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## REVIEW

# Assessment of work ability with the Work Ability Index (WAI) in a nursing population: a literature review

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## Abstract

*Aim:* The present research aimed to provide a systematic analysis of the work ability (WA) of nurses assessed through the Work Ability Index (WAI) with a focus on factors influencing WA in the studied population. *Design:* A systematic literature review. *Methods:* In January 2024, a literature search was performed using Medline / PubMed and ScienceDirect databases, in order to identify studies focused on assessment of WA with the WAI among nurses. Databases were searched using 'work ability index' and 'nurse' as key terms. Articles were selected according to PRISMA guidelines. *Results:* Three hundred twenty-two studies were identified in the initial search (230 studies indexed by Medline / PubMed and 92 by ScienceDirect). After applying inclusion and exclusion criteria, a total of 16 studies were included in the systematic review. The results revealed common factors that affect WA among nurses. These factors are grouped as follows: age, gender, marital status, education, years of work, shift work, and diagnosed diseases. *Conclusion:* Assessing the WA of nurses with the WAI provides a comprehensive and structured approach to understanding their capacity to meet the demands of their profession while considering various dimensions of health and work-related factors.

**Keywords:** nurses, WAI, work ability, Work Ability Index.

## Introduction

Work ability (WA) is an important evidence-based concept central to occupational health research. It was designed in the early 1980s, at the Finnish Institute of Occupational Health (FIOH) (Ilmarinen & von Bonsdorf, 2015; Tuomi et al., 1998). WA is defined as the balance between individual resources such as health and functional capacities, competence, values, attitudes, and motivation and work demands such as work arrangement and work management (Ilmarinen et al., 2005). These factors interact with each other and change throughout life and with aging. It has been suggested that the aim of the WA concept was to promote sustainable WA and work well-being during the aging process (Ilmarinen, 2019). An inadequate balance between human factors and work demands have been associated with declining WA (Nygård, 2020). Although there are many instruments available that can be used for assessing WA, the Work Ability Index (WAI) questionnaire has proven to be the most widely used tool for the assessment of WA due to the fact that it enables a high degree of validity for the measurement

of WA (Abdolalizadeh et al., 2012; Freyer et al., 2019; Peralta et al., 2012). Organizations utilize the WAI to identify employees at risk of decreased WA, enabling targeted interventions to enhance well-being and prevent long-term health issues. Therefore, it is proposed as a screening and diagnostic tool for the development of health support measures (Seibt et al., 2008). Evidence from the literature indicates that the WAI questionnaire has been evaluated for internal consistency, reliability, and validity among various population groups and has proven to be a reliable and cross-culturally appropriate tool (Adel et al., 2019; Pranjic et al., 2019; Smrekar et al., 2020). The original measure of WA, the WAI, is a summary measure of items in the WAI questionnaire. Results range from 7 to 49 points. A low WAI suggests low WA and a higher WAI suggests greater WA. In addition, based on the results of the WAI, recommendations for measures to be taken in order to maintain, support, improve, or restore WA can be proposed (Tuomi et al., 1998). Evidence from the literature indicates that nursing is a demanding profession characterized by physical, emotional, and cognitive challenges (Dobnik et al., 2018; Starc, 2018). The nature of the work can impact nurses' overall well-being, affecting not only their job satisfaction but also their ability to provide

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high-quality patient care consistently. Understanding these challenges is crucial for contextualizing the application of the WAI in nursing. The literature has already shown that the WAI questionnaire enables an identification of poor WA among nurses and, consequently, the identification of nurses in need of an intervention (Carel et al., 2013). Based on WAI results, healthcare institutions can implement targeted interventions, including various health promotion programs, mental health support, and ergonomic adjustments to the work environment.

The present study focused on a systematic analysis of existing evidence about the importance of the WAI in the context of nursing, its application and potential benefits to the nurses and healthcare organization. This systematic review can shed light on this issue, since WA is a crucial component that affects nurses' health and well-being and is a significant global challenge for the healthcare sector. Due to the aging of the nursing population, work demands, stress, occupational hazards and other workplace challenges it is important to focus on factors influencing WA among nurses in order to prevent negative health determinants in workplaces.

## Aim

The present research aimed to provide a systematic analysis of the WA of nurses assessed through the WAI with a focus on factors influencing WA in the studied population.

## Methods

### Design

A systematic literature review. The review was conducted according to the PRISMA checklist (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

### Eligibility criteria

Studies were selected in accordance with the following criteria:

- Study design: cross-sectional studies and studies aimed at psychometric testing of the WAI were included.
- Study instrument: the WAI questionnaire consists of ten questions. Studies using shortened versions of the WAI were excluded.
- Study population: population of nurses regardless of the workplace were included. Studies conducted among other healthcare professionals were excluded.

- Study language: studies published in English were included. Studies published in other languages were excluded.
- Full text: studies with free access and available full text were included.
- Publication date: there were no restriction on the publication date.

### Search strategy

The following steps were used: determination of the research question, search strategy, eligibility criteria, information sources, search, selection of sources of evidence, critical evaluation of individual sources of evidence, selection of studies, data extraction, and analysis. In January 2024, a literature search was performed using Medline / PubMed and ScienceDirect databases in order to identify studies on assessment of WA with the WAI among nurses.

The research questions were set as follows:

1) What is the level of WA among nurses as assessed with the WAI?
2) What are the factors that affect WA among nurses?

Databases were searched using 'work ability index' and 'nurses' as key terms.

### Study selection inc. PRISMA flow diagram

The PRISMA guidelines were used in order to select studies. Three hundred twenty-two studies were identified in the initial search (230 studies indexed by Medline / PubMed and 92 by ScienceDirect). Studies that were not available in English, studies using shortened versions of the WAI, studies conducted among other healthcare professionals, and studies without free access and available full text were excluded. The studies were initially screened by title and keyword. Afterwards, the abstracts were screened for relevance. The full texts of the studies were carefully reviewed for validation before inclusion. Research articles that met the criteria were included. Sixteen publications met the criteria and were considered acceptable for further analysis (Figure 1).

### Evaluation of quality of articles

The studies that fulfilled the inclusion criteria were examined. The quality of included studies was evaluated by two independent researchers. The following data was taken from the selected studies; author, year, country, sample size, mean age, mean WAI, and factors affecting WAI of nurses. The full texts of the selected studies were reassessed by the same pair of researchers. Differences of opinion

between the researchers regarding the results were discussed until a consensus was reached.

### Data extraction

Characteristics of the included studies are presented in Table 1. The elements of the studies were: author, year of publication, size of sample, mean age of participants, mean WAI, and factors affecting WA of nurses. The extracted common factors were classified as follows: age, gender, marital status, education, years of work, shift work, diagnosed diseases, and other. The factors that were placed under the term 'other' were factors that were mentioned in results of selected studies, but were not as common as other results.

The synthesis of the data was narrative and tabular. The data were analyzed using the summative content analysis approach, to explore the stated research questions.

### Results

Three hundred twenty-two studies were identified in the initial search (Figure 1). After we applied the inclusion and exclusion criteria, a total of 16 articles were included in the systematic review. The overview of the studies finally included are reported in Table 1. The included studies were published between 2008 and 2024. The study population were nurses working in different hospital departments across different countries such as Slovenia, Poland, Jordan, Israel, South-west Nigeria, Croatia, Northwest Ethiopia, Greece, Canada, Brazil, Iran, and Tunisia.
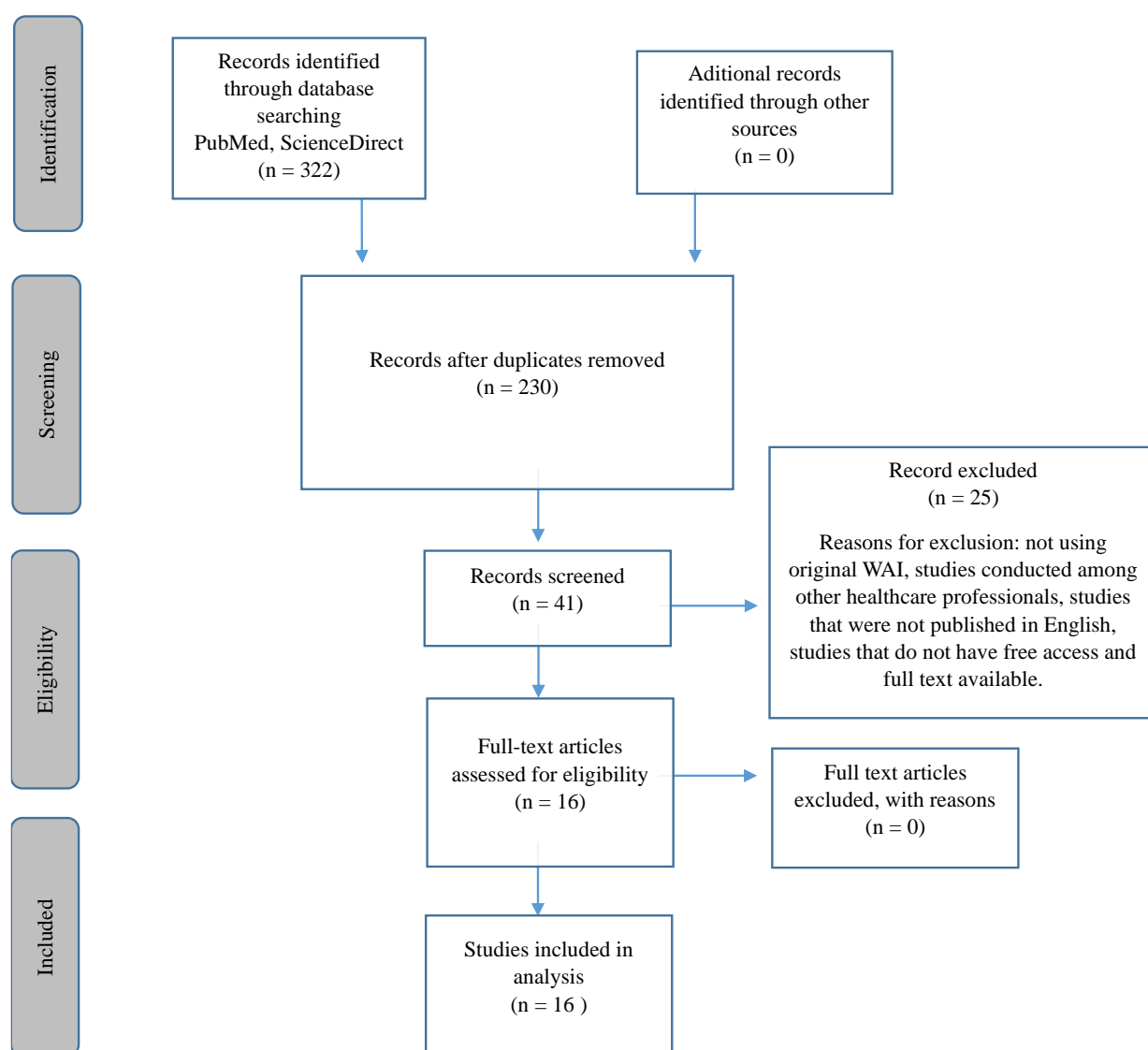


**Figure 1** PRISMA flow diagram

**Table 1** Overview of the studies included in the review (Part 1)

| Authors, year of publication, country | Sample size | Mean age | Mean WAI | Factors affecting WAI of nurses | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Age | Gender | Marital status | Education | Years of work | Shift work | Diagnosed diseases | Other |
| Žmauc et al. (2019), Slovenia | 433 | 53.75 | 36.98 | - | - | - | + | - | + | | Part-time nurses had significantly lower WAI scores than full-time nurses. |
| Rypicz et al. (2021), Poland | 349 | 46.90 | 34.00 | + | | | + | + | | | |
| Heyam et al. (2018), Jordan | 349 | 29.20 | 29.30 | + | | - | | - | + | | Work setting, transportation, job satisfaction significantly predict WA. |
| Abbasi et al. (2016), Iran | 750 | 33.10 | 36.92 | + | - | | | + | | | |
| Carel et al. (2013), Israel | 515 | 41.10 | 41.90 | + | - | - | | | | | |
| Akodu and Ashalejo (2019), South-west Nigeria | 135 | 40.23 | - | | + | | | | | | A significant association between work status and WA. |
| Rostamabadi et al. (2017), Iran | 214 | - | 39.80 | + | - | - | - | + | | + | A significant association between BMI and WA. |
| Abbasi et al. (2017), Iran | 750 | 33.10 | 36.90 | + | | | | + | | + | The mean WAI was significantly associated with total WRQoL score. |
| Smrekar et al. (2022), Croatia | 713 | 38.40 | 40.60 | + | + | | + | | | + | A significant association between sense of coherence, attending ongoing education, physical activity, transportation mode by car, and poor WA. |

*+ factors that affect WA among nurses; – factors that do not affect WA among nurses; WA – work ability; WAI – Work Ability Index*

**Table 1** Overview of the studies included in the review (Part 2)

| Authors, year of publication, Country | Sample size | Mean age | Mean WAI | Factors affecting WAI of nurses | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Age | Gender | Marital status | Education | Years of work | Shift work | Diagnosed diseases | Other |
| Abebe et al. (2023), Northwest Ethiopia | 410 | 30.00 | 36.00 | | + | | + | | | + | A significant association between poor sleep quality and WA. |
| Habibi et al. (2012), Iran | 228 | 38.40 | 38.25 | + | | | | | | + | |
| Merchaoui et al. (2017), Tunisia | 1181 | 44.26 | 40.00 | | | | | + | + | | |
| Katsaouni et al. (2024), Greece | 323 | 43.68 | 39.29 (for permanent workers). 40.10 (for temporary workers) | | | | | | | + | |
| Nowrouzi et al. (2015), Canada | 111 | 41.90 | 29.2% (WAI < 37), 70.8% (WAI 37), | | | + | | | | | Respondent ethnicity, and mean number of patients per shift, job and career satisfaction had a positive influence on WA scores. |
| Rotenberg et al. (2008), Brasil | 1248 | 40.00 | inadequate WA 40.5% females, and 25.6% males | | + | | | | | | |
| Bouzgarrou et al. (2023), Tunisia | 1179 | 42.60 | 40.00 | + | | | | | | | |

*+ factors that affect WA among nurses; – factors that do not affect WA among nurses; WA – work ability; WAI – Work Ability Index*

Research question 1: What is the level of WA among nurses as assessed with the WAI?

The mean value range of WAI among nurses was between 29.3 and 41.1. A higher WAI was reported among nurses employed in Israeli hospitals (Carel et al., 2013), while among nurses employed in Jordanian hospitals it was considerably lower (Heyam et al., 2018).

Research question 2: What are the factors that affect WA among nurses?

The results revealed common factors that affect WA among nurses. These factors were grouped as follows: age, gender, marital status, education, years of work, shift work, and diagnosed diseases. The details are presented in Table 1.

The results showed that nurses' education level significantly affected WAI scores (Žmauc et al., 2019), and that nurses with a higher level of education had a higher WAI score (Rypicz et al., 2021). It has been reported that WA decreases with age (Bouzgarrou et al., 2023; Carel et al., 2013; Rypicz et al., 2021) and with seniority (Merchaoui et al., 2017; Rypicz et al., 2021). Heyam et al. (2018) suggested that nurses' age, work setting, work shift, transportation, and job satisfaction significantly predicted WA. Abbasi et al. (2016) indicated a significant relationship between WAI, age groups, and work experience. Akodu & Ashalejo (2019) reported a significant association between gender, work status and WA. Rostamabadi et al. (2017) suggested a significant association between age, body mass index (BMI), and job experience with WAI scores, and a strong and negative association between WAI score and diseases. According to Abbasi et al. (2017), the mean WAI score was significantly associated with total Work-Related Quality of Life (WRQoL) score. Rotenberg et al. (2008). reported a statistically significant association between total workload and inadequate WAI for females only. A statistically significant negative association between sense of coherence score and poor WAI score was reported by Smrekar et al. (2022). Abebe et al. (2023) reported that factors such as male gender, holding a Bachelor of Science in Nursing, poor sleep quality, and chronic disease were significantly associated with nurses' level of WA. Habibi et al. (2012) indicated age and diagnosed diseases (third WAI item) as the most influential factors on WAI scores. Katsaouni et al. (2024) reported that, among permanent nurse employees, occupational accidents and injuries to the back and the upper or lower limbs, musculoskeletal disorders of the spine or neck, cardiovascular, neurological and gastrointestinal disorders were more frequent, while among temporary nurse employees, only mental health disorders were more frequent. Nowrouzi et al. (2015) reported three models (personal system model, workplace system model, and combined model) in which certain variables had an influence on WAI score. Variables from the personal system model (marital status, respondent ethnicity, and mean number of patients per shift) significantly contributed to the variance in WAI scores. Variables from the workplace system model (job and career satisfaction) had a positive influence on WAI scores, while work absenteeism showed an inverse relationship with WAI scores. Variables from the combined model (work absenteeism, job satisfaction, marital status, and ethnicity) were significantly related to WAI scores. The details are presented in Table 1.

## Discussion

WA is a crucial occupational health issue among nurses due to exposure to workload and health-related stressors. The WAI has significant applications in nursing for assessing and managing work-related health issues. It provides a comprehensive understanding of an individual's WA, enabling organizations to make informed decisions about employee well-being, productivity, and overall workforce sustainability. Utilization of the WAI is important in identifying employees at risk of decreased WA, enabling targeted interventions to enhance well-being and prevent long-term health issues.

Regarding level of WAI, a higher WAI was reported among nurses employed in Israeli hospitals (Carel et al., 2013), while among nurses employed in Jordanian hospitals it was considerably lower (Heyam et al., 2018).

The results revealed common factors that affect WA among nurses. These factors are grouped as follows: age, gender, marital status, education, years of work, shift work, and diagnosed diseases.

Regarding the impact of age on WA, it has been suggested that WAI decreases with age (Bouzgarrou et al., 2023; Carel et al., 2013; Habibi et al., 2012; Rypicz et al., 2021). Hatch et al. (2018) revealed that older age was a significant predictor of poor WA among hospital nurses. It has also been suggested that aging is associated with a variety of changes including a decline in physical capabilities, and significant increases in the risks of various aging-related diseases (Guo et al., 2022). All of this can potentially impact certain aspects of WA. Therefore, understanding how WA changes over the course of a nursing career is essential. It has been proposed that implementing programs that focus on physical health, mental

well-being, and stress management could benefit nurses across different age groups (National Academies of Sciences et al., 2021).

Regarding the effect of gender on WA, the results of our research suggested that a higher proportion of female nurses tend to have inadequate WA (Rotenberg et al., 2008). In addition, Abebe et al. (2023) reported that males had 2.43 times better odds of having a higher level of WA compared to female nurses. Abebe et al. (2023) stated that the possible reason might be due to the fact that female nurses may face challenges related to balancing work and family responsibilities. In this regard, offering flexible work arrangements could accommodate the diverse needs of female nurses, supporting work-life balance and contributing to overall WA.

In the present study, the results indicated that marital status affected WA (Nowrouzi et al., 2015). Qu & Wang (2015) reported that marital status had a positive influence on nurses' subjective well-being. Evidence from previous research has suggested that married individuals often report a high level of well-being (Stutzer & Frey, 2006) and life satisfaction (Botha & Booysen, 2013). On the contrary, a study by Simunić & Gregov (2012) reported that married nurses with children, working rotational shifts, experienced higher conflict between work and family. The explanation could be that nurses have multiple roles outside the workplace, such as taking care of their children and other family members. According to Boström et al. (2016), the balance between family life and work can be a source of recovery and better WA, while an imbalance in life due to problems outside work can be a source of poor WA.

Considering the effect of education on WA, it has been suggested that education level significantly effects WAI scores among nurses (Rypicz et al., 2021; Žmauc et al., 2019). Several previous studies have reported that nurses with a higher level of education had higher WAI scores (Golubic et al., 2009; Mehrdad et al., 2016). In summary, level of education appears to significantly shape the professional profile of nurses and can impact their WA in various ways.

The findings of the present research revealed an association between years of work experience and WA. With increasing years of work experience, nurses are continuously exposed to work related hazards, especially ergonomic hazards, which is likely to increase the risk of musculoskeletal disorders and poor WA outcomes. In addition, nurses experience significant physical changes during working life, which is likely to increase the risk of poor WA (Kenny et al., 2008).

Regarding the effect of shift work on WA, it has been suggested that shift work represents a negative risk factor for workers' health since the body's natural defenses are reduced at night (Dehring et al., 2018). It has also been suggested that shift work is a potential risk factor for the occurrence of psychiatric disorders and low quality of life in nurses (Okuyan & Deveci, 2017). According to Ljevak et al. (2021), shift work can adversely influence psychophysical homeostasis, resulting not only in substandard performance of nursing staff, but also potentially hazardous effects on their overall health.

With regard to diagnosed diseases (third item of the WAI) and WA, the results of the present research indicated that diagnosed diseases were influential factors on WAI scores (Habibi et al., 2012). According to Katsaouni et al. (2024), the most frequent conditions among permanent employed nurses were: occupational accidents and injuries to the back and the upper or lower limbs, musculoskeletal disorders of the spine or neck, cardiovascular, neurological and gastrointestinal disorders, while only mental health disorders were more frequent among temporary employed nurses. Bernal et al. (2015) found musculoskeletal diseases among hospital nurses to be the main cause of disability. Rostamabadi et al. (2017) reported musculoskeletal problems, digestive diseases, and skin diseases as the most common diseases among nurses in intensive care units (ICUs). The examination of diagnosed diseases within the WAI provides valuable insights into the intersection of health and WA among nurses. The prevalence and impact of health conditions on WA underscore the importance of holistic healthcare and preventive measures within the nursing profession. Understanding the specific diseases affecting nurses can inform targeted interventions and accommodations to support their continued contributions to patient care. Rostamabadi et al. (2017) proposed the following interventions to promote WA among nurses: the development of healthcare programs focused on creating a healthy work environment; the establishment of a well-structured preventive attitude to control diseases; the development of a well-designed organizational framework aimed at increasing the level of performance and motivation; and the reduction of the level of fatigue and workload. Continuous monitoring of WA could be considered an intervention aimed at the identification of nurses in need of support. It has been suggested that the WAI questionnaire is the most used instrument for the assessment of WA worldwide (Ilmarinen & von Bonsdorf, 2015). According to WAI results, recommendations

for interventions to be taken can be planned and implemented in order to create a healthy work environment and to protect and promote nurses' health.

*Limitation of study*

This review has several limitations. The literature search for relevant studies for the review was limited by the English language only criterium. In addition, the institutional availability of the full-text articles and scientific databases was a second limiting factor in this review.

## Conclusion

The crucial role of the WAI in the evaluation of nurses' WA, at the intersection between occupational health and workforce sustainability in healthcare, is paramount. Our study demonstrated the WAI's capacity to identify nurses at risk of deteriorating work capability, enabling stakeholders to enact early corrective action to address occupational health challenges, while building and maintaining a robust and competent nursing workforce. The research underscores the need for organizational support and calls for the implementation of several strategies to strengthen nurses' work ability. These approaches aim to advance nurses' wellbeing, while also raising the quality of patient care and reducing the waste and inefficiency that now characterize the healthcare system. The recommendation is for WAI assessments to be included in regular nurses' health evaluations, linked to nurse-specific, targeted, evidence-based programs. Such a formulation advances the framing of a comprehensive understanding of the various determinants affecting nurses' work ability, along with the design of interventions that serve to maintain and enhance work ability – thereby ensuring the effectiveness and financial viability of such measures across diverse healthcare settings.

## Ethical aspects and conflict of interest

The authors declare no conflict of interest.

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## Author contributions

Conception and design (MS, BI, SR, SČ), data analysis and interpretation (MS, BI, SČ), manuscript draft (MS, BI), critical revision of the manuscript (SČ), final approval of the manuscript (MS, BI, SR, SČ).

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