**Title**
Gender and Work in Ergonomics: Recent trends

**Running Head**
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**Abstract**
Since the establishment of the Gender and Work Technical Committee (TC) of the International Ergonomics Association (IEA) in 2006, many researchers have addressed the role of sex and gender in ergonomics, producing a great deal of new information. This special issue aims to present new ways of viewing women's work and gender differences in work-related injury risks in an era of rapidly changing labour market configurations. It offers innovative methods for integrating sex and gender into ergonomic analysis and for designing work environments. It shares reflections on the intersection of vulnerabilities according to certain identity markers. Finally, it contributes to establishing milestones standards of practice so that the consideration of sex and gender can be more systematically modelled in ergonomics research and interventions, for example in training ergonomists or in knowledge transfer initiatives.

**Keywords**
Ergonomics; Sex and Gender Integration; Sex and Gender Based Analysis, Knowledge Transfer, Training Future Ergonomists

**Practitioner Summary**
This editorial article provides an overview of the background and the content of the Special Issue “Gender and Work in Ergonomics: Recent trends”

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## Article

Since the establishment of the Gender and Work Technical Committee (TC) of the International Ergonomics Association (IEA) in 2006, many researchers have addressed the role of sex and gender in ergonomics, producing a great deal of new information. In 2011, Sandrine Caroly and Karen Messing edited a special issue of *Work: A Journal of Prevention, Assessment, and Rehabilitation* dealing with "Gender, Work Schedules and Work/Family Regulation". Nine articles were published analyzing work activity deployed at the interface of the private and paid work spheres by health care workers (Estryn-Béhar et al., Doniol-Shaw and Lada, Barthe et al. Chatigny, Caroly), teachers (Cau-Bareille, Riel and Messing, Ahlgren and Gillander Gadin) bus drivers (Scheller), and police officers (Caroly) and an additional article dealt with the legal aspects of the work-family interface. In 2012, Rima Habib and Karen Messing edited a special issue of *Ergonomics* on "Gender, Women's Work and Ergonomics". In this issue, thirteen articles were published addressing gendered aspects of such parameters as work content (Salerno et al., Calvet et al.), circulatory responses to prolonged standing (Bahk et al.), neck pain (Stock and Tissot, Côte), plantar pressure (Chung et al.), patterns of injury (Théberge) and their prevention (Rasmussen et al.), and other factors determining musculoskeletal disorders (Wählstrom et al., Bell and Steel, Motamedzade and Moghimbeigi, Ahlgren et al., and Habib et al.).

In 2017, Jessica Riel and colleagues coordinated an issue of *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* called "Women's Occupational Health: Resisting When We Can", concentrating on the challenges encountered in developing research, interventions, and policies to improve the health of women at work. The issue describes a number of instances where women in the Québec labour movement have attempted to reconcile equality concerns with protecting their own health. The eight articles address successes, failures, and puzzles encountered by ergonomics researchers in different work contexts, such as teaching (Riel, Laberge), health care (Messing), cleaning (Lefrançois), and food processing (Major) . Many challenges are addressed in those articles, such as dealing with pregnancy (Gravel), the work/family interface (Lefrançois) and gender stereotypes that influence workplace occupational health interventions. Several of the articles deal with regulatory and policy issues confronting those who seek to promote the health of women in the workplace (Bernstein, Sultan-Taïeb, Gesualdi-Fecteau).

In 2020, Marie Laberge and colleagues coordinated an issue of *Applied Ergonomics* on why and how to integrate sex and gender in ergonomics, with articles that focused on the scientific rationale for integrating sex and gender, but also on the methods for doing so. The issue included seven papers addressing methods to better capture women's specific situations (e.g., the work-family interface), intervention research aimed at making work more equitable, and evaluation of the impact of considering sex and gender in ergonomics.

Finally, Christelle Casse and Marianne de Troyer edited a book called *Gender, Working conditions and health. What has changed?* published by the European Trade Union Institute in 2020 (French

version) and 2021 (English version). It included papers written by specialists in the field, treating three themes: (1) the differences between the working conditions of women and men and the different kinds of occupational risks they face; (2) gaining recognition of the health impacts of gendered working conditions;(3) the types of interventions and policies needed to reduce gender inequalities at work and mitigate their harmful impact on health.

We note an evolution since the publication of the first special issue. We observe that the nature of ergonomics studies and concerns have broadened. While earlier research reported new knowledge describing women's invisible work as well as inequitable employment and working conditions, more recent research addresses ethical, methodological, and training issues for ergonomists. Moreover, ergonomists are increasingly thinking about knowledge transfer to a wider audience, including businesses, unions, and organizations that require ergonomics services. We are at a turning point where the knowledge needed to better understand sex and gender issues in workplaces is increasingly available but its deployment is limited. In fact, this field remains relatively understudied and underused by ergonomists and businesses.

Before editing this special issue of Ergonomics, the Gender and Work TC of the IEA organized four thematic symposia at the 2021 IEA conference, held virtually in Vancouver, Canada. Specifically, these symposia addressed 1) sex/gender-inclusive ergonomics knowledge transfer, 2) sex/gender-inclusive ergonomics training for ergonomists, 3) sex/gender-sensitive study of non-standard work among vulnerable populations, and 4) sex/gender-differentiated exposures and perception of risks at work. This special issue was initiated with the goal of bringing these contributions together in a scientific publication, as well as providing an opportunity for further research on the topic to be shared.

The present special issue proposes new ways of taking account of women's work and illustrating gender differences in work-related injury risks. It also offers innovative methods for integrating sex and gender into ergonomic analysis and for designing work environments. It shares reflections on the intersection of vulnerabilities according to certain identity markers (sex-gender + culture, social class, disability, etc.). Finally, it contributes to establishing milestones standards of practice so that the consideration of sex and gender can be more systematically modelled in ergonomics research and interventions, for example in training ergonomists or in knowledge transfer initiatives.

Cunha, Silva, Macedo & Lacomblez have focused on the technical act from a gender perspective. The purpose of their paper is to analyse the operating methods and strategies adapted to various work situations associated with technical acts of women and men in the cork industry and their evolution in the context of current technological transformations. The article presents techniques used by male and female workers in their different work settings (separate jobs and tasks) resulting in differential effects on health. More value is attributed to men’s technical approaches, and this, in the case of the companies analyzed, may have contributed to slowing down the pace of automation of their tasks. On the other hand, the value of the women’s techniques appears to be less recognized, even though they are mobilized to compensate for the limits of machines, and decisively contribute to the quality of the product. Women’s work activity seems to be more prone to automation of its processes, but in fact, automation, in some cases, has led to a loss of quality due to the underestimation of women’s contribution. This demonstration of the efficacy of the

women’s work methods contributes to current debates about the limits of technology by demonstrating the importance of unrecognized work techniques.

Habib and colleagues present the first research aimed at obtaining direct testimony of 4090 Syrian refugee children who work in Lebanon on psychosocial risk factors and musculoskeletal pain. Using a cross-sectional survey and adopting a gender-sensitive analysis, their results show associations between difficult working conditions, socioeconomic pressure and increased reporting of musculoskeletal pain in these children. The authors target priorities for action in order to protect them. Based on their research results, they emphasize the importance of taking into account the differential exposure of boys and girls to psychosocial stressors.

Salerno and Giliberti look at women's acute work injuries of the wrist/elbow as well as carpal tunnel syndrome and /epicondylitis, using data from the Italian National Compensation Authority over a five-year period (2015-2019). This article aims to identify typical musculoskeletal disorders (MSD)and syndromes (such as carpal tunnel and epicondylitis) experienced by women at work. While we already know that the job sectors where a majority of employees are women are more likely to experience a MSD-related work injury, this article digs deeper and shows that specific injuries are related to specific sectors. For example, hairdressers and laundry workers are more at risk of developing wrist/elbow acute work injuries, while in manufacturing, epicondylitis and carpal tunnel syndrome are more common. These data are useful to continue to enrich our knowledge of the work-related health problems experienced by women in specific sectors, so that the practitioners can devise better and more efficient prevention interventions.

Doing gender-equitable research and intervention also requires reflecting on methodologies and measurement tools, because they can help to make gender differences apparent or, on the contrary, conceal them. Ferreira da Silva and colleagues propose a gender-sensitive scale for measuring musculoskeletal discomfort. Applying a specific statistical process based on item-response theory (ITR) models to the pain symptoms workers reported on body maps, the authors are able to grasp differences in musculoskeletal symptom patterns of male and female workers, even at a similar level of global musculoskeletal discomfort. An empirical study in a large Brazilian footwear factory emphasizes the interest of this tool for understanding the differential progressive installation of MSDs in men and women as well as its causes, opening up avenues for an improved prevention.

Lefrançois and Trottier's article examines a subject that is not widely covered in the scientific literature, namely work-family balance (WFB) in the construction industry. Based on a mixed design (20 qualitative interviews and 789 survey responses), this study adopts a gendered perspective to highlight determinants and strategies for dealing with WFB deployed by men and women working on construction sites, as well as their consequences for health. The data illustrate persistent gender stereotypes and gendered social norms in the industry and suggest that strong actions are required to move this industry toward a more equitable work culture.

Laberge, Vignet and Chatigny examined the impact of using Self-Reflective Interviews (SRIs) as an effective learning method for students with learning difficulties enrolled in a prework practicum for semi-skilled trades. The article identifies desirable adaptations of the SRI method for this special subpopulation at risk of exclusion, to provide recommendations for how to use it to develop occupational health and safety skills, and to demonstrate its usefulness as a sex/gender sensitive

approach. The youth targeted were enrolled in a training program called “Work-Oriented Training Path.” This program prepares young people for employment who are experiencing serious school difficulties due to a disability, a learning difficulty, a language difficulty, or an adaptation disorder. Many of the young people on this pathway are recent immigrants. For these adolescents, the SRI technique probably requires adaptation for use by teachers who are not ergonomists nor experts on work activity analysis, as well as by the trainees, who are quite young, have limited experience and face learning challenges. It is also possible that young men’s and young women’s ease with giving feedback differs, interfering with the women’s learning process. The article shows that certain components of the SRI method pose challenges for this population: lack of vocabulary, fragile balance between pride in one's work and lack of self-esteem, particularly when seeing oneself on the screen during feedback, little previous experience that would help in making lack of knowledge or other difficulties explicit, and an unbalanced power relationship with the interviewer that can hinder expression. Precautions are proposed to adapt the SRI method to this population, since it presents numerous advantages from a didactic and developmental point of view.

Parnell and colleagues tackle the “default male” perspective that has shaped the design of transport systems, resulting in gender inequities that notably impact women’s access to paid work, the conditions of their care work, as well as their health and safety as transport users. This scoping review provides a basis for understanding the mechanisms by which transport systems generate gender inequities and for developing gender equitable research and design in the field of transport systems. Based on consideration of 233 articles, the review investigates the contribution of six gender factors – family roles, perceived safety, ergonomic standards, mobility need, user behavior and urban structure – across seven transport modes - road vehicles, pedestrians, cyclists, buses, rail, aviation, and maritime.

Dupont and colleagues report on a qualitative study describing the employment experience of people with disabilities. The authors present the results of a phenomenological analysis of 41 interviews with working people with a physical, visual, hearing or chronic pain disability (12 men and 29 women), employed in a wide range of job sectors. The authors demonstrate that people with disabilities face a variety of physical and social barriers in obtaining and maintaining employment. They encounter many negative assumptions concerning their ability to perform their jobs in a similar fashion to people who do not have disabilities, assumptions that influence their intention to disclose their disability to their colleagues and employer. Disability bias overlaps with sex and gender bias and makes disabled women even more at risk of exclusion in workplaces. This study underlines the relevance of intersectional models to understand work situations that can exclude or discriminate some subpopulations.

Messing, Blanchette-Luong and Chadoin describe a series of challenges confronting ergonomists as they attempt to improve gender and ethnoracial equity as well as health during ergonomics interventions. The context of the interventions they describe is atypical, carried out in partnership with women’s committees and health and safety committees in trade unions, but the questions asked are generalizable to other situations. The situations involve moments where it seems that ergonomists' identities as professionals and citizens merge. The article describes four such situations, and what the ergonomists have done and not done. The authors then describe their thoughts and concerns about what action could/should have be done. The aim of this article is not to prescribe a single “best” way to react, but rather to present and explore different perspectives on

these situations. The authors propose that questioning such situations and actions collectively can be a step toward a contribution of ergonomics to improving equity at work. The authors suggest that descriptions of these types of situations (and the various ways they can be approached) should be integrated into the training of ergonomists, in order to promote greater social and political awareness among young practitioners as well as better-quality interventions.

Finally, the article from Laberge and colleagues presents a multiple case study that explores the uptake of sex/gender-related concepts and practices by ergonomics students exposed to specialized training sessions developed by the GESTE (French acronym for "Gender, Environment, Health, Work and Equity") team in Quebec, Canada. The results show that the students appreciated the training and considered it useful for their future professional practice. However, they found it difficult to apply the concepts and theories in practice. Although they may be comfortable with taking into account anthropometric measures when strength, posture or movement seem problematic, students rarely consider the social aspects related to the interactions between men and women at work, nor the power dynamics that cause more difficult conditions for one of the two sexes. It is possible that learning how to consider sex and gender in interventions is an advanced skill in ergonomics and that it is difficult for young ergonomists to assimilate it along with basic activity analysis skills. The authors recommend that other kinds of training and support be given to students over time (mentoring, continuing education, etc.), in addition to initial training in this area.

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