

# IMPACT OF SENSE OF COHERENCE ON WORK ABILITY: A CROSS-SECTIONAL STUDY AMONG CROATIAN NURSES VPLIV OBČUTKA KOHERENCE NA DELOVNO ZMOŽNOST: PRESEČNA ŠTUDIJA MED HRVAŠKIMI MEDICINSKIMI SESTRAMI

Martina SMREKAR<sup>1,2</sup>, Lijana ZALETEL-KRAGELJ<sup>2</sup>, Alenka FRANKO<sup>2,3\*</sup>

<sup>1</sup>University of Applied Health Sciences Zagreb, Mlinarska cesta 38, 10000 Zagreb, Croatia

<sup>2</sup>University of Ljubljana, Faculty of Medicine, Chair of Public Health, Zaloska 4, 1000 Ljubljana, Slovenia

<sup>3</sup>University Medical Centre Ljubljana, Clinical Institute of Occupational Medicine, Grablovičeva ulica 42, 1000 Ljubljana, Slovenia

Received: Feb 3, 2022  
Accepted: May 24, 2022

Original scientific article

## ABSTRACT

### Keywords:

nursing, SOC-29 instrument, stress, work ability index, work environment

**Introduction:** Aimed at preparing the basis for planning evidence-based public health measures for preservation/improvement of nurses' work ability (WA), the objective was to assess the relationship between WA and sense of coherence (SOC).

**Methods:** A cross-sectional study was conducted in 2018 among 713 nurses in Croatia. The association between poor WA index (PWAI) and SOC score (SOCs), adjusted for possible confounders, was determined by binary logistic regression analysis.

**Results:** The results of univariate logistic regression analysis showed a statistically significant negative association between SOCS and PWAI (OR=0.977, 95% CI 0.968 - 0.986, p<0.001). The results of multivariate logistic analysis showed an even stronger statistically significant negative association between SOCS and PWAI (OR=0.966, 95% CI 0.954 - 0.977, p<0.001) when adjusted for confounders.

**Conclusions:** The present study suggested SOC as an important health promoting resource of nurses which might offer protection regarding work-related stress. Weak SOC could be an important explanatory factor of poor WA. Accordingly, improving SOC by implementing health promotion measures in nurses' workplace could be an important way to increase the WA among nurses.

## IZVLEČEK

### Ključne besede:

zdravstvena nega, vprašalnik SOC-29, stres, indeks delovne sposobnosti, delovno okolje

**Uvod:** Namen raziskave je bil pripraviti temelje za načrtovanje z dokazni podprtih javnozdravstvenih ukrepov za ohranitev/izboljšanje delovne sposobnosti medicinskih sester, pri čemer je bil cilj oceniti odnos med delovno sposobnostjo in občutkom koherence.

**Metode:** Presečna raziskava je bila opravljena leta 2018 na vzorcu 713 hrvaških medicinskih sester. Povezanost med nizko vrednostjo indeksa telesne sposobnosti in povzeto mero lestvice občutka koherence smo ob upoštevanju motečih dejavnikov ocenili z metodo binarne logistične regresije.

**Rezultati:** Rezultati univariatne logistične regresije so pokazali statistično pomembno negativno povezanost med povzeto mero lestvice občutka koherence in nizko vrednostjo indeksa telesne sposobnosti (OR = 0,977; 95-odstotni IZ 0,968-0,986; p < 0,001). Rezultati multivariatne logistične regresije so pokazali še močnejšo negativno statistično pomembno povezanost med povzeto mero lestvice občutka koherence in nizko vrednostjo indeksa telesne sposobnosti (OR = 0,966; 95-odstotni CI 0,954-0,977; p < 0,001).

**Zaključki:** Ta študija nakazuje, da je občutek koherence lahko pomemben vir dobrega zdravja pri medicinskih sestrah in bi lahko predstavljal zaščito pred stresom, povezanim z delom. Nizek občutek koherence je lahko pomemben dejavnik, ki pojasnjuje slabo delovno sposobnost. Krepitev občutka koherence z uvedbo ukrepov promocije zdravja na delovnem mestu medicinskih sester bi lahko bil pomemben način za izboljšanje delovne sposobnosti med njimi.

\*Corresponding author: Tel. + 386 31842308; E-mail: [alenka.franko@siol.net](mailto:alenka.franko@siol.net)

## 1 INTRODUCTION

Work ability (WA) is an evidence-based concept defined as a balance between worker's personal resources and work-related factors (1). In order to obtain more knowledge about an individual's WA, the Finnish Institute of Occupational Health constructed an instrument, the Work Ability Index Questionnaire (WAIQ) (2, 3), as a tool for investigating how long individuals are actually able to work (1). The measure obtained by the WAIQ is the Work Ability Index (WAI). WAIQ was recommended to be used as a diagnostic instrument for the development of measures for health support (4).

Sense of coherence (SOC) is a coping resource that helps individuals to identify and use their external and internal resources (Generalized Resistance Resources - GRR) for problem solving and managing stressful life events (5, 6). Additionally, SOC was supposed to allow the individual experience of a stressful event to be perceived as meaningful, manageable and comprehensible by mobilizing GRRs, which arise from cultural, social and environmental conditions of living and early childhood rearing, and socialization experiences (6). Literature has shown that strong SOC has a positive effect on health and quality of life (7). It is also suggested that SOC is a health resource positively associated with well-being in a work environment (6, 8); furthermore, it moderates the effects of unfavourable working conditions on health outcomes (6).

Considering that the nursing profession is mentally and physically demanding and stressful (9, 10), it is necessary for nurses to maintain good mental and physical health in order to adequately perform their job. Unfortunately, a recent study revealed that they had poorer health compared to the general population (11). According to Prochnow et al., exposure to stress can have negative consequences on nurses' WA and health (12). Consequently, it is essential to recognize the importance of ensuring a positive and healthy working environment to avoid such consequences (13).

In the context of nurses' WA, SOC could be seen as a resource for adequate coping with workplace stressors (6). The literature demonstrates that a strong SOC protects nurses from stress (14) and contributes to nurses' healthy functioning at work (8). The literature has also shown that healthcare workers, including nurses, with strong SOC more often seek strategies for coping with stress (15). According to Masanotti et al., nurses' individual and work-related factors, such as age, gender, marital status, educational level, years of work experience, type of employment, shift work, work department, job satisfaction and work engagement, are an integral part of the GRRs and participate in the modelling of the nurses' SOC (16). All this is closely related to health promotion, more precisely to the workplace health promotion concept for nurses (17). Health promotion measures in nursing environments are more effective if they are evidence-based (18).

In Croatia, a study by Golubic et al. carried out about a decade ago showed that occupational stress was present also among Croatian nurses (19). The organization of work and financial issues, lower educational level and older age are the factors significantly associated with low WA (19). According to our knowledge and available literature, the relationship between WA and SOC in the population of nurses has not yet been explored either among Croatian nurses or elsewhere in the world. Consequently, aimed at preparing the basis for planning evidence-based health promotion measures for the preservation/improvement of nurses' WA, the objective of this study was to assess this relationship among Croatian nurses.

## 2 METHODS

### 2.1 Study design, research method and population

A cross-sectional study (survey type: health interview survey) was conducted. Data were collected in 2018 at the University Hospital Centre (UHC) in Croatia, a large health institution similar to other institutions around the world, which employs a large number of nurses. A total population of 1,465 nurses of different profiles (nurses with secondary school education, bachelors of nursing, masters of nursing) employed in different departments of the UHC were considered for inclusion in the study. The only exclusion criterion was absence from the work-place at the time of the survey. Due to sick leave, annual leave and study leave 165 nurses were excluded and consequently 1,300 were invited to participate in the study.

### 2.2 Data collection procedures

The principal investigator held a meeting with the head nurses of each clinic at the UHC and presented to them the aim and objectives of the research and the research protocol. The paper-and-pencil self-administered study questionnaire was distributed to the nurses in all hospital departments personally by the first author. Anonymity was assured by using special identification codes unique to each participant. Written informed consent was obtained from each participant, gathered separately from completed questionnaires.

### 2.3 Measurement instruments

The two main instruments used in this study were WAIQ and the 'orientation to life questionnaire', also called the SOC scale.

The WAIQ consists of 10 questions divided into 7 items: 1 - current WA compared to highest WA ever (1 question; scoring 0-10), 2 - WA in relation to demands (2 questions: physical job demands, mental job demands; scoring 2-10), 3 - current diseases (1 question/14 diseases; scoring 1-7), 4 - estimated work impairment due to diseases (1 question;

scoring 1-6), 5 - illness within last year (12 months) (1 question: number of whole days being off work; scoring 1-5 points), 6 - estimation of own work ability in 2 years (1 question; scoring 1, 4 or 7), and 7 - mental capacities (3 questions; scoring 1-4). Detailed description of the instrument and scoring is provided elsewhere (3). In our study the Croatian version of a WAIQ (WAIQ-CRO) was used, which demonstrated satisfactory internal consistency (Cronbach's  $\alpha=0.71$ ) and a three-factor structure (20).

The SOC scale could be short (13-item scale or SOC-13) or long (29-item scale or SOC-29). In either of them items are scored on a seven-point scale (5). In this study the Croatian version of the SOC-29 (SOC-29-CRO) was used, which demonstrated high internal consistency (Cronbach's  $\alpha=0.89$ ) and a one-factor structure (21).

## 2.4 Variables in the study

The observed outcome (a central phenomenon in the study that is intended to be explained to the greatest extent possible) was based on the WAI obtained by the administration of the WAIQ (2, 3). The WAI is a summary measure obtained by summing up the scores of individual responses to all items of WAIQ ranging from 7-49 points. A higher WAI suggests a better WA. The WAI could be analysed as a numeric value or categorized into four categories: 7-27 points indicating a poor WAI, 28-36 points a moderate WAI, 37-43 points a good WAI, and 44-49 points indicating an excellent WAI (2, 3). For the purposes of our study, based on previous studies (10, 22), the WAI was dichotomized into two groups: poor (<37 points) and good WAI ( $\geq 37$  points). The poor WAI (PWAI) was considered the observed outcome and was included in the analysis as a dependent variable.

The explanatory factor (a phenomenon by which the occurrence of the observed outcome is intended to be explained) was the SOC score (SOCS), a summary measure obtained by summing up the scores of individual responses to all items of SOC-29, ranging from 29 to 203 points. A higher SOCS suggests a stronger SOC (5, 6).

As potential confounders (control variables) (phenomena that could potentially distort the assessment of the association between the observed outcome and explanatory factor), four groups of phenomena were considered. The first group consisted of socio-demographic characteristics: gender (female, male), age ( $\leq 40$  years,  $>40$  years), marital status (married, other), educational level (secondary school, bachelor of nursing, master of nursing), ongoing education (yes, no). The second group consisted of health behaviour: number of cigarettes per day (0, 1-5,  $>5$ ), and physical activity (maximum 2 days per week, about 3 days per week, every day or almost every day). The third group consisted of work-related factors: work length (<1 year, 1-20 years,  $>20$  years), work department (departments with special demands: polyclinic, oncology/haematology, psychiatric

and paediatric units; other), time getting to work ( $\leq 30$  minutes,  $>30$  minutes), transportation mode (by car only, on foot only; other). The last group consisted of self-reported health conditions: injury from accidents, musculoskeletal diseases, cardiovascular diseases, respiratory diseases, mental disorders, neurological and sensory diseases, digestive diseases, genitourinary diseases, skin diseases, tumours, endocrine and metabolic diseases, blood diseases and birth defects (all of them yes, no).

## 2.5 Statistical analysis

In both the univariate and multivariate analyses of association between SOC and poor WAI, binary logistic regression was used. In the univariate analysis the direct method was used in which all independent variables in a block are entered in a single step. In multivariate analysis the stepwise method was used, more precisely the forward selection method using a likelihood criterion, in which independent variables enter the model step by step according to the criterion. The dummy variables were created for categorical explanatory/confounding factors with more than two categories (the simple method was applied). P-values  $<0.05$  were considered statistically significant. Data analysis was performed using IBM SPSS Statistics for Windows (Version 21.0. SPSS Inc. Chicago. IL. USA).

## 3 RESULTS

### 3.1 Description of the study group

Out of 1,300 nurses 713 agreed to participate in the study (response rate 54.8%). The mean age of participants was 38.4 years (SD 12.5, range 19-65). Table 1 presents their characteristics. The lowest response rate to a single question was 99%.

### 3.2 Statistical properties of the main variables observed

The mean value of total WAI score was 40.6 points (SD 5.6, range 16-49). According to WAI categories, 2.5% of respondents had poor, 19.1% average, 44.0% good, while 34.4% had excellent WAI. Accordingly, 21.6% of nurses had PWAI (WAI  $<37$ ), while 78.4% had good WAI. The mean value of the SOCS was  $145.0 \pm 22.1$  points (SD 22.1, range 81-200).

### 3.3 Results of univariate analysis of association between SOC-score and WAI

The data for univariate analysis of association were available for 685-691/713 participants (96.1-96.9%). The main result showed a statistically significant negative association between SOCS and PWAI (OR=0.977, 95% CI 0.968-0.986,  $p<0.001$ ), meaning that if SOCS increased by one point, the odds for PWAI were 97.7% of the odds of participants having SOCS value one point lower. Interpreted

**Table 1.** Characteristics of participants in the study of impact of sense of coherence on work ability of Croatian nurses (n=713).

Characteristic	Category	n	%
<b>SOCIO-DEMOGRAPHIC FACTORS</b>			
Gender	Female	630	88.4
	Male	83	11.6
Age (years)	≤40	408	57.3
	>40	304	42.7
Marital status	Married	371	52.1
	Other	341	47.9
Level of education	Secondary school	429	60.2
	Bachelor of nursing	256	35.9
	Master of nursing	28	3.9
Ongoing education	No	564	79.2
	Yes	148	20.8
<b>HEALTH BEHAVIOURS</b>			
Number of cigarettes	0	437	61.3
	1-5	51	7.2
	>5	224	31.5
Physical activity (days per week)	Maximum 2 days	409	57.4
	About 3 days	123	17.3
	Every day/almost every day	180	25.3
<b>WORK-RELATED FACTORS</b>			
Work length (years)	<1	23	3.2
	1-20	391	54.9
	>20	299	41.9
Work department	Department with special demands	146	20.6
	Other	562	79.4
Time getting to work (minutes)	≤30	241	33.9
	>30	469	66.1
Transportation mode	By car only	252	35.7
	On foot only	19	2.7
	Other	435	61.6
<b>SELF-REPORTED HEALTH CONDITIONS</b>			
Injury from accidents	No	550	77.1
	Yes	163	22.9
Musculoskeletal diseases	No	497	69.7
	Yes	216	30.3
Cardiovascular diseases	No	597	83.7
	Yes	116	16.3
Respiratory diseases	No	624	87.5
	Yes	89	12.5
Mental disorders	No	692	97.1
	Yes	21	2.9
Neurological and sensory diseases	No	654	91.7
	Yes	59	8.3
Digestive diseases	No	586	82.2
	Yes	127	17.8
Genitourinary diseases	No	645	90.5
	Yes	68	9.5
Skin diseases	No	657	92.1
	Yes	56	7.9
Tumours	No	674	94.5
	Yes	39	5.5
Endocrine and metabolic diseases	No	611	85.7
	Yes	102	14.3
Blood diseases/birth defects	No	652	91.4
	Yes	61	8.6

**Table 2.** Results of univariate logistic regression analysis of association between selected factors and PWAI in the study of impact of SOC on WA of Croatian nurses (n=685-691).

Factor	Category		OR	95% CI for OR (lower-upper)	p
	Observed	Reference			
SOCS			0.977	(0.968-0.986)	<0.001
<b>SOCIO-DEMOGRAPHIC FACTORS</b>					
Age >40 years	Yes	No	4.338	(2.926-6.430)	<0.001
Gender	Female	Male	2.383	(1.162-4.887)	0.018
Marital status	Married	Other	1.320	(0.916-1.904)	0.137
Educational level	Bachelor of nursing	Secondary school	0.586	(0.393-0.872)	0.008
	Master of nursing	Secondary school	0.121	(0.016-0.909)	0.040
Ongoing education	Yes	No	0.372	(0.211-0.658)	0.001
<b>HEALTH BEHAVIOURS</b>					
Number of cigarettes	1-5	0	0.531	(0.171-1.654)	0.275
	>5	0	2.316	(0.759-7.066)	0.140
Physical activity (days per week)	Maximum 2 days	Every day/almost every day	3.003	(1.548-5.824)	0.001
	About 3 days	Every day/almost every day	3.063	(1.506-6.229)	0.002
<b>WORK-RELATED FACTORS</b>					
Work length (years)	1-20	<1	0.531	(0.171-1.654)	0.275
	>20	<1	2.316	(0.759-7.066)	0.140
Department with special demands	Yes	No	1.412	(0.922-2.161)	0.112
Time getting to work (minutes)	>30	≤30	0.772	(0.521-1.144)	0.198
Transportation mode	By car only	Other	0.666	(0.447-0.991)	0.045
	On foot only	Other	1.215	(0.423-3.490)	0.718
<b>SELF-REPORTED HEALTH CONDITIONS</b>					
Injury from accidents	Yes	No	7.086	(4.741-10.590)	<0.001
Musculoskeletal diseases	Yes	No	9.969	(6.611-15.033)	<0.001
Cardiovascular diseases	Yes	No	6.177	(3.997-9.547)	<0.001
Respiratory diseases	Yes	No	3.113	(1.948-4.975)	<0.001
Mental disorders	Yes	No	6.694	(2.587-17.325)	<0.001
Neurological and sensory diseases	Yes	No	8.769	(4.852-15.849)	<0.001
Digestive diseases	Yes	No	5.367	(3.525-8.170)	<0.001
Genitourinary diseases	Yes	No	3.069	(1.812-5.198)	<0.001
Skin diseases	Yes	No	2.909	(1.645-5.145)	<0.001
Tumours	Yes	No	3.409	(1.765-6.583)	<0.001
Endocrine and metabolic diseases	Yes	No	2.902	(1.843-4.572)	<0.001
Blood diseases/birth defects	Yes	No	1.679	(0.934-3.019)	0.083

Legend: SOCS - sense of coherence score; CI - confidence interval; OR - odds ratio

in another way, if SOCS decreased by one point, the odds for PWAI increased by 2.4% (OR:  $1/0.977=1.024$ ). The details are presented in Table 2.

### 3.4 Results of multivariate analysis of the association between SOC-score and WAI

Complete data for multivariate logistic regression analysis were available for 657/713 participants (92.1%). The results showed an even stronger statistically significant negative association between SOCS and PWAI (OR=0.966, 95% CI 0.954-0.977,  $p<0.001$ ) when adjusted for confounders, meaning that if SOCS increased by one point, the odds for PWAI were 96.6% of the odds of participants having SOCS

value one point lower. Interpreted in another way, if SOCS decreased by one point, the odds for PWAI increased by 3.5% (OR:  $1/0.966=1.035$ ). The details are presented in Table 3.

## 4 DISCUSSION

The results of our study revealed a statistically significant negative association between SOCS and PWAI, indicating that the lower the SOC is, the greater the odds of PWAI are. In other words, weak SOC could be a predictor of PWAI and improving SOC could significantly increase WA among nurses. Based on these results, we can propose SOC as an important and suitable intervention targeted outcome to consider in managing WA difficulties in



**Table 3.** Results of multivariate logistic regression analysis of the association between selected factors and PWAI in the study of impact of SOC on WA of Croatian nurses (n=657).

Factor	Category		OR	95% CI for OR (lower-upper)	p
	Observed	Reference			
<b>SOCS</b>			0.966	(0.954-0.977)	<0.001
Age >40 years	Yes	No	2.991	(1.739-5.147)	<0.001
Musculoskeletal diseases	Yes	No	3.509	(2.056-5.989)	<0.001
Cardiovascular diseases	Yes	No	3.114	(1.713-5.661)	<0.001
Neurological and sensory diseases	Yes	No	4.398	(1.992-9.711)	<0.001
Injury from accidents	Yes	No	2.833	(1.628-4.929)	<0.001
Digestive diseases	Yes	No	2.299	(1.300-4.067)	0.004
Genitourinary diseases	Yes	No	2.121	(1.036-4.344)	0.040
Respiratory diseases	Yes	No	1.939	(1.017-3.698)	0.044

Legend: SOCS - sense of coherence score; CI - confidence interval; OR - odds ratio

clinical practice in nurses. Bearing in mind that stressful job demands are one of the major problems for nurses, identifying an independent modifiable coping resource is a great contribution.

The lack of similar studies makes it very difficult to compare our results. However, we can make some general comparisons. If we first want to make some comparisons in terms of the impact of SOC on WA, we can conclude that our results are consistent with the results of similar studies conducted on other population groups. To our knowledge, the relationship between SOC and WA was explored for example among unemployed people (23) and among Japanese workers employed in the information technology sector (24). Similar to our study, their findings indicated that low SOC was related to impaired WA (23, 24). To this we can add that the results of our study showed something extremely important - SOC as an explanatory factor of WA from the univariate to the final multivariate model has not lost its power. On the contrary, the power increased even more. In parallel, all other factors that entered the final model lost a substantial portion of their power. This suggests that these factors interact with each other, while SOC remains an independent factor. We can also make some other comparisons. If we comment on the effect of age on WA, the final results of the present study showed that nurses older than 40 years have significantly higher odds for PWAI in comparison to the younger ones. This is consistent with the findings of other studies. Hatch et al. demonstrated, for example, that older age is a predictor of low WA among nurses from the southeast USA (25). Previous studies conducted among Croatian nurses also showed that WA decreases significantly with age (10, 19). The reason could be found in a reduction of functional capacity of the individual due to the aging process and deficit in physical health (25). Contrary to our expectations, Rostamabadi et al. did not find an association between aging and WAI in their multivariate model among intensive care unit nurses (26). However, in their study, participants were aged only

up to 39 years, while in our study a significant part was older than 40. Furthermore, it is important to explain why the authors of the present study considered it necessary for age to be dichotomized into two categories:  $\leq 40$  and  $>40$  years. It was suggested that nurses over 40 years of age can experience visual and hearing impairments, weight gain, pain associated with musculoskeletal disorders and reduction in strength and flexibility (27) which can result in a reduced capacity to perform as well as younger nurses (27). Evidence showed that interventions targeting disease prevention and health maintenance from midlife and earlier may be effective ways to maintain nurses' WA with age (25). This should be a priority as the population of nurses is constantly aging (28).

To discuss the importance of self-assessed health conditions for WA, which proved to be important in our study, the most difficult thing was finding appropriate studies for comparison. Similar findings to our study regarding musculoskeletal diseases were reported among Brazilian nurses (29). The results of the systematic review and meta-analysis of Bernal et al. also showed that musculoskeletal diseases among nurses were the main causes of disability (30). As the high percentage of sick leave among healthcare workers can be largely attributed to musculoskeletal disorders, continuous workplace health-promoting measures to manage ergonomic risk factors in the aging nursing population would be of the utmost importance (31). SOC could also play an important role in these activities as it was shown that it influences nurses' healthy functioning at work (8).

Our study has some potential limitations. First, one can argue that this study involved participants from only one health institution. However, this institution is a typical large healthcare facility where a large number of nurses performing various tasks are employed. Consequently, this allows an in-depth study of health problems related to the nurses' workplace, which is a strength rather than a limitation. Second, one could argue the low response rate.

However, there is no agreed-upon standard for acceptable response rates (32). According to Babbie, cited by Draugalis et al., 50% is regarded as an acceptable response rate in social research postal surveys (32). Consequently, we assumed that the response rate achieved in our study still permits robust reliable conclusions to be drawn. Third, one could argue that the results are based only on nurses employed in a clinical setting. However, regardless of this, the results can also be roughly applied to some extent to nurses employed at the primary level of healthcare, considering the fact that it is possible to find to a certain extent an analogy between the work of nurses employed at the UHC (especially in the polyclinic departments) and primary healthcare nurses. Fourth, confounding factors may also be a subject of discussion. On the one hand, it could be pointed out that some are missing, e.g. minor children or relatives in care or a leading position. However, the selection was based on previous studies about SOC and WAI among nurses (16, 19). Additionally, some confounding factors included seem to be too inclusive, e.g. mental disorders (covering very different disorders) or endocrine and metabolic disease. In these cases, we were limited by the WAI questionnaire, and such details were also beyond the scope of this study and may be the subject of more in-depth research in the future. In addition, for some confounders, one might argue that the categories were too broad to allow us to identify a risk area, e.g. work department, work length or number of cigarettes per day. In these cases, the aggregation of categories was indicated by the requirements of statistical methods. Next, one could argue how the missing values were dealt with. As the minimum response rate to an individual question was very high, making the possibility of bias due to missing values very small, data imputation methods were not applied. Finally, participants' motivation to respond is a limitation of the present study. It is unknown whether the nurses who participated in the study had the same level of SOC as the nurses who did not participate in the study. On the other hand, the study also has some important strengths. First, this study is the first to explore the association between SOC and WA in the nursing population. The results of this study might be especially useful for implementing health promotion in nurses' workplaces to preserve WA of this high-risk-for-stress population, as SOC could be seen as an important coping mechanism that nurse educators can integrate into nursing education. Second, the results of this study are applicable not only in Croatia but also in countries that were part of former Yugoslavia due to the similar transition process in departing from a common healthcare system. However, they are also applicable in general.

The findings of this study could serve as evidence for evidence-based planned public health measures for maintaining/enhancing good health among healthcare workers, especially nurses. Evidence about WA in the

nursing profession demonstrated that WA is important for nurses in order to ensure good working conditions and to reduce work-related diseases and illness (33). As the evidence also demonstrated that the nursing profession is associated with stressful working conditions contributing to inadequate WA (34), monitoring SOC could be seen as a tool for the identification of nurses in need of support to cope better with stress, especially in those working environments where higher risk for burnout is expected, such as intensive care units (35). Moreover, as SOC could be considered an important factor of adjustment to difficulties among nurses with poor WAI, since people with strong SOC perceive a stressful situation as a challenge rather than as a threat (6), interventions for enhancing SOC could reduce the rates of poor WAI. An individual's SOC could be helpful in understanding the support needed in relation to health and WA and should be considered as an intervention outcome (36).

There is still much scope for further research in this area. First, it would make sense to extend the study to nurses employed in primary care. Additionally, it would make sense to extend the study to other healthcare profiles as well as to carry out an intervention study in which the intervention would be aimed at strengthening SOC in nurses who were found to have low SOC, and then reassess whether their WA has changed.

## 5 CONCLUSIONS

The present study proved an association between SOC and WA. SOC could be helpful in understanding the support needed in relation to health and WA, and should be considered as an intervention outcome. Improving SOC and consequently WA and implementing health promotion in nurses' workplaces could be an important way to increase WA.

## ACKNOWLEDGEMENTS

The authors are grateful to all the nurses who took part in the survey.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## FUNDING

The authors declare no funding.

## ETHICAL APPROVAL

The study protocols were approved by UHSM (code EP - 7811/16-19). The study was carried out in accordance with the ethical principles of the Helsinki Declaration. Nurses were informed that participation in the study is voluntary and anonymous. Informed consent was obtained from each nurse before enrolment.

## REFERENCES

- Ilmarinen J, von Bonsdorff M. Work Ability. In: Whitbourne SK, editor. *The encyclopedia of adulthood and aging*. Hoboken, NJ: John Wiley&Sons. Inc, 2015: 1-5.
- Ilmarinen J. The work ability index (WAI). *Occup Med (Lond)*. 2007;57:160. doi: 10.1093/occmed/kqm008.
- Tuomi K, Ilmarinen J, Jahkola A, Katajarinne L, Tulkki A. *Work ability index*. Helsinki: Finnish Institute of Occupational Health, 1998.
- Seibt R, Spitzer S, Blank M, Scheuch K. Predictors of work ability in occupations with psychological stress. *J. Public Health*. 2008;17(1):9-18. doi: 10.1007/s10389-008-0194-9.
- Antonovsky A. *Unraveling the mystery of health: How people manage stress and stay well*. San Francisco, CA: Jossey-Bass, 1987.
- Mittelmark MB, Sagy S, Eriksson M, Bauer GF, Pelikan JM, Lindström B, et al., editors. *The handbook of salutogenesis*. Cham, CH: Springer, 2017.
- Štern B, Zaletel-Kragelj L, Hojs Fabjan T. Impact of sense of coherence on quality of life in patients with multiple sclerosis. *Wien Klin Wochenschr*. 2021;133(5-6):173-181. doi: 10.1007/s00508-020-01704-y.
- Basińska MA, Andruszkiewicz A, Grabowska M. Nurses' sense of coherence and their work related patterns of behaviour. *Int J Occup Med Environ Health*. 2011;24:256-66. doi: 10.2478/S13382-011-0031-1.
- Dobnik M, Maletič M, Skela-Savič B. Work-related stress factors in nurses at Slovenian hospitals - a cross-sectional study. *Zdr Varst*. 2018;57:192-200. doi: 10.2478/sjph-2018-0024.
- Sorić M, Golubić R, Milošević M, Juras K, Mustajbegović J. Shift work, quality of life and work ability among Croatian hospital nurses. *Coll Antropol*. 2013;37:379-84.
- Turchi V, Verzuri A, Nante N, Napolitani M, Bugnoli G, Severi FM, et al. Night work and quality of life. A study on the health of nurses. *Ann Ist Super Sanita*. 2019;55(2):161-69. doi: 10.4415/ANN\_19\_02\_08.
- Prochnow A, Bosi de Souza Magnago TS, de Souza Urbanetto J, Beck CL, Soares de Lima SB, Bitencourt Toscani Greco PB. Work ability in nursing: relationship with psychological demands and control over the work. *Rev Lat Am Enfermagem*. 2013;21(6):1298-1305. doi: 10.1590/0104-1169.3072.2367.
- Lorber M, Treven S, Mumel D. Well-being and satisfaction of nurses in Slovenian hospitals: a cross-sectional study. *Zdr Varst*. 2020;59(3):180-88. doi: 10.2478/sjph-2020-0023.
- Malagón-Aguilera MC, Fuentes-Pumarola C, Suñer-Soler R, Bonmatí-Tomás A, Fernández-Peña R, Bosch-Farré C. El sentido de coherencia en el colectivo enfermero. *Enferm Clin*. 2012;22:214-8. doi: 10.1016/j.enfcli.2012.06.002.
- Ilić IM, Arandjelović MŽ, Jovanović JM, Nešić MM. Relationships of work-related psychosocial risks, stress, individual factors and burnout - questionnaire survey among emergency physicians and nurses. *Medycyna Pracy*. 2017;68(2):167-78. doi: 10.13075/mp.5893.00516.
- Masanotti GM, Paolucci S, Abbafati E, Serratore C, Caricato M. Sense of coherence in nurses: a systematic review. *Int J Environ Res Public Health*. 2020;17(6):1861. doi: 10.3390/ijerph17061861.
- Schaller A, Gernert M, Klas T, Lange M. Workplace health promotion interventions for nurses in Germany: a systematic review based on the RE-AIM framework. *BMC Nurs*. 2022;21(1):65. doi: 10.1186/s12912-022-00842-0.
- Piper S. *Health promotion for nurses: theory and practice*. New York, NY: Routledge, 2009.
- Golubic R, Milosevic M, Knezevic B, Mustajbegovic J. Work-related stress, education and work ability among hospital nurses. *J Adv Nurs*. 2009;65:2056-66. doi: 10.1111/j.1365-2648.2009.05057.x.
- Smrekar M, Franko A, Petrak O, Zaletel-Kragelj L. Validation of the Croatian version of work ability index (WAI) in population of nurses on transformed item-specific scores. *Zdr Varst*. 2020;59(2):57-64. doi: 10.2478/sjph-2020-0008.
- Smrekar M, Petrak O, Zaletel-Kragelj L, Franko A. Validation of the Croatian version of the sense of coherence 29-item scale in Croatian nurses. *Zdr Varst*. 2020;59(3):155-63. doi: 10.2478/sjph-2020-0020.
- Safari S, Akbari J, Kazemi M, Mououdi MA, Mahaki B. Personnel's health surveillance at work: effect of age, body mass index, and shift work on mental workload and work ability index. *J Environ Public Health*. 2013;2013:289498. doi: 10.1155/2013/289498.
- Vastamäki J, Wolff HG, Paul KI, Moser K. Sense of coherence mediates the effects of low work ability on mental distress during unemployment. *J Workplace Behav Health*. 2014;29(4):317-32. doi: 10.1080/15555240.2014.956931.
- Ohta M, Higuchi Y, Kumashiro M, Yamato H, Sugimura H. Work improvement factors for the amelioration of work ability, with a focus on individual capacity to deal with stress in an it company. *J UOEH*. 2015;37:23-32. doi: 10.7888/juoeh.37.23.
- Hatch DJ, Freude G, Martus P, Rose U, Müller G, Potter GG. Age, burnout and physical and psychological work ability among nurses. *Occup Med (Lond)*. 2018;68(4):246-54. doi: 10.1093/occmed/kqy033.
- Rostamabadi A, Zamanian Z, Sedaghat Z. Factors associated with work ability index (WAI) among intensive care units' (ICUs') nurses. *J Occup Health*. 2017;59:147-55. doi: 10.1539/joh.16-0060-OA.
- Stichler JF. Healthy work environments for the ageing nursing workforce. *J Nurs Manag*. 2013;21(7), 956-963. doi: 10.1111/jonm.12174.
- Tomietto M, Paro E, Sartori R, Maricchio R, Clarizia L, De Lucia P, et al. Work engagement and perceived work ability: An evidence-based model to enhance nurses' well-being. *J Adv Nurs*. 2019;75(9):1933-42. doi: 10.1111/jan.13981.
- Maciel Júnior EG, Trombini-Souza F, Maduro PA, Souza Mesquita FO, Alves da Silva TF. Self-reported musculoskeletal disorders by the nursing team in a university hospital. *BrJP*. 2019;2(2):155-58. doi: 10.5935/2595-0118.20190028.
- Bernal D, Campos-Serna J, Tobias A, Vargas-Prada S, Benavides FG, Serra C. Work-related psychosocial risk factors and musculoskeletal disorders in hospital nurses and nursing aides: a systematic review and meta-analysis. *Int J Nurs Stud*. 2015;52(2):635-48. doi: 10.1016/j.ijnurstu.2014.11.003.
- Dernovšček Hafner N, Miklič Milek D, Dodić Fikfak M. Hospital staff's risk of developing musculoskeletal disorders, especially low back pain. *Zdr Varst*. 2018;57(3):133-39. doi: 10.2478/sjph-2018-001.
- Draugalis JR, Coons SJ, Plaza CM. Best practices for survey research reports: a synopsis for authors and reviewers. *Am J Pharm Educ*. 2008;72:1-6. doi: 10.5688/aj720111.
- Viola F, Larese Filon F. Benessere lavorativo e salute: indagine con work ability index (WAI) su un campione di infermieri in una struttura ospedaliera del Nord-Est. *Med Lav*. 2015;106(2):129-39.
- Fischer FM, Borges FN, Rotenberg L, Latorre Mdo R, Soares NS, Rosa PL, et al. Work ability of health care shift workers: What matters? *Chronobiol Int*. 2006;23(6):1165-79. doi: 10.1080/07420520601065083.
- Friganović A, Kurtović B and Selić P. A cross-sectional multicentre qualitative study exploring attitudes and burnout knowledge in intensive care nurses with burnout. *Zdr Varst*. 2021;60(1):46-54. doi: 10.2478/sjph-2021-0008.
- Super S, Wagemakers MAE, Picavet HSJ, Verkooijen KT, Koelen MA. Strengthening sense of coherence: opportunities for theory building in health promotion. *Health Promot Int*. 2016;31(4):869-78. doi: 10.1093/heapro/dav071.