500 ml, need for transfusion) and neonatal outcomes corrected for lethal anomalies (neonatal mortality of live born babies who died within 28 completed days from birth), Apgar score <7 at 5 minutes of life, perinatal asphyxia and severe perinatal asphyxia (diagnosed according to criteria of Sarnat and Sarnat (10), and Erb's palsy).

Table 1. Classification of caesarean section in labour.

Foetal distress (no oxytocin)		
Dystocia	Inefficient uterine action (cervical dilatation <1 cm/h)	Poor response (maximum dose reached) *
		Inability to reach maximum dose due to foetal intolerance
		Inability to reach maximum dose because of over-contracting or not following unit protocol
	Efficient uterine action (cervical dilatation >1cm/h)	Cephalopelvic disproportion
		Malposition (e.g. occipito posterior)

Chi-square test was used for statistical comparison between units. A P value ≤0.05 was considered statistically significant. The software used for statistical analysis was IBM SPSS Statistics for Windows Version 21.0 (Armonk, NY: IBM Corp.).

3 RESULTS

There were 41,246 deliveries in Slovenia during the study period. Of these, 8,332 (20.2%) were CS. In Group 1, according to the Robson's Ten Group Classification System (nulliparous patients with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses) there were 13,572 deliveries and 1,567 (12.0%) CS.

Group 1 contributed 19.1% to the overall CS rate. Table 2 presents numbers and percentages of CS in Group 1 classified according to the proposed classification of CS in labour for every delivery unit in Slovenia.

Table 2. Distribution of categories of caesarean sections in labour in nulliparous women with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses (Group 1 according to the Robson's Ten Group Classification System) in 14 maternity units in Slovenia in years 2013 and 2014.

Category	Maternity unit														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	over all
Total number of deliveries in Group 1 in each maternity unit	323	1366	567	514	1138	3629	1421	720	418	824	1161	608	529	354	13572
Number of CS in Group 1 (% of CS in Group 1)*	32 (9.9%)	141 (10.3%)	23 (4.1%)	61 (11.9%)	198 (17.4%)	397 (10.9%)	107 (7.5%)	90 (12.5%)	74 (17.7%)	96 (11.7%)	109 (9.4%)	80 (13.2%)	85 (14.4%)	74 (20.9%)	1567 (12.0%)
Foetal distress + no oxytocin*	6 (18.8%)	35 (24.8%)	7 (30.4%)	4 (6.6%)	30 (15.2%)	30 (7.6%)	7 (6.5%)	4 (4.4%)	7 (9.5%)	16 (16.7%)	8 (7.3%)	7 (8.8%)	1 (1.2%)	5 (6.8%)	167 (10.7%)
Poor response (maximum dose reached)*	0 (0.0%)	2 (1.4%)	0 (0.0%)	4 (6.6%)	0 (0.0%)	5 (1.3%)	2 (1.9%)	1 (1.1%)	7 (9.5%)	1 (1.0%)	0 (0.0%)	7 (8.8%)	0 (0.0%)	2 (2.7%)	31 (2.0%)
Inability to reach maximum dose due to foetal intolerance*	0 (0.0%)	4 (2.8%)	0 (0.0%)	0 (0.0%)	5 (2.5%)	15 (3.8%)	1 (0.9%)	6 (6.7%)	0 (0.0%)	1 (1.0%)	1 (0.9%)	0 (0.0%)	3 (3.5%)	2 (2.7%)	38 (2.4%)
Inability to reach maximum dose because of over-contracting or not following units protocol*	12 (37.5%)	12 (8.5%)	6 (26.1%)	14 (23.0%)	46 (23.2%)	114 (28.7%)	23 (21.5%)	23 (25.6%)	5 (6.8%)	24 (25.0%)	41 (37.6%)	0 (0.0%)	39 (45.9%)	10 (13.5%)	369 (23.5%)
Cephalopelvic disproportion*	6 (18.8%)	37 (26.2%)	5 (21.7%)	28 (45.9%)	50 (25.3%)	121 (30.5%)	12 (11.2%)	22 (24.4%)	12 (16.2%)	27 (28.1%)	24 (22.0%)	23 (28.7%)	21 (24.7%)	27 (36.5%)	415 (26.5%)
Malposition (e.g. occipito posterior)*	4 (12.5%)	22 (15.6%)	2 (8.7%)	3 (4.9%)	24 (12.1%)	23 (5.8%)	3 (2.8%)	10 (11.1%)	19 (25.7%)	13 (13.5%)	6 (5.5%)	9 (11.3%)	8 (9.4%)	10 (13.5%)	156 (10.0%)
Impossible to classify*	4 (12.5%)	29 (20.6%)	3 (13.0%)	8 (13.1%)	43 (21.7%)	89 (22.4%)	59 (55.1%)	24 (26.7%)	24 (32.4%)	14 (14.6%)	29 (26.6%)	34 (42.5%)	13 (15.3%)	18 (24.3%)	391 (25.0%)

* represents statistically significant differences between units (P≤0.05); percentages are related to total numbers of caesarean sections in Group 1 in each maternity unit.

Rates of CS in Group 1 differed significantly among different maternity units (from 4.1% (unit 3) to 20.9% (unit 14)). The most common indication for CS was cephalopelvic disproportion. Overall, 26.5% of all primary CS in Group 1 were performed for cephalopelvic disproportion (dystocia with efficient uterine action and without foetal malposition). However, incidences of diagnosis of cephalopelvic disproportion differed significantly among units: from 11.2% in unit 7 to 45.9% in unit 4 (odds ratio (OR) 6.72; 95% confidence interval (CI) 3.10–14.71; P<0.001).

Significant differences were seen in other groups of CS in labour as well. Foetal distress without labour augmentation was the indication for CS in 10.7% of primary CS overall, ranging from 1.2% in unit 13 to 30.4% in unit 3 (OR 36.75; 95% CI 4.23–319.44; P<0.001). There were also significant differences in ranges of CS for inability to reach the maximum dose of oxytocin due to foetal intolerance (no such cases recorded in units 1, 3, 4, 9, and 12 and 6.7% of primary CS in unit 8).

Significant differences were also observed in proportions of CS in Group 1 due to an inability to reach maximum oxytocin dose because of the uterus over-contracting or not following unit's protocols. Proportion of all primary CS in Group 1 in this sub-group ranged from 0% in unit 12 to 45.9% in unit 13.

When comparing unit 3 (the unit with lowest overall CS rate in Group 1, i.e. 4.1%) and unit 14 (the unit with highest overall CS rate in Group 1, i.e. 20.9%), the proportion of primary CS for foetal distress without oxytocin was significantly higher in unit 3 (30.4% vs. 6.8%, OR 6.04; 95% CI 1.70–21.50; P=0.003). Different types of dystocia were, therefore, diagnosed relatively less frequently in unit 3, as was also the case with other units with lower overall primary CS rates.

A significant proportion of cases could not be classified (overall 25.0%, range 12.5% to 55.1% among units). The reasons for inability to classify a case were that either the dose of oxytocin reached, or foetal presentation were not entered in the database.

Table 3 presents maternal and neonatal outcomes in each maternity unit in the Robson's Ten Group Classification System Group 1. There were statistically significant differences in all outcomes studied except neonatal mortality. Unit 3 (the unit with lowest CS rate) had higher rates of maternal morbidity, however, neonatal mortality and morbidity were higher in some other units. Neonatal or maternal morbidity were not lower in unit 14, the unit with highest CS rate.

Table 3. Maternal and neonatal outcomes (corrected for lethal congenital malformations) in Group 1 (Robson's Ten Group Classification System – nulliparous women with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses) in 14 maternity units in Slovenia in years 2013 and 2014.

Outcome	Maternity unit														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	over all
3rd or 4th degree perineal tear*	1 (0.3%)	3 (0.2%)	10 (1.8%)	1 (0.2%)	5 (0.4%)	3.9 (1.1%)	11 (0.8%)	3 (0.4%)	1 (0.2%)	6 (0.7%)	4 (0.3%)	1 (0.2%)	2 (0.3%)	3 (0.8%)	90 (0.7%)
PPH >500ml*	9 (2.8%)	6 (0.4%)	41 (7.2%)	3 (0.6%)	4 (0.4%)	227 (6.2%)	9 (0.6%)	3 (0.4%)	4 (1.0%)	20 (2.4%)	42 (3.6%	8 (1.3%)	36 (6.1%)	3 (0.8%)	415 (3.0%)
Transfusion*	2 (0.6%)	0 (0.0%)	2 (0.4%)	0 (0.0%)	0 (0.0%)	18 (0.5%)	1 (0.1%)	1 (0.1%)	0 (0.0%)	1 (0.1%)	0 (0.0%)	3 (0.5%)	0 (0.0%)	0 (0.0%)	28 (0.2%)
Neonatal mortality	0 (0.0%)	0 (0.0%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.3%)	3 (0.0%)
Apgar <7 at 5'*	1 (0.3%)	0 (0.0%)	1 (0.2%)	1 (0.2%)	6 (0.5%)	19 (0.5%)	8 (0.6%)	1 (0.1%)	5 (1.2%)	2 (0.2%)	2 (0.2%)	1 (0.2%)	2 (0.3%)	3 (0.8%)	52 (0.4%)
Perinatal asphyxia*	8 (2.4%)	5 (0.4%)	1 (0.2%)	0 (0.0%)	16 (1.4%)	30 (0.8%)	1 (0.1%)	2 (0.3%)	12 (2.9%)	3 (0.4%)	14 (1.2%)	4 (0.7%)	28 (4.7%)	3 (0.8%)	127 (0.9%)
Severe asphyxia*	1 (0.3%)	0 (0.0%)	1 (0.2%)	0 (0.0%)	2 (0.2%)	1 (0.0%)	0 (0.0%)	1 (0.1%)	3 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	9 (0.1%)
Erb's palsy*	0 (0.0%)	0 (0.0%)	1 (0.2%)	0 (0.0%)	2 (0.2%)	3 (0.1%)	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.1%)	0 (0.0%)	3 (0.5%)	1 (0.3%)	12 (0.1%)

PPH postpartum haemorrhage; * represents statistically significant differences between units (P≤0.05); percentages are related to total numbers of deliveries in Group 1 in each maternity unit.

4 DISCUSSION

The main finding of the present study is that classifying primary CS into foetal distress and several dystocia sub-groups reveals significant differences among maternity units. Such classification could, especially when supported by evaluation of perinatal outcomes, allow a meaningful analysis of CS rates in different hospitals leading to evidence-based initiatives to improve clinical practice.
Various forms of dystocia are diagnosed less frequently in units with lower rates of primary CS, while the proportion of primary CS for foetal distress without labour augmentation is relatively larger in such units. One of the forms of dystocia is the inability to achieve efficient uterine action due to foetal distress with oxytocin augmentation. Such cases were significantly less frequent in units with lower primary CS rates compared to units with higher rates. Since units with lower CS rates did not have higher rates of neonatal mortality and morbidity, it can be argued that primary CS could be safely reduced in certain units with better training in foetal heart rate interpretation (11). However, maternal adverse outcomes, such as incidence of severe perineal trauma and postpartum haemorrhage, were higher in units with lower CS rates and this has to be taken into account when designing strategies for reduction of CS rates. There also seem to be significant differences in diagnosing cephalopelvic disproportion and uterine hyperstimulation. Better training and/or supervision could, again, have an important impact on rates of primary CS in certain units.

A high-dose regimen for labour induction and augmentation with oxytocin has been recommended for all maternity units in Slovenia (12). It includes an initial oxytocin infusion of 2 to 5mU/min with increments every 20–30 min until a maximum dose of 40mU/min is reached (12). Results of the present study indicate that a significant number of maternity units do not follow the proposed regimen (different proportions of CS in which maximum oxytocin dose has not been reached despite inefficient uterine action and no foetal distress). Although conflicting results have been reported from trials comparing low- to high-dose oxytocin regimens, some authors have found that high-dose oxytocin for labour augmentation is associated with a decrease in CS (13–15). Some units could, therefore, potentially reduce their CS rates with a stricter adherence to the proposed oxytocin regimen.
The study has several limitations. Small numbers in certain sub-groups make comparisons between units difficult. The main limitation is, however, the inability to classify a significant proportion of CS. Nevertheless, we showed that classification of CS in labour using NPIS data can yield important information for future perinatal audit in the country. Moreover, one of the purposes of using classification systems is also to analyse the quality of data collection. Our results indicate that future efforts to improve collection of data on maximum oxytocin dose reached during labour should be undertaken. This is even more important when considering the significant differences in proportions of CS that could not be classified in different units, suggesting different standards of data collection. Differences in sub-groups of primary CS between units found in our study should, therefore, be interpreted with caution. Still, even when only comparing units with similar proportions of non-classified cases, differences are still apparent.

In conclusion, our study suggests that a classification system of primary CS in labour can provide important information on different clinical practices in different units. Knowledge of these differences can lead to the development of effective strategies to safely reduce primary CS rates. In addition, our data also showed that efforts to improve collection of data are needed in order to apply this classification to all maternity units in the country.

CONFLICT OF INTEREST

The authors declare that no conflict of interest exists.

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ETHNICAL APPROVAL

This retrospective study of anonymous entries did not require approval by the ethical committee.

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MANAGEMENT OF FRAILTY AT INDIVIDUAL LEVEL: NARRATIVE REVIEW OF PHYSICAL ACTIVITY FROM THE EUROPEAN PERSPECTIVE OF JOINT ACTION ON FRAILTY – JA ADVANTAGE

MANAGEMENT KRHKOSTI NA RAVNI POSAMEZNIKA: PREGLED LITERATURE IZ EVROPSKE PERSPEKTIVE PROJEKTA SKUPNEGA UKREPANJA ADVANTAGE

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Review

ABSTRACT

Introduction: This paper aimed to review the effect of physical activity and exercise in frail older persons. As the process which leads to frailty and disability can be slowed down or even completely reversed, it can be appropriate for early interventions.

Methodology: A literature search was conducted in the following databases: PubMed, Cochrane, Embase, Cinahl and UpToDate. The criterion in selecting the literature was that articles were published from 2002 to 2017. From 620,043 initial hits, 25 publications were selected.

Results: Physical activity and exercise in frail elderly are effective and relatively safe and may reverse frailty.

Conclusion: Different exercise interventions in frail elderly persons can increase strength and power, improve balance and reduce fall incidence resulting in greater quality of life. From this perspective, physical exercise interventions should become daily routine in frail elderly persons.

Keywords:
physical activity, exercise, frailty

IZVLEČEK

Uvod: *Namen tega prispevka je pregledati učinek fizične aktivnosti in telovadbe pri krhkih starostnikih. Ker se lahko proces, ki vodi h krhkosti in odvisnosti od drugih upočasni ali popolnoma zavre, je primeren za zgodnje intervencije.*

Metode: *Za to raziskavo je bil uporabljen pregled literature v naslednjih podatkovnih bazah: PubMed, Cochrane, Embase, Cinahl in UpToDate. Vključitveni kriterij je bil objava člankov v letih 2002 do 2017. Od 620.043 zadetkov je bilo izbranih 25 publikacij.*

Rezultati: *Fizična aktivnost in vadba starejših krhkih oseb je učinkovita in relativno varna ter lahko odpravlja krhkost.*

Zaključki: *Različne vadbene intervencije pri krhkih starejših osebah lahko povečajo telesno moč, izboljšajo ravnotežje in zmanjšujejo nevarnost padcev, kar izboljšuje kakovost življenja. Iz te perspektive naj intervencije telesne aktivnosti postanejo del dnevne rutine starejših oseb.*

Ključne besede:
telesna aktivnost, vadba, krhkost

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1 INTRODUCTION

Sedentary lifestyle is the sole most important factor in the development of chronic diseases (1). Sedentary behaviour has a strong negative impact on health outcomes among older adults, including higher risk of all-cause mortality, metabolic syndrome, high triglycerides, high blood pressure, overweight, abdominal obesity, mental disorders, etc. (2). Maintaining this lifestyle for years may accelerate some aspects of secondary ageing, such as speeding the reduction in bone mineral density, maximal oxygen consumption, and skeletal muscle strength and power (3), which are all used as determinants of frailty. In the elderly population, sedentary lifestyle is even more pronounced (4) which additionally increases the risk of becoming frail in older age.

The number of older persons is increasing, however, the number of the "oldest" old is rising even more rapidly. Older age is related to physical and cognitive decline, which contributes to an increased number of frail persons with increasing age (5). Frailty affects many domains including muscle strength, mobility, balance, endurance, co-ordination and, in general, there is a decrease in the level of physical and functional activity (6).

Reduced physical functioning is the most dominant sign of frailty (7, 8). The ageing associated loss of muscle mass seems to be one of the major causes for reduced physical abilities in older age and, consequently, disability and frailty (9). There are many influences contributing to this process, for example, motor neuron death, and hormonal and immunological changes as a normal part of ageing (10). On the other hand, there are additional behavioural influences such as poor nutrition and reduced physical activity that affect muscle mass reduction and are more pronounced with ageing. This is a very important observation since nutrition and physical activity can be changed by adopting an active and healthy lifestyle.

Frailty among older persons is a dynamic process (11). During the observed period (51 months), transitions to states of greater frailty were more common (rates up to 43.3%) than transitions to states of lesser frailty (rates up to 23.0%), and the probability of transitioning from being frail to non-frail was very low (rates between 0%–0.9%). With shorter observation intervals, the transition rates are even higher (12). Disability lasting only 1 or 2 months is strongly associated with the development of future disability and death (13). This strongly suggests that preventing frailty is a key factor for maintaining an active and healthy lifestyle in older age. However, even if frailty occurs, it can still be reversed. In the above-mentioned studies no specific treatments were performed to reverse frailty.

There is abundant evidence from prospective and clinical studies that physical activity not only delays but also prevents or reverses frailty. For instance, a recent observational study (14) showed that physical activity might attenuate frailty. Mild physical activity was insufficient to significantly slow the progression of frailty, moderate physical activity reduced the progression of frailty in some age groups (particularly ages 65 and above) and vigorous activity significantly reduced the trajectory of frailty progression in all older adults.

A dose-response relationship has been shown in several studies. Higher cardiorespiratory fitness showed improved survival with higher function of metabolic equivalents (METs) across all age groups (15).

2 METHODS

Descriptive research methodology was used to review peer-reviewed medical literature. A narrative literature review was conducted as it enables the obtainment of data from various sources and ensures a holistic understanding of the research subject. The literature search was conducted using the following databases: PubMed, The Cochrane Library, Embase, UpToDate, Cumulative Index of Nursing and Allied Health Literature (CINAHL), by means of several combinations of selected search words in the English language and their synonyms were prepared and used with Boolean operators AND or: Frail Muscle strength *() OR Frailty Activity *() OR Elderly Exercise *() OR Older adult Functional ability *() OR Aged functional decline *() OR Older person Mobility *() OR Geriatric Disability *() OR Inactivity Vulnerable Elderly *() OR Physical activity Aged Function *() OR Training Aged *() OR Functional outcomes Geriatric *() OR Physical interventions Vulnerable *() OR Sports Older person *() OR Patterns of activity Older adult *() OR Leisure activity Elderly *(); searching in title, key words and in abstract.

The selection criterion for articles to be included in the review was that they were published during the last 15 years, i.e. between 2002 and 2017. Key words were selected from a proposal of key words that was prepared by the task leader and the working group focusing on Physical activity as part of the European Commission project "Joint Action on Frailty prevention – JA ADVANTAGE", Work Package 6 – Management of Frailty at Individual Level. Final paper selection was also performed by the working group focusing on Physical activity.

The inclusion criteria were based on scientific facts, contextual relevance and full-text availability. Articles regarding current policies and guidelines on frailty prevention in older people that were published in peer-reviewed scientific journals. Information from editorials, letters, interviews, posters and articles with no access to full text were not included in the study. The total number of all search results was 620,043. After excluding

duplicates and taking inclusion criteria into account, a total of 25 articles/sources remained for analysis (Table 1). Initial selection using database search engines was performed by the Joint Action Advantage Work package 6 working group (selection of 119 sources). Further selection and analysis was performed by authors.

The process of the Literature Review is displayed in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) diagram, as shown in Figure 1.

With our approach, we found papers of different evidence levels of research. Between selected papers of different evidence levels of research, we included 4 qualitative and 21 quantitative researches. Data synthesis was conducted using the descriptive method.

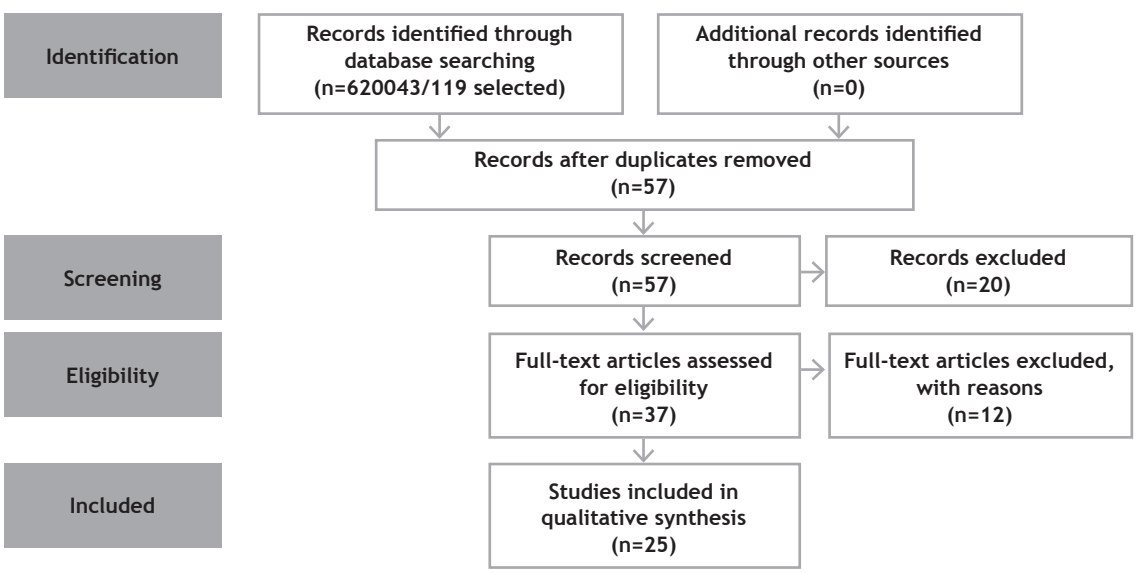

Figure 1. Flowchart of search strategy and literature selection process – PRISMA diagram.

3 RESULTS

Table 1. Search table.

	Key word	No. of hits	Chosen hits	Repeated chosen hits	Final selection
PubMed	Frail Muscle strength	627	16	6	1
	Frailty Activity	1261	12	1	1
	Elderly Exercise	119309	11	11	3
	Older adult Functional ability	57636	11	11	2
	Aged functional decline	6779	3	2	1
	Older person Mobility	4694	2	2	1
	Geriatric Disability	4277	4	4	1
	Inactivity Vulnerable Elderly	52	1	1	1
	Physical activity Aged Function	92075	14	11	2
	Training Aged	245729	16	10	3
	Functional outcomes Geriatric	1724	2	1	1
	Physical interventions Vulnerable	741	4	1	1
	Sports Older person	8246	4	4	1
	Patterns of activity Older adult	11744	6	6	1
	Leisure activity Elderly	54789	6	6	1
Cochrane	Frail Muscle strength	171	5	5	1
	Frailty Activity	186	0	0	0
	Elderly Exercise	2321			1
	Older adult Functional ability	229	0	0	0
	Aged functional decline	1279	0	0	0
Embase	Older person Mobility	328	0	0	0
	Geriatric Disability	511	0	0	0
	Inactivity vulnerable Elderly	9	0	0	0
	Physical activity Aged Function	791	0	0	0
UpToDate	Training Aged	2680	1	1	1
	Functional outcomes Geriatric	1180	0	0	0
	Physical interventions Vulnerable	101	0	0	0
	Sports Older person	483	0	0	0
Cinahl	Patterns of activity Older adult	47	1	1	1
	Leisure activity Elderly	30	0	0	0
	Frail Muscle strength	14	0	0	0
Other sources					
		620043	119		25

4 DISCUSSION

Physical activity and exercise in frail elderly are effective and relatively safe and may reverse frailty. Most studies researched the effects of interventions on fall prevention and functional outcomes. Different exercise interventions in frail elderly persons can increase strength and power, have the potential to maintain or even slightly increase fat-free mass, and are effective in improving aerobic capacity and balance.

4.1 Strength and Power

The main reason behind strength and power decline is sarcopenia, loss of muscle mass with age due to motor neuron death, immunological factors, hormonal change, increased sedentary lifestyle and malnutrition (10). Supervised centre-based interventions seem to be more effective than home ones in improving strength in frail older persons (16–19) but not in all examples (20–23).

An important parameter of strength gain is exercise load, i.e. intensity, usually expressed in % of 1RM (one repetition maximum). Siegrist et al. (23) reported no strength gains after 16 weeks of a supervised exercise training program (1 hour/week) with strength and power training, challenging balance and gait training with increasing, but in general low, levels of difficulty. Tai-chi based and low-level strength exercise programs (24) produced a small but significant improvement in strength. With fitness machines and loads of 60% of 1RM substantial strength improvements were obtained (about 20% in isometric exercises and about 100% in lifting weights). Similar effects were seen in a study by Binder et al. (17) with exercise loads of 70–80% of 1RM. In the oldest old persons, 70% of 1RM load managed to improve leg press strength by 20% after 8 weeks of hypertrophy type strength training. Weight training with loads between 60–80% of 1RM increases muscle mass even in very old persons (25). The gains in strength and muscle mass may be similar in young and older women (26). These results are consistent with findings in healthy older persons where greater loads are related to greater increases in strength and power parameters (27) supporting a dose-response relationship. Exercise interventions were of different durations, ranging from 8 weeks up to 2 years. Already the shortest trial duration was enough to increase strength (28).

One interesting exercise principle is integrating exercise into everyday routines; however, high levels of improvisation and motivation are required. Results from the LiFE project (20) showed a limited effect of this approach on strength improvement. Its major limitation seemed to be low exercise loads, as high loads were hard to achieve in everyday routines.

Amino acid supplementation (AAS) may promote muscle growth but does not necessarily improve strength and power in healthy older adults (29). In older sarcopenic women, knee strength was improved in the exercise + AAS group but not in the exercise only group (30). This implies that AAS may augment muscle strength in this population. In another study (31) supplementation with milk fat globule membrane had no effect on muscle mass and strength gains. Similarly, supplementing vitamin D did not show any effect on strength (32). Supplementation with iron, folate, vitamin B6 and B12, calcium and Vitamin D (33) showed no additional improvement in strength, however, it increased overall physical activity and energy.

4.2 Endurance

Loss of aerobic capacity may be due to decreased muscle mass or lower cardiac output (35). Ehsani et al. (36) studied cardiovascular adaptation in older mild-to-moderate frail subjects after endurance exercise at 78% of peak heart rate. They found 14% increase in peak VO2 after 9 months of intervention and that the main adaptation was increase in heart rate and probably stroke volume. It is not possible to draw conclusions on the optimal regime to improve endurance and VO2 max.

4.3 Balance and Risk of Falling

Exercise programs are effective in reducing falls and fall-related injuries in healthy older persons (37, 38). El-Khoury et al. (39) showed that exercise can reduce fall risk (including for serious falls) by 19% in older women already at risk of falls. Similar results (22% reduction) were seen in a study by Lord et al. (40) where, in the group with a previous fall, the incidence was reduced by 31%. Tai-chi and low-level exercise (24) reduced fall incident rate ratio by 58% overall. In a study by Siegrist et al. (23), the fall incidence in the exercise group was roughly half compared to the control group which received no treatment. This shows that fall prevention interventions in frail older persons are effective, however, they generally have a smaller effect on fall prevention compared to healthy older persons (37). Additionally, exercise reduced fear of falling (23, 41). Faber et al. (22) showed that frail persons, compared to pre-frail, benefit more from exercise intervention in terms of fall reduction. The opposite was found for improving balance and mobility.

There is abundant evidence that exercise intervention improves balance in frail elderly persons (19, 20, 22–24, 36, 39, 41–43), even in very old persons. A combination of strength and balance training further improves balance outcomes (17, 42, 43, 45). When strength and balance were complemented with gait and functional exercises (23, 39, 42) no additional effect on balance outcomes was observed.

Lifestyle integrated exercise was similarly effective as structured strength and balance training in promoting balance (20). This makes it possible to integrate balance exercises into daily activities.

4.4 Adverse Effects and Risks

Although exercise is generally safe for older people (46), this may not be valid for frail older persons. Some studies reported adverse effects, including falls during exercise sessions (36); groin strain and pelvic stress fracture (20); a wrist fracture, a twisted ankle, and two bruises (39); two reports of back pains (45); 9 (not identified) reported events related to intervention or testing (19); 23 reports of knee and back pain (32); 107 (5.0%) adverse events including IADL-ADL dependency, hospitalization or any fall (33); 11 reports of non-specified aches and pains (24). There was no pattern observed in adverse events related to interventions. However, there are some concerns that high-intensity exercise might pose a greater risk of injury than a program of lower intensity (32).

5 CONCLUSION

Physical activity and exercise in frail elderly are effective and relatively safe and may reverse frailty. Different exercise interventions in frail elderly persons can increase strength and power, have the potential to maintain or even slightly increase fat-free mass, are effective in improving aerobic capacity and balance, reduce fall incidence and improve quality of life. From this perspective, physical exercise interventions should become daily routine in frail elderly persons and supported by long-term care legislation.

The aim of this research was to present the results of a narrative literature review and data analysis focusing on physical activity in the context of managing frailty at an individual level. For the purposes of this research, a literature review method was used. The method proved to be appropriate and the aim was achieved.

CONFLICTS OF INTEREST

None.

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ETHICAL APPROVAL

Not applicable.

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FRAILTY ASSESSMENT SCALES FOR THE ELDERLY AND THEIR APPLICATION IN PRIMARY CARE: A SYSTEMATIC LITERATURE REVIEW

OCENJEVALNE LESTVICE KRHKOSTI STAROSTNIKA IN NJIHOVA RABA NA PRIMARNI RAVNI: SISTEMATIČNI PREGLED LITERATURE

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Review

ABSTRACT

Keywords:
elderly, frailty, assessment scales, primary care

Background: The increase in the elderly population is causing changes and challenges that demand a comprehensive public health response. A specific characteristic of the elderly is their frailty. Today's problems with identifying levels of frailty are being resolved by numerous tools in the form of frailty assessment scales. This systematic review establishes which frailty assessment scales for the elderly are being used and what their applicability in primary care is like in Slovenia and around the world.

Methods: Documents published after 2010 were searched for in the PubMed database using keywords and other specific criteria.

Results: A total of 177 search hits were obtained based on various search strings. The final analysis included 28 articles, of which three were systematic literature reviews. These three covered quantitative studies, mainly consisting of observational cross-sectional surveys or cohort studies. Three other studies featured non-systematic literature reviews. Quantitative studies (mainly cross-sectional surveys or cohort studies) prevailed among the remaining 22 articles. One study had a qualitative design (Delphi method). The main outcome measures observed by all studies were frailty assessment scales for the elderly, the majority of which were evaluated on a sample of the elderly.

Conclusions: None of the assessment scales examined are used as the gold standard for primary care. A variety of tools are being used in clinical practice to assess frailty in elderly patients, highlighting the need for standardization and guidelines. This requires evaluating the current assessment scales in terms of validity and reliability, and suitably improving them.

IZVLEČEK

Ključne besede:
starostniki, krhkost, ocenjevalne lestvice, primarno zdravstveno varstvo

Uvod: *Povečan delež starejšega prebivalstva povzroča spremembe in prinaša izzive, kar zahteva celovit odziv na področju javnega zdravja. Specifičnost starostnikov je tudi njihova krhkost. Ta za posameznika pomeni večje tveganje za negativne rezultate, povezane z zdravjem. Ugotavljanje krhkosti daje teoretični okvir, v katerem lahko zdravnik primarnega zdravstvenega varstva oblikuje celovit pristop ocenjevanja in zdravljenja starejšega bolnika s kompleksno multimorbidnostjo na preprost in strukturiran način. Težave določanja stopnje krhkosti danes rešujejo številna orodja v obliki ocenjevalnih lestvic krhkosti. Slovenija se je v letu 2017 pridružila Evropski komisiji pri Skupnem evropskem ukrepanju za preprečevanje starostne krhkosti in oslabljenosti »Joint Action«. Eden izmed predlogov ukrepov in aktivnosti je tudi razviti, implementirati in spremljati sistem presejanja na krhkosti po posameznih področjih. Sicer z merjenjem krhkosti lahko pridobimo uporabne podatke, a je za oblikovanje informacij pomemben izbor ustreznega, veljavnega instrumenta. Pojavlja se vprašanje o količini in kakovosti uporabe ocenjevalnih lestvic krhkosti starostnikov. Namen sistematičnega pregleda literature je ugotoviti, katere ocenjevalne lestvice merjenja krhkosti starostnika se uporabljajo in kakšna je domnevna uporabnost na primarni ravni v svetu in v Sloveniji.*

Metode: *Sistematično je bila pregledana literatura, objavljena po letu 2010, o ocenjevalnih lestvicah krhkosti starostnika. Iskanje dokumentov je potekalo v bibliografski bazi PubMed po določenih kriterijih s ključnimi besedami: frailty, elderly, evaluation scale, primary, frailty scale, frailty screening in primary care.*

Rezultati: *Vseh zadetkov glede na različne iskalne nize je bilo 177. V končno analizo se je uvrstilo 28 člankov, od tega trije sistematični pregledi literature. Ti vključujejo kvantitativne raziskave, v večini opazovalne presečno pregledne ali kohortne študije. Tri raziskave so nesistematični pregledi literature. Med 22 drugimi raziskavami prevladujejo raziskave s kvantitativnimi zasnovami, v večini so presečno pregledne ali kohortne študije. Ena študija ima kvantitativno zasnovo, zbiranje podatkov pa je potekalo z delfsko metodo. Opazovani izidi vseh študij so ocenjevalne lestvice starostnikov. V večini so jih raziskovalci vrednotili na vzorcu starostnikov.*

Zaključki: *Zaradi starajočega se prebivalstva je potreba po ureditvi področja merjenja krhkosti starostnikov s pomočjo ocenjevalnih lestvic vse večja. Za ugotavljanje krhkosti starejših se v praksi uporablja toliko orodij, da je potreba po standardizaciji in smernicah velika. Nobena izmed ocenjevalnih lestvic nima vloge zlatega standarda uporabe za primarno raven. Pred implementacijo v slovenski prostor je potrebno obstoječe ocenjevalne lestvice vrednotiti po kriterijih veljavnosti in zanesljivosti ter jih primerno izboljšati.*

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1 INTRODUCTION

The population's age structure has been changing greatly over the past decades, with the population becoming increasingly older, including in Slovenia (1, 2). This causes many changes and challenges that demand a comprehensive public health response (3, 4).

A specific characteristic of the elderly is their frailty. It is defined as "a condition or syndrome which results from a multi-system reduction in reserve capacity to the extent that a number of physiological systems are close to, or past, the threshold of symptomatic clinical failure." As a consequence, the frail person is at increased risk of disability and death from minor external stresses (5). Identifying the level of frailty is a useful clinical concept for predicting and preventing frailty (6–8). Frailty in the elderly entails a changed perspective on age by replacing the outdated term "chronological age" with the more accurate and personalized parameter of "biological age," and it can be measured in individuals (9). Problems with identifying the level of frailty, which were common in the past (5), are now being solved by numerous tools that can also be applied to the elderly (10, 11).

Frailty assessment thus provides a theoretical framework that primary care physicians can use to develop a comprehensive approach to assessing and treating elderly patients with complex multimorbidity in a simple and structured way (7). In Slovenia, an important role in this regard is also played by family doctors and their teams (12). The importance of using frailty measurement tools is supported by the global lack of key information and evidence on the health of the elderly, which hinders the development and evaluation of suitable policies and programs for them (13). Frailty measurements can generally provide useful information, but that requires selecting an appropriate valid instrument (9). In agreement with the Ministry of Health, in 2017, Slovenia joined the EU Commission's Joint Action on the Prevention of Frailty. The main outcome of Joint Action will be a common European model to approach frailty, leading to the development of improved strategies for diagnosis care and education for frailty, disability and multi-morbidity. The Joint Action outcomes are expected to contribute to the prevention of the growing burden of disability and chronic diseases and to a more effective response to older people's needs of care delivery, a central priority for the EU and its MS. One of the measures and activities proposed was to develop, implement, and monitor a frailty screening system by individual area (14).

The question is how many frailty assessment scales are available and what their quality is like. In Slovenia, there is a need for the knowledge of frailty assessment scales for the application at the primary level. They established the subject of Geriatrics and subject Elderly, dying patient, palliative at the Faculty of Medicine at the University of Ljubljana. In Slovenia, payment models for multimorbidity and elderly are also changing. This literature review identifies research on frailty assessment scales for the elderly published after 2010. Its goals were to determine which frailty assessment scales are available, what they measure, and whether they are used in primary care. The fundamental research question is whether the knowledge on frailty assessment scales provides a selection of assessment scales that could be applied to primary care in Slovenia in order to assess the frailty of the elderly.

2 METHODS

Literature on frailty assessment scales for the elderly was systematically reviewed. The data was collected in February 2018.

2.1 Document Sources

Documents were searched for in the online bibliographical database PubMed (15).

2.2 Document Identification Methods

Documents were searched for using the following keywords: frailty, elderly, evaluation scale, primary, frailty scale, frailty screening, and primary care. Searches were performed using Boolean operators for PubMed: (((frailty) AND elderly) AND evaluation scale); (((frailty) AND elderly) AND rating scale); (((frailty) AND elderly) AND measuring); ((frailty) AND screening) AND primary care). The search was limited to full-text open-access English articles published after 2010.

2.3 Methods of Selecting Documents to be Included in the Analysis

The selection in PubMed was narrowed down to full-text research articles. The keywords selected had to be included in the article's title or abstract, the articles had to refer to the elderly, and they had to be written in English and published in the past 8 years. An article was deemed appropriate if it featured a study connected with the frailty assessment scales used for the elderly. Studies containing clinical frailty scales or scales used for populations other than the elderly and clinical frailty scales were not included. After selecting the relevant articles, an open discussion took place in a heterogeneous group of experts with diplomas from the Faculty of Medicine and Faculty of Health Sciences at the University of Ljubljana and head lecturer of subject Determinants of health and disease on Interdisciplinary doctoral programme in Biomedicine, field Public Health. Another discussion took place in a group of students specialized in Family Medicine from Faculty of Medicine at the subject

Elderly, dying patient, palliative. Their suggestions and comments found a place in the final selection of articles and frailty assessment scales for eventual application in primary care.

2.4 Selection of Relevant Data for t he Systematic Review

The data collected included year, country, research design, units observed, number of participants, and main conclusions.

2.5 Methods for Assessing Study Quality

The suitability of the studies included was evaluated in terms of their agreement with the search string.

3 RESULTS

Twenty-eight articles meeting the criteria set were selected for final analysis (Table 1).

3.2 Main Characteristics of the Research Studies Reviewed

This analysis includes three systematic literature reviews that together cover more than 70 quantitative studies, consisting largely of observational cross-sectional surveys or cohort studies. Three studies included in the final analysis are non-systematic literature reviews (Table 1).

3.1 Selecting Documents for Systematic Review

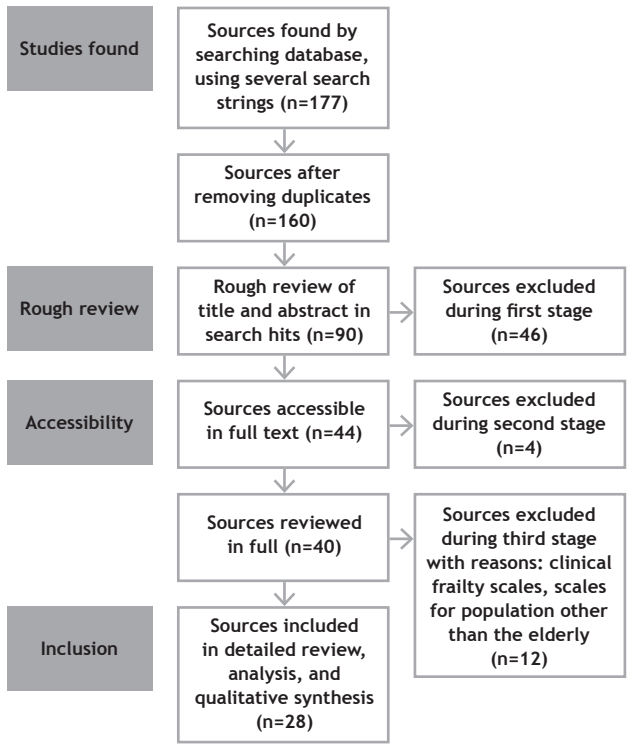

Figure 1. The procedure of selecting documents for inclusion in the systematic review of literature on frailty assessment scales for the elderly and their application in primary care.

Table 1. Main characteristics and results on frailty assessment scales for the elderly.

Document	Country	No. of studies included in final analysis	Research design	Year studies were conducted	Main conclusions
Bouillon et al., 2013 (16)	UK	27	Quantitative design: mostly cross-sectional studies	1948 –2011	Twenty-seven frailty scales were identified, but their reliability and validity were rarely evaluated. None of them are used as the gold standard.
Vermeulen et al., 2011 (17)	Netherlands	28	Quantitative design: longitudinal and cohort studies	1975 –2010	The strongest predictors are low physical activity and slow walking speed.
Drubbel et al., 2014 (18)	Netherlands	20	Quantitative design: one cross-sectional survey and 19 cohort studies	2001 –2012	The Frailty Index (FI) is a valid instrument for assessing frailty.
Li et al., 2017 (19)	Canada	Non-systematic literature review	51 references	Not provided	Measuring the grades of frailty in the elderly could assist in the assessment, management, and decision-making for osteoporosis and osteoporotic fractures.
Singh et al., 2014 (20)	US	Non-systematic literature review	101 references	Not provided	There are numerous frailty assessment scales available.
Dawson and Dennison, 2016 (21)	New Zealand	Non-systematic literature review	36 references	Not provided	At present, while diagnostic tools have been developed to identify those with the condition (e.g. the PRISMA 7 questionnaire), as there are many conditions which frailty mimics, the problem of low specificity remains.

Twenty-two studies from various countries, published after 2010, are dominated by quantitative, mostly cross-sectional or cohort studies. One study (22) has a qualitative design and data for it was collected using the Delphi method. The number of subjects included in the study depends on the research design, ranging from 100 to 5,000 in the majority of the studies; the age criteria used vary. Four studies include geriatric specialists: GPs, specialist physicians, and so on (22–25). Four studies (26–29) are based on databases that already exist. The main outcome measures observed by all studies are frailty assessment scales, indexes, or indicators analysed from various perspectives (Table 2).

Table 2. Main characteristics and results on frailty assessment scales for the elderly.

Document	Country	Research design	No. of participants / characteristics	Main outcome measures	Main conclusions
Roppolo et al., 2015 (30)	Italy	Quantitative design: cross-sectional study	267 community-dwelling elderly people	The Cardiovascular Health Study index and the Tilburg Frailty Indicator	Different instruments capture different frail individuals.
Malmstrom et al., 2015 (31)	USA	Quantitative design: longitudinal cohort study	998 Afro-Americans, 49 to 65 years old	How well the International Academy of Nutrition and Aging (FRAIL) frailty scale predicts future disability compared to the Study of Osteoporotic Fractures (SOF) frailty scale, the phenotype-based Cardiovascular Health Study (CHS) frailty scale, and the comprehensive Frailty Index (FI)	Combined use of instruments proves to be the best for predicting disability and mortality.
Romero-Ortuno et al., 2010 (26)	Ireland	Quantitative design: cross-sectional survey	17.304 women and 13.811 men over 50 included in the Survey of Health, Aging and Retirement in Europe (SHARE)	The authors created and validated a simple frailty screening instrument.	The SHARE Frailty Instrument has sufficient construct and predictive validity.
Romero-Ortuno and Soraghan, 2014 (27)	Ireland	Quantitative design: longitudinal population-based study	4.001 women and 3.057 men 75 or older from the Survey of Health, Aging and Retirement in Europe (SHARE)	The mortality prediction of the SHARE-FI75+ was compared with that of previous frailty scales in SHARE (SHARE-FI, 70-item index, phenotype, FRAIL).	The SHARE-FI75+ could help identify frailty in primary care.
Jotheeswaran et al., 2016 (32)	India	Quantitative design: cross-sectional survey, group-based observational study, measurement instrument validation	150 frail and/or care-dependent elderly people in the primary care setting	Three primary care physicians administered EASY-Care comprehensive geriatric assessment.	Robust measurement properties.
Uchmanowicz et al., 2014 (33)	Poland	Quantitative design: cross-sectional survey, measurement instrument validation	100 Polish patients 42 men and 58 women	The aim was to adopt and test the validity of the Polish version of the TFI	The TFI is a valid and reproducible instrument for assessing frailty among the Polish population.
van Kempen et al., 2013 (34)	Netherlands	Quantitative design: observational pilot study, cross-sectional survey	seven academic GP practices in and around Nijmegen, the Netherlands; a total of 151 patients were included	The aim was to describe the development of the Easycare-TOS.	The instrument meets the efficiency, flexibility, and acceptability requirements for use in primary care.

Document	Country	Research design	No. of participants / characteristics	Main outcome measures	Main conclusions
Morris et al., 2016 (28)	US	Quantitative design: cross-sectional survey, measurement instrument development, and evaluation	464.788 people served by home care agencies	The aim was to present the development and evaluation of the interRAI HC Frailty Scale.	The instrument is based on a strong conceptual foundation.
van Kempen, et al., 2015 (23)	Netherlands	Quantitative design: cross-sectional, explorative observational study	six family practices and one geriatric department; 587 patients 70 or older registered in these practices	The aim was to compare the frailty assessments provided by family physicians and geriatricians.	Geriatricians assess patients as frail more often than family physicians.
Morley et al., 2013 (22)	US	Qualitative design: the Delphi method	delegates of six major international, European, and US societies, and seven other frailty specialists	The aim was to reach consensus on frailty.	A report was produced based on the consensus.
Castell et al., 2013 (35)	Spain	Quantitative design: cross-sectional study	1.327 people older than 65	The aim was to estimate frailty based on the walking speed of the elderly urban population and apply the findings to primary care.	Detection of a walking speed below 0.8 m/s is a simple approach to diagnosing frailty in primary care.
Eyigor et al., 2015 (36)	US	Quantitative design: cross-sectional multicentre study	1.126 people over 65 from 13 centres	The Fried frailty criteria, the Mini Nutritional Assessment, the Centre for Epidemiological Studies Depression (CES-D) scale, the Charlson Comorbidity Index	Age, female gender, low education level, being a housewife, living with the family, being sedentary, presence of an additional disease, using four or more drugs/day, avoiding going outside, at least one visit to any emergency department within the past year, hospitalization within the past year, non-functional ambulation, and malnutrition increase the risk of frailty.
Drubbel et al., 2013 (37)	Netherlands	Quantitative design: cross-sectional observational study	1.580 patients 60 or older from a Dutch primary care centre	Whether a Frailty Index (FI), based on ICPC-coded primary care data, and the Groningen Frailty Indicator (GFI) questionnaire identify the same older people as frail.	The FI and the GFI moderately overlap in identifying frailty. Authors suggest an initial FI screening in routine healthcare data, followed by a GFI questionnaire for patients at high risk as the preferred two-step frailty screening process in primary care.
Silva et al., 2016 (38)	Brazil	Quantitative design: cross-sectional observational study	345 elderly people	Self-perceived health, anamnesis, Lawton and Brody's Scale, Katz Index, Geriatric Depression Scale, Timed Up and Go Test, and Study of Osteoporotic Fracture Index	Risk of falls, frailty, functional performance on the Instrumental Activities of Daily Living, insomnia, and familial support are related to self-perceived health.
Bertoli et al., 2017 (39)	Italy	Quantitative design: cross-sectional observational study	112 elderly subjects: 62 were hospitalised following hip fracture and 50 control subjects were outpatients	Thyroid stimulating hormone (TSH), free triiodothyronine (FT3), and free thyroxine (FT4) were measured to evaluate the prevalence of thyroid hormone modifications in elderly frail subjects and its relationship with frailty.	Measuring FT3 can be a useful laboratory parameter.

Document	Country	Research design	No. of participants / characteristics	Main outcome measures	Main conclusions
Theou et al., 2015 (40)	Ireland	Quantitative design: longitudinal study	4.961 elderly Irish residents	Whether frailty assessment differs when constructing frailty indices using solely self-reported or test-based health measures.	Self-reported and test-based measures should be combined when trying to identify levels of frailty.
van Kempen et al., 2015 (24)	Netherlands	Quantitative design: longitudinal primary care registry-based cohort study	4.961 elderly Irish residents a 587 patients of four GP practices in the Netherlands	The aim was to determine the predictive value of EASY-Care TOS for negative health outcomes within the year from assessment.	GPs can predict negative health outcomes in their older populations efficiently and almost as accurately as specialists in this area.
Bruyère et al., 2017 (25)	Belgium, EU survey	Quantitative design: international online cross-sectional survey	388 clinicians from 44 countries, mostly doctors (93%), with geriatrics as their primary field of practice (83%).	How practitioners measure the geriatric syndrome of frailty in their daily routine.	52.8% always assess frailty in their daily practice and 64.9% of them diagnose frailty using more than one instrument.
Metzelthin et al., 2010 (41)	Netherlands	Quantitative design: cross-sectional survey	687 community-dwelling elderly people 70 or older.	The Groningen Frailty Indicator (GFI), the Tilburg Frailty Indicator (TFI), the Sherbrooke Postal Questionnaire (SPQ), and the Groningen Activity Restriction Scale (GARS)	The GFI and the TFI showed high internal consistency and construct validity in contrast to the SPQ. It is not yet possible to conclude whether the GFI or the TFI should be preferred. The SPQ seems less appropriate for postal screening of frailty.
Lee et al., 2017 (42)	Canada	Quantitative design: retrospective chart review	Complete frailty screening data were available for 383 patients75 and older.	The aim was to examine the accuracy of individual Fried frailty phenotype measures in identifying the Fried frailty phenotype in primary care.	The use of gait speed or grip strength alone was found to be sensitive and specific as a proxy for the Fried frailty phenotype, but the use of both measures together was found to be accurate, precise, specific, and more sensitive than other possible combinations. Assessing both measures is feasible within primary care.
Campitelli et al., 2016 (29)	Canada	Quantitative design: retrospective cohort study	resident Assessment Instrument (RAI) data for all long-stay home care clients (66 or older) in Ontario, Canada (n=234.552)	The aim was to examine two versions of a frailty index (a full and a modified FI), and the CHESS scale, and compare their baseline characteristics and their predictive accuracy.	The different approaches to detecting vulnerability resulted in different estimates of frailty prevalence. The gains in predictive accuracy were often modest with the exception of the full FI.
Vergara et al., 2016 (43)	Spain	Quantitative design: prospective multicentre cohort study	900 individuals 70 or older	The Tilburg Frailty Indicator (TFI), the Gérontopôle Frailty Screening Tool (GFST), and the KoS model together with two biomarker levels (SOX2 and p16INK4a) for adverse events related to frailty.	Great potential for direct application in primary care.

Table 3. Frailty assessment scales that were identified for eventual application in primary care.

Frailty assessment scale	Short description
The FRAIL (22)	fatigue, resistance, aerobic, illnesses, loss of weight
The Cardiovascular Health Study Frailty Screening Measure (22)	weight loss, exhaustion, low activity, slowness, weakness
The SHARE Frailty Instrument (SHARE-FI) (26)	exhaustion, weight loss, handgrip strength, slowness, low activity
The SHARE Frailty Instrument (SHARE-FI) 75+ (27)	fatigue, low appetite, weakness, slowness.
interRAI home care frailty scale (28)	29 assessment items; the areas of function, movement, cognition and communication, social life, nutrition and clinical symptoms
Study of Osteoporotic Fractures (SOF) frailty scale (31)	weight loss, reduced energy level, inability to rise from a chair, reduced energy level
Tilburg Frailty Indicator (TFI) (33, 41, 43)	Sociodemographic characteristics of a participant. The physical domain: physical health, unexplained weight loss, difficulty in walking, balance, hearing problems, vision problems, strength in hands, and physical tiredness. The psychological domain: cognition, depressive symptoms, anxiety, and coping. The social domain: living alone, social relations, and social support
easycare Two-step Older persons Screening (Easycare-TOS) (24, 34)	14 questions about the functioning of the patient in somatic, psychological, and social domains
Frailty Index (FI) (37)	includes 40 variable
Groningen Frailty Indicator (GFI) (25, 37, 41)	15 self-report items and screens for loss of functions and resources in four domains: physical, cognitive, social, and psychological
Short Physical performance Battery (SPPB) (25)	balance, 4-metre gait speed and chair stand test
Edmonton frail scale (25)	cognitive impairment, health attitudes, social support, medication use, nutrition, mood, continence, functional abilities
Frail scale status (25)	fatigue, resistance, ambulation, illness and loss of weight
Gerontopole frailty screening tool (GFST) (22, 25, 43)	The first 6 questions evaluate the patient's status (living alone, involuntary weight loss, fatigue, mobility difficulties, memory problems and gait speed), whereas the last two assess the general practitioner's personal view about the frailty status of the individual and the patient's willingness to be referred to the Frailty Clinical for further evaluation.
SEGA grid (25)	functional decline, including age, provenance, drugs, mood, perceived health, history of falls, nutrition, comorbidities, IADL, mobility, continence, feeding and cognitive functions
Strawbridge questionnaire (25)	two or more functional domains (physical, cognitive, sensory and nutritive).
Frailty phenotype (25, 44)	unintentional weight loss (10 lbs in past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity

4 DISCUSSION

4.1 Systematic Review Results

Considering that frailty is a common feature of the elderly, it is also important to obtain information on this area. Veninšek and Gabrovec (45) identified four main areas essential for the clinical management of frailty: definition of frailty, epidemiology of frailty, tools for screening and diagnosis frailty and successful interventions for decreasing frailty. The priority objective of the WHO Global Strategy and Action Plan on Aging and Health (13) to fill information gaps at the global level is thus well grounded. This is also confirmed by the results of this systematic review. The international survey conducted by Bruyère et al. (25), which included 44 countries, shows that frailty assessment is becoming a routine daily practice in treating elderly patients. According to this study, 205 (52.8%) clinicians, of whom the majority are geriatric specialists, always assess frailty in their daily practice and 38.1% report measuring it sometimes (25). All international consensus groups recommended all persons older than 70 years should be screened for frailty (22).

Factors, such as age and malnutrition, increase the risk of frailty (36), but individual deviations may be great, and the level of frailty may vary. Physical frailty in the elderly is a complex condition and the musculoskeletal aging phenotype comprises four key elements: osteoporosis, osteoarthritis, sarcopenia, and frailty (21). On the other hand, measuring the grades of frailty in the elderly can assist in assessment, management, and decision-making for osteoporosis and osteoporotic fractures (19). Fried et al. (44) proposed five frailty criteria: weakness, slow walking speed, low physical activity, self-reported exhaustion, and unintentional weight loss. The majority of physicians (64.9%) generally measure and diagnose frailty using more than one instrument (25). The most widely used tool is the gait speed test, which is performed by 43.8% of physicians (25) and is a simple yet efficient indicator for diagnosing frailty in primary care (17). This is followed by the clinical frailty scale (34.3%), the SPPB test (30.2%), the frailty phenotype test (26.8%), and the frailty index (16.8%) (25). Examples of some commonly used and validated frailty tools include the FRAIL, the Cardiovascular Health Study Frailty Screening Measure, the Clinical Frailty Scale, and the Gérontopôle Frailty Screening Tool (22). The Phenotype of Frailty is the most evaluated and frequently-used measure (16). The results of ADVANTAGE JA research (46) showed that there are multiple measurements used to screen and diagnose frailty. They have considered the most relevant, the recommended tools of frailty would be: Clinical Frailty Scale, Edmonton Frailty Scale, FRAIL Index, frailty phenotype, Inter-Frail, Prisma-7, Sherbrooke Postal Questionnaire, Short Physical performance Battery (SPPB), Study of Osteoporotic Fractures Index (SOF) and gait speed.

Other researchers (16, 20, 43) report a great variety of frailty scales, but their reliability and validity have rarely been examined (16). Bouillon et al. (16) highlight that only a few studies have evaluated frailty scales in terms of reliability and validity or following specific standards. An acceptable reliability coefficient and predictive validity has been confirmed for the CSHA Clinical Frailty Scale and the Edmonton Frail Scale. The frailty index and the Fried scale have been tested for validity, but not reliability (16). Specific anomalies (terminological and professional anomalies or plagiarism) occur with many assessment scales (16).

The majority of studies positively conclude that the scales examined are efficient for identifying the level of frailty (18, 26–28, 31, 32–34, 37, 42). Other studies determine that different instruments result in different estimates of frailty and that the gains in the tests' predictive accuracy are often modest (29, 30). The level of frailty assessed by geriatricians and GPs may differ (23, 24). Among other things, frailty can also be related to self-perceived health (38).

Bruyère et al. (25) report that a variety of tools are being used, highlighting the need for standardization and guidelines. None of the assessment scales are used as the gold standard in primary care (18, 27, 34, 42, 43). Widely used scales – a good example of which is the frailty scales developed by Fried et al. (44) – must be based on strict criteria. In addition, improvements and consensus of everyone involved in the healthcare for the elderly are required (16).

4.2 Research Limitations and Strengths

Conclusions can be drawn regarding the possible application of existing scales in Slovenia. It would make sense to expand the literature review by including search strings that also identify psychological frailty (e.g. "mental" frailty scales). This is the first review of literature which investigates frailty scales for use at primary level and in terms of reliability and validity.

4.3 Relevance of the Systematic Review Results for the Discipline

This systematic review provides insight into which frailty assessments scales are used for the elderly, who assesses frailty of the elderly, and the importance of primary care in assessing elderly people's frailty.

4.4 Potential for Further Research

There is a need for more research that assesses the validity, reliability, user-friendliness, comparability, etc., of different frailty scales.

5 CONCLUSION

Due to population ageing, there is an increasingly greater need for standardizing the measurement of geriatric frailty using frailty assessment scales. According to the situation (resource constraints) we estimate that the most appropriate scales for primary care in Slovenia are Frailty phenotype (44), Short Physical performance Battery (SPPB) (25) and Edmonton frail scale (25). Implementing such scales in Slovenia requires further research and discussions by leading specialists in this area on extended professional college of doctors of family medicine. Also, nurses from modal practices should be included. Consensus between various healthcare levels should be reached.

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CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

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ETHICAL APPROVAL

The method used in this systematic review involves no ethical issues and therefore no ethical approval was necessary.

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Vsako navajanje trditev ali dognanj drugih morate podpreti z referenco. Reference naj bodo v besedilu navedene po vrstnem redu, tako kot se pojavljajo. Referenca naj bo navedena na koncu citirane trditve. Reference v besedilu, slikah in tabelah navedite v oklepaju z arabskimi številkami ((1), (2, 3), (4-7)). Reference, ki se pojavljajo samo v tabelah ali slikah, naj bodo oštevilčene tako, kot se bodo pojavile v besedilu. Kot referenc ne navajajte izvlečkov in osebnih dogovorov (slednje je lahko navedeno v besedilu). Seznam citirane literature dodajte na koncu prispevka. Literaturo citirajte po priloženih navodilih, ki so v skladu s tistimi, ki jih uporablja ameriška National Library of Medicine v Index Medicus. Uporabljajte numerično citiranje. Imena revij krajšajte tako, kot določa Index Medicus (popoln seznam na naslovu URL: http://www.nlm.nih.gov).

Navedite imena vseh avtorjev, v primeru, da je avtorjev šest ali več, navedite prvih šest avtorjev in dodajte et al.

Če ima članek/knjiga DOI številko, jo mora avtor navesti na koncu reference.

PRIMERI ZA CITIRANJE LITERATURE

primer za knjigo:

1. Anderson P, Baumberg P. Alcohol in Europe. London: Institute of Alcohol Studies, 2006.
2. Mahy BWJ. A dictionary of virology. 2nd ed. San Diego: Academic Press, 1997.

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5. Florez H, Pan Q, Ackermann RT, Marrero DG, Barrett-Connor E, Delahanty L, et al. Impact of lifestyle intervention and metformin on health-related quality of life: the diabetes prevention program randomized trial. J Gen Intern Med. 2012;27:1594-601. doi: 10.1007/s11606-012-2122-5.

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6. Anon. Early drinking said to increase alcoholism risk. Globe. 1998;2:8-10.

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8. Shen HM, Zhang QF. Risk assessment of nickel carcinogenicity and occupational lung cancer. Environ Health Perspect. 1994;102(Suppl 2):275-82.
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11. Shaw EH. An exploration of the process of recovery from heroin dependence: doctoral thesis. Hull: University of Hull, 2011.

primer za elektronske vire:

12. EQ-5D, an instrument to describe and value health. Accessed January 24th, 2017 at: https://euroqol.org/eq-5d-instruments/.

TABELE

Tabele v angleškem jeziku naj bodo v besedilu prispevka na mestu, kamor sodijo. Tabele naj sestavljajo vrstice in stolpci, ki se sekajo v poljih. Tabele oštevilčite po vrstnem redu, vsaka tabela mora biti citirana v besedilu. Tabela naj bo opremljena s kratkim angleškim naslovom. V legendi naj bodo pojasnjene vse kratice, okrajšave in nestandardne enote, ki se pojavljajo v tabeli.

SLIKE

Slike morajo biti profesionalno izdelane. Pri pripravi slik upoštevajte, da gre za črno-beli tisk. Slikovno gradivo naj bo pripravljeno:

- črno-belo (ne v barvah!);
- brez polnih površin, namesto tega je treba izbrati šrafure (če gre za stolpce, t. i. tortice ali zemljevide);
- v linijskih grafih naj se posamezne linije prav tako ločijo med samo z različnim črtkanjem ali različnim označevanjem (s trikotniki, z zvezdicami...), ne pa z barvo;
- v grafih naj bo ozadje belo (tj. brez ozadja).

Črke, številke ali simboli na sliki morajo biti jasni, enotni in dovolj veliki, da so berljivi tudi na pomanjšani sliki.

Ročno ali na pisalni stroj izpisano besedilo v sliki je nedopustno.

Vsaka slika mora biti navedena v besedilu. Besedilo k sliki naj vsebuje naslov slike in potrebno razlago vsebine. Slika naj bo razumljiva tudi brez branja ostalega besedila. Pojasniti morate vse okrajšave v sliki. Uporaba okrajšav v besedilu k sliki je nedopustna. Besedila k slikam naj bodo napisana na mestu pojavljanja v besedilu.

Fotografijam, na katerih se lahko prepozna identiteta bolnika, priložite pisno dovoljenje bolnika.

MERSKE ENOTE

Naj bodo v skladu z mednarodnim sistemom enot (SI).

KRATICE IN OKRAJŠAVE

Kraticam in okrajšavam se izogibajte, izjema so mednarodno veljavne oznake merskih enot. V naslovih in izvlečku naj ne bo kratic. Na mestu, kjer se kratica prvič pojavi v besedilu, naj bo izraz, ki ga nadomešča, polno izpisan, v nadaljnjem besedilu uporabljano kratico navajajte v oklepaju.

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Prispelo gradivo z javnozdravstveno tematiko mednarodnega pomena posreduje uredništvo po tehnični brezhibnosti v strokovno recenzijo trem mednarodno priznanim strokovnjakom. Recenzijski postopek je dvojno slep. Po končanem uredniškem delu vrnemo prispevek korespondenčnemu avtorju, da popravke odobri in upošteva. Popravljen čistopis vrne v uredništvo po spletni aplikaciji Editorial Manager. Uredništvo dopušča obravnavo največ treh revizij. Če tretja revizija rokopisa ne upošteva vseh pripomb recenzentov, se rokopis umakne iz uredniškega postopka. Sledi jezikovna lektura, katere stroške krije založnik. Med redakcijskim postopkom je zagotovljena tajnost vsebine prispevka. Avtor dobi v pogled tudi prve, t. i. krtačne odtise, vendar na tej stopnji upoštevamo samo še popravke tiskarskih napak. Krtačne odtise je treba vrniti v treh dneh, sicer menimo, da avtor nima pripomb.

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