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Review Paper

## APPLICATION AND ADVANTAGES OF THE ROSA METHOD IN ASSESSING THE RISK OF MUSCULOSKELETAL DISORDERS AMONG COMPUTER USERS

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**Abstract.** *The ROSA method (Rapid Office Strain Assessment) is a validated observational tool developed for the systematic assessment and quantification of exposure to ergonomic risks in office work environments. It is modeled after established assessment systems such as RULA (Rapid Upper Limb Assessment) and REBA (Rapid Entire Body Assessment) and is based on a structured checklist with visual illustrations, enabling consistent and repeatable evaluation of computer workstation ergonomics. The ROSA method specifically focuses on identifying risk factors associated with the development of work-related musculoskeletal disorders, such as awkward postures, prolonged static sitting, improper positioning of monitors and input devices, and repetitive movements. The method allows objective scoring of various workstation components (e.g., chair, screen, keyboard, mouse, telephone), leading to a final score that reflects the level of risk and the need for ergonomic intervention. Among the key advantages of the ROSA method is its structured nature, which enables a systematic approach to identifying ergonomic deficiencies and ensures greater reliability of results. The visual representations make it easier to use even for individuals without specialized ergonomic knowledge, making the method accessible to a broader range of users. Moreover, ROSA does not require special equipment and allows for quick assessment, which is particularly important in resource-limited environments. Because of these features, the method is suitable for assessing both traditional office setups and living environment workstations. Due to its practicality, ease of use, and clear interpretation, ROSA method is widely accepted both in occupational medicine practice and in research settings. It is considered one of the most effective methods for detecting musculoskeletal risks in workers who use touchscreen devices or computers—both in conventional office environments and remote or home-based work. Thus, ROSA serves not only as a diagnostic tool but also as a basis for targeted ergonomic improvements aimed at preventing long-term musculoskeletal strain.*

**Key words:** ergonomics, musculoskeletal disorders, workstation assessment, office environment, risk factors

### Introduction

Work-related musculoskeletal disorders (MSDs) remain one of the most frequent occupational health problems worldwide, particularly in office environments where prolonged computer use, static postures, and repetitive movements are prevalent. MSDs affect muscles, tendons, ligaments, joints, and peripheral nerves, contributing to pain, discomfort, weakness, and reduced functional capability [1, 2]. Their increasing prevalence, especially in occupations involving computer work, has been

documented across numerous studies, with reported symptom rates often ranging from 30% to over 70% among office employees [3–8].

MSDs also represent a substantial socioeconomic burden. They account for more than half of work absences [9], approximately one-third of workers' compensation claims [9, 10], and contribute an estimated 1% of national GDP in direct and indirect economic costs in industrialized countries [11]. In Europe, MSDs are consistently reported as one of the most prevalent work-related health problems, affecting nearly three out of five workers [12, 13].

Given these consequences, the need for effective ergonomic interventions and standardized risk-assessment tools for screen-based work has become increasingly evident. This review synthesizes current knowledge on the epidemiology and risk factors of MSDs in office work, provides an overview of common ergonomic assessment methods, and offers a focused examination of the Rapid Office Strain Assessment (ROSA), addressing its methodological features, validation, and advantages.

### **Epidemiology of MSDs in Office Work**

MSDs are highly prevalent among office workers and computer users, with symptom rates varying widely across countries and occupational groups. Studies report prevalence estimates ranging from 30% to 75% depending on the anatomical region assessed, exposure duration, and work-related factors [3-8, 14, 15].

Back, neck, and upper-limb complaints are the most common. For example, a study among office employees in China found back pain to be the most prevalent MSD [5]. Research in Iran reported that 75% of computer users experienced MSDs occasionally, while 20–25% reported daily symptoms, with neck and trunk pain being the most frequent [7]. Similarly, among university students using laptops and desktop computers, 52.8% reported MSD symptoms, with neck pain most commonly affected [8].

At the European level, recent analyses by the European Agency for Safety and Health at Work indicate that approximately 60% of workers experience MSDs, with office workers representing a particularly affected group [12, 13]. This high prevalence underlines the need for targeted preventive strategies in screen-based occupations.

### **Ergonomic and Anthropometric Risk Factors**

Ergonomic risk factors in office environments typically include improper posture, prolonged static sitting, awkward neck or shoulder positioning, contact stress, repetitive keyboard and mouse use, and poor workstation layout [14–20]. Anthropometric mismatch, where workstation components do not align with the worker's body dimensions, further contributes to biomechanical strain.

Common workstation-related risk factors include [20]:

- a) monitor height and distance → neck extension or flexion;
- b) chair design and adjustability → lumbar and pelvic loading;
- c) keyboard and mouse position → wrist deviation, shoulder elevation;
- d) desk height → shoulder abduction, upper-back strain;
- e) contact stress on forearms and wrists.

These factors often act cumulatively, and the adverse effects develop gradually over time [20]. Consequently, early detection through ergonomic assessment is essential for effective prevention and intervention.

### **Overview of Ergonomic Assessment Tools for Screen-Based Work**

Numerous ergonomic assessment methods have been developed to evaluate musculoskeletal risk in office environments. These approaches include observational tools, checklist-based instruments, and semi-quantitative techniques for estimating postural and biomechanical load. The most commonly applied methods for assessing risks at screen-based workstations are summarised in Table 1, which provides an overview of their scope, methodological characteristics, and suitability for office computer work.

These assessment methods vary in their level of complexity, required observation time, and suitability for different work environments. Tools that are specifically designed for computer-based tasks, most notably ROSA method [23], offer distinct advantages in office ergonomics, because they incorporate workstation characteristics commonly associated with screen-based work. ROSA was developed explicitly for seated computer tasks and therefore captures key elements of office workstations, including chair design, monitor height, and keyboard and mouse configuration. Its effectiveness has been demonstrated in several validation studies, which show strong correlations between ROSA scores and reported musculoskeletal discomfort. As a result, the method enables rapid identification of problematic workstation features and provides a practical foundation for implementing ergonomic improvements in administrative and office settings.

Table 1: Overview and comparative characteristics of commonly used ergonomic risk assessment methods for screen-based work [21-25].

Method	Founders / Year	Key characteristics	Advantages	Limitations	Suitability for computer/ office work
<b>RULA</b> (Rapid Upper Limb Assessment)	McAtamney & Corlett, 1993 [21]	Assesses upper-limb, neck and trunk posture	Fast, simple, minimal equipment	Focuses mainly on upper limbs; less sensitive to seated office work	<b>Moderate</b>
<b>REBA</b> (Rapid Entire Body Assessment)	Hignett & McAtamney, 2000 [22]	Evaluates whole-body postural load, useful for healthcare and manual handling	Broad applicability; includes load/force	Less precise for sedentary, screen-based tasks	<b>Low–moderate</b>
<b>ROSA</b> (Rapid Office Strain Assessment)	Sonne, Villalta & Andrews, 2012 [23]	Designed specifically for office workstations; evaluates chair, monitor, keyboard, mouse	<b>Best suited for office computer work</b> ; visual scoring; workstation-specific	Does not include psychosocial risk factors	<b>Very high</b>
<b>OWAS</b> (Ovako Working Posture Analysis System)	Karhu, Kansu & Kuorinka, 1977 [24]	Classifies trunk, arm and leg postures; mainly for industrial tasks	Good for heavy physical work	Very limited sensitivity for static sitting postures	<b>Low</b>
<b>QEC</b> (Quick Exposure Check)	Li & Buckle, 1999 [25]	Combines observational and subjective worker assessments	Includes workers' perceived load	Not tailored to office environments	<b>Moderate</b>

### Comparison of ergonomic assessment tools

Several observational ergonomic assessment tools exist for identifying musculoskeletal risks in different work environments. However, their suitability varies substantially depending on the nature of tasks, body regions involved, and the specificity required for particular workplace settings. Traditional tools such as RULA [21] and REBA [22] remain widely used due to their simplicity and broad applicability across occupational groups, yet both were originally developed for industrial, manual-handling, or healthcare contexts. While these methods enable rapid evaluation of postural load, they are less sensitive to the subtle, static and low-force postures characteristic of computer work.

Similarly, Ovako Working Posture Analysis System [24] and Quick Exposure Check [25] provide more general assessments of whole-body exposure or combined

biomechanical and subjective workload, but they lack the level of detail necessary for evaluating seated, screen-based tasks. In contrast, the ROSA method, developed specifically for office environments, incorporates workstation components such as chair design, monitor height, keyboard and mouse configuration, and associated postural behaviours [23]. As illustrated in Table 1, ROSA stands out as the only method among commonly used assessment tools that is explicitly tailored to computer-based work, making it the most relevant choice for contemporary office settings.

Given the high prevalence of musculoskeletal disorders linked to prolonged computer use, ROSA provides a practical, structured and validated approach for identifying ergonomic hazards and guiding workstation redesign. Its visual scoring system, ease of application, and strong predictive validity make it particularly valuable for ergonomists and occupational health professionals seeking effective tools for risk assessment in office environments.

### **ROSA method: validation, reliability and advantages**

ROSA was developed by Sonne, Villalta, and Andrews (2012) as an observational checklist for assessing ergonomic risk factors in office environments [23]. It evaluates three major workstation components:

- a) chair (seat height, depth, armrests, back support),
- b) monitor and telephone and
- c) keyboard and mouse.

Each component is scored based on posture, adjustment, and equipment configuration. Scores are combined to generate a final risk level indicating whether the workstation requires immediate intervention [23].

ROSA has been demonstrated to correlate with musculoskeletal discomfort and workstation deficiencies. de Barros et al. (2022) confirmed its usefulness in detecting risk differences before and after ergonomic interventions, supporting its application in longitudinal evaluations[26].

Table 2 provides an overview of key published studies that have tested the validity, reliability, and practical usefulness of the ROSA method across different contexts, countries, and assessment approaches.

Evidence across the reviewed studies demonstrates that the ROSA is a generally reliable and valid instrument for evaluating ergonomic risk in office settings. The original validation established strong inter- and intra-rater reliability and meaningful associations with self-reported discomfort, providing a solid foundation for its use as a screening tool. Cross-cultural adaptations, such as ROSA-Br, further support its reliability and construct validity across different observer profiles and contexts.

Alternative applications, including photo-based scoring, suggest that ROSA can be used remotely, albeit with somewhat reduced specificity. Importantly, intervention studies show that ROSA is sensitive to ergonomic improvements, reinforcing its

utility for monitoring change. Recent cross-sectional findings across diverse office environments continue to link higher ROSA scores with musculoskeletal discomfort, confirming its relevance for contemporary workstation risk assessment.

### **Strengths of the ROSA method**

ROSA presents several methodological and practical advantages that contribute to its broad adoption in ergonomic research and practice. Originally developed for modern office and computer-based environments [23], the tool was intentionally designed to be quick to administer, operationally simple, and suitable for use in real workplace conditions without the need for specialized equipment. Subsequent studies have reaffirmed its practicality, cross-context applicability, and strong measurement properties [26, 28].

Key advantages of ROSA include:

- purpose-built for office and computer-intensive work [23],
- rapid and practical for field assessments, enabling efficient screening of large numbers of workstations [23],
- minimal resource and equipment requirements, enhancing feasibility for practitioners,
- applicability across office and administrative industrial settings, supported by cross-cultural validation studies [26],
- clear, structured scoring system, which facilitates prioritization of ergonomic interventions,
- compatibility with visual, image-based assessments, improving usability and allowing remote evaluation [28],
- demonstrated reliability and sensitivity to ergonomic change, confirmed in both validation and intervention studies [23, 26].

ROSA's usability, structured approach, and evidence-based reliability have positioned it as a practical and effective instrument for identifying ergonomic risks in office environments.

Table 2. Summary of empirical studies evaluating the validity, reliability, and practical applicability of the ROSA method [23, 26-29].

Study (year, location)	What was tested / Context	Key findings on ROSA validity / reliability
Sonne MWL, Villalta DL, Andrews DM (2012), original publication — Canada / general office environments [23]	Development and initial evaluation of ROSA on 72 office workstations	High inter- and intra-rater reliability (ICC = 0.88 and 0.91), significant correlation between ROSA final score and self-reported whole-body discomfort (R = 0.384). Demonstrated usefulness of ROSA as risk-screening tool. Acceptable intra-observer reliability (for both trained and untrained observers) and full inter-observer reliability, ICC ranges 0.43–0.86. Construct validity supported by moderate correlations with other ergonomic instruments; ROC analysis AUC up to 0.72–0.89 for risk-threshold detection.
Cross-cultural validation: Brazilian-Portuguese version “ROSA-Br” (2019) [27]	Adaptation of ROSA for Brazil; observers rated video recordings of office workers + field assessments	Inter-rater reliability ICC = 0.667–0.856; sensitivity of correctly classifying at-risk workstations 79%, specificity 55%. Average error ~2 points on 10-point ROSA scale; moderate correlation ( $\rho = 0.33$ ) between on-site and photo-based final scores. Shows feasibility of remote assessments, though specificity (false positives) and scoring error are noted. Experimental group showed statistically significant reductions in ROSA final and sub-scores (mean reductions ~2.9 points overall), while control group showed no change. This demonstrates that ROSA is sensitive to ergonomic improvements and can quantify changes in risk exposure.
Photo-based ROSA assessment study (2016) [28]	Compared standard on-site assessments vs. photo-based assessments of 23 workstations, by multiple ergonomists	18.8% of workplaces classified at risk; significant positive correlation between ROSA final score and reported neck/back discomfort. Confirms applicability of ROSA in diverse occupational settings.
Intervention study — pre/post ergonomics intervention (2022) [26]	60 office workers; ROSA applied before and after workstation adjustments	18.8% of workplaces classified at risk; significant positive correlation between ROSA final score and reported neck/back discomfort. Confirms applicability of ROSA in diverse occupational settings.
Recent cross-sectional assessment in a manufacturing-company’s office staff using ROSA + Cornell questionnaire (2021) [29]	208 office employees; correlation of ROSA score with self-reported discomfort via Cornell musculoskeletal questionnaire	18.8% of workplaces classified at risk; significant positive correlation between ROSA final score and reported neck/back discomfort. Confirms applicability of ROSA in diverse occupational settings.

## **Discussion**

The reviewed evidence indicates that MSDs remain a significant burden among office and computer-based workers, with consistently high prevalence rates reported across regions [13]. These disorders are driven by multiple ergonomic risk factors, including suboptimal workstation design, anthropometric mismatches, and prolonged static postures—factors repeatedly highlighted in the literature on office ergonomics. Observational assessment tools therefore play a central role in identifying modifiable risks and informing targeted interventions.

Within this group of methods, the ROSA has received considerable empirical attention. Its design, specifically tailored for screen-intensive office tasks, allows for a structured evaluation of key workstation components [23]. Validation studies across different cultural and occupational contexts have shown that ROSA demonstrates acceptable to high reliability [23, 26, 28] and correlates with self-reported discomfort, supporting its construct validity. Furthermore, intervention research confirms that ROSA is sensitive to ergonomic changes, as significant reductions in ROSA scores have been documented following workstation adjustments [26].

At the same time, certain limitations of ROSA must be acknowledged. As with all observational tools, outcomes depend on assessor skill and judgment, which may introduce variability, particularly in borderline scoring categories. Additionally, ROSA captures workstation configuration at a single point in time and does not measure dynamic postures or temporal exposure patterns. To address these gaps, combining ROSA with complementary approaches, such as RULA for postural analysis, digital monitoring of break patterns, or wearable sensors for continuous biomechanical exposure, may provide a more comprehensive understanding of individual risk.

Overall, the literature suggests that ROSA is a practical and evidence-supported tool for ergonomic risk screening in office environments. Its strengths in usability, structured assessment, and demonstrated sensitivity to change support its continued use in both research and applied ergonomics, provided it is integrated within a broader, multimodal assessment strategy.

## **Conclusion**

MSDs remain a major occupational health concern in office environments, driven by prolonged computer use and inadequate workstation ergonomics. Effective prevention requires early identification of risk factors, systematic assessment, and user-centred ergonomic interventions. Among the available tools, ROSA provides a validated, practical, and efficient means of evaluating screen-based workstations. Its strengths support its continued use in ergonomic practice and research aimed at reducing MSD prevalence and promoting healthier work environments.

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## PRIMJENA I PREDNOSTI METODE ROSA U PROCJENI RIZIKA OD MIŠIĆNO-KOŠTANIH OBOLJENJA PRI RADU NA RAČUNARU

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**Sažetak.** Metoda ROSA (Rapid Office Strain Assessment) je validirani opservacijski alat razvijen za sistematsko procjenjivanje i kvantifikaciju izloženosti ergonomske rizicima u kancelarijskom radnom okruženju. Zasnovana je na poznatim metodama kao što su RULA (Rapid Upper Limb Assessment) i REBA (Rapid Entire Body Assessment) i temelji se na strukturiranoj kontrolnoj listi sa slikovnim prikazima, što omogućava dosljedno i ponovljivo procjenjivanje ergonomije računarskih radnih stanica. Metoda ROSA posebno se fokusira na prepoznavanje faktora rizika povezanih s razvojem mišićno-koštanih oboljenja povezanih s radom, kao što su nepravilni položaji tijela, dugotrajno statično sjedenje, nepravilno postavljanje monitora i ulaznih uređaja, te ponavljajući pokreti. Ova metoda omogućava objektivno bodovanje različitih komponenti radnog mjesta (npr. stolica, ekran, tastatura, miš, telefon), što vodi ka konačnoj ocjeni koja odražava nivo rizika i potrebu za ergonomske intervencijom. Jedna od glavnih prednosti metode ROSA je njena strukturiranost, koja omogućava sistematski pristup u identifikaciji ergonomske nedostataka i osigurava veću pouzdanost rezultata. Vizuelni prikazi olakšavaju upotrebu čak i onima bez specijaliziranog znanja iz ergonomije, čineći ovu metodu dostupnom široj grupi korisnika. Osim toga, ROSA ne zahtijeva posebnu opremu i omogućava brzu procjenu, što je posebno značajno u sredinama s ograničenim resursima. Zbog tih karakteristika, metoda je pogodna kako za klasične kancelarije, tako i za rad od kuće. Zahvaljujući svojoj praktičnosti, jednostavnoj upotrebi i jasnoj interpretaciji, ROSA metoda je široko prihvaćena kako u praksi medicine rada, tako i u istraživačkom okruženju. Smatra se jednom od najučinkovitijih metoda za otkrivanje mišićno-koštanih rizika kod radnika koji koriste ekrane na dodir ili računare – bilo u standardnim kancelarijskim uslovima ili prilikom rada na daljinu odnosno od kuće. ROSA tako služi ne samo kao dijagnostički alat, već i kao osnova za ciljane ergonomske intervencije s ciljem prevencije dugotrajnih mišićno-koštanih opterećenja.

**Glavne riječi:** ergonomija, mišićno-koštani poremećaji, procjena radnog mjesta, kancelarijsko okruženje, faktori rizika

