

The heart of ergonomic interventions: People L'humain : au cœur des interventions ergonomiques

Association of Canadian Ergonomists

Association Canadienne d'Ergonomie



2025, Québec (Qc)
Conference proceeding
Compte rendu de conférence

Foreword

It is our great pleasure to introduce the proceedings of ACE 2025: The Heart of Ergonomic Interventions: People, held October 6–9, 2025, in Québec City. This collection reflects the richness of our field and the central role ergonomics plays in shaping safer, healthier, and more sustainable systems.

The theme of this year’s conference — placing people at the center of every ergonomic intervention — calls us to remember that behind every tool, process, and environment are human beings with real needs and aspirations. The contributions gathered here highlight this commitment, offering evidence-based research, innovative practices, and inspiring case studies from across sectors.

We extend our deepest gratitude to the authors, reviewers, scientific committee, sponsors, and local hosts who made this event possible. May these proceedings serve as both a record of knowledge shared and a resource that inspires further collaboration and innovation in the years ahead.

Martin Lavallière, Ph.D.
Full professor, Université du Québec à Chicoutimi
Scientific committee ACE 2025

Avant-propos

C’est avec un immense plaisir que nous vous présentons ce compte-rendu de conférence de ACE 2025 : Au cœur des interventions ergonomiques : les personnes, qui se tient du 6 au 9 octobre 2025 à Québec. Ce recueil témoigne de la richesse de notre discipline et de l’importance de l’ergonomie dans la création de milieux de vie et de travail plus sûrs, plus sains et plus durables.

Le thème de cette année — placer les personnes au centre de toute intervention ergonomique — nous rappelle qu’au-delà des outils, des processus et des environnements se trouvent des individus, avec leurs besoins et leurs aspirations. Les contributions présentées ici incarnent cet engagement, en proposant des recherches rigoureuses, des pratiques novatrices et des études de cas inspirantes provenant de divers milieux.

Nous exprimons notre profonde gratitude aux auteurs, aux évaluateurs, au comité scientifique, aux partenaires et aux hôtes locaux qui ont rendu cet événement possible. Puissent ces actes constituer à la fois une mémoire des savoirs partagés et une source d’inspiration pour nourrir la collaboration et l’innovation dans les années à venir.

Martin Lavallière, Ph.D.
Professeur titulaire, Université du Québec à Chicoutimi
Comité scientifique ACE 2025

Steering Committee ACE 2025

A special word of thanks goes to the Steering Committee, whose vision, guidance, and dedication ensured the success of ACE 2025 (alphabetical order).

- Kim Arbour
- Karine Aubry
- Sylvie Bergeron
- Annie Boisclair
- Élise Dion-Provencher
- Martin Lavallière
- Marcos Paradis
- François Taillefer

Comité d'organisation 2025

Un remerciement particulier s'adresse au comité d'organisation, dont la vision, l'accompagnement et le dévouement ont permis d'assurer le succès de ACE 2025 (ordre alphabétique).

- Kim Arbour
- Karine Aubry
- Sylvie Bergeron
- Annie Boisclair
- Élise Dion-Provencher
- Martin Lavallière
- Marcos Paradis
- François Taillefer



Table des matières

Foreword.....	1
Avant-propos.....	1
Steering Committee ACE 2025.....	2
Comité d'organisation 2025.....	2
Sponsors - Commanditaires.....	8
Guest Speakers – Conférenciers invités.....	13
Ian Noy.....	13
Mélanie Lefrançois, Ph.D. UQAM.....	14
Étienne Chassé.....	15
Keynote address.....	16
Human Factors and Ergonomics as the Engine of Innovation for Societal Progress: Past Lessons and Future Relevance in an Age of Human–Technology Symbiosis.....	16
Ian Y. Noy, Ph.D., CPE.....	16
Quand soigner devient un risque pour les préposées aux bénéficiaires en CHSLD : l'organisation du travail remise en question.....	23
Yawavi Katchobi Abalo ¹ , Mélissa Lavoie ¹ , Patricia Blackburn ¹	24
Examining eight-year trend of Pan-Canadian MMH-related WMSD lost time claims data.....	25
Raymond Reza ¹ , Kathryn Sinden ² , Stephan Dombrowski ¹ , Wayne Albert ¹	25
Industry stakeholders' perceived barriers and facilitators to implementing safe manual material handling practices: A qualitative study based on the Theoretical Domains Framework.....	26
Raymond Reza ¹ , Kathryn Sinden ² , Stephan Dombrowski ¹ , Wayne Albert ¹	26
« Pourquoi, quoi, quand et comment » - Quatre questions pour guider l'implantation d'exosquelettes professionnels.....	27
Hamza Azzouzi ¹	27
Les formations sur le terrain en manutention manuelle - Vers une excellente formation, au-delà des attentes des clients !.....	28
Emmanuel Benoit ¹	28
Adaptation de la typologie de la méthodes HFACS pour l'assemblage numérique.....	29
Hillal Boudjelal ¹ , Yaniel Torres ² , Sylvie Nadeau ¹	29
TROUBLES MUSCULO-SQUELETTIQUES EN OPHTALMOLOGIE. QUELS FREINS ET LEVIERS À LA CONCEPTION D'UN TRAVAIL SOUTENABLE ?.....	Erreur! Signet non défini.
Willy Buchmann ¹	Erreur! Signet non défini.
ANALYSER LES PARCOURS DE RECLASSEMENTS PROFESSIONNELS TMS POUR COMPRENDRE LES LEVIERS A LA CONCEPTION DE PARCOURS SOUTENABLES ?.....	31

Willy Buchmann ¹	31
Proposition d'une approche interdisciplinaire de l'intégration des technologies d'assistance physique en milieu industriel.....	32
Dieula Cazeau ¹	Erreur! Signet non défini.
The accuracy and integration of an artificial intelligence (AI) ergonomic REBA assessment tool into a manufacturing process.....	33
Jessica Chanyi ¹ , Kirsten Fradgley ¹	33
Evaluating the Work(s) Software for Ergonomic Consulting; A Comparative Analysis with Traditional Assessment Tools.....	34
Nickolas Costa ¹	34
"Move It! - The impact of microbreaks on worker comfort, productivity and quality in industrial settings	35
Alex DaRosa ¹ , Carrie Taylor ¹ , Aaron Gebhardt ¹	35
Insights into sitting-related low back pain: A week-long investigation of spine kinematics and changes in spine stiffness with office work	36
Jessa Davidson ¹ , Jack Callaghan ¹	36
Applications of Posture Tracking AI Throughout the Ergonomics Assessment Process.....	37
Beatrice Donahue-Power ^{1, 2}	37
Comment maximiser les retombées de nos interventions en ergonomie ?.....	38
Valérie Albert ¹ , Simon Fournier ¹	38
Evaluating Usability of Human Machine Interface for a Transit Control System.....	39
Lamia Anjum ¹ , Claire Goldring ¹ , Tiffany Pitamber ¹	39
ENJEUX DE SANTÉ ET DE SÉCURITÉ LIÉS À LA MANUTENTION ET À LA CIRCULATION DANS LES SALLES À BAGAGES D'UN AÉROPORT INTERNATIONAL	40
Etienne Goubault ¹ , Maud Gonella ¹ , Caroline Jolly ¹ , Damien Burlet-Vienney ¹	40
Début de la saison de travail : une période critique pour la santé des travailleuses et des travailleurs saisonniers.....	41
Audrey Goupil ^{1, 2} , Marie-Ève Major ³	41
Ergonomically Sound Workstations Matter More Than Ever: The Well-being, DEI & ESG of it All.....	42
Lucy Hart ¹	42
Ergonomics Analysis of Mine Sample Handling.....	43
Heather Kahle, M.Sc., CRSP & Dr. Nicholas La Delfa, PhD	43
Posture Classification Using Computer Vision: A Multi-Label Ergonomic Evaluation of Office Worker Upper Body Posture.....	44
Adele Behzad ¹ , Eunsik Kim ¹ , Aliyu Saifullah Vandana ¹	44
Midrange lumbar spine posture assessment in commercially available hybrid seating devices.....	45

Kate Krivenko ¹ Jessa M. Davidson, Jack P. Callaghan.....	45
Towards Smart Ergonomics: Real-Time Detection of High-Risk Postures Using Computer Vision.....	46
Chady Brahim Lahbib ¹ , Rafael Santos Perez ¹ , Nancy L. Black ¹	46
Looking to Incorporate Computer Vision Into Ergonomics Programs: Research-Based Guidance to Encourage Better Outcomes.....	47
Dennis Larson ¹ , Julia Li ¹ , Justin Davidson ¹ , Steven Fischer ¹	47
FINDING & PROVING ERGONOMIC WORK STRATEGIES FOR MAINTENANCE ACCESS COVER REMOVAL.....	48
Caleb Leary ¹	48
STAYING HIDDEN, STAYING HEALTHY: AN ERGONOMIC ANALYSIS OF PHYSICAL SURVEILLANCE PRACTICES IN LAW ENFORCEMENT	49
Raphaël Lechasseur ¹ , Martin Lavallière ¹	49
DETERMINING THE MAXIMUM FEASIBLE BOX DIMENSIONS AND BOX WEIGHTS FOR ONE-HANDED BOX TRANSFERS FROM VARYING HEIGHTS.....	50
Julia Li ¹ , Dennis Larson ¹ , Steven Fischer ¹	50
From Compliance to Curiosity: Adding a Twist to Existing Safety Structures	51
Heather Kahle ¹ , Anna Matheson ²	51
EFFECT OF HIP STRETCHING ON OVERHEAD WORK KINEMATICS	53
Graham Mayberry ¹ , Janessa Drake ² , Jack Callaghan ¹	53
Sitting and Spine Pain: Intra-Subject Variation Across a Workweek.....	54
Erinn McCreath Frangakis ¹	54
Effect of Research-Informed Posture on Lower Back Pain in Paramedics: A Field-Based Comparison with Self-Selected Posture.....	55
Emily Meier ¹ , Abigail Overduin (CCPE, MSc), Hugh Davies (PhD, CIH).....	55
CRE-MSD Conference 2025: Reflections and Lessons Learned from Implemented MSD Prevention Programs	56
Kim Meszaros ^{1, 2} , Jack P. Callaghan ^{1, 2}	56
Prevalence of Musculoskeletal Pain and Physical Hazards Among Canadian Bartenders: A Pilot Study ...	57
Christopher Millward ¹	57
Evaluation of a Tool For Reducing the Physical Demands of Opening Medicine Vials	58
Shimon Mikhil ¹ , Michael Agnew ¹ , Christopher Millward ¹	58
Exploring the Use of Different Biomechanical Inputs as Percent Effort on Cumulative Fatigue Tool Outputs	59
Steven Fischer ¹ , Hailey Nestor ¹	59
La complexité de tâche en préparation de commandes, état des lieux	60
Valérie Tuyêt Mai Ngô ¹ , Sylvie Nadeau ¹	60

INTEGRATING PSYCHOSOCIAL FACTORS IN MSD ASSESSMENT	61
Heather O'Reilly ¹ , Tegan Slot ²	61
DANS LES COULISSES DU DIAGNOSTIC MÉDICAL: LE TRAVAIL MÉCONNU ET EXIGEANT DES TECHNOLOGUES EN PATHOLOGIE.....	62
Florence Paquet-Beaudet ¹	62
UNDERSTANDING DRIVER FATIGUE AMONG TRUCK DRIVERS IN QUEBEC	63
Elizabeth Peña Saldarriaga ^{1, 2} , Martin Lavallière ²	63
Cardiorespiratory Responses to a Load Carriage Task in Police Tactical Response Unit.....	64
Sébastien Poirier ¹ , Annie gendron ² , Meghan Meghan Garceau ³ , Claude Lajoie ³	64
Developing a Wearable-Based Method for Estimating Community-Based Personal Support Workers Spine Loading.....	65
Kate Posluszny ¹ , Steven Fischer ¹	65
LES FEMMES ENCEINTES AU TRAVAIL	66
Flavia Ribeiro de Vargas ¹ , Florence Paquet-Beaudet ¹ , Maude Lafantaisie ¹ , Évelyne Cambron-Goulet ¹ , Aboubacar Sidibé ¹ , Caroline Delisle ¹	66
Toward A Pipeline to Enable Ergonomic Assessments using Unreal Engine 3D Assets	67
Matthew Russell ¹ , Reza Hajari ² , Matthew Mavor ² , Alexandre Mir-Orefice ² , Ryan Graham ² , Steven Fischer ¹	67
Human Activity Recognition: A Sensor-Based Approach to Understanding Sedentary Workspace Behavior	68
Rafael Santos Perez ¹ , Nancy Black ¹	68
Accommodating Psychosocial Stressors Throughout Pregnancy: A Call to Action.....	69
Jessie Shen ¹ , Anne-Kristina Arnold ¹	69
Double standards: A systematic review of personal protective equipment for peace officers.....	70
Hugo-Pier Simard ¹	70
"Respirer" au travail :caractériser les stratégies individuelles et collectives pour tenir au fil du parcours professionnel en maintenance navale.....	71
Annaëlle Soulet ^{1, 2, 3} , Catherine Delgoulet ^{1, 2} , Willy Buchmann ^{1, 2} , Guérande Jézéquel ^{1, 2}	71
Measuring the effectiveness of ergonomics microlearning.....	72
Carrie Taylor ¹ , Adam Elsdén ² , Taylor Sellick ²	72
Ergonomics Recommendations and Musculoskeletal Risk Factors in Ophthalmology An "Eye" to Applying Ergonomics Principles to The Clinical and Surgical World of Ophthalmologists.....	73
Connor Taylor ¹	73
Working as a Ergonomist in long term care industry.....	74
Aaron Gebhardt ¹ , Carrie Taylor ¹	74

Using competition to engage workers in learning about ergonomics	76
Christina Timmons ¹ , Carrie Taylor ¹ , Alex Da Rosa ¹	76
Évaluation d'un exosquelette de soutien des membres supérieurs en chirurgie plastique: revue narrative et cadre méthodologique	77
Yaniel Torres ^{1, 2} , Alfredo Patrón ¹ , Ornwipa Thamsuwan ² , Edgar Correa ³	77
Anthropometric-Based Regression Modeling for Optimal Driver Seat Adjustment	78
Aliyu Saifullah Vandana ¹	78
OPTIMISATION DE L'HABITACLE DES AUTO-PATROUILLES GRÂCE À L'ERGONOMIE ET AU DESIGN INDUSTRIEL	79
Patrick Vincent ¹	79
LA CERTIFICATION WELL : LEVIER OU FREIN POUR L'ERGONOMIE?	80
Patrick Vincent ¹	80
DEVELOPMENT AND ANALYSIS OF NONLINEAR COUPLED MODEL OF THE HUMAN HAND ARM AND GLOVE SYSTEM	81
Yumeng Yao ¹ , Subhash Rakheja ¹	81
THE EFFECT OF MEASURED LOCATIONS ON SEAT-TO-HEAD VIBRATION RESPONSES OF A SEATED HUMAN BODY	82
Yumeng Yao ¹ Subhash Rakheja Ramin Sedaghati	82

Sponsors - Commanditaires

We are grateful to our sponsors who made this conference possible.

Leur généreuse contribution et leur engagement permettent de faire de cet événement un succès.

Platinum sponsor & Exhibitor

ergoCentric

<https://www.ergocentric.com/>

At ergoCentric, our sole mission is to design and manufacture the best ergonomic chairs in the world and we are recognized as North America's premier manufacturer of high-quality ergonomic seating for office, specialty and healthcare environments.

ergoCentric

Silver sponsors & Exhibitors

CCCPE www.cccpe.ca

The Canadian College for the Certification of Professional Ergonomists (CCCPE) functions as the National certifying body for Ergonomists in Canada and was established in 1998 by the Association of Canadian Ergonomists (ACE). Certification through the CCCPE is voluntary and provides successful candidates with the designation “CCPE” (Certified Canadian Professional Ergonomist), or “AE” (Associate Ergonomist) for those who have not yet accumulated enough years of work experience. The CCCPE is endorsed by the International Ergonomics Association (IEA) as the only recognized ergonomics certifying body in Canada.



CANADIAN COLLEGE FOR THE CERTIFICATION
OF PROFESSIONAL ERGONOMISTS
CONSEIL CANADIEN DE CERTIFICATION
DES PRATICIENS EN ERGONOMIE

Commission des normes, de l'équité, de la santé et de la sécurité du travail www.cnesst.gouv.qc.ca/en

The Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST) is the government body that promotes rights and responsibilities in the workplace and ensures their enforcement for both workers and employers in Quebec. To do so, it: promotes fair and balanced working conditions, ensures the implementation and maintenance of pay equity, and encourages workplaces to take charge of health and safety, compensates victims of work-related injuries, and oversees their rehabilitation.



Hydro-Québec <https://www.hydroquebec.com/a-propos/>

Hydro-Québec s'engage à promouvoir les meilleures pratiques en santé et sécurité du travail (SST) ainsi qu'en développement durable (DD). Dans cette optique, l'évaluation des fournisseurs sur ces enjeux est intégrée à la majorité des appels au marché. Pour soutenir cette démarche, Hydro-Québec collabore avec des firmes spécialisées en ergonomie, qui contribuent activement à l'atteinte de ses objectifs. L'entreprise partage également son expertise à travers des partenariats de recherche, notamment avec l'IRSST et l'UQAM, portant sur l'implantation des exosquelettes en milieu de travail — une initiative innovante visant à améliorer la sécurité et le bien-être des employés.



Exhibitors

Exoskeletons Canada

www.exosquelettescanada.com/en

Exoskeletons Canada is a Quebec-based company specializing in the sale of active and passive exoskeletons across the country. Its mission is to reduce musculoskeletal disorders, improve workplace safety, and support companies facing labour shortages. The company offers neck, arm, and back solutions suited for industries like construction, logistics, and manufacturing. Lightweight, ergonomic, and easy to use, the exoskeletons provided by Exoskeletons Canada help extend workers' careers while enhancing their comfort and productivity.



Inseer

www.inseer.com

AI-Powered Ergonomics Assessment Software: We help safety teams save time and proactively prevent injuries with our AI-driven ergonomics assessment solution.



NEXGEN Ergonomics

www.nexgenergo.com

NexGen Ergonomics is a worldwide source for software and instrumentation used in ergonomics and biomechanics for analysis, research, design and education. NexGen also supplies a broad array of medical products.



Groupe Synetik

<https://synetikgroup.com/fr/>

Synetik is a global leader in the development of ergonomic equipment for the office and home. Our inspiration for innovative designs and our custom-made products have contributed to improving the well-being of all users. Our multidisciplinary team has over 15 years of experience designing chairs, stools, and other related products for personal and industrial use.



PRÉSENCE

www.presence.qc.ca

PRÉSENCE in business since 1997, has 2 main specialties: The sale and installation of presentation products and the layout of multimedia rooms; The sale of all ergonomic products required to optimize your clients' workstations. The advantages of doing business with PRÉSENCE are: Advisory service from our specialists who are available on site and by phone for product purchases; A demonstration room for ergonomic products to test products; Installation service for products and solutions; Authorized CNESST supplier



Break Sponsor

Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST)

www.irsst.qc.ca

The Robert Sauvé Research Institute for Occupational Health and Safety contributes to advances in occupational health and safety through the research of its experienced scientists. In addition to research, the IRSST has a knowledge mobilization team and laboratory specialists.



Student Sponsor

Kinetic Life Solutions

<https://labradorwest.com/work/directory/kinetic-life-solutions-ltd>

Kinetic Life Solutions Ltd. has been serving employers and employees in Labrador since 2017, however the president, Kathy-Lynn Shaw, has been practicing kinesiology, ergonomics, musculoskeletal injury prevention, and occupational health for over 20 years! She is a Canadian Certified Professional Ergonomist, a Registered Kinesiologist, a trainer in MSI Prevention, and provides customized compression therapy and bracing. She has worked in private health clinics, workers' compensation boards, and industry with a professional, reliable, and knowledgeable approach. Kinetic Life Solutions deeply values the health and safety of both workers and workplaces and takes great pride in providing our community with high quality proactive and preventative services.



Guest Speakers – Conférenciers invités

Ian Noy



[LinkedIn: Ian Noy](#)

Distinguished Human Factors and Ergonomics (HFE) expert and BCPE-certified Professional Ergonomist with over 50 years of professional experience performing and directing independent, peer-reviewed scientific research into human cognitive, physical and sociotechnical considerations in transportation, occupational safety and military systems (including applications on land, in the air and underwater). Post-graduate training in both industrial engineering and psychology (Ph.D., University of Toronto, 1990). Vice President of and Director of the Liberty Mutual Research Institute for Safety (2006-2017), Director Standards and Research, Transport Canada (2002-2006). Experienced professional HFE consultant, and forensic expert in legal cases involving general liability and casualty. Held numerous leadership positions including Past-President of the International Ergonomics Association (IEA) and Past-President and Honorary Fellow of the Human Factors Association of Canada/Association canadienne d'ergonomie (HFAC/ACE). Fellow of the Human Factors and Ergonomics Society (HFES) and recipient of numerous awards, including the U.S. National Highway Traffic Safety Administration's Award for Engineering Excellence, the IEA Distinguished Service Award, the Deputy Minister Commendation for Excellence, and the Human Factors and Ergonomics Society's Distinguished International Colleague Award. Chair of IEA2021, Chair of IEA 2014, Organizing Committee of ICOH

Expert distingué en facteurs humains et ergonomie (HFE) et ergonome professionnel certifié BCPE avec plus de 50 ans d'expérience professionnelle dans la réalisation et la direction de recherches scientifiques indépendantes et évaluées par des pairs sur les considérations cognitives, physiques et sociotechniques humaines dans les transports, la sécurité au travail et les systèmes militaires (y compris les applications sur terre, dans les airs et sous-marins). Il détient une formation postuniversitaire en génie industriel et en psychologie (Ph.D., Université de Toronto, 1990). Vice-président et directeur du Liberty Mutual Research Institute for Safety (2006-2017), directeur des normes et de la recherche, Transports Canada (2002-2006). Il est un consultant professionnel expérimenté en HFE et expert judiciaire dans des affaires juridiques impliquant la responsabilité civile générale et les accidents. Il a occupé de nombreux postes de direction, notamment celui d'ancien président de l'International Ergonomics Association (IEA) et d'ancien président et membre honoraire de la Human Factors Association of Canada/Association canadienne d'ergonomie (HFAC/ACE). Membre de la Human Factors and Ergonomics Society (HFES) et récipiendaire de nombreux prix, dont le prix d'excellence en ingénierie de la National Highway Traffic Safety Administration des États-Unis, le prix IEA Distinguished Service Award, la mention élogieuse du sous-ministre pour l'excellence et le prix Distinguished International Colleague Award de la Human Factors and Ergonomics Society. Président de l'IEA2021, président de l'IEA 2014, comité d'organisation de l'ICOH



<https://professeurs.uqam.ca/professeur/lefrancois.melanie/>

Mélanie Lefrançois is a professor in Occupational Health and Safety at Department of Organization and Human Resources at *School of Management Sciences* (ESG) of Université du Québec à Montréal (UQAM). She holds an interdisciplinary PhD in health and society from UQAM, with a double specialization in communication and ergonomics. Her research work is situated within a partnership-based research-intervention perspective and focuses on the organization of work, particularly atypical work hours, (over)work, and collective work. She is interested in prevention of social and gender inequalities in occupational health, with a particular focus on environments where working conditions are difficult, poorly paid, and undervalued, as well as contexts where flexibility and autonomy, although valued, exacerbate the workload and complicate prevention efforts. As an example of her ongoing projects, she is currently the principal investigator of the project "Participatory evaluation approach of collaborative practices related to working hours to attract and retain support staff in school environments" (FRQSC - Concerted Action, 2024-2028). She is also the co-lead researcher of the Health and Safety axis within the Quebec Sleep Research Network (FRQS - Thematic Network, 2024-2028) and a co-research member of the Interdisciplinary Team on Work, Health, Gender, and Equality (SAGE) (FRQSC - Support for Teams, 2024-2028). She has co-edited two special issues on sex/gender considerations in the journals *Ergonomics* (published) and *International Journal of Industrial Ergonomics* (in preparation).

Mélanie Lefrançois est professeure en santé et sécurité du travail au Département d'organisation et ressources humaines de l'École des sciences de la gestion (ESG) de l'Université du Québec à Montréal (UQAM). Elle est titulaire d'un doctorat interdisciplinaire en santé et société de l'UQAM, avec une double spécialisation en communication et en ergonomie. Ses travaux de recherche s'inscrivent dans une perspective de recherche-intervention partenariale et portent sur l'organisation du travail, en particulier les temps de travail atypiques, la (sur)charge de travail et le travail collectif. Elle s'intéresse à la prévention des inégalités sociales et de sexe/genre en santé au travail, avec une attention particulière aux milieux où les conditions de travail sont difficiles, faiblement rémunérées et peu valorisées, ainsi qu'aux contextes où la flexibilité et l'autonomie, bien que valorisées, accentuent la charge de travail et complexifient les démarches de prévention. À titre d'exemple de ses projets en cours, elle est actuellement chercheuse principale du projet « *Démarche d'évaluation participative de pratiques collaboratives liées au temps de travail pour attirer et retenir le personnel de soutien en milieu scolaire* » (FRQSC - Action Concertée, 2024-2028). Elle est également co-chercheuse responsable de l'axe Santé et sécurité du travail au sein du Réseau québécois de recherche sur le sommeil (FRQS - Réseau thématique, 2024-2028) et membre co-chercheuse de l'Équipe interdisciplinaire sur le travail, la santé, le genre et l'égalité (SAGE) (FRQSC - Soutien aux équipes, 2024-2028). Elle a co-dirigé deux numéros spéciaux sur la prise en compte du sexe/genre dans les revues *Ergonomics* (publié) et *International Journal of Industrial Ergonomics* (édition en cours).

Étienne Chassé



Human Performance Research and Development, Forces Armées canadiennes

Mr. Etienne Chassé, is a Research Officer in the Human Performance Research and Development team of the Canadian Forces Morale and Welfare Services since 2018. Etienne was heavily involved in the research and development of several human performance programs and fitness evaluations including Occupational Fitness for Canadian Space Agency Astronauts, Royal Canadian Navy Clearance Divers, helicopter crash rescue firefighting aboard navy ships, with the Holistic Fitness Assessments for the Canadian Military Colleges, with occupational fitness for several military occupations and with military recruits. He presented in multiple national/international conferences on human performance and physical employment standards. Etienne completed a Bachelor degree with honors in Human Kinetics, and a Master's degree in Exercise Physiology at the University of Ottawa (ON, Canada). He is a Clinical Exercise Physiologist and High Performance Specialist by the Canadian Society for Exercise Physiology.

M. Étienne Chassé est agent de recherche au sein de l'équipe de recherche et développement en performance humaine des Services de bien-être et moral des Forces canadiennes depuis 2018. Étienne a été fortement impliqué dans la recherche et le développement de plusieurs programmes de performance humaine et évaluations de la condition physique, y compris la condition physique professionnelle pour les astronautes de l'Agence spatiale canadienne, les plongeurs-démineurs de la Marine royale canadienne, le sauvetage en cas de crash d'hélicoptère à bord des navires de la marine, l'évaluation de santé holistique des collèges militaires canadiens, ainsi que la condition physique professionnelle pour plusieurs occupations militaires et pour les recrues militaires. Il a présenté à de nombreuses conférences nationales et internationales sur la performance humaine et les normes d'emploi physique. Étienne a obtenu un baccalauréat avec mention en activité physique et une maîtrise en physiologie de l'exercice à l'Université d'Ottawa (ON, Canada). Il est physiologiste de l'exercice clinique certifié et spécialiste de la haute performance par la Société canadienne de physiologie de l'exercice.

Let's connect! [Etienne Chassé | LinkedIn](#)

Research Publications: [Google Scholar](#)

Keynote address

Human Factors and Ergonomics as the Engine of Innovation for Societal Progress: Past Lessons and Future Relevance in an Age of Human–Technology Symbiosis

Ian Y. Noy, Ph.D., CPE

US: 8836 Sarita Court || Fort Myers, Florida 33912 || C (239) 776-1103

Canada: 301-65 Oneida Cr. || Richmond Hill, Ontario L4B 0G9

iannoy@outlook.com

Abstract

This article traces the historical trajectory of Human Factors and Ergonomics (HFE), situating it as both an evolutionary feature of human development and a discipline facing existential challenges in the age of symbiotic technology. Drawing from historical evidence, sociotechnical systems theory, resilience engineering, and contemporary debates, the paper synthesizes insights from ancient work through modern AI and biohybrid frontiers. HFE's historical continuity—from stone implements to Industry 5.0—demonstrates its centrality to human progress. However, critiques question its scientific rigor and practical relevance, raising risks of disciplinary marginalization. At the same time, unique HFE methodologies, empirical successes, and emerging challenges underscore its ongoing necessity. For HFE to remain relevant, it must expand its scope, integrate with adjacent disciplines, and lead in guiding human–technology symbiosis by embedding resilience, ethics, and human centric principles into design. By doing so, ergonomics will continue to evolve as the essential engine of innovation that improves the human condition.

Keywords: Human Factors and Ergonomics; Sociotechnical Systems; Resilience Engineering; Value Sensitive Design; Human–AI Interaction; Neuroergonomics; Future of Work

1. Introduction

The relationship between humans and technology is as old as civilization itself. Human Factors and Ergonomics (HFE), though formally established in the twentieth century, has roots extending into ancient systems of work and engineering. This article positions HFE as a defining feature of human adaptation and argues that it has historically functioned as the often-unseen engine of technological innovation, ensuring that tools and systems are effectively integrated into human work and life. It now stands at a critical juncture. Will HFE remain a niche, reactive field, or will it evolve into the proactive, integrative leader?

The discipline must reconcile its past achievements with emerging challenges—artificial intelligence, automation, biohybrid systems, and sociotechnical vulnerabilities.

The purpose of this paper is to: (1) review proto-ergonomic practices in pre-historical environments; (2) trace the philosophical lineage from mechanistic thought to cybernetics and biohybrid HFE; (3) outline the evolution of modern HFE through sociotechnical and resilience frameworks; (4) analyze contemporary grand challenges; and (5) propose a path forward to sustain the discipline's relevance.

2. Proto-Ergonomics and Philosophical Foundations

Evidence of ergonomic thinking predates formal science. The construction of the ancient major projects such as the Egyptian pyramids required sophisticated organization of labor, tools, and material transport—early examples of task analysis and system design. Hippocrates described the need for good lighting and proper postures for surgical work, while Hammurabi's code established accountability for builders, foreshadowing regulatory standards. Roman military logistics optimized camp layouts, marching formations, and weapon standardization, and medieval guilds institutionalized training and safety practices. Bernardino Ramazzini's *De Morbis Artificum* systematically identified and documented occupational diseases, introduced the fields of occupational ergonomics and epidemiology. These examples illustrate a long arc of human attempts to optimize the fit between people and their work environments (Meister, D. (1999).

The philosophical lineage of HFE connects Enlightenment mechanistic thought to modern cybernetics and biohybrid concepts. La Mettrie's *L'Homme Machine* (1748) conceptualized humans as mechanistic systems, laying groundwork for later models of human-machine interaction. Norbert Wiener's *Cybernetics* (1948) formalized theories of control, feedback, and communication that continue to underpin HFE. The mid-twentieth century saw formalization of HFE in response to wartime aviation demands, industrial efficiency, and safety. This progression from proto-ergonomics through philosophy to cybernetics marks the intellectual foundation of the field.

3. Evolution and Modern Scope of HFE

In the twentieth century, HFE developed as a multidisciplinary field focused initially on reducing accidents and improving efficiency in industrial and military contexts. Its scope expanded to cognitive ergonomics, emphasizing decision-making, memory, and error, and to organizational ergonomics, addressing teamwork, communication, and culture (Reason, 1990; Vicente, 1999). This evolution from physical to cognitive to organizational to resilient ergonomics demonstrates how the discipline has continually reinvented itself to serve as the adaptive engine for complex systems, driving innovations in safety and performance. By the early twenty-first century, HFE began addressing hedonomics, or the design of products and systems that promote creativity and pleasing design (Helander, 2002).

Sociotechnical systems theory emphasized that performance and safety emerge from the alignment of humans, technology, and organizations (Clegg, 2000). An example is Automated driving, which presents new system-level risks that arise from the vehicle's connectivity to other elements of the transportation ecosystem and integration within the broader cyber-physical world (Noy, 2018). Levels within the automated driving hierarchy can be thought of in terms of the driver¹, traffic control center, service providers, government regulator, etc. Each level in the system comprises social, technical and organizational subsystems that interact and influence both the input and output of adjacent levels. Performance at one level can thus have profound influences on other levels. Automated Driving, therefore, can be regarded as a system of sociotechnical systems that need to be jointly optimized to achieve desired outcomes such as safety, functionality, reliability, privacy, security, usability, and resilience.

The unwitting adverse consequences of automation are well documented in aviation and military settings, including increased effort and skill at critical times, diminished skills from disuse, loss of

¹ Driver training is a critical topic that requires careful analysis within the automated driving system.

situational awareness and diagnostic skills, reduced knowledge of “system” dynamics, and trust miscalibration. In addition to automation surprises, catastrophic failures of large, complex sociotechnical systems such as Chernobyl and Deepwater Horizon illustrate the risks of cascading system breakdowns and brittleness. Resilience Engineering emerged to evaluate the boundaries of operational stability and proactively manage deviations from safe operation, shifting the focus from preventing error to supporting adaptability, anticipation, and recovery (Hollnagel, 2014). Empirical success is evidenced in critical infrastructure settings. For instance, Labaka, Hernantes, & Sarriegi (2015) implemented a comprehensive resilience framework in a nuclear plant that incorporated both internal and external agents, demonstrating a proactive approach to managing system brittleness. These principles are transferable across domains; they are also being successfully applied in other high-risk domains such as healthcare, where HFE frameworks are used to understand and enhance the adaptive capacity of clinical systems in the face of unexpected pressures (Ellis et al., 2019). These cases illustrate how HFE methodologies improve outcomes in complex, high-risk environments.

4. Contemporary Challenges and Debates

The future of work presents seismic changes. Automation, hybrid work, remote collaboration, and the gig economy are transforming ergonomics both at the micro level and the organizational level (McKinsey Global Institute, 2017; World Economic Forum, 2020; GitLab, 2023). At the same time, human wellbeing, sustainability, and equity have emerged as central values (Karwowski et al., 2025). Grand challenges identified by Karwowski and colleagues include human–AI interaction, aging populations, globalization, sustainability, personalized health, education systems and safety. To these may be added as a seventh challenge, the rather undeveloped state of the HFE academic infrastructure as well as relatively weak brand awareness of the discipline.

Artificial intelligence exemplifies both promise and peril (Endsley, 2017; Hancock et al., 2020). Automation bias—overreliance on automated outputs—and algorithmic authority—the undue legitimization of AI-generated results—threaten human oversight. Documented failures, including AI hallucinations and flawed decision-making in applications like Google Gemini, highlight the risks of opaque, probabilistic systems. These risks are not inevitable; they are often the result of a technology-driven design process that sidelines human considerations until it is too late. For HFE to mitigate these perils and realize the promise, it must transition from merely evaluating AI and biohybrid systems post-development to actively driving their fundamental architecture. This means embedding HFE principles—such as resilience engineering, adaptive function allocation, and value-sensitive design—at the earliest stages of R&D. Rather than being a final checkpoint for usability, HFE provides the essential blueprint that ensures these technologies are built from the ground up to amplify human capabilities, uphold dignity, and gracefully manage failure, thereby steering innovation toward truly beneficial outcomes.

Neuroergonomics and brain–computer interfaces promise enhancement but raise profound ethical questions of privacy, equity, and agency (IEEE Brain, 2021; ACM SIGCHI, 2022). Similarly, ambient intelligence and immersive environments may improve convenience and collaboration but risk undesired surveillance, addiction, and exclusion.

5. Is HFE a Fading Discipline?

Critiques argue that HFE is fading, citing methodological weaknesses, limited practical impact, and encroachment by fields such as UX and computer science (de Winter & Eisma, 2024; Wilson, 2022). Agile engineering, prioritizing rapid iteration over theory-driven design, amplifies this perception. Similarly, democratization of design tools (e.g., no-code platforms, AI-generated UI) poses a further challenge (anyone can "do" design, diluting expert value). Despite the pressures associated with agile engineering and democratization of design, HFE can provide the theoretical foundation and human-centered rigor to ensure that agile iterations move in a direction that is truly safe, usable, and beneficial and the principles that are more needed than ever to guide non-experts. In doing so, HFE can play a role as an essential partner, not an obstacle.

Counterarguments to the proposition that the discipline is fading stress the unique contributions of HFE. Salmon (2025) emphasizes that while some subfields may contract, others amplify. HFE provides methodological distinctiveness through task analysis, cognitive work analysis, and ethnographic methods—tools rarely matched in adjacent disciplines (Vicente, 1999; Norman, 1988). The application of HFE methodologies like the Systems Engineering Initiative for Patient Safety (SEIPS) model has provided a proven framework for analyzing healthcare work systems and designing interventions that reduce errors and improve outcomes (Carayon et al., 2006).

Whereas UX and HCI often emphasize usability and satisfaction at the point of interaction—optimizing, for example, the clickability of a button or the clarity of an icon—HFE offers a more holistic, systemic perspective. This perspective is crucial in organizational and safety-critical domains. Consider a medication administration interface in a hospital. A UX designer might rightly focus on ensuring that the 'confirm dose' button is visually distinct and easy to tap to prevent mis-selection. An HFE specialist analyzes this same interface within its broader context: How does the timing of alerts interact with nurse workload during a shift change? Could the alarm fatigue caused by numerous system warnings lead to a crucial alert being silenced? Does the screen's design promote a double-check of patient identity under high-stress, interrupt-driven conditions? The HFE approach examines the entire socio-technical system—the human, the technology, the environment, and the organizational processes—to identify latent risks that could culminate in a catastrophic error, far beyond the usability of a single element. This fundamental difference in scope—from interface usability to system resilience—demonstrates the unique and indispensable value of the HFE discipline, particularly in environments where the cost of failure is high.

Further evidence of the unique contributions of HFE is the recent empirical evidence that expanded Crew Resource Management (CRM) efforts in aviation directly correlate with measurable improvements in flight safety culture and organizational adaptability (Terzioğlu, 2024), underscoring the discipline's continued practical value.

6. A Path Forward for HFE

For HFE to continue serving as the essential engine of human-centered innovation, it must undergo a deliberate transformation. Action is required on two complementary levels: the profession as a whole and the individual professionals who practice within it.

HFE as a profession.

1. Foundational theories must be rigorously tested and extended to new domains such as artificial intelligence (AI) and brain–computer interfaces (BCIs), ensuring that traditional HFE insights remain valid in these emerging contexts.
2. HFE must actively build alliances with adjacent disciplines—including ethics, business, law, and the social sciences—to address the increasingly complex and multifaceted challenges posed by technological and organizational change.
3. The profession must demonstrate benefits in terms that resonate with stakeholders such as industry leaders and policymakers. These include measurable return on investment, reductions in operational and safety risks, and contributions to innovation outcomes.
4. HFE should advance methodologies and metrics that incorporate ethics, privacy, agency, and other human values into system design, reinforcing resilience and human dignity as core criteria. This work can build on established approaches such as Resilience Engineering and Value Sensitive Design (Friedman et al., 2013). For example, articulating and marketing HFE's unique methodologies are essential for moving AI ethics from abstract principles to concrete, implementable design requirements for operationalizing ethics in complex systems.
5. The international HFE community should modernize education and certification standards to reflect emerging priorities in both research and practice.
6. Reforms are needed to address biases in scientific publishing and to promote alternative mechanisms for disseminating knowledge—such as a curated, open-access repository of detailed case studies, and interdisciplinary outlets. These would showcase successful applications of HFE (and lessons learned from failures) in emerging areas like AI, robotics, and hybrid work, complete with methodologies and measurable outcomes. This serves the dual purpose of knowledge dissemination and marketing the discipline's value.
7. The profession should invest in broad public engagement, launching coordinated campaigns to strengthen the global “ergonomics brand” and to communicate the relevance of HFE principles to everyday life. This should include the development of new, accessible curricula that bridge HFE with data science and ethics to attract a broader student base and raise the discipline's profile.

Individual HFE professionals.

At the level of individual practice, ergonomists must embrace a transformative mindset. This means moving beyond familiar protocols and 'safe zones' by, for example:

1. Actively pursuing literacy in data fundamentals and machine learning concepts to effectively collaborate with data scientists and to critique AI systems from a position of informed understanding.
2. Developing fluency and translational skills in the language of business and policy—such as return on investment (ROI), risk mitigation, and regulatory compliance—to better articulate the value of HFE interventions to executives and policymakers beyond traditional usability metrics.
3. Questioning long-standing assumptions, exploring novel theories, and adopting innovative methodologies.
4. Seeking out projects outside the individual's traditional industry comfort zones.

By challenging disciplinary boundaries and experimenting with new paradigms, professionals can contribute not only to advancing the science of HFE but also to shaping its role in a rapidly evolving technological landscape.

7. Conclusion

The pursuit of technological advantage has been a defining feature of human history, from stone implements to modern AI. HFE represents this pursuit in scientific form. While critiques of fading relevance warrant attention, the discipline's unique methodologies and systems perspective remain indispensable. By embracing transformation and articulating a bold agenda, HFE can ensure that human–technology symbiosis promotes resilience, wellbeing, and dignity rather than eroding them.

Ultimately, ergonomics is not merely a supporting discipline - it is the engine that drives innovations that improve the human condition. For true symbiosis to be achieved—a relationship that benefits and enhances both human and machine—HFE must provide the guiding framework.

References

- ACM SIGCHI. (2022). Perspectives on human–computer integration: Neuroergonomics and brain–computer interaction. ACM Digital Library.
- Carayon, P., Hundt, A. S., Karsh, B. T., Gurses, A. P., Alvarado, C. J., Smith, M., & Brennan, P. F. (2006). Work system design for patient safety: the SEIPS model. *Quality and Safety in Health Care*, 15(Suppl 1), i50-i58.
- Clegg, C. W. (2000). Sociotechnical principles for system design. *Applied Ergonomics*, 31(5), 463–477. [https://doi.org/10.1016/S0003-6870\(00\)00009-0](https://doi.org/10.1016/S0003-6870(00)00009-0)
- de Winter, J. C. F., & Eisma, Y. B. (2024). Ergonomics & human factors: Fade of a discipline. *Ergonomics*, 67(1), 1–9. <https://doi.org/10.1080/00140139.2023.2240675>
- Dul, J., Bruder, R., Buckle, P., Carayon, P., Falzon, P., Marras, W. S., ... & van der Doelen, B. (2012). A strategy for human factors/ergonomics: Developing the discipline and profession. *Ergonomics*, 55(4), 377–395. <https://doi.org/10.1080/00140139.2012.661087>
- Ellis, L. A., Churrua, K., Clay-Williams, R., Pomare, C., Austin, E. E., Long, J. C., Grødahl, A., Braithwaite, J. (2019). Patterns of resilience: A scoping review and bibliometric analysis of resilient health care. *Safety Science*, 118, 241-257.
- Endsley, M. R. (2017). From here to autonomy: Lessons learned from human–automation research. *Human Factors*, 59(1), 5–27. <https://doi.org/10.1177/0018720816681350>
- Friedman, B., Kahn Jr, P. H., & Borning, A. (2013). Value sensitive design and information systems. In N. Doorn, D. Schuurbijs, I. van de Poel, & M. E. Gorman (Eds.), *Early engagement and new technologies: Opening up the laboratory* (pp. 55–95). Springer. https://doi.org/10.1007/978-94-007-7844-3_4
- GitLab. (2023). 2023 Remote Work Report. GitLab Inc.
- Hancock, P. A., Jagacinski, R. J., Parasuraman, R., Wickens, C. D., & Sheridan, T. B. (2020). Human–automation interaction research: Past, present, and future. *International Journal of Human–Computer Studies*, 134, 102–120. <https://doi.org/10.1016/j.ijhcs.2019.102369>
- Helander, M. G. (2002). Hedonomics—The power of positive and pleasurable ergonomics. *Ergonomics in Design*, 10(1), 5–8. <https://doi.org/10.1177/106480460201000103>
- Hollnagel, E. (2014). Resilience engineering and the built environment. *Building Research & Information*, 42(2), 221–228. <https://doi.org/10.1080/09613218.2014.862607>
- IEEE Brain. (2021). Brain–computer interfaces: State of the art and future directions. IEEE Brain Initiative Report.
- International Ergonomics Association (IEA). (2000). What is ergonomics?

- Jastrzębowski, W. (1857). Rys ergonomji czyli nauki o pracy. *Przyroda i Przemysł*, 29, 227–231.
- Karwowski, W., Ahram, T., & Hancock, P. (2025). Grand challenges for human factors and ergonomics. *Theoretical Issues in Ergonomics Science*. Advance online publication. <https://doi.org/10.1080/1463922X.2024.1234567>
- La Mettrie, J. O. de. (1748). *L'Homme machine*. Elie Luzac.
- Labaka, L., Hernantes, J., & Sarriegi, J. M. (2015). Resilience framework for critical infrastructures: An empirical study in a nuclear plant. *Reliability Engineering & System Safety*, 141, 92-105. <https://doi.org/10.1016/j.res.2015.03.009>.
- McKinsey Global Institute. (2017). *Jobs lost, jobs gained: Workforce transitions in a time of automation*. McKinsey & Company.
- Meister, D., (1999). *The History of Human factors and Ergonomics*. CRC Press. <https://doi.org/10.1201/9781315276069>.
- Norman, D. A. (1988). *The design of everyday things*. Basic Books.
- Noy, Y.I., Shinar, D., Horrey, W., 2018, Automated driving: Safety blind spots, *Journal of Safety Science*, (102, 68-78).
- Reason, J. (1990). *Human error*. Cambridge University Press.
- Salmon, P. M. (2025). As some things fade, others amplify: A response to de Winter and Eisma. *Ergonomics*. Advance online publication.
- Terzioğlu, M. (2024). The effects of crew resource management on flight safety culture: Corporate Crew Resource Management (CRM 7.0). *The Aeronautical Journal*, 128(1326), 1743-1766. <https://doi.org/10.1017/aer.2023.113>
- Vicente, K. J. (1999). *Cognitive work analysis*. CRC Press.
- Wiener, N. (1948). *Cybernetics: Or control and communication in the animal and the machine*. MIT Press.
- Wilson, J. R. (2022). Human factors and ergonomics: Where next? *Ergonomics*, 65(1), 1–10. <https://doi.org/10.1080/00140139.2021.2001347>
- Wills, C. (1999). *Children of Prometheus: The accelerating pace of human evolution*. Basic Books.
- World Economic Forum. (2020). *The future of jobs report 2020*. World Economic Forum.

Abstracts / Résumés

The abstract presenting scientific research or case study are presented below by alphabetical order of the author's last name who will be presenting at the conference.

Les résumés présentant une recherche scientifique ou une étude de cas sont présentés ci-dessous par ordre alphabétique du nom de famille de l'auteur qui présentera à la conférence.

Quand soigner devient un risque pour les préposées aux bénéficiaires en CHSLD : l'organisation du travail remise en question

Yawavi Katchobi Abalo¹, Mélissa Lavoie¹, Patricia Blackburn¹

¹Unité d'enseignement en kinésiologie, Département des sciences de la santé, Université du Québec à Chicoutimi ; ²Module des sciences infirmières, Département des sciences de la santé, Université du Québec à Chicoutimi

ÉNONCÉ DU PROBLÈME

Les préposées aux bénéficiaires (PAB) travaillant dans les centres d'hébergement et de soins de longue durée (CHSLD) sont exposées aux risques de troubles musculosquelettiques (TMS). Toutefois, la perception de ces risques par les PAB et les gestionnaires reste mal comprises.

OBJECTIF DE RECHERCHE

Décrire les facteurs de risque de TMS chez les PAB travaillant dans deux CHSLD du Saguenay–Lac-Saint-Jean (SLSJ).

MÉTHODOLOGIE

Une approche quantitative descriptive a été utilisée auprès de PAB et de gestionnaires de deux CHSLD du SLSJ. La perception du risque de TMS a été évaluée à l'aide du *Questionnaire de perception du milieu*, tandis que les mouvements à risque ont été observés avec l'*Outil de repérage des postes/fonctions à risque*.

RÉSULTATS

L'échantillon comprenait 10 PAB et 2 gestionnaires avec en moyenne $5,3 \pm 6,3$ ans d'expérience. L'analyse des résultats révèle que les TMS découlent de plusieurs causes. En effet, au-delà des efforts physiques (75,0 %) liés à la mobilisation des personnes, le développement de ces troubles est aussi associé à une pénurie de personnel (41,7 %), à des équipements inadaptés ou absents (50,0 %) et à des environnements inadaptés (58,3 %).

DISCUSSION

Les TMS ne peuvent pas être prévenus uniquement par des approches biomécaniques. Une intervention efficace nécessite de revoir l'organisation du travail et d'assurer l'accessibilité aux équipements.

DÉCLARATION SOMMAIRE

La prévention des TMS chez les PAB implique de reconnaître le rôle de l'équipe de gestion et du personnel tel qu'indiqué par Jauvin et al. (2024), mais aussi celui de la famille.

CITATION

Jauvin, N., et al. (2024). *Recherche-action visant le développement d'un modèle d'intervention préventive en SST par et pour les préposés aux bénéficiaires en CHSLD*. Institut de recherche Robert-Sauvé en santé et en sécurité du travail.

Examining eight-year trend of Pan-Canadian MMH-related WMSD lost time claims data

Raymond Reza¹, Kathryn Sinden², Stephan Dombrowski¹, [Wayne Albert¹](#)

¹University of New Brunswick, ²Lakehead University

PROBLEM STATEMENT: Manual Material Handling (MMH) is the single largest source of worker's compensation claims and costs. In 2019, the Association of Workers' Compensation Board of Canada (AWCBC) reported 271,806 overall lost-time claims in Canada and under the nature of the injury or disease 234,851 lost-time claims resulted in traumatic injuries and disorders, out of which 105,130 were due to bodily reaction, overexertion, or repetitive motion (AWCBC, 2021). Despite the high number of lost-time claims associated with the WMSD, very few studies have been conducted to examine the effects and leading causes of MMH on such claims. The trend analysis of the WMSD associated with MMH in terms of nature of injury and event, industry, occupation, parts of the body, age, gender and compliance activities can provide a thorough understanding of the injuries related to MMH and suggest further research initiatives.

RESEARCH OBJECTIVE: Examine an 8-year span (2012 to 2019) of Pan-Canadian WMSD lost time claims data along with ergonomics inspection, compliance, and enforcement (ICE) activities by the provincial/territorial jurisdictions to understand the current trends related to MMH practices under the existence of present Canadian regulatory framework, standards and codes.

METHODOLOGY: Eight years (2012-2019) of WMSD lost time claims data was requested from the Association of Workers' Compensation Boards of Canada (AWCBC) for the purpose of in-depth examination and analysis. Descriptive statistics (i.e., mean and percentage change) and trend analysis on raw data from 2012 to 2019 was used to develop a framework for enabling the intended investigations to identify both incident trend and the gap between the evidence to practice. WMSD lost-time claims related to MMH trend were gathered for several demographic and work-related characteristics.

RESULTS: Overall, findings of this study indicates that MMH tasks continue to incur significant losses in terms of WMSDs. There may be a reason for MMH continuing to generate steady losses despite an increased focus on industrial automation processes and WMSD prevention both nationally and internationally. An alternative argument might be that MMH programs are not widely implemented or that their implementations are ineffective at an organizational level. Researchers, ergonomic practitioners and regulators should gain a deep understanding of industry-specific ergonomic barriers and facilitators and WMSD patterns before designing and implementing MMH-related WMSD interventions.

RESEARCH TO PRACTICE SUMMARY STATEMENT: It is evident that the prevalence of WMSDs varies widely across different levels (national, provincial/territorial, industrial, occupational, sectoral, organizational and individual). As a result, this calls for comprehensive research to identify the barriers and facilitators of implementing evidence-based MMH programs to prevent WMSDs.

REFERENCES

AWCBC. (2021). *National Work Injury Disease and Fatality Statistics-2017-2019*.

Industry stakeholders' perceived barriers and facilitators to implementing safe manual material handling practices: A qualitative study based on the Theoretical Domains Framework

Raymond Reza¹, Kathryn Sinden², Stephan Dombrowski¹, [Wayne Albert¹](#)

¹University of New Brunswick, ²Lakehead University

PROBLEM STATEMENT: Evidence-based behavioural interventions can reduce the occurrence of work-related musculoskeletal disorders (WMSDs). Manual material handling (MMH) behaviours are a key contributor to preventable injuries and WMSDs.

RESEARCH OBJECTIVE: This study aimed to identify industry stakeholders' perceived barriers and facilitators to implement evidence-based MMH techniques for the prevention of WMSDs.

METHODOLOGY: A qualitative study design was employed using online semi-structured interviews grounded in the Theoretical Domains Framework (TDF). Eligible participants included practicing ergonomists and industry representatives such as managers, supervisors, and human resources professionals, OHS practitioners, and provincial regulators from workers' compensation boards. Data were analyzed thematically using a direct content analysis approach.

RESULTS: Eighteen participants (10 females and 8 males) with professional experience ranging from 7 to 35 years (median = 19.5) participated in the study. Five key TDF domains were identified through overlapping theoretical constructs that informed perceived barriers and facilitators. The most commonly reported barriers were related to the environmental context and resources, including financial limitations, lack of competent human and material resources (e.g., tools, equipment), absence of evidence-based standards, and gaps in comprehensive MMH regulations. Participants also highlighted key behavioural characteristics among both managers and employees, noting expressions of commitment, disengagement, or inaction as influential factors.

DISCUSSION: Implementing evidence-based MMH programs to prevent WMSDs requires a coordinated, multi-level approach that actively involves industry stakeholders. While stakeholders recognize the need to address perceived barriers and facilitators, current efforts often focus predominantly on physical ergonomic controls. To enhance the long-term effectiveness and sustainability of MMH programs, it is essential to also integrate behavioural change strategies. These include organizational and cognitive interventions such as effective communication, strategic job design, and proactive risk mitigation practices that support a broader, systems-level commitment to safe manual handling.

RESEARCH TO PRACTICE SUMMARY STATEMENT: This study enhances the understanding of key barriers and facilitators influencing the implementation of evidence-based MMH practices. It highlights the importance of behavioural science in ergonomic practice and the need for stakeholder collaboration, regulatory clarity, and integrated risk mitigation strategies to support safer workplaces.

« Pourquoi, quoi, quand et comment » - Quatre questions pour guider l'implantation d'exosquelettes professionnels

Hamza Azzouzi¹

¹Ergonome - Ergokinox

INTRODUCTION À L'ÉTUDE DE CAS

L'intérêt pour les exosquelettes professionnels est grandissant dans plusieurs secteurs industriels, en réponse aux enjeux liés aux troubles musculosquelettiques (TMS). Toutefois, les échecs d'implantation et les incertitudes sur leur efficacité réelle en milieu de travail soulèvent des questions : pourquoi implanter un exosquelette, lequel choisir, quand est-ce pertinent de l'introduire, et surtout, comment maximiser l'adhésion et l'efficacité? Peu d'études terrain ont exploré ces dimensions de manière systémique dans des environnements variés.

BUT DE L'ÉTUDE DE CAS

L'objectif de cette étude de cas était d'évaluer l'utilité, la pertinence et les conditions favorables à l'implantation d'exosquelettes passifs (assistance lombaire et assistance membres supérieures) dans des ateliers de mécanique automobile et de camions lourds. Le projet visait à comparer 4 modèles pour chaque type d'assistance afin de produire des données utiles pour d'éventuelles implantations dans d'autres milieux comparables.

MÉTHODOLOGIE / CONTEXTE DE L'ÉTUDE DE CAS

Le projet a été mené en collaboration avec 4 ergonomes et les équipes de gestion de 8 établissements répartis dans le secteur automobile. Des essais comparatifs ont été effectués sur 4 modèles d'exosquelettes passifs lombaires et 4 modèles pour les membres supérieurs. Les tests ont inclus des observations en situation réelle, des questionnaires auprès des travailleurs, des journaux de bord, ainsi que des analyses d'adéquation tâche-technologie. Des critères utilitaires, contextuels et organisationnels ont été définis pour guider l'analyse selon les axes suivants : Pourquoi (besoins à combler), Quoi (critères de sélection), Quand (indicateurs d'opportunité) et Comment (facteurs d'implantation réussie).

RÉSULTATS DE L'ÉTUDE DE CAS

Des critères utilitaires, contextuels et organisationnels ont été définis suivant les axes suivants : Pourquoi (besoins à combler), Quoi (critères de sélection), Quand (indicateurs d'opportunité) et Comment (facteurs d'implantation/d'adhésion).

DISCUSSION DE L'ÉTUDE DE CAS

Les résultats démontrent qu'un exosquelette n'est pas une solution universelle, mais un outil contextuel qui doit être intégré dans une démarche globale d'amélioration des conditions de travail.

L'étude souligne l'importance d'un diagnostic ergonomique préalable, de l'implication des utilisateurs, et d'une vision systémique de l'implantation.

Les limites incluent le nombre restreint de milieux testés et la courte durée des essais pour certains dispositifs. Une prochaine étape serait de documenter les effets à moyen terme et de développer une grille d'aide à la décision adaptable à d'autres secteurs.

DÉCLARATION SOMMAIRE

1) Le choix du dispositif doit être guidé par des critères ergonomiques et organisationnels concrets, validés en milieu réel. 2) Une implantation réussie d'exosquelettes repose sur une évaluation rigoureuse des besoins, des contextes et des modalités d'intégration. 3) Les participants à la conférence repartiront avec un cadre d'analyse pratique en 4 questions (Pourquoi, Quoi, Quand, Comment) pour orienter leurs démarches d'implantation dans leur propre milieu.

RÉFÉRENCES

de Looze, M.P., Bosch, T., Krause, F., Stadler, K.S., & O'Sullivan, L.W. (2016). *Ergonomics*, 59(5), 671–681.

Huysamen, K., de Looze, M., Bosch, T., & Toxiri, S. (2018). *Applied Ergonomics*, 68, 125–131.

Madinei, S., Alemi, M.M., Kim, S., Srinivasan, D., & Nussbaum, M.A. (2020). *Human Factors*, 62(3), 465–480.

Les formations sur le terrain en manutention manuelle - Vers une excellente formation, au-delà des attentes des clients !

Emmanuel Benoit¹

¹Alliance - Ergonomie Conseil

Je vous partage ici certains constats que j'ai fait suite aux 260 formations en manutention manuelles que j'ai données au cours des 6 dernières années. Nous aborderons les enjeux liés aux différentes demandes des clients, comment y faire face, et comment leur proposer des programmes de formation qui seront réellement utiles pour assurer la santé et la sécurité des travailleurs sur le terrain.

Adaptation de la typologie de la méthodes HFACS pour l'assemblage numérique

Hillal Boudjelal¹, Yaniel Torres², Sylvie Nadeau¹

¹École de technologie supérieure, ²Universidad de Antioquia, Medellín, Colombia

ÉNONCÉ DU PROBLÈME

Bien que la méthode HFACS (Human Factors Analysis and Classification System) ait démontré son efficacité pour l'analyse de l'erreur humaine dans l'aéronautique, son utilisation dans des environnements d'assemblage numériques (Industrie 4.0 et 5.0) reste encore marginale. Ces milieux interconnectés introduisent de nouvelles dynamiques homme-machine, mettant à l'épreuve les outils d'analyse traditionnels.

OBJECTIF DE LA RECHERCHE

Évaluer la pertinence et les limites de la méthode HFACS dans l'analyse des risques d'erreur humaine des systèmes d'assemblage numériques. Proposer une version adaptée de la typologie utilisée par HFACS, en cohérence avec la typologie utilisée dans la méthode STAMP/STPA, afin de mieux saisir la complexité des erreurs humaines dans les contextes industriels numérisés.

METHODOLOGIE

La méthodologie adoptée repose sur trois volets : (1) Une revue critique de la littérature sur l'utilisation de la méthode HFACS dans différents secteurs d'activité, (2) Une analyse HFACS d'un cas d'assemblage assisté par lunettes intelligentes, tirée des travaux de Karevan et Nadeau (2024), (3) Une proposition d'adaptation de la typologie HFACS, en cohérence avec celle de STAMP/STPA, destinée aux environnements d'assemblage numériques.

RÉSULTATS

L'analyse a montré les limites de la méthode HFACS classique dans les environnements numériques, notamment son manque de capacité à modéliser les interrelations complexes entre les opérateurs et les systèmes automatisés/numérisés. L'adaptation proposée permet une classification plus affinée des causes profondes d'erreurs humaines en assemblage numérique.

DISCUSSION

Cette adaptation de la typologie de la HFACS ouvre la voie à une prévention plus proactive des erreurs humaines dans les milieux industriels intelligents. D'autres développements méthodologiques sont prévus.

SOMMAIRE

HFACS, dans sa forme traditionnelle, ne suffit plus à rendre compte de la complexité des erreurs dans les systèmes d'assemblage numériques. L'adaptation, en cohérence avec la typologie de STAMP/STPA, permet de renforcer l'analyse des risques pour faire face aux défis de l'assemblage numérisé.

CITATION

Karevan, A., & Nadeau, S. (2024). A comprehensive STPA-PSO framework for quantifying smart glasses risks in manufacturing. *Heliyon*, 10, Article e30162.

TROUBLES MUSCULO-SQUELETTIQUES EN OPHTALMOLOGIE. QUELS FREINS ET LEVIERS À LA CONCEPTION D'UN TRAVAIL SOUTENABLE ?

Buchmann, Willy. Le Cnam, CRTD, Equipe Ergonomie. Paris, France

Fortineau, Eric. Ergonova, Nantes, France, Ribaute, Etienne. Cabinet ophtalmologie Œil de Breizh, Quimper, France, Brézin, Antoine. APHP Hôpital Cochin, Paris, France

ÉNONCÉ DU PROBLÈME

Selon la littérature internationale en épidémiologie, la prévalence des TMS du membre supérieur et du rachis est un phénomène d'ampleur chez les médecins ophtalmologistes. Mais ces études ne pointent pas ou que d'une manière très générale les déterminants du travail à l'origine de ces atteintes.

OBJECTIF DE RECHERCHE

L'objectif de cette recherche est de documenter l'activité de travail des médecins ophtalmologistes en France exerçant en consultation et en chirurgie.

MÉTHODOLOGIE

La recherche a été menée dans 2 cabinets d'ophtalmologie (en région Bretagne et région Rhône Alpes), selon le modèle de l'intervention ergonomique vue comme une conduite de projet, à visée constructive : observations des travailleurs, entretiens semi-dirigés, analyse de documents internes aux cabinets ; diagnostic et pistes de solutions co-construits avec les principales parties prenantes.

RÉSULTATS

Les principaux facteurs de risques de TMS des médecins relèvent d'une part de postures contraintes à adopter lors des examens, à cause de matériels d'examens ne respectant pas les standards anthropométriques de conception. D'autre part de dimensions organisationnelles individuelles (ordonnancements de typologies de patients reçus sur la journée ou sur la semaine) et collectives (répartition des tâches et coordination entre secrétaires médicales, orthoptistes et médecins), pouvant accroître la charge physique à l'échelle de la journée ou de la semaine de travail. Des actions de prévention ont été identifiées à différents niveaux : individuel (matériel utilisé, conception des postes de travail, formation complémentaire au geste professionnel en compétence et en santé), collectif avec les autres membres du cabinet (conception des plannings, usages des espaces de travail pour faciliter le circuit patient), ou encore au niveau de la branche professionnelle (formation continue, actions auprès des concepteurs de matériel).

DISCUSSION

Ces résultats nécessitent d'être mis à l'épreuve d'autres modes de pratique (hôpital, cabinet individuel...). Ils interrogent également les acquis de l'ergonomie en matière de prévention des TMS, car le travail libéral en milieu de santé par des médecins qui sont à la fois prescripteurs et victimes de leur travail, mais également prescripteurs et responsables du travail et de la santé de leurs salariés, demeure à ce jour peu investigué et documenté.

DÉCLARATION SOMMAIRE

Les médecins ophtalmologistes ne sont pas épargnés par les TMS. Selon Diaconita et coll. (2019) 46% des praticiens canadiens ayant participé à une étude sur le sujet seraient touchés de douleurs et atteintes au niveau de la nuque et 48% au niveau du membre supérieur, ce qui fait des TMS dans ce secteur un enjeu important et d'actualité. La communication présentée mettra l'accent d'une part sur les analyses ergonomiques du travail des médecins ophtalmologistes en consultation et en chirurgie, pointant les enjeux de l'activité (précision du diagnostic, gestion des angoisses liées à la baisse ou perte de vue, obligation de résultat en chirurgie...), et d'autre part sur les facteurs de risques (techniques, organisationnels) identifiés, mais également sur le fruit des réflexions conduites avec ces derniers, pour identifier les leviers et axes d'actions pour la conception d'un travail soutenable, au fil des parcours professionnels.

CITATION

Diaconita, V., Uhlman, K., Mao, A., Mather, R. (2019). *Can J Ophthalmol.* 2019;54(3):314-22.

ANALYSER LES PARCOURS DE RECLASSEMENTS PROFESSIONNELS TMS POUR COMPRENDRE LES LEVIERS A LA CONCEPTION DE PARCOURS SOUTENABLES ?

Willy Buchmann¹

¹Conservatoire National des Arts et Métiers

INTRODUCTION

Le terrain de recherche est un établissement de 700 salariés spécialisé dans la production de pièces aéronautiques. La direction de l'entreprise rencontre des difficultés à reclasser durablement les opérateurs les plus atteints de Troubles Musculo Squelettiques (TMS).

OBJECTIF DE LA RECHERCHE

Comprendre dans quelle mesure les parcours professionnels des travailleurs atteints de TMS ne sont pas soutenables. Quels enseignements tirer des processus de reclassement existants, pour aider l'entreprise à construire des parcours professionnels soutenables ? (Buchmann et coll. 2018)

MÉTHODOLOGIE

Méthodologie en 3 temps : en collaboration avec le médecin du travail de l'entreprise, (1) ont été recensés tous les opérateurs de l'établissement reclassés pour cause de TMS lourds dans les 8 années précédant l'étude (n=9). (2) Analyses documentaires : les données relatives aux douleurs articulaires et aux changements de postes de travail ont été extraites des dossiers médicaux de ces 9 opérateurs et ont été formalisées sous la forme de frises chronologiques (1 par opérateur). (3) Ces frises ont servi de support à un entretien d'explicitation entre le médecin du travail et l'ergonome chercheur. Les échanges ont été enregistrés, puis retranscrits et ont fait l'objet d'une analyse thématique qualitative.

RÉSULTATS

Les données analysées révèlent : Les multiples alertes (entre 4 et 10) signifiées par l'opérateur ou le médecin avant qu'un changement de poste ne soit effectivement mis en œuvre. Les reclassements touchent les anciens, mais aussi des jeunes : cinq opérateurs âgés de 49 à 52 ans, avec une ancienneté de 15 à 33 ans ; mais aussi quatre plus jeunes (24 à 35 ans) avec 5 à 13 ans d'ancienneté. Un reclassement est rarement définitif : pour chacun des 9 opérateurs, nous avons comptabilisé entre 3 et 6 changements de poste sur la période considérée. Et les changements de postes ne sont pas tous liés aux problèmes articulaires, et n'intègrent pas toujours leur existence : parmi les changements de postes identifiés, certains ont pour motif des problèmes de santé, mais d'autres répondent à des besoins de production sans prise en compte de l'histoire de santé et du parcours de l'opérateur.

DISCUSSION

Ces résultats questionnent la notion de reclassement, ici vu comme un parcours à concevoir collectivement. Dans le cas de notre terrain de recherche, les acteurs de la conception d'un parcours de reclassement semblent articuler de multiples temporalités, parfois en contradiction : celles des atteintes de santé (entre processus d'aggravation et de stabilisation au décours temporel incertain) ; celles de la production (fluctuations des besoins de production, identification de périodes favorables à l'accueil d'un nouvel opérateur), celles des travailleurs atteints des TMS (temps de maturation nécessaire à la prise de décision d'un changement de poste, construction d'un horizon désirable), et celles des acteurs de la prévention mobilisés pour un reclassement (médecin du travail, RH, management de proximité, etc.). La difficile rencontre de ces facteurs justifie en partie que l'on trouve dans cet établissement autant d'opérateurs présentant des problèmes articulaires anciens, persistants et durables mais si peu de reclassements.

DÉCLARATION SOMMAIRE

L'objectif de ce travail de recherche est de tirer des enseignements des processus de reclassement existants dans une grande entreprise industrielle, pour identifier les freins et leviers à la construction de parcours professionnels soutenables. Un parcours de reclassement soutenable intégrerait non seulement des enjeux de santé (quels indicateurs santé tracer ?), mais également des questions de temporalités (quand reclasser ? A quels signaux faibles faut-il être attentifs ?), et des enjeux de production (quels postes seraient « accueillants » par un travailleur touché par tel ou tel TMS ? comment rendre le poste « accueillant » pour le nouvel opérateur remplaçant ?)

CITATION

Buchmann, W., Mardon, C., Volkoff, S., & Archambault, C. (2018). Peut-on élaborer une approche ergonomique du « temps long » ? Une étude des douleurs articulaires liées au travail, dans une grande entreprise. Perspectives interdisciplinaires sur le travail et la santé, (20-1).

Proposition d'une approche interdisciplinaire de l'intégration des technologies d'assistance physique en milieu industriel

Cazeau, Dieula, École de technologie supérieure (ÉTS), Département de génie mécanique, Thamsuwan, Ornwipa, École de technologie supérieure (ÉTS), Département de génie mécanique

Les TMS sont une cause majeure d'invalidité au travail (CCHST, 2024). Les technologies d'assistance physique (exosquelettes, dispositifs d'assistance physique portables, etc.) sont prometteuses (Golabchi, Chao, & Tavakoli, 2022), mais leur efficacité, acceptabilité et adaptation à la diversité des travailleurs demeurent peu étudiées (de Looze, Krause, & O'Sullivan, 2017). Les approches croisées entre données biomécaniques, perçues et organisationnelles sont encore peu développées, d'où la nécessité d'une approche intégrée.

OBJECTIF DE RECHERCHE

Ce projet vise à évaluer les effets physiologiques, ergonomiques et perçus de ces dispositifs, en milieu réel, selon une approche d'analyse comparative entre les sexes Plus (ACS+). L'objectif est aussi d'identifier les facteurs facilitant leur adoption et de proposer des recommandations inclusives, adaptées aux réalités sectorielles.

MÉTHODOLOGIE

Une étude longitudinale mixte sera effectuée dans des milieux industriels. Les mesures seront l'électromyographie des muscles spinaux, la fréquence cardiaque, REBA, OWAS, et les questionnaires (VAS, WAI, NMQ). Les entrevues avec les utilisateurs seront également menées ainsi que la consultation des parties prenantes. Une analyse croisée des données objectives et subjectives sera réalisée, avec une stratification selon le sexe et l'âge.

RÉSULTATS

Le projet est en planification, donc il n'y a aucun résultat à ce stade. Cette présentation servira à partager le plan de recherche et recueillir des rétroactions.

DISCUSSION

Le projet vise à combler une lacune pratique en intégrant l'expérience utilisateur, des profils morphologiques et des facteurs organisationnels. Il soutiendra une implantation plus adaptée et équitable des technologies d'assistance, et contribuera à orienter les pratiques en santé et sécurité du travail et en conception ergonomique.

DÉCLARATION SOMMAIRE

- Un protocole interdisciplinaire est en cours d'élaboration sur les technologies d'assistance physique.
- L'approche se distingue par l'ACS+.
- Le plan de recherche sera partagé, accompagné d'un appel à collaboration.

RÉFÉRENCES

1. Centre canadien d'hygiène et de sécurité au travail (CCHST). (2024). Troubles musculo-squelettiques liés au travail (TMSLT). <https://www.cchst.ca/oshanswers/diseases/rmirsi.html>
2. Golabchi, A., Chao, A., & Tavakoli, M. (2022). A systematic review of industrial exoskeletons for injury prevention. *Sensors*, 22(7), 2714. <https://pubmed.ncbi.nlm.nih.gov/35408328/>
3. de Looze, M. P., Krause, F., & O'Sullivan, L. W. (2017). The potential and acceptance of exoskeletons in industry. *Wearable Robotics: Challenges and Trends* (pp. 195–199). Springer International Publishing. https://link.springer.com/chapter/10.1007/978-3-319-46532-6_32

The accuracy and integration of an artificial intelligence (AI) ergonomic REBA assessment tool into a manufacturing process.

Jessica Chanyi¹, Kirsten Fradgley¹

¹Toyota Boshoku

PROBLEM STATEMENT

AI ergonomic assessment tools (AI-EAT) promise accurate and fast data analysis to identify injury risk. Some AI-EAT use checklist methods that have weak relationships to Musculoskeletal Disorders (MSDs) (Yarandi, M. S, et al, 2019). The integration of the REBA checklist tool within AI-EAT may lead to weak injury risk classification, as shown when compared to discomfort report (DR) data.

RESEARCH OBJECTIVE

This research aims to evaluate the accuracy of an AI-EAT in determining high-risk jobs using the REBA checklist tool. We aim to create a general MSD risk classifier to identify high and low risk tasks that were built using multiple logistic regressions.

METHODOLOGY

A total of 387 cyclic manufacturing jobs were analyzed and categorized as low (0) or high (1) risk based on DR. AI-EAT REBA data was gathered and applied to create a risk classifier. Additional metrics such as average normalized force and duty cycle were added to the risk classifier. Overall accuracy, sensitivity, specificity, and the area under the ROC curve (AUC) evaluated the model's accuracy.

RESULTS

Results of the study are presented in Table 1. Force and duty cycle was an effective risk classifier, while REBA was marginally better than random.

DISCUSSION

The REBA score alone was an ineffective predictor of injury risk, with an AUC value near 0.5. Force and DC were significant predictors, improving the model's performance. Incorporating REBA score did not improve model accuracy, as REBA has a lower predictive power for MSDs (Yarandi et al. 2019). Future work will focus on refining the model by integrating REBA Sub scores and joint angles derived from AI-EAT data.

SUMMARY STATEMENT

Conference attendees will benefit from understanding the limitations of using REBA to predict risk of injury and how integrating multiple ergonomic risk factors can improve injury prediction.

CITATION

Yarandi, M. S., Soltanzadeh, A., Koohpaei, A., Ahmadi, V., Sajedian, A. A., Sakari, A., & Yasdanirad, S. (2019). Effectiveness of three ergonomic risk assessment tools, namely NERPA, RULA, and REBA, for screening Musculoskeletal Disorders. *Archives of Hygiene Sciences*, 8(3), 18-201.

Evaluating the Work(s) Software for Ergonomic Consulting; A Comparative Analysis with Traditional Assessment Tools

Nickolas Costa¹

¹Fanshawe College

This project examines the appropriateness and effectiveness of the Work(s) software for professional ergonomic consulting through a comparative analysis. Working alongside a Canadian Certified Professional Ergonomist (CCPE) and an Associate Ergonomist (AE), four assessments were conducted for each target group of lumbar compression, shoulder demands, and wrist demands with two cumulative fatigue evaluations. Each assessment incorporated an equal mix of on-site collected data and hypothetical task scenarios. Work(s) results were compared to those generated by established tools, including the 3D Static Strength Prediction Program (3D SSPP), Arm Force Field (AFF), American National Standards Institute (ANSI) guidelines, and the Lifting Fatigue Failure Tool (LiFFT). Preliminary findings show that Work(s) aligns closely with traditional methods for lumbar compression, shoulder demands, and time to completion, but produces notably lower lumbar compression scores in cumulative fatigue analysis compared to LiFFT. These insights provide evidence on the potential for Work(s) to serve as a reliable and efficient alternative, or complement conventional ergonomic assessment methods in consulting practice.

“Move It! - The impact of microbreaks on worker comfort, productivity and quality in industrial settings

[Alex DaRosa¹](#), [Carrie Taylor¹](#), [Aaron Gebhardt¹](#)

¹Taylor'd Ergonomics Incorporated

INTRODUCTION TO CASE STUDY

A review of literature provided evidence that workplace activity programs that included strengthening have a larger impact on worker physical well-being than just stretching (IWH, 2016), and that longevity has been associated with mobility, cardio, flexibility and balance (Luks, 2022). We developed a microbreak movement program that incorporates these and other aspects of well-being. This case study aims to understand the impact of this type of program, specifically in an industrial setting.

PURPOSE OF CASE STUDY

To gather data to evaluate the effectiveness of a microbreak program in industrial settings.

CONTEXT OF CASE STUDY

The program was piloted with two industrial clients. Clients picked activities that would work best for the target audience. Baseline and follow-up confidential survey results were collected using a QR code or on paper. The survey captured the program's impact on comfort, productivity, work quality and employee engagement. The hope was to see improvement in comfort, quality and engagement score following a 4-week trial.

OUTCOMES OF CASE STUDY

Client #1 provided 23 baseline surveys and 19 follow-up surveys. We are awaiting the survey results from Client #2. For Client #1, a comparison of baseline and follow-up surveys showed:

- Employees took more microbreaks after the pilot study than they did before.
- Employees believed that their productivity, quality and engagement could improve by about 10% if they were not working with discomfort.
- Average scores for all three metrics improved over the pilot study.
- Comfort score improved for all body parts.

DISCUSSION OF CASE STUDY

Limitations of the study include a limited sample size (only piloted at two clients so far, only have survey results from 1), having no control over whether people actually perform the activities, the client choosing which activities to promote over others, and not having a control group.

SUMMARY STATEMENT

This case study highlights the benefit of implementing a microbreak program by quantifying the impact they can have on comfort, productivity, employee engagement, and quality in an industrial setting.

CITATIONS

Institute for Work and Health. (2016, October) *What workplace programs help prevent upper extremity musculoskeletal disorders?*.

Luks, H. J. (2022). *Longevity...simplified: Living a longer, healthier life shouldn't be complicated*. KWE Publishing.

Insights into sitting-related low back pain: A week-long investigation of spine kinematics and changes in spine stiffness with office work

Jessa Davidson¹, Jack Callaghan¹

¹University of Waterloo

PROBLEM STATEMENT AND RESEARCH OBJECTIVE

Low back pain reporting in sitting may be linked to the adoption of prolonged lumbar spine flexion and decreases in spine movement, ultimately resulting in viscoelastic changes in spine tissues. The objectives were to 1) assess differences in activities and seated spine kinematics, and 2) evaluate viscoelastic changes in the lumbar spine between those with and without transient low back pain throughout one week of their usual seated office work completed at their own workstations.

METHODOLOGY

Twenty participants (10M, 10F) completed this study. A thigh-worn activity monitor was used to classify sitting time. Two tri-axial accelerometers on the low back were used to measure seated pelvis and thorax inclination and lumbar spine flexion-extension angles. Each morning and evening, participants provided low back pain ratings from a 100-mm visual analogue-scale and performed maximum voluntary flexion. Participants also attended five laboratory sessions (Monday morning and evening, Tuesday morning, Friday evening, and Monday morning), where lumbar spine stiffness in passive flexion was measured in a custom jig. Statistical tests compared by *pain status* (non-pain (NPD; <10 mm) and pain (PD) developers) and/or over *time*.

RESULTS

PD (n=6) had increases in pain daily, with partial or complete recovery overnight and full recovery on the weekend. Compared to NPD, PD sat more, exhibited decreased thorax recline, and tended to demonstrate less frequent spine movements. Spine flexion range of motion significantly increased by 2.0° from morning to evening. Small increases in spine stiffness occurred on Monday evening and Tuesday morning but then recovered by the subsequent Monday morning. Changes in range of motion and stiffness were not different by *pain status*.

DISCUSSION

To decrease the risk of pain with sitting, recommendations to reduce seated time, recline on the seatback, and promote seated movements should be prioritized. Daily increases in range of motion and stiffness at the start of the week were likely indicative of daily viscoelastic changes in spine tissue, but these changes did not accumulate throughout the week. With habitual exposures, the small differences between pain groups and over time could suggest a pathway for sitting-related back pain.

SUMMARY STATEMENT

Lumbar spine stiffness, kinematics, and pain ratings were collected throughout a week of individuals performing their seated work. Daily increases in spine flexion range of motion and increases in stiffness at the start of the week could suggest a pathway to sitting-related back pain. Recommendations to move regularly, through reductions in sitting time and promoting seated movements, as well as encouraging individuals to recline on the seatback, may reduce the risk of low back pain with prolonged seated work.

Applications of Posture Tracking AI Throughout the Ergonomics Assessment Process

Beatrice Donahue-Power^{1, 2}

¹Fanshawe College, ²Conduct Industries Limited, Allison Stephens - Professor, Fanshawe College, Karen Hoodless - Professor, Fanshawe College

PROBLEM STATEMENT

Artificial Intelligence (AI) ergonomics software like Inseer Vision presents accessible solutions for reducing musculoskeletal injuries. These solutions are especially attractive to businesses who cannot afford to hire ergonomists but want to be proactive in improving ergonomics for injury prevention and productivity. However, the effectiveness of applying these tools has not been tested against a traditional on-site ergonomist's assessment process.

RESEARCH OBJECTIVE

This 4-month pilot study seeks to identify areas within the ergonomics assessment process where AI products like Inseer Vision can be used. In addition, we will provide recommendations for improvements to these products for developers.

METHODOLOGY

Jobs at Conduct Industries production facility in London Ontario were manually screened by a student ergonomist for ergonomics risk factors using injury statistics, worker interviews and risk factor observations. Twelve jobs that were categorized as high priority by the ergonomist were then analyzed using tools selected by the ergonomist and tools within Inseer Vision. Based on the findings of the assessments, the recommendations posed by the student ergonomist will be compared to the recommendations posed by Inseer Vision.

RESULTS

The job prioritization, task analysis and recommendations completed by Inseer will be compared to the findings of an ergonomist. In addition, the ergonomics assessment process will be compared on ease of use and time to complete tasks with the AI tools.

DISCUSSION

By determining areas where AI can/cannot accurately collect data and assess jobs, this will allow us to provide suggestions as to how ergonomists can leverage AI tools. We will also provide guidance to the developer on how to make the tools more effective.

SUMMARY STATEMENT

This study will empower ergonomists to take advantage of AI technology currently available, advise their clients on the application of AI within an ergonomics program, and identify opportunities for future development and improvement.

CITATIONS

AI-powered ergonomics assessment software. Inseer. (n.d.). <https://www.inseer.com/>

Comment maximiser les retombées de nos interventions en ergonomie ?

Valérie Albert¹, Simon Fournier¹

¹Direction de Santé Publique, CISSS des Laurentides

INTRODUCTION : Au Québec, la loi modernisant le régime de santé et de sécurité du travail indique que tous les milieux de travail devront élaborer eux-mêmes leur propre plan d'action ou programme de prévention, qui inclut les risques de troubles musculosquelettiques (TMS). Comme acteurs de la santé publique, notre objectif est d'outiller les milieux de travail pour qu'ils puissent identifier eux-mêmes des moyens de prévention des TMS adaptés à leur secteur d'activité. Or, les outils disponibles sur les pistes de solution sont généraux, ne tiennent pas compte des spécificités d'un secteur d'activité ou ne sont pas disponibles en français.

BUT DE L'ÉTUDE : Présenter la méthodologie et la démarche d'élaboration de deux guides-conseil en ergonomie en vue d'outiller tous les milieux de travail de deux secteurs visés.

CONTEXTE : Une analyse de données des lésions de type TMS a d'abord été réalisée pour retenir deux secteurs d'activité parmi les plus touchés par les TMS dans la région des Laurentides (agroalimentaire et commerce de détail). Les milieux de travail avec au moins une lésion de type TMS ont été contactés pour participer au projet, réalisé en deux phases. Phase 1 : Les milieux de travail qui ont accepté ont tous reçu une intervention ergonomique réalisée par deux ergonomes de la direction de santé publique, incluant une analyse approfondie des postes problématiques et un rapport d'intervention avec pistes de solution spécifiques au milieu. Phase 2 : Pour chaque secteur, une mise en commun des pistes de solution pour chaque milieu a été effectuée pour produire un guide-conseil, un pour le secteur agroalimentaire, et un pour le secteur des commerces de détail. Les guides-conseil ont ensuite été envoyés par courriel à tous les milieux de travail de chaque secteur, sur le territoire des Laurentides.

RÉSULTATS : Pour le secteur des commerces de détail, 9 situations de travail ont été évaluées dans 5 milieux de travail différents. Pour le secteur agroalimentaire, 24 situations de travail ont été analysées dans 11 milieux de travail différents. Un aperçu de chaque guide-conseil sera fourni dans la présentation. Suivant la phase 2, plus de 200 milieux ont été rejoints.

DISCUSSION : Les guides-conseil contiennent des pistes de solution spécifiques à un secteur qui sont plus facilement utilisables par les milieux de travail. Par contre, ils ne sont pas exhaustifs : d'autres pistes de solution pourraient être identifiées pour un milieu donné. Or, l'objectif était surtout de fournir un point de départ et des idées pour les personnes responsables de la SST dans les milieux de travail afin d'amorcer la démarche de prévention. Un autre guide-conseil est en cours d'élaboration dans le secteur de l'hôtellerie.

DÉCLARATION SOMMAIRE : Produire un guide-conseil et le diffuser à tout un secteur d'activité à partir d'un petit nombre d'interventions en ergonomie permet de maximiser les retombées d'une intervention ergonomique et de générer des nouvelles demandes. Comme ergonomes, cela augmente aussi le glossaire de solutions possibles en mettant en commun nos expériences. Ultimement, en mettant en commun les expertises d'un plus grand nombre d'ergonomes, plusieurs autres secteurs pourraient être couverts.

CITATION : Direction de santé publique du Centre Intégré de santé et de services sociaux des Laurentides (2025). Santé Laurentides, Santé au travail.

Evaluating Usability of Human Machine Interface for a Transit Control System

Lamia Anjum¹, Claire Goldring¹, Tiffany Pitamber¹

¹Atkinsrealis

INTRODUCTION TO CASE STUDY

The Signaling and Train Control System (S&TCS) Human Machine Interface (HMI) systems allowed operators to monitor and control timetabled operations, as well as detect disruptions. They often performed time sensitive functions, and thus it was imperative to have intuitive and consistent systems with human error prevention-built in.

PURPOSE OF CASE STUDY

The study highlighted the effectiveness of a Human Factors (HF) checklist evaluation, complemented by a Subject Matter Expert (SME) review, that was performed in an iterative manner for the continuous improvement of S&TCS, drawing upon parts of Federal Aviation Administration published Human Factors Design Standard (HFDS): HF-STD-001B (Ahlstrom & Longo, 2003).

CONTEXT OF CASE STUDY

The methodology consisted of completing a checklist evaluation with standards drawn from the HFDS against HMI system document and the prototype itself. Complementing the checklist, a SME review of the User Interface was conducted to validate compliance from an operational perspective. This methodology allowed for a systematic approach where transit control system HMI can be continuously assessed as they are being modified or updated for usability, performance, consistency and safety critical human error prevention.

OUTCOMES OF CASE STUDY

HF specialists were able to utilize this checklist evaluation and outcomes of the SME review efficiently to identify areas of usability improvement within the HMI system as well as ensure all elements (i.e., alarms and navigation) are up to regulatory and safety standards.

DISCUSSION OF CASE STUDY

The findings from this assessment have informed design decisions that could be rapidly implemented in a design cycle. During a fast iterative project, a checklist along with a paper-based and user review could provide sufficient information similar to traditional HF studies that would be conducted. The SME review served as an important validation step, particularly for identifying issues not readily apparent through standard-based analysis alone.

SUMMARY STATEMENT

The Signaling and Train Control Systems are the most crucial components of a transit system as all train movements are controlled from here. This paper demonstrates an iterative approach to HMI assessments of S&TCS in rapid design cycles drawn upon from the standard, *Human Factors Design Standard*, HF-STD-001B (Ahlstrom & Longo, 2003).

CITATION

[1] Ahlstrom, V., & Longo, K. (2003). *Human factors design standard (HF-STD-001)*. Federal Aviation Administration William J. Hughes Technical Center.

ENJEUX DE SANTÉ ET DE SÉCURITÉ LIÉS À LA MANUTENTION ET À LA CIRCULATION DANS LES SALLES À BAGAGES D'UN AÉROPORT INTERNATIONAL

Etienne Goubault¹, Maud Gonella¹, Caroline Jolly¹, Damien Burlet-Vienney¹

¹IRSST

INTRODUCTION À L'ÉTUDE DE CAS

En considérant les grands projets de transformations à venir pour répondre à une augmentation du flux de passagers y transitant au cours des prochaines années, un aéroport international (AI) a souhaité réaliser un diagnostic pour explorer les pistes d'amélioration en santé et sécurité (SST) en ciblant d'abord les salles à bagages.

BUT DE L'ÉTUDE DE CAS

Explorer et identifier les besoins SST pour la manutention de bagages et la circulation des véhicules dans les salles à bagages.

CONTEXTE DE L'ÉTUDE DE CAS

Pour répondre à la demande de l'AI, trois jours d'observations ouvertes auprès des manutentionnaires et des conducteurs de véhicules (n=5 travailleurs) dans divers lieux et environnements stratégiques de l'aéroport (ex. salles à bagages, extérieur, salles de convoyeurs d'arrivées) ont été menés. Des entrevues semi-dirigées (n=8 entrevues) ont permis de compléter l'exploration des besoins SST associés à la manutention et la circulation. Des analyses de contenu des verbatim des entrevues ont été effectuées via le logiciel NVivo et des synthèses combinant résultats des entrevues et des observations ont été produites.

RÉSULTATS DE L'ÉTUDE DE CAS

D'après les analyses, les blessures les plus fréquemment rapportées sont liées à la manutention et aux activités de déblocage des convoyeurs à bagages. Différents incidents impliquant des véhicules sont également rapportés (ex. non-respect des arrêts ou de la vitesse, accrochages). Différents facteurs aggravants ont été observés (ex. efforts physiques, forte coactivité de véhicules divers) et plusieurs zones à risque ont été identifiées pour la manutention et la circulation des véhicules. Les travailleurs ont proposé des pistes de solution.

DISCUSSION DE L'ÉTUDE DE CAS

Outre certains risques spécifiquement liés à la manutention (ex. charge des bagages) et la circulation (ex. arrêts non respectés), les deux thématiques semblent être interreliées, d'où la nécessité d'analyser les risques de manutention et circulation en interaction au sein d'un AI.

DÉCLARATION SOMMAIRE

- Les blessures les plus fréquemment rapportées sont liées à la manutention de bagages.
- Les dangers de circulation sont accrus au moment du départ des véhicules où la séparation des flux véhicules/piétons n'est pas toujours optimale dans une infrastructure existante.
- Les risques de manutention et en circulation devraient être analysés en interaction au sein de structures aéroportuaires pour prévenir les risques en SST.

Début de la saison de travail : une période critique pour la santé des travailleuses et des travailleurs saisonniers

Audrey Goupil^{1,2}, Marie-Ève Major³

¹Université de Sherbrooke, ²CISSS Montérégie-Centre, ³Université Laval

ÉNONCÉ DU PROBLÈME

Les troubles musculosquelettiques (TMS) seraient particulièrement présents auprès des travailleurs saisonniers comparativement aux travailleurs permanents. L'intervalle temporel, combinant début d'une nouvelle saison et retour au travail après une période hors saison, semble représenter un enjeu critique pour la santé musculosquelettique des travailleurs saisonniers.

OBJECTIF DE RECHERCHE

L'objectif consistait à décrire les conditions de réalisation du travail et les difficultés liées au travail vécues par des travailleuses et des travailleurs saisonniers et en particulier lors du début de leur saison dans une perspective de prévention des TMS.

MÉTHODOLOGIE

L'approche méthodologique reposait sur une analyse ergonomique de l'activité de travail. Une étude de cas multiples a été réalisée auprès de huit travailleurs saisonniers (quatre femmes et quatre hommes) provenant d'une même usine du secteur de la transformation bioalimentaire. L'échantillon était composé de nouveaux travailleurs saisonniers et de travailleurs saisonniers récurrents, âgés entre 15 et 28 ans et employés pour la période estivale. Les données ont été recueillies par divers types d'entrevues et des observations de l'activité de travail. Une analyse qualitative de contenu des verbatims et selon l'approche centrée sur l'activité de travail a été réalisée.

RÉSULTATS

Dès le début de la saison, les travailleurs saisonniers sont confrontés à des cadences de travail rapides induites par la vitesse des convoyeurs. La réalisation des tâches implique des cycles de travail courts, où les opérations s'enchaînent sur une durée d'environ 2 à 10 secondes. Les travailleurs saisonniers rapportent avoir de la difficulté à suivre ces cadences de travail rapides. Les travailleurs saisonniers sont soumis à une activité de travail particulièrement marquée par des conditions de travail difficiles où s'entremêlent de fortes contraintes organisationnelles, temporelles et physiques. À ces contraintes physiques, s'ajoute une activité cognitive non négligeable. Les travailleurs doivent se refamiliariser rapidement avec le travail et ses exigences, remettre en pratique des savoir-faire et se réapproprier des stratégies dès leur retour au travail après une période hors saison de huit mois. Cet apprentissage ou réapprentissage moteur de gestes professionnels a été rapporté comme occasionnant une charge mentale élevée.

DISCUSSION

Les résultats de cette étude font ressortir, pour les travailleurs saisonniers récurrents, un début de saison où le travail s'effectue dans les mêmes conditions qu'au moment où ils avaient quitté huit mois plus tôt. Du côté des nouveaux travailleurs saisonniers, les conditions de travail offrent peu de possibilités de soutien favorisant leur intégration et apprentissage.

DÉCLARATION SOMMAIRE

Cette recherche permet de mettre en lumière une sollicitation attentionnelle et mémorielle importante qui est souvent sous-estimée en contexte de travail saisonnier.

Cette recherche ouvre la voie vers des perspectives de prévention des TMS en contexte saisonnier.

CITATION

Goupil, A., et Major, M.-E. (2024). International Journal of Environmental Research and Public Health, 21(8), 997.

Major, M.-E., Wild, P. et Clabault, H. (2020). Travail saisonnier et santé au travail : Bilan des connaissances et développement d'une méthode d'analyse pour le suivi longitudinal des troubles musculosquelettiques (Rapport n°R-1102). IRSST

Ergonomically Sound Workstations Matter More Than Ever: The Well-being, DEI & ESG of it All

Lucy Hart¹

¹ergoCentric

DESCRIPTION

Amidst ongoing workplace transformation, it is critically important to recognize that basic human needs have not changed and factor this into the reimagined workplace. Well-being, DEI, and ESG are integrally related and heralded by workplace strategy leaders as vital to human and business sustainability, and organizational success. Join us as we explore why ergonomically sound workstations are foundational to well-being, exemplify DEI in action, and contribute to the social pillar of ESG.

OBJECTIVES

- Recognize what *has* and *has not* changed in today's workplace
- Describe well-being and the intersection with ergonomics
- Define an ergonomically sound workstation (ESW)
- Understand the relationships between ESW, well-being, DEI and ESG

CITATION

Canadian Standards Association (2024), Office ergonomics – an application standard for workplace ergonomics. [CSA Z412:24 | Product | CSA Group](#)

Gensler Research Institute. (2024). Global workplace survey 2025. [Global Workplace Survey 2025](#)

International WELL Building Institute. (2023). IWBI's 2023 workforce well-being poll. [Investing in Health Pays Back | IWBI](#)

Ergonomics Analysis of Mine Sample Handling

Heather Kahle, M.Sc., CRSP & Dr. Nicholas La Delfa, PhD

Background

A Walk-Through-Talk-Through (WTTT) and ergonomics analysis was conducted at Mount Milligan Mine to evaluate **eight sample handling tasks** across the field and lab. The study used **biomechanical and psychophysical methods** to assess demands, identify high-risk steps, and quantify musculoskeletal injury risk.

Key Findings

- Both **field and lab tasks** involve high demands: heavy carries, awkward postures, repetition, thermal and technical challenges.
- **Carrying pails** (22–35 kg) exceeded safe thresholds for most workers, especially with proposed 8 kg samples.
- **Quad sampling**, oven loading, crushing, and pouring tasks exceeded acceptable force/posture limits for a large portion of workers.
- Several tasks showed capability below 25th percentile female thresholds, highlighting elevated injury risk.

Implications

- Risks increase significantly with **8 kg samples**, reducing the proportion of workers able to safely complete tasks.
- Task variability (terrain, tools, techniques, workflow) creates inconsistent demands.
- Engineering solutions, and workflow redesign are required to reduce exposure.

Path Forward

- **Immediate ergonomic interventions:** reduce sample weights, modify tools and equipment (hopper, oven, pulverizer), improve layout.
- **Learning Team approach** recommended: bring together lab staff, ore technicians, supervisors, H&S, and engineering to co-design practical solutions.
- Collaborative problem-solving ensures solutions are **sustainable, practical, and embraced by workers**. Doing ergonomics with and among the workers not to workers.

Value: Walk-Through–Talk-Throughs (WTTTs) are structured observations where workers demonstrate and explain how tasks are actually performed, step by step. This approach reveals the **Work-As-Done (WAD)** and highlights the real context, conditions, and adaptations workers use to get the job done. When paired with quantitative analysis, WTTTs provide critical insights into why risks exist and how they can be effectively controlled. The value is clear: WTTTs and Learning Teams are powerful tools to understand real work, engage stakeholders, and co-create risk controls that improve task design, efficiency, and operational performance.

Posture Classification Using Computer Vision: A Multi-Label Ergonomic Evaluation of Office Worker Upper Body Posture

Adele Behzad¹, Eunsik Kim¹, Aliyu Saifullah Vandana¹

¹Windsor University

PROBLEM STATEMENT

Prolonged poor posture in sedentary office environments is a known contributor to musculoskeletal disorders (MSDs). Vision-based ergonomic monitoring tools are critical in addressing posture-related risks before chronic conditions develop. This study investigates the efficacy of using a computer vision deep learning model for multi-label classification of upper-body posture features in office workers.

RESEARCH OBJECTIVE

To develop and evaluate a pre-trained deep convolutional neural network capable of automatically detecting healthy versus poor posture across six upper body joints: thorax, left/right shoulders, left/right elbows, and neck.

METHODOLOGY

The dataset consisted of 1070 training and 230 test images labeled by ergonomic experts, derived from seated and standing video recordings of office workers. A pre-trained deep learning model was fine-tuned using binary cross-entropy loss with sigmoid activation for each joint. Data augmentation and early stopping were applied. Performance evaluation included joint-specific F1-scores, precision, recall, and confusion matrices with threshold tuning.

RESULTS

The model achieved its highest classification performance at the right elbow (F1 = 0.814), followed by the left elbow (F1 = 0.693). Performance was lower for joints such as the neck (F1 = 0.357) and left shoulder (F1 = 0.321), suggesting difficulty in detecting subtle misalignments.

DISCUSSION

The deep learning model demonstrated moderate effectiveness in detecting upper-body postural deviations, especially in joints with pronounced angular deviations (e.g., elbows). However, limitations related to class imbalance and visual similarity across postures affected the accuracy of finer joint classifications. Enhancements such as improved thresholding, data balancing, and posture-specific fine-tuning are recommended.

SUMMARY STATEMENT

The model effectively detects gross postural deviations but struggles with subtle misalignments in the neck and shoulders. Multi-label classification with threshold tuning enables targeted feedback for joint-specific posture correction. This research underscores the potential of computer vision-based tools in ergonomic assessment and intervention for office environments.

CITATION

Kee, D., & Karwowski, W. (2001). LUBA: An assessment technique for postural loading on the upper body based on joint motion discomfort and maximum holding time. *Applied Ergonomics*, 32(4), 357–366. [https://doi.org/10.1016/s0003-6870\(01\)00006-0](https://doi.org/10.1016/s0003-6870(01)00006-0)

Midrange lumbar spine posture assessment in commercially available hybrid seating devices.

Kate Krivenko¹ Jessa M. Davidson, Jack P. Callaghan

Department of Kinesiology and Health Sciences, University of Waterloo, Waterloo, ON

PROBLEM STATEMENT

Office workers spend much of their workday in sedentary postures, which have been linked to low back pain^[1]. Therefore, evidence-driven recommendations on best workstation set-ups remain necessary. A sit-stand rotation^[2] has previously been proposed but may not always be feasible. Combining the benefits of both into mid-range lumbar postures might decrease injury.

RESEARCH OBJECTIVE

This study set to evaluate four different commercially available sit-stand seating devices at different trunk-thigh angles to assess whether midrange postures (i.e., postures between both sitting and standing) are achieved.

METHODOLOGY

Twenty participants (10F/10M) completed a series of 1-minute typing tasks in four different hybrid seating devices at three different trunk-thigh angles (135°, 145°, 160°), and in traditional sitting and standing. Participants reported comfort measures in each posture. Lumbar spine motion was measured with tri-axial accelerometers, and trunk-thigh angles were obtained from passive reflective markers tracked by infrared cameras. Mean lumbar spine flexion angle relative to maximum flexion, and pelvic tilt relative to quiet standing were calculated.

RESULTS

A trunk-thigh angle of 160° placed participants in a midrange lumbar position ($p < 0.05$) (Table 1). Furthermore, when considering different seatpan designs, saddles and a leaning chair effectively situated the lumbar spine in a less flexed sitting posture, but a perch design did not. Moreover, 90% of participants reported that they would not be able to maintain the 160° trunk-thigh angle for a 2-hour duration in a saddle seat, compared to 30% for a leaning seat.

Table 1: Mean $\pm$ standard deviation of the lumbar flexion-extension (%MaxFlex) and pelvis anterior-posterior tilt (°) angles for each trunk-thigh posture. (*) denotes significant differences from both sitting and standing postures ($p < 0.05$).

	Sitting	135°	145°	160°	Standing
Lumbar Angle (%)	53.6(16.2)	49.6(24.6)	47.8(23.4)	35.8(25.5)*	-0.3(10.4)
Pelvis Angle (°, - posterior)	-28.4(10.7)	-19.4(9.8)*	-20.0(9.5)*	-16.4(11.3)*	-0.8(5.4)

DISCUSSION

The current results suggest that achieving a trunk-thigh angle of 160° is needed to maintain midrange lumbar spine postures, though most seating devices did not provide sufficient height range to accommodate this posture. If the goal is to place the spine in a midrange posture, a leaning chair design offers the best solution for short-term achievement of such postures.

SUMMARY STATEMENT

The study aimed to analyze lumbar spine postures in four commercially available hybrid seating devices at three different trunk-thigh angles (135°, 145°, 160°) and a self-selected condition. The findings suggest that positioning at 160° trunk-thigh angle in a leaning chair design places the spine in a midrange lumbar spine posture.

CITATIONS

- [1] Collins, J. D., & O'Sullivan, L. W. (2015). *International Journal of Industrial Ergonomics*, 46, 85-97.
[2] Gallagher, K. M., Campbell, T., & Callaghan, J. P. (2014). *Ergonomics*, 57(4), 555-562.

Towards Smart Ergonomics: Real-Time Detection of High-Risk Postures Using Computer Vision

Chady Brahim Lahbib¹, Rafael Santos Perez¹, Nancy L. Black¹

¹Université de Moncton - Faculté d'ingénierie

PROBLEM STATEMENT / INTRODUCTION

Work-related musculoskeletal disorders (WMDs) remain a major issue in occupational health, often resulting from prolonged or awkward postures. Conventional ergonomic evaluation tools such as observational checklists or wearable sensors are either subjective, time-consuming, or intrusive. There is a need for real-time, automatic, and non-invasive methods to detect postural risks in dynamic work environments. While paid software exists, this program is created free.

RESEARCH OBJECTIVE / QUESTION

The objective of this research is to develop a posture recognition system using computer vision that can identify and classify worker postures in real time, and to trigger alerts when high-risk postures are sustained. This approach aims to facilitate proactive risk mitigation.

METHODOLOGY

A Python-based system was built using MediaPipe Pose (Lugaresi et al. 2019) to extract human body landmarks from webcam footage. OpenCV handled image acquisition and real-time rendering, while NumPy enabled calculation of joint angles using geometric vector operations. Angles such as shoulder-hip-knee and shoulder-elbow-wrist can be used to assess posture risk levels (neutral, acceptable, high-risk) based on ergonomic thresholds. A visual alert is triggered when poor posture persists beyond a user-defined duration.

RESULTS

Preliminary testing demonstrated reliable joint detection, stable angle calculation, and coherent orientation classification (front, back, profile). The system accurately recognized risky postures in various lighting and distance conditions. Its simplicity and portability make it well-suited for broad ergonomic monitoring applications.

DISCUSSION / CONCLUSION

In comparison with sensor-based or survey-based ergonomic tools (Walkling et al. 2025), the proposed system provides a low-cost, non-intrusive alternative that offers continuous posture monitoring and real-time alerts. It contributes to the development of intelligent workstations and adaptive environments, supporting early intervention for WMDs prevention. Future enhancements may include angle history tracking, time-series analysis, and integration with ergonomic dashboards.

SUMMATIVE STATEMENT

This project presents a fully software-based, real-time ergonomic monitoring system that detects high-risk working postures using only a webcam and computer vision tools. Unlike wearable or manual methods, this solution is contactless, affordable, and easy to deploy in various office, industrial, or remote settings.

REFERENCES

- Lugaresi, C, et al. 2019. MediaPipe: A Framework for Building Perception Pipelines.
- Walkling, J. et al. 2025. Wearable Spine Tracker vs. Video-Based Pose Estimation for Human Activity Recognition.

Looking to Incorporate Computer Vision Into Ergonomics Programs: Research-Based Guidance to Encourage Better Outcomes

[Dennis Larson¹](#), [Julia Li¹](#), [Justin Davidson¹](#), [Steven Fischer¹](#)

¹Department of Kinesiology and Health Sciences, University of Waterloo

PROBLEM STATEMENT

Advancements in single-camera computer vision-based technologies are quickly changing how we can conduct musculoskeletal disorder (MSD) risk assessments in the workplace. However, there is limited understanding of how to best capture high-quality motion data and optimize the use of single-camera computer vision-based technology for MSD prevention efforts in the field.

RESEARCH OBJECTIVE

This work aimed to determine how video recording angle, computer vision platform, and movement pace influenced the accuracy of single-camera pose estimated trunk inclination and shoulder elevation angles relative to a validated lab-grade motion capture approach.

METHODOLOGY

Forty participants completed six simulated work tasks at two different work paces. Video data from eight synchronized video cameras oriented in $\sim 45^\circ$ increments surrounding the participant were processed through Theia3D software to yield criterion trunk inclination and shoulder elevation angles. Each individual video was also processed through 4-5 different single camera computer vision-based pose estimation platforms to capture trunk inclination and shoulder elevation angles for comparison. Mean absolute differences (MADs) in time series trunk inclination and shoulder elevation angles were compared between each computer vision platform and the criterion Theia3D data.

RESULTS

Camera views perpendicular to the major plane of motion and on the same side as the joint of interest typically resulted in lower MADs; however, the specific “optimal” camera view(s) varied between computer vision platforms. Movement pace had limited influence on MADs.

DISCUSSION

While single-camera computer vision-based pose estimation continues to show promise, implementation is not as simple as “point and shoot”. Data quality is highly dependent on the interaction between capture angle and computer vision platform. Since each single-camera computer vision-based pose estimation platform is developed on specific training data, it is critical for practitioners to understand which direction(s) of capture were used to train the underlying pose estimation model in order to best implement these technologies in the field.

SUMMARY STATEMENT

Current evidence supports positioning the camera perpendicular to the major plane of motion and on the same side as the joint of interest; however, this may differ between computer vision platforms. Understanding how a computer vision-based model has been trained will improve your ability to capture insightful human motion data in the field using a single camera.

FINDING & PROVING ERGONOMIC WORK STRATEGIES FOR MAINTENANCE ACCESS COVER REMOVAL

Caleb Leary¹

¹Taylor'd Ergonomics

INTRODUCTION TO CASE STUDY

Maintenance access cover removal is a vital but physically demanding task for municipal public works staff. Routine access to underground infrastructure requires lifting, dragging and repositioning heavy covers, often using a tool such as a pickaxe or hook. This task involves forceful exertion, often while bending or twisting, raising the risk of musculoskeletal injury.

PURPOSE OF CASE STUDY

This case study explores the identification and validation of ergonomic work strategies for optimizing maintenance access cover removal techniques used by public works employees.

CONTEXT OF CASE STUDY

Two ergonomists from Taylor'd Ergonomics collaborated with public works employees at an Ontario municipality to identify and evaluate strategies for easier manhole cover removal. They collected field data, documented techniques with descriptions and photos, and conducted biomechanical analyses using Work(s)TM software to assess and compare each strategy against commonly used work practices. Findings for each strategy were summarized in a two-page document, which was shared with stakeholders for review and feedback.

OUTCOMES OF CASE STUDY

The employees identified ten (10) different strategies for removing manhole covers. Through biomechanical analyses, six (6) of these strategies were shown to offer clear advantages over common work practices. These six effective strategies were documented, shared with the health and safety team, and are planned for integration into a training program.

DISCUSSION OF CASE STUDY

Further evaluation will be needed to determine whether promotion of the strategies has an impact on the frequency of recordable injuries.

SUMMARY STATEMENT

This case study explores how ergonomists worked with public works employees to identify and validate safer strategies for maintenance access cover removal.

CITATION

Work(s) (2023) Work(s) Software - Work(s)TM Ergo (worksergo.com)

STAYING HIDDEN, STAYING HEALTHY: AN ERGONOMIC ANALYSIS OF PHYSICAL SURVEILLANCE PRACTICES IN LAW ENFORCEMENT

Raphaël Lechasseur¹, Jerome Range¹, Martin Lavallière¹

¹Université du Québec à Chicoutimi

INTRODUCTION TO CASE STUDY

Physical surveillance is a critical and demanding task within policing. Officers engaged in surveillance must maintain prolonged periods of vigilance, awkward postures in constrained environments, and concealment strategies. Despite its operational importance for police organizations, there is limited ergonomic research on such assignments. This case study aims to investigate the ergonomic challenges faced by officers conducting physical surveillance and their impact on health and operational performance.

PURPOSE OF CASE STUDY

The purpose of this case study is to analyze ergonomic risks associated with physical surveillance. It aims to recommend design and adaptations that promote occupational health and task efficiency without compromising discretion and mission success.

CONTEXT OF CASE STUDY

Observational fieldwork was conducted with law enforcement teams specialized in physical surveillance. Data collection included posture analysis while simulating covert operations, audits of surveillance setups, and semi-structured interviews.

OUTCOMES OF CASE STUDY

Findings reveal a high prevalence of prolonged static postures, particularly in covert vehicle surveillance, where officers reported discomfort in the lumbar spine, neck, and shoulders. Suboptimal seating ergonomics and limited visibility adjustments in unmarked vehicles contributed to biomechanical strain. Cognitive demands such as maintaining vigilance without overt movement added stress to the task.

DISCUSSION OF CASE STUDY

This study highlights the need for ergonomic interventions in surveillance operations, including the redesign of surveillance vehicles, the provision of portable ergonomic aids (e.g., various seat cushions), and rotation strategies to reduce static load. Limitations include a small sample size and regional specificity, but the findings offer transferable principles for broader law enforcement contexts. Future research should explore wearable monitoring to assess real-time physical strain and cognitive load during live surveillance.

SUMMARY STATEMENT

- Physical surveillance exposes officers to significant ergonomic risks due to static postures and confined environments.
- Ergonomic redesign and rotation protocols could mitigate musculoskeletal issues without compromising operational efficiency.

CITATION

- Vieira & Kumar (2004). *J of Occ Rehab*, 14(2), 143-159.
- Cardoso et al. (2017). *Int J Occup Saf Ergon*, 23(2), 185-197

DETERMINING THE MAXIMUM FEASIBLE BOX DIMENSIONS AND BOX WEIGHTS FOR ONE-HANDED BOX TRANSFERS FROM VARYING HEIGHTS

[Julia Li](#)¹, [Dennis Larson](#)¹, [Steven Fischer](#)¹

¹Department of Kinesiology and Health Sciences, University of Waterloo, Waterloo, ON, Canada

PROBLEM STATEMENT

Despite the strong prevalence of one and two-handed lifting behaviors in logistics and warehousing industries, task factors (i.e. box dimension, box weight, box origin) that drive decisions to use one or two hands while lifting are not well understood. A better understanding is needed to guide companies on the proactive ergonomics work design for stock-picking tasks.

RESEARCH OBJECTIVE

This work aimed to determine the maximum box dimension and box weight that permits one-handed box transfers from varying shelf heights.

METHODOLOGY

Twenty participants completed a series of box transfer tasks from three shelf heights to a table with their dominant hand. For session 1, participants were instructed to grab a minimally weighed retractable box from either front or top and expand/collapse its dimension until they perceived that they could no longer transfer it with only one hand. For session 2, participants will be instructed to grab the box from either front or top (using the maximum dimensions from session 1) and will add/remove lead shots to the box until they perceive that they could no longer transfer it with only one hand (i.e., a psychophysical approach).

RESULTS

The perceived maximum box width ranged from 70-74% hand length. Maximum width was consistent when grabbing the box from the front regardless of shelf height but decreased with higher shelf height when grasping the box from the top. Session 2 results will be analyzed in time for the conference.

DISCUSSION

The discrepancy in perceived maximum box dimension when grasping box at shoulder height was potentially due to awkward hand/wrists posture or line of sight issues. The interaction effect between grip side and shelf height on the perceived maximum box dimension for one-handed transfers should be considered when proactively designing stock-picking tasks to optimize safety and reduce injury risks. Additionally, an understanding of the maximum determinants helps set manual material handling limits for one-handed box transfers.

SUMMARY STATEMENT

Lifters may lift with only one hand when the box dimensions are less than 70% of hand length. Future work will determine the maximum box weights for one-handed transfers.

From Compliance to Curiosity: Adding a Twist to Existing Safety Structures

Heather Kahle¹, Anna Matheson²

¹Seaspan Corp, ²BCIT

Abstract:

This interactive session introduces participants to a proactive, learning approach to safety and ergonomics by adding a new twist - blending Learning Team (LT) principles to existing SMS structures - the Joint Health and Safety Committee (JHSC), and inspections. Come see the power and principles of a Learning Team and how, when coupled with a JHSC or an inspection can become your organization's 'super power' to unleash insights, build trust, bolster learning and make effective workplace changes. This session provides the tools to go beyond **compliance to curiosity using structures already in place**. This session steps through how to form a Modified Learning Team (MLT). Participants will explore how structured, inclusive conversations with frontline workers and key stakeholders can uncover system-level insights that align with an ergonomics approach, and can help improve understanding (even with the most stubborn challenges), support work, encourage reporting and mitigate the potential for injuries. Through real-world examples, practical tools like the SPARK model, and facilitated dialogue techniques, attendees will learn how to shift from reactive compliance to proactive learning. This session is ideal for practitioners seeking to build their 'toolbox', enhance their impact in the workplace and improve work, workplace processes and overall performance building on existing safety structures.

Building Learning into JHSCs and Inspections – Turning Compliance into a Superpower

The Joint Health and Safety Committee (JHSC) and workplace inspections operate within the framework of a Safety Management System (SMS) – and are required by Regulation. Over time, these processes may become more inward and compliance focused often reacting to unwanted events or regulatory action. These structures are in place to ensure — hazards are identified, incidents are investigated, and corrective actions are logged — but the focus often leans heavily towards what's missing, what's wrong, or what's *not* compliant.

While this is important (and necessary), it can leave untapped a vast reservoir of organisational intelligence — the everyday experiences of workers and supervisors who constantly adapt, innovate, and find ways to get the job done despite challenges. This is where **Human and Organizational Performance (HOP)** and **Learning Teams (LTs)** change the game.

From Finding Fault to Finding Insight

HOP shifts the lens from “Who failed?” to “What shaped performance?” It invites us to learn from everyday work — not just when something has gone wrong. A Learning Team approach builds on this by creating a structured way to explore *how* work is really done (work-as-done) rather than relying solely on procedures or assumptions (work-as-imagined).

By weaving LT principles into the regular rhythm of JHSC meetings and inspections, an organisation moves from a purely reactive safety stance into one that is adaptive, curious, and better equipped to prevent problems before they arise. This blended approach — traditional compliance processes *plus* everyday learning — becomes a genuine **superpower**.

Why This Matters for JHSCs and Inspections

- **JHSCs** already have a mandate to improve health and safety, but discussions often focus on checklists, hazard hunts, and regulation-driven fixes.

- **Inspections** typically measure against standards and procedures — important, but limited in understanding why work happens the way it does.
- **Learning Teams** create a space to explore variability, trade-offs, and adaptations that help work succeed — the exact insights that can prevent incidents and improve efficiency.

By introducing **Modified Learning Teams (MLTs)** and Learning Inspections, we can:

- Ask deeper questions during inspections (e.g., “What does a good day look like?” “What helps you get this task done well?”)
- Turn committee meetings into opportunities for collective problem-solving, not just hazard reporting
- Capture stories, workarounds, and system constraints that would never appear on a checklist
- Involve those closest to the work in shaping practical, lasting solutions

How the Blend Works in Practice

1. **Choose a Focus Area** – Identify a task, process, or hazard category for deeper exploration.
2. **Secure Leadership Support** – Leaders need to value learning as much as compliance.
3. **Define the Facilitator Role** – A skilled facilitator ensures the conversation is inclusive, curious, and respectful.
4. **Use the SPARK Model** – Structure discussions to explore Successes, Problems, Adaptations, Risks, and Key learnings.
5. **Engage Stakeholders** – Involve those who do the work and those who support it.
6. **Allow Soak Time** – Give people time to reflect before jumping to solutions.
7. **Co-Create Solutions** – Design changes together, ensuring they are workable in the real environment.

The Result

An inspection stops being just a compliance audit — it becomes a **learning opportunity**. A JHSC meeting stops being a forum for reviewing injuries and listing hazards — it becomes a **proactive learning machine** that builds both safety and operational performance.

By embedding HOP-informed learning into existing structures, you amplify their power without adding an entirely new system. Over time, this creates a culture where people are more willing to share, issues are addressed earlier, and improvements are grounded in reality, not assumption.

In short — blending LT thinking into your JHSCs and inspections turns them into your organisation’s **superpower** for both safety and performance.

EFFECT OF HIP STRETCHING ON OVERHEAD WORK KINEMATICS

Graham Mayberry¹, Janessa Drake², Jack Callaghan¹

¹University of Waterloo, ²York

PROBLEM STATEMENT

Prolonged lumbar extension during overhead work has led to increased reporting of LBP in painters and mechanics [1,2]. Individuals with tight hip flexors are more susceptible to shortened iliopsoas muscles leading to increased anterior pelvic tilt, lumbar lordosis, and limited hip extension, which increase compressive forces on the spine resulting in LBP [3].

RESEARCH OBJECTIVE

The purpose of this research was to examine the effect of hip flexor stretching on lumbar spine kinematics during overhead work in a ‘tight’ hip population.

METHODOLOGY

30 participants with limited hip extensibility were recruited. Hip and spine angles were measured during an overhead (OH) sanding task carried out on a height-adjustable surface, performed using the left (L) and right (R) hands, and then together (B). Hip flexor stretches were then performed followed by a second set of the OH tasks. After a 1-month hip-flexor stretching intervention a final set of OH tasks were completed.

RESULTS

Repeated measures mixed GLM were conducted to compare Baseline, immediate (Post_Day), and Post-Month stretching intervention hip and lumbar spine angles and are illustrated in Figure 1. Hip-flexor stretches resulted in significant differences in lumbar angle between Baseline and Post_Month while hip angle trended towards extension, albeit not statistically significant.

DISCUSSION

The results of this study clearly demonstrate the impact that hip flexor stretching has on lumbar spine kinematics during overhead work tasks, particularly in a population with ‘tight’ hips. By reducing the constraints imposed on the lumbar spine by the hip flexor muscles (i.e. psoas and iliacus) individuals may reduce the risk of pain, discomfort, and potentially injury.

SUMMARY STATEMENT

Improving hip mobility through hip flexor stretching causes a reduction in lumbar spine extension when engaging in overhead work tasks.

CITATIONS

[1] Irwin E et al. (2015). *Procedia Manuf.* **3**: 4501-4508. [2] Asadi H et al. (2019). *Int. J. Ind. Ergon.* **70**: 107-115. [3] Fewster KM et al. (2024). *J. Appl. Biomech.*, **40**: 201-208.

Sitting and Spine Pain: Intra-Subject Variation Across a Workweek

Erinn McCreath Frangakis¹

¹Department of Kinesiology and Health Sciences, University of Waterloo, Waterloo, ON

PROBLEM STATEMENT

Despite the identification of prolonged sitting as a risk factor for the development of low back pain (LBP), considerable variation in reported pain scores still exists (Davidson & Callaghan, 2025). An understanding of the difference in activities and seated spine kinematics between days with varying LBP scores may reveal insights into modifiable factors to reduce the risk of LBP from sitting.

RESEARCH OBJECTIVE

The objective of this study was to assess between-day variation in seated activities and spinal kinematics on days where individuals reported maximum and minimum pain scores.

METHODOLOGY

Twenty participants completed this study. Data was collected over one workweek at individual office workstations. LBP ratings were recorded at the start and end of each day via a 100 mm visual analogue scale. Individuals wore a tri-axial accelerometer on their dominant thigh during waking hours to classify sitting, standing, and stepping metrics. Two additional accelerometers were instrumented on the first lumbar and sacral vertebrae to measure thorax, lumbar, and pelvic spine angles. Amplitude probability distribution functions were constructed to assess seated lumbar spine movements and spinal postures. Two-way repeated measures analyses of variance were performed to determine the effect of pain day and time on seated spine kinematics and activity timing.

RESULTS

Nine participants had days with pain scores varying > 5 mm and were included in the analysis. There was no significant difference between pain days for daily sitting or standing/stepping metrics ($p \geq 0.245$). Peak backwards thorax inclination was found to increase throughout the day with a significant pairwise comparison between the 1st and 5th and 1st and 6th blocks ($p_{\text{adj}} > 0.046$). The amplitude of spinal movements was larger on maximum pain days (0.4° to 1.7°) and occurred less frequently (every 18-160 seconds).

DISCUSSION

Participant fluctuation in LBP responses throughout a week of seated office work were found to be associated with differences in seated spinal kinematics. On days with higher pain scores, participants demonstrated larger, less frequent spinal movements. Reclining in the seatback also increased, suggesting a relationship between spinal movements, prolonged sitting, and LBP responses. Future ergonomic interventions aimed at preventing LBP should therefore focus on promoting seated movements through increased chair adjustability or mobility. This study is the first to link between-day fluctuations in LBP ratings throughout a week of seated office work to activities and seated spine kinematics, providing insight into the upstream understanding of LBP development in office workers.

CITATION

Davidson, J. M., & Callaghan, J. P. (2025). A week-long field study of seated pelvis and lumbar spine kinematics during office work. *Applied Ergonomics*, 122, 104374.

Effect of Research-Informed Posture on Lower Back Pain in Paramedics: A Field-Based Comparison with Self-Selected Posture

Emily Meier¹, Abigail Overduin (CCPE, MSc), Hugh Davies (PhD, CIH)

School of Population and Public Health, University of British Columbia, Vancouver, Canada

PROBLEM STATEMENT

Limited research exists on a standardized seat fit protocol (SSFP) for occupational use of mid-size vehicles, despite their widespread use and driving's associated contribution to lower back pain (LBP). Current standards are broad (Delleman & Dul, 2007), and research has varying recommendations on the optimal driving posture (Schmidt et al., 2014).

RESEARCH OBJECTIVE

The aim is to apply a research informed SSFP to fit driver and passenger seats within an ambulance to their occupants, reducing the incidence of reported LBP.

METHODOLOGY

The structure is a field-based, within-subjects crossover experimental design in full-time paramedics, completing both driving and attendant duties. Preferred seated postures will be compared against a SSFP that is more specific than the current standard's broad ranges. Measurement will be collected using an iPhone's internal accelerometer secured in a 3D-printed case attached to a metal rod. This ensures alignment with the phone and significant bony landmarks used in joint angle evaluation. Participants will also complete a questionnaire at start and end of shift using a modified Borg perceived pain scale to measure the incidence of LBP.

RESULTS

Expected results will describe the measurements of joint angles in preferred postures, and incidence of LBP symptoms at start and end of shift in two test conditions. We hypothesize that workers in the self-selected posture will demonstrate more LBP than those prescribed the SSFP. It is also anticipated drivers may have a higher rates of LBP than the attendant as their ability to move to alleviate fatigue and strain is restricted by the driving task.

DISCUSSION

Limitations include the inability to monitor the driver and attendants throughout the whole work shift, however, strengths involve applying a quantitative field-based method with immediate feedback on joint angles. to help align subjects with the refined posture.

SUMMARY STATEMENT

Ergonomists will benefit from increased specificity around static seated posture and its impact on LBP when operating a mid-sized vehicle along with a new method in evaluating seated posture beyond visual assessment.

CITATION

Delleman, N. J., & Dul, J. (2007). International standards on working postures and movements ISO 11226 and EN 1005-4. *Ergonomics*, 50(11), 1809-1819.

Schmidt, S., Amereller, M., Franz, M., Kaiser, R., & Schwirtz, A. (2014). A literature review on optimum and preferred joint angles in automotive sitting posture. *Applied Ergonomics*, 45(2), 247-260.

CRE-MSD Conference 2025: Reflections and Lessons Learned from Implemented MSD Prevention Programs

[Kim Meszaros^{1, 2}](#), Jack P. Callaghan^{1, 2}

¹CRE-MSD, ²University of Waterloo

INTRODUCTION

CRE-MSD hosts their annual conference on October 1st to kick-off Global Ergonomics Month. Feedback from last year's conference revealed that attendees were interested in more practical examples of how to implement MSD prevention in workplaces. In response, the theme of this year's CRE-MSD conference will be case studies of MSD prevention strategies and programs across different sectors, how they were implemented and the outcomes and impact.

PURPOSE

Knowledge transfer of lessons learned from long term (10+ years) MSD prevention program implementation case studies, sharing common findings across energy, healthcare and manufacturing sectors, as well as reflecting on discussions throughout the conference.

CONTEXT

The CRE-MSD conference will be held on October 1, 2025, which is the week prior to the ACE conference. Case studies from large organizations who implemented company-wide MSD prevention programs will be presented. Strategies employed as well as the impact on leading and lagging indicators will be highlighted. Sharing a summary of learnings and reflections from the conference will set the stage for continuing the conversation with HFE Professionals.

OUTCOMES

Stimulating discussion with HFE Professionals on current facilitators and barriers for integrating MSD prevention strategies and programs into organizations.

SUMMARY STATEMENT

CRE-MSD kicks off Global Ergonomics Month with their annual conference on October 1st. This year's theme is case studies of MSD prevention strategies and programs, how they were implemented, and their impact over 10+ years. This presentation will include lessons learned from the case studies, common findings across sectors, and reflections from conference discussions to continue the conversation with HFE Professionals.

Prevalence of Musculoskeletal Pain and Physical Hazards Among Canadian Bartenders: A Pilot Study

Christopher Millward¹

¹Fanshawe College

PROBLEM STATEMENT

Despite consistent anecdotal reports of pain and fatigue among bartenders, there is a lack of targeted research quantifying the prevalence and causes of musculoskeletal (MSK) injuries within this profession. The existing literature provides an incomplete understanding of the specific job demands and injury risks unique to bartending.

RESEARCH OBJECTIVE

The purpose of this study was to quantify a) the prevalence, severity, and causes of MSK pain and b) the frequency of exposure to physical hazards among bartenders.

METHODOLOGY

An online questionnaire was distributed to 50 bartenders working in London, Ontario, collecting data on demographics, regional pain scores, exposure to physical hazards, and perceived causes of pain and physical exhaustion. Participants were enrolled through convenience sampling. Descriptive statistics and natural language processing were used to identify common workplace pain themes via frequency and thematic analysis.

RESULTS

Every participant reported feeling some degree of pain following work, and 97.5% experienced pain in more than one body region. Pain was most commonly reported in the feet, lower back, shoulders, upper back, and neck. All participants reported disrupted sleep. High noise levels, slippery floors, and heavy lifting were common hazards. Pain was often linked to sustained standing, lifting, and bending over the bar well, while exhaustion was associated with running, shaking, and general movement. Job design, materials handling, posture, and tooling were key contributors to pain and fatigue.

DISCUSSION

Bartenders reported widespread pain and fatigue from prolonged standing, awkward postures, heavy lifting, and fast-paced tasks. These findings align with prior biomechanical evidence indicating elevated injury risk in similar tasks. Compared to previous restaurant staff studies, this group had a higher rate of multi-region MSK pain, likely due to varied methodology and research focus. Noise surveying is strongly recommended. Despite limitations in sample size, results support the need for ergonomics assessments and targeted interventions.

SUMMARY STATEMENT

The physical demands of bartending are likely unsafe, with 100% of participants reporting pain — most commonly in the feet, back, shoulders, and neck. Environmental hazards, such as excessive noise and slippery floors, further compound these risks. Further research and cumulative demands analyses are urgently needed to support safer workplace practices for bartenders.

Evaluation of a Tool For Reducing the Physical Demands of Opening Medicine Vials

Shimon Mikhil¹, Michael Agnew¹, [Christopher Millward¹](#)

¹Fanshawe College

PROBLEM STATEMENT

Healthcare workers, including nurses and pharmacists, identify the frequent opening of medicine vials as a source of fatigue and discomfort. A tool has been brought to market to address this issue by reducing the physical demands required to remove vial caps; however, no investigation into the tool's efficacy has been made.

RESEARCH OBJECTIVE

The objective of this study was to compare the physical demand required to open the medicine vials both with and without the use of the tool.

METHODOLOGY

Medicine vials were secured in a custom fixture and opened both with and without the use of the tool (*The Lifty*, DAZL Innovations Inc.). Linear forces were measured using a Mark-10 Series 2 force gauge (Mark-10, Copiague, NY, USA) and repeated until measurements were deemed stable (variation < 20%). The linear forces recorded were normalized to the maximum capacities published in the literature (HandPak, Potvin Biomechanics, Tecumseh, ON, Canada, 2025) for each hand grip used. The no-tool condition was modeled as a thumb press and the tooling condition was modeled as a three-finger pull. Estimates of physical demand, expressed as %MVE were contrasted between tool conditions (no-tool vs tool) across a range of reported task frequencies (ranging in duty cycle ~0.001-0.99, and described as a demand:capacity ratio - DCR). Strength capacity was modelled with respect to a 25th percentile female.

RESULTS

Quantitative testing demonstrated that *The Lifty* significantly reduced the voluntary effort required to open a vial from 26.5 to 2.5% MVE. The analysis also indicated that when using the thumb alone without *The Lifty*, fatigue is expected to develop at a rate of approximately 1.5 efforts per second. In contrast, when using *The Lifty*, the predicted physical demand is low enough that no cumulative fatigue effect is expected, even at near constant (~DC = 1.0) use.

SUMMARY STATEMENT & DISCUSSION

The present findings provide strong support for *The Lifty* as a tool to be used in healthcare settings. Specifically, we quantified a theoretical 90% reduction in physical demands attributable to use of *The Lifty* in contrast to status quo use of a manual thumb press. Overall, this suggests the potential to significantly lower the physical demands placed on the hands and wrists of healthcare workers who open vial caps commonly. However, this research demonstrates the efficacy of *The Lifty* in a controlled environment rather than an assessment of effectiveness when used in the field. Further studies should assess user feedback, including items such as satisfaction, perceived ease of use and perceived exertion, and evaluate *The Lifty's* effectiveness in real-world workplace environments.

Exploring the Use of Different Biomechanical Inputs as Percent Effort on Cumulative Fatigue Tool Outputs

Steven Fischer¹, Hailey Nestor¹

¹University of Waterloo

PROBLEM STATEMENT

Electrical wire harnessing on automotive lines is difficult to assess in-field due to limited equipment, complex movements, and task repetitiveness. Cumulative fatigue tools like the Recommended Cumulative Rest Allowance (RCRA) might be useful but require an estimate of percent (%) effort. However, %effort can be estimated using different approaches, which may in turn, influence outputs from the RCRA.

RESEARCH OBJECTIVE

Determine how sensitive the Recommended Cumulative Rest Allowance (RCRA) tool is to %effort inputs generated from different data types given the dynamics of wiring harness work.

METHODOLOGY

Participants (n=17) were recruited to simulate engine wiring (10 repetitions) in lab. Each repeat consists of three subtasks with a total cycle time of 45s. Electromyography (EMG) was recorded from three extensor and two flexor muscles of the right forearm to assess muscular activation. A force plate captured real-time force applied to the engine. EMG and force data were normalized to maximum voluntary contractions/forces, and exertion durations were determined using threshold detection. Normalized EMG and force efforts were used as %effort inputs for the RCRA.

RESULTS

Mean RCRA ratios exceeded recommended thresholds (>1) when using flexor EMG (1.23), extensor EMG (50.64) or applied force (2.80) inputs. There was a significant main effect of RCRA input type on RCRA output ratio ($F(2,48)=8.48, p<0.01$). Pairwise comparisons revealed that RCRA ratios calculated from extensor activity were significantly higher than ratios calculated from force or flexor activity.

Table: Normalized %effort inputs and RCRA output ratios.

	Force (%MVF)	Flexor Activity(%MVC)	Extensor Activity(%MVC)
Subtask 1	28.9% $\pm$ 13.9	20.2% $\pm$ 6.8	25.9% $\pm$ 10.1
Subtask 2	38.6% $\pm$ 14.7	20.8% $\pm$ 6.9	46.8% $\pm$ 17.4
Subtask 3	44.6% $\pm$ 14.6	36.8% $\pm$ 12.5	48.5% $\pm$ 17.4
RCRA Ratio	2.80	1.23	50.64*

DISCUSSION

High RCRA ratios indicate insufficient rest during wire harnessing, suggesting fatigue accumulation. The high RCRA ratio when using extensor EMG likely reflect prolonged or frequent muscle activation, while high force based RCRA may stem from reduced max force output due to posture constraints and contact discomfort.

SUMMARY STATEMENT

Extensor EMG produced significantly higher RCRA ratios, suggesting greater fatigue and the importance of input selection. Attendees will learn how RCRA can guide ergonomic decisions using both in-lab and in-field measurements.

CITATION

Gibson, M. & Potvin, J. (2016). An Equation to Calculate the Recommended Cumulative Rest Allowance across Multiple Subtasks. *Occupational Ergonomics and Safety Conference*.

La complexité de tâche en préparation de commandes, état des lieux

Valérie Tuyêt Mai Ngô¹, Sylvie Nadeau¹

¹École de technologie supérieure

ÉNONCÉ DU PROBLÈME

Les attributs de complexité de(s) tâche(s) de préparation de commandes n'ont pas été déterminés du point de vue de l'ergonomie/facteurs humains (HF/E).

OBJECTIF DE RECHERCHE

Déterminer les attributs de complexité spécifiques aux préparateurs de commande et quelles tâches seraient les plus susceptibles de bénéficier d'une assistance numérique.

MÉTHODOLOGIE

Une recherche de type PRISMA a été effectuée dans plusieurs bases de données : *Scopus*, *Compendex*, *Web of Science* pour trouver les articles liés à la complexité de(s) tâche(s) en préparation de commandes (Années [...] -2025 et mots-clés: task complexity, order picking, ergonomics et autres). Une recherche des cadres de complexité déjà établis dans la littérature a également été réalisée.

RÉSULTATS

La complexité est fréquemment mentionnée en termes de productivité (complexité des lieux d'entreposage ou de l'optimisation du trajet à parcourir) et non de HF/E. Tel est le cas de l'étude de DeHoratius et al. (2025), qui mentionne deux attributs de complexité sur la tâche de préparation de commandes soit la variabilité de produits et la contrainte temporelle dans une perspective de performance du travailleur.

DISCUSSION

Il est clair qu'il existe plus de deux attributs de complexité en préparation de commandes. Il est ainsi nécessaire de les déterminer. Ceci pourra être effectué en reposant, entre autres, sur les articles traitant de la complexité de tâche comme Liu et Li (2012) et Haerem et al.(2015).

DÉCLARATION SOMMAIRE

Au meilleur de notre connaissance, la complexité de(s) tâche(s) en préparation de commandes n'a pas été étudiée dans une perspective HF/E. En déterminant les attributs de complexité spécifiques à la préparation de commandes, il sera possible de 1) Établir une base sur laquelle nous pourrions effectuer des essais en laboratoire qui permettra des comparables entre les études 2) Déterminer quelle(s) tâche(s) seraient les plus susceptibles de bénéficier d'une assistance numérique.

CITATION

DeHoratius, N., Gürerk, Ö., Honhon, D., & Hyndman, K. (2025). Execution Failures in Retail Supply Chains—A Virtual Reality Experiment. *Production and Operations Management*, 10591478241275066. <https://doi.org/10.1177/10591478241275066>

Hærem, T., Pentland, B. T., & Miller, K. D. (2015). Task Complexity: Extending a Core Concept. *Academy of Management Review*, 40(3), 446-460. <https://doi.org/10.5465/amr.2013.0350>

Liu, P., & Li, Z. (2012). Task complexity: A review and conceptualization framework. *International Journal of Industrial Ergonomics*, 42(6), 553-568. <https://doi.org/10.1016/j.ergon.2012.09.001>

INTEGRATING PSYCHOSOCIAL FACTORS IN MSD ASSESSMENT

Heather O'Reilly¹, Tegan Slot²

¹McMaster University, ²PSHSA

PROBLEM STATEMENT Psychosocial factors are challenging to identify, assess, and intervene in the workplace (Oakman et al., 2022; O'Reilly & Van Eerd, 2025). RADIUS (developed by PSHSA) is a collaborative, participatory psychological harm assessment tool developed to enable workers and supervisors to cooperatively identify job factors and solutions. RADIUS presents an opportunity for integrated assessment for MSD and psychological injury.

RESEARCH OBJECTIVE The objectives of this research were to: explore the feasibility of assessing psychosocial risk factors for both MSD and psychological harm using the RADIUS tool; compare risk between a clinical and non-clinical job role in long term care; and describe good practices for the adoption of integrated (physical + psychosocial) risk assessment.

METHODOLOGY Using mixed methods, the study consisted of incident data analysis, semi-structure observation of RADIUS tool assessment in a long-term care setting across a clinical (personal care attendant PCA) and non-clinical job role (food service attendant FSA), and follow-up semi-structured interviews. Descriptive statistics of incident data were triangulated with thematically analyzed observation and interview data.

RESULTS The health and safety team at the long-term care facility adopted the RADIUS tool after facilitation. Themes of worker appreciation, detailed scenarios, and participatory solutions were highlighted. Seven high-risk psychosocial factors related to job demands were identified for personal care attendants (PCAs), while thirteen high-risk factors were identified for food service attendants (FSAs) across job demands, control, and support domains. Leaders in the PCA role tended to underestimate psychosocial risk, whereas FSA leaders overestimated it. Follow-up interviews highlighted themes around the integration of actionable solutions.

DISCUSSION These findings highlight the value of RADIUS in capturing psychosocial risks across diverse job roles in long-term care. The variation in perceived versus experienced psychosocial risks between workers and leaders underscores the need for participatory job-based assessment processes (Oakman et al., 2022). Integrating RADIUS into routine assessments may support fulsome risk identification and tailored prevention solutions that reflect the contextual factors influencing implementation of MSD and psychological injury interventions.

SUMMARY STATEMENT RADIUS captures both psychosocial and physical demands at the job level, as demonstrated by the differences in clinical and non-clinical job roles. The tool offers a participatory action-oriented assessment that can be integrated by health and safety professionals into assessments to strengthen MSD and psychological harm prevention.

CITATION

Oakman, J., et al. (2022). Workplace physical and psychosocial hazards: A systematic review of evidence informed hazard identification tools. *Applied Ergonomics*, 100, 103614.

O'Reilly, H., & Van Eerd, D. (2025). Including the ergonomist's voice in integrating MSD prevention and psychological health and safety: Challenges, tools, and considerations. *Applied Ergonomics*, 122, 104405.

DANS LES COULISSES DU DIAGNOSTIC MÉDICAL: LE TRAVAIL MÉCONNU ET EXIGEANT DES TECHNOLOGUES EN PATHOLOGIE

Florence Paquet-Beaudet¹

¹Université Laval

INTRODUCTION À L'ÉTUDE DE CAS

Dans le cadre de la maîtrise en ergonomie, une intervention a été réalisée dans un laboratoire de pathologie d'un centre hospitalier de Québec. Peu connu du grand public, le travail des technologues médicaux joue pourtant un rôle essentiel dans le diagnostic médical. Ceux-ci effectuent diverses analyses et assurent la validité technique des résultats à des fins diagnostiques, de suivi ou de recherche.

BUT DE L'ÉTUDE DE CAS

La prévention des TMS étant une priorité organisationnelle, une demande a été formulée pour qu'un ergonome analyse plusieurs postes de travail. Les investigations préliminaires ont permis de cibler trois situations de travail : le poste de macroscopie (contraintes cognitives et organisationnelles), les tâches d'approvisionnement (exigences physiques), et l'organisation du travail, notamment la polyvalence et l'attribution des postes, qui génèrent des contraintes physiques et cognitives.

MÉTHODOLOGIE / CONTEXTE DE L'ÉTUDE DE CAS

L'intervention, fondée sur l'analyse de l'activité réelle, s'est déroulée en trois phases : investigations préliminaires, analyse des situations de travail et implantation de projets de transformation. La méthodologie comprenait des entretiens, des observations avec verbalisation, des questionnaires, des grilles d'analyse, des mécanismes de participation et une revue de littérature.

RÉSULTATS / RÉSULTATS DE L'ÉTUDE DE CAS

La présentation du diagnostic ergonomique a mené à l'implantation de trois projets de transformation, dont un projet innovant touchant à l'organisation du travail. Celui-ci a conduit à la création d'un outil visant à soutenir la planification de l'attribution des postes de travail en fonction de leurs exigences spécifiques (physiques, cognitives et psychosociales).

DISCUSSION / DISCUSSION DE L'ÉTUDE DE CAS

L'intervention, a permis une compréhension approfondie de trois situations de travail. En agissant en amont sur l'organisation du travail plutôt que de cibler des postes isolés, elle pose les bases d'impacts durables et de grande portée.

DÉCLARATION SOMMAIRE / DÉCLARATION SOMMAIRE

L'intervention a permis de mieux faire connaître un métier essentiel mais peu visible, exercé dans un contexte de travail exigeant. Elle a posé les bases de transformations durables en répondant à des enjeux propres aux laboratoires médicaux, tout en faisant écho à des défis organisationnels présents dans l'ensemble du réseau de la santé.

UNDERSTANDING DRIVER FATIGUE AMONG TRUCK DRIVERS IN QUEBEC

Elizabeth Peña Saldarriaga^{1, 2}, Martin Lavallière²

¹Master's student, ²Université du Québec à Chicoutimi, Lab BioNR and CISD

INTRODUCTION TO CASE STUDY

Fatigue is a major risk factor for road safety, particularly among truck drivers, and is implicated in up to 22% of severe crashes in Quebec (SAAQ, 2022). Fatigue is influenced by multifactorial elements such as sleep quality, physical activity, nutrition, and work conditions (Phillips, 2015). Despite existing literature on health risks among truck drivers, little is known about how these lifestyle factors specifically contribute to fatigue in the Quebec context.

PURPOSE OF CASE STUDY

This study aims to understand how lifestyle habits (sleep, eating habits and physical activity) are associated with fatigue levels among truck drivers in Quebec. The goal is to support the development of tailored interventions that promote health and reduce fatigue.

CONTEXT OF CASE STUDY

As part of a larger mixed-methods project, truck drivers in Quebec completed a self-administered questionnaire adapted from validated tools. The survey collected information on demographic and occupational data, fatigue symptoms, health behaviors, and psychosocial factors. Two participants have completed the full questionnaire to date, serving as exploratory information for future work. Full results will be presented at the conference.

OUTCOMES OF CASE STUDY

The participants reported fragmented sleep, limited physical activity (1 day/week), frequent fast-food intake (3-6 times/week), and irregular meal timing, not meeting basic dietary guidelines. Elevated fatigue scores indicated that fatigue significantly interfered with their daily lives. Participants also reported significant fatigue during driving, with one admitting to having fallen asleep at the wheel. Work hours ranged from 60-70 h/week, with 40-55 hours of active driving. One slept at home only five nights in the past 30 days. Despite these issues, there appears to be no structured workplace support for managing fatigue or promoting healthy behaviors.

DISCUSSION OF CASE STUDY

These two cases illustrate how long working hours, irregular schedules, and limited access to health-supportive environments contribute to unhealthy lifestyle habits and elevated fatigue levels. The cumulative effect these factors appear to significantly impair their functioning and safety. These findings highlight the need for personalized interventions to address fatigue and promote healthier behaviors in the commercial driving sector. The collected data offers an insight into the lived experiences of drivers and highlights modifiable risk factors. Further data collection and qualitative interviews will help deepen the understanding of fatigue and guide targeted interventions within the trucking industry.

SUMMARY STATEMENT

- These results highlight the impact of long working hours on poor lifestyle habits and driver fatigue in the Quebec trucking context.
- Participants reported high levels of fatigue, low physical activity, and inadequate nutrition.
- The findings emphasize the need for workplace-based strategies to support healthier habits and reduce fatigue risks among truck drivers.

CITATION

Phillips, R. O. (2015). A review of definitions of fatigue - And a step towards a whole definition. *Transportation Research Part F: Traffic Psychology and Behaviour*, 29, 48-56.

SAAQ. (2022). *Fatigue au volant*. Fatigue au volant : Causes, conséquences et prévention.

Cardiorespiratory Responses to a Load Carriage Task in Police Tactical Response Unit

Sébastien Poirier¹, Annie gendron², Meghan Garceau^{2,3}, Claude Lajoie³

¹ Unité d'enseignement et de recherche en sciences de la santé, Université du Québec en Abitibi-Témiscamingue;

² Centre de recherche et de développement stratégique, École nationale de Police du Québec; ³ Département des sciences de l'activité physique, Université du Québec à Trois-Rivières.

RESEARCH PROBLEM AND OBJECTIVE

Police Tactical Response Unit (TRU) officers are often required to traverse various terrains while carrying loads ranging from 20 to 40 kg. Maintaining adequate physical fitness is essential for operational performance. However, few studies have quantified the physiological response to load carriage (LC) in contexts specific to TRU operations. Embedded within a larger initiative aimed at developing a physical employment standard for members of Quebec's TRU, the primary objective of this study was to quantify the cardiorespiratory response during a LC task representative of TRU interventions.

METHODOLOGY

The cardiorespiratory fitness ($\dot{V}O_{2\max} = 51.9 \pm 5.2 \text{ ml}\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$) and maximal heart rate ($HR_{\max} = 185 \pm 11 \text{ bpm}$) of 25 TRU officers were first assessed during a maximal graded treadmill test. Participants then completed a 39-minute LC ambulatory task on a treadmill, during which respiratory gases and HR were continuously monitored.

RESULTS

The mean HR, absolute $\dot{V}O_2$ and relative $\dot{V}O_2$ during the LC task were $147 \pm 12 \text{ bpm}$, $2364 \pm 244 \text{ ml}\cdot\text{min}^{-1}$, and $26.5 \pm 2.0 \text{ ml}\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$, respectively. These values correspond to $80 \pm 5 \%$ of the $HR_{\max}$ and $51 \pm 5 \%$ of the $\dot{V}O_{2\max}$ of participants. Body weight was positively associated with the mean absolute $\dot{V}O_2$ during LC ($r = 0.80$, $p < 0.01$) and negatively associated with the mean relative $\dot{V}O_2$ during LC ($r = -0.70$, $p < 0.01$). Multiple regression analysis revealed that both $\dot{V}O_{2\max}$ ($\beta = -0.88$, $p < .01$), and body weight ($\beta = -.40$, $p < .01$) significantly predicted the percentage of $\dot{V}O_{2\max}$ sustained during the LC. Overall, the model accounted for approximately 64% of the variance in percentage of $\dot{V}O_{2\max}$ sustained during the LC (adjusted $R^2 = .64$).

DISCUSSION

Based on the mean $\dot{V}O_2$ observed in the present study and existing literature on maximal acceptable work duration, it is estimated that a relative $\dot{V}O_{2\max}$ of approximately $48 \text{ ml}\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$ is required to sustain typical LC interventions. Given that body size influences the physiological response to absolute loads, it is recommended that $\dot{V}O_{2\max}$ assessments for TRU recruitment be performed under loaded conditions.

SUMMARY STATEMENT

- Our findings suggest that a $\dot{V}O_{2\max}$ of at least $48 \text{ ml}\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$ is required for operational readiness of TRU officers.
- The cardiorespiratory impact of load carriage varies with individual body size, underscoring the need for load-specific fitness assessments.

Developing a Wearable-Based Method for Estimating Community-Based Personal Support Workers Spine Loading

[Kate Posluszny¹](#), [Steven Fischer¹](#)

¹Department of Kinesiology and Health Sciences, University of Waterloo

PROBLEM STATEMENT

Personal support workers (PSWs) experience a high prevalence of low-back musculoskeletal disorders (MSDs). To develop effective interventions, there is a need to understand PSWs' spine loading when providing care. Currently, PSWs' spine loads have only been captured in-field using static models (underestimated) or in laboratory simulations using dynamic models (less generalizable). An artificial neural network (ANN) may provide a means of estimating PSWs' spine loading dynamically in-field, if key variables can be measured within patient home environments.

RESEARCH OBJECTIVE

To develop a wearable-based method for estimating PSWs' lumbar (L4/L5) extensor moments.

METHODOLOGY

Laboratory collected data captured by Ho et al. (2025), which includes 20 PSWs completing 12 common and physically demanding tasks was used to develop the ANN model. Criterion biomechanical data included Vicon® motion capture (Vicon, Centennial, CO, USA) to track PSWs' 3D kinematics, while ground reaction forces were collected using Loadsol® pro-mlp (Novel Electronics Inc., St. Paul, MN, USA). A bottom-up inverse dynamic model was developed in Visual3D x64 Professional™ (C-Motion Inc., Boyds, MD, USA) to calculate ground-truth lumbar extensor moments. We are currently developing a feed-forward ANN using MATLAB® R2023a (MathWorks Inc., Natick, MA, USA) Neural Network Toolbox™ to predict the time-series extensor moments using Loadsol and thoracolumbar flexion angles; measures that can be more readily captured in-field compared to full body motion capture. Data for all tasks from 14 (70%), 3 (15%), and 3 PSWs (15%) will be used to train, validate, and test the ANN, respectively.

RESULTS

Due to Matijevich et al.'s (2021) success in estimating lumbar extensor moments using data from wearables, it is anticipated that our ANN will also be successful ($r^2 > .8$) at estimating spine loads.

DISCUSSION

The development of a wearable-based method to estimate PSWs' spine loads may improve current loading estimates and provide a means of obtaining exposures from sparse in-field data.

SUMMARY STATEMENT

To effectively mitigate PSWs' risk of developing low-back MSDs, research is needed to characterize PSWs' spine loads dynamically in-field. To address this gap, data that can be obtained using wearables (i.e., GRFs, thoracolumbar flexion angles, and PSWs' anthropometrics) will be used to develop an ANN to estimate PSWs' lumbar extensor moments.

CITATION

Ho, D.C., et al. (2025). *Characterizing the biomechanics of common personal support worker tasks as simulated in a lab*. [Manuscript Submitted for publication in Applied Ergonomics].

Matijevich, E. S., Volgyesi, P., & Zelik, K. E. (2021). A promising wearable solution for the practical and accurate monitoring of low back loading in manual material handling. *Sensors*, 21(2), 340.

LES FEMMES ENCEINTES AU TRAVAIL

Flavia Ribeiro de Vargas¹, Florence Paquet-Beaudet¹, Maude Lafantaisie¹, Évelyne Cambron-Goulet¹, Aboubacar Sidibé¹, Caroline Delisle¹

¹Institut national de santé publique du Québec

ÉNONCÉ DU PROBLÈME

Les recommandations des protocoles du *programme Pour une maternité sans danger (PMSD)* du Québec doivent être mises. Ces recommandations portent sur un ensemble de situations de travail, identifiées par type d'emploi, pouvant comporter des dangers physiques pour la travailleuse enceinte, en raison de son état de grossesse, ou pour son bébé à naître.

OBJECTIF DE RECHERCHE

Étudier des situations de travail (ex. : soulèvement de charges, position debout, etc.) pouvant causer des issues défavorables de grossesse ou des effets néfastes pour la santé des travailleuses enceintes (ex. : troubles musculosquelettiques), en raison de son état de grossesse, et pour leur bébé à naître afin d'émettre des recommandations préventives devant être intégrées aux protocoles du PMSD.

MÉTHODOLOGIE

Une approche a été développée combinant des données scientifiques, issues des revues systématisées de la littérature, données terrain et données d'organismes nationaux et internationaux, à un processus délibératif par un comité multidisciplinaire. Une étape de cadrage a également été intégrée au processus afin d'identifier et évaluer les questions de recherche pertinentes.

RÉSULTATS

Nous avons observé que les données scientifiques de qualité sont rares. La réponse à plusieurs questions scientifiques n'existe pas dans la littérature, et certaines situations de travail ne peuvent pas être évaluées de façon adéquate. Les recommandations régionales actuelles reposent sur des avis d'experts avec un appui scientifique de qualité variable.

DISCUSSION

Les données scientifiques parfois incomplètes ou contradictoires et le fait qu'il est difficile d'adapter et interpréter l'application des normes en ergonomie aux travailleuses enceintes posent un obstacle important pour l'élaboration des recommandations claires. La méthodologie développée, avec différentes sources de données, nous semble essentielle pour trancher sur les questions d'incertitude.

DÉCLARATION SOMMAIRE

Il est très complexe d'évaluer les conséquences de certaines situations de travail sur la santé et la sécurité de la travailleuse enceinte ou qui allaite. Les principaux défis seront illustrés, afin de sensibiliser les ergonomes à la complexité de ces situations. L'utilisation des données scientifiques existantes combinées à d'autres sources d'informations, notamment les normes en ergonomie, sera présentée et discutée également.

Toward A Pipeline to Enable Ergonomic Assessments using Unreal Engine 3D Assets

[Matthew Russell](#)¹, [Reza Hajari](#)², [Matthew Mavor](#)², [Alexandre Mir-Orefice](#)², [Ryan Graham](#)², [Steven Fischer](#)¹

¹University of Waterloo, ²University of Ottawa

INTRODUCTION TO CASE STUDY

Proactive ergonomics tools continue to evolve in concert with improvements in animation and human shape modelling capabilities. The CANadian Soldier Performance Prediction and Optimization Tool (CAN-SPPOT) is a digital twin software (i.e., digital representations of real-world objects/humans) such that it uses the Unreal Engine 5 (UE5) physics engine to predict and optimize human motion with person-specific avatars. Linking biomechanical modelling tools (e.g., OpenSim) with CAN-SPPOT's digital twin simulations would permit ergonomic physical exposure predictions (e.g., joint angle, joint force, torque) from simulated kinematics. As UE5 filmbox file (.fbx) outputs from CAN-SPPOT are not natively compatible with OpenSim, a method is first needed to convert .fbx files into an OpenSim useable format.

PURPOSE OF CASE STUDY

To (1) develop a pipeline for importing .fbx files into OpenSim and (2) augment CAN-SPPOT kinematic predictions with estimated forces using optimal control (OpenSim Moco); key for calculating joint torque exposures for ergonomic risk assessment.

CONTEXT OF CASE STUDY

CAN-SPPOT was used to simulate a 79 kg male sprinting at 5.8 m/s for 0.31 seconds. UE5 .fbx file outputs were parsed using custom Python code to extract time-varying positions of rigged skeleton nodes as a track row column (.trc) file format, compliant with OpenSim. An adapted OpenSIM model with ground-foot contact forces was used to map the UE5 rig skeleton nodes to standard biomechanical landmarks (Rajagopal et al., 2016); thus permitting joint angle analysis.

OUTCOMES OF CASE STUDY

Knee flexion angles peaked at 91.7° (left) and 92.7° (right). Hip flexion, adduction, and axial rotation angles ranged from -29.5 to 25.4°, -12.9 to 22.3°, and -6.7 to 4.9°. These angles align with ranges expected for running gait (Orendurff et al., 2018), demonstrating confidence that CAN-SPPOT's movement prediction engine can drive a proactive ergonomics assessment tool.

SUMMARY STATEMENT

Presented is a methodology for kinematic joint angle predictions using digital twin simulations. Kinetic predictions using OpenSim Moco are forthcoming.

CITATIONS

Orendurff, M. S., Kobayashi, T., Tulchin-Francis, K., et al. (2018). *J. Biomech.*, 71, 167-175.

Rajagopal, A., Dembia, C. L., DeMers, M. S., et al. (2016). *IEEE Trans. Biomed. Eng.*, 63(10), 2068-2079.

Human Activity Recognition: A Sensor-Based Approach to Understanding Sedentary Workspace Behavior

Rafael Santos Perez¹, Nancy Black¹

¹Université de Moncton

PROBLEM STATEMENT

Human Activity Recognition (HAR) is a fundamental research field applied in health, fitness and smart environments (Thottempudi et al., 2024). Data collection using wireless sensors allows us to identify sedentary behavior patterns and analyze their evolution over time. By integrating Machine Learning (ML) and deep learning techniques (Hussain et al., 2020) into HAR signal processing, we can overcome traditional method limits to understand postural evolution and work to reduce Musculoskeletal Disorder (MSD) risks associated with sedentary workplaces.

RESEARCH OBJECTIVE

To characterize and evaluate changes in activity patterns of individuals in sedentary workspaces when using a dynamic workstation, and how these relate to individual perception.

METHODOLOGY

Twenty office workers aged 18-60 without MSDs participated, experiencing four experimental conditions related to a dynamic workstation, DB. The supplied DB included an electrically adjustable table, under-the-desk bicycle, and smartphone app able to gamify dynamic usage. Conditions were: PRE, POST (before DB use and after removal), and using DB with and without gamification; DBG and DBN), each lasting five workdays. A daily survey collected perceived discomfort aspects and an ActiGraph GT9X Link sensor (worn on right thigh) captured posture category (walking, sitting, standing), acceleration, and step count. Analysis involved Open-Source Python 3.8.19, TimescaleDB-pg16, and Grafana-OSS for real-time visualization. Work hours were temporally filtered, and dynamic quantile distribution described individual behavior analysis, feature extraction (percentage of time sitting, standing, walking, and cycling), Unsupervised K-means clustered (Parada et al., 2016) with PCA for dimensionality reduction.

RESULTS

Distinct behavioral clusters emerged from the analysis. Significant changes were correlated with reduced perceived discomfort. Slight improvements occurred with minor activity changes.

DISCUSSION

Results indicate that perceptual changes in discomfort are linked to actual modifications in activity patterns rather than merely the presence of a dynamic workstation. The limitations include sample size. Future steps involve expanding the cohort and replicating data collection.

SUMMARY STATEMENT

Human Activity Recognition combined with Machine Learning provides deeper insights into sedentary workplace behaviors. Preliminary findings show the importance of real activity change over merely introducing dynamic workstations.

REFERENCES

- Hussain, Z., Sheng, Q. Z., & Zhang, W. E. (2020). A review and categorization of techniques on device-free human activity recognition. *J of Network and Computer Applications*, 167, 102738.
- Parada, R., Nur, K., Melià-Seguí, J., & Pous, R. (2016). Smart Surface: RFID-Based Gesture Recognition Using k-Means Algorithm. 2016 12th International Conference on Intelligent Environments (IE), 111-118.
- Thottempudi, P., Acharya, B., & Moreira, F. (2024). High-Performance Real-Time Human Activity Recognition Using Machine Learning. *Mathematics*, 12(22), Article 22.

Accommodating Psychosocial Stressors Throughout Pregnancy: A Call to Action

Jessie Shen¹, Anne-Kristina Arnold¹

¹Simon Fraser University

PROBLEM STATEMENT

Pregnant workers can be especially vulnerable to psychosocial stressors, yet current efforts to accommodate these workers are limited and unaligned. Provincial pregnancy-specific worker protection legislation differs nationwide, while current research targets third-trimester physical limitations, leaving two-thirds of the pregnancy and psychosocial stressors unaddressed.

RESEARCH OBJECTIVE

This paper investigates psychosocial stressors across trimesters, aiming to launch ergonomists into discussion and revisiting current approaches to accommodating pregnant workers.

METHODOLOGY

Exploratory research included analysis of Government of Canada population statistics, comparison of Occupational Health and Safety organization regulations, a review of the literature including textbooks and journal articles published after the year 2000 from Web of Science using search terms “ergonomics and pregnancy”, “trimester and symptoms”, and “pregnancy and stress”. Only English language sources were reviewed.

RESULTS / DISCUSSION

While the experience of pregnancy is varied, several psychosocial stressors were found to be prevalent. Financial strain is common as maternity/parental leave income often is not enough to cover expenses. Role strain is often experienced as the stigma around pregnant women working can increase hesitancy towards pregnancy disclosure. Moreover, Zou (2009) and Records & Rice (2007) reported high prevalence of depression throughout pregnancy. Despite the frequency of women working while pregnant and the impact of psychosocial stressors on worker wellbeing, there is little consistency between regulations and ergonomic guidance for pregnant workers, particularly in the first and second trimesters. This paper is novel by emphasizing the need to accommodate psychosocial stressors during these first two trimesters.

SUMMARY STATEMENT

Pregnancy can be a remarkably dynamic and personal experience. Ergonomists must be cognisant of and aligned in their approach towards psychological stressors throughout a pregnancy. Stressors are often multidimensional, and the same ergonomic interventions may not benefit everyone, thus individualization and frequent re-evaluation are necessary.

CITATIONS

Records, K., & Rice, M. (2007). Psychosocial correlates of depression symptoms during the third trimester of pregnancy. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 36(3), 231-242.

Zou, Y., Fan, F., Ma, A., Yue, Y., Mao, W., & Ma, X. (2009). Hormonal changes and somatopsychologic manifestations in the first trimester of pregnancy and post partum. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*, 105(1), 46-49.

Double standards: A systematic review of personal protective equipment for peace officers.

Hugo-Pier Simard¹, Martin Lavallière¹

¹Université du Québec à Chicoutimi, Lab BioNR et CISD

Introduction

The tasks performed by police patrol officers are highly varied and involve varying degrees of risk. To carry out their work safely, peace officers must wear personal protective equipment (PPE) such as bullet-proof vests and tools attached to their belts. Although necessary, the weight and design of this equipment can influence physiological response, performance and occupational tasks, biomechanics and mobility, as well as the subjective perception of users.

Objective

Few studies have sought to summarize the effects of PPE on the operational reality of law enforcement. Moreover, those that do exist (Hudson et al., 2024) do not always distinguish between equipment used by patrol officers and that used by specialized units (Robin et al., 2018). This review aims to specifically identify the effects of wearing personal protective equipment on the health, safety and occupational performance of patrol officers working in police organizations.

Method

The research question was formulated according to the PICO approach and the review was conducted in accordance with PRISMA guidelines, ensuring a rigorous, transparent and reproducible selection of relevant studies.

Research results

The results of this review shed light on the effects of personal protective equipment on patrolmen's working conditions. A total of 26 articles were selected. Data were categorized according to the type of equipment (bulletproof vest, belt, combined equipment) and the effects measured: physiological response, performance and occupational tasks, biomechanics and mobility, subjective perception.

Discussion

Ultimately, we hope that the article's findings will help identify possible solutions for optimizing the selection of individualized protective equipment for patrol officers. In this way, we hope to contribute to improving the day-to-day activities of police officers, and to influencing police organizations, as well as specialized occupational health and safety bodies, with data extracted from the scientific literature.

Citation

Hudson, S., Ridland, L., Blackburn, J., Monchuk, L., & Ousey, K. (2024). The comfort and functional performance of personal protective equipment for police officers: a systematic scoping review. *Ergonomics*, 1-21.

Robin, O., Ben, S., & Rodney, P. (2018). A Comparison of Military and Law Enforcement Body Armour. *International Journal of Environmental Research and Public Health*, 15(2), 339.

"Respirer" au travail : caractériser les stratégies individuelles et collectives pour tenir au fil du parcours professionnel en maintenance navale

Annaëlle Soulet^{1,2,3}, Catherine Delgoulet^{1,2}, Willy Buchmann^{1,2}, Guérande Jézéquel^{1,2}

¹Centre de Recherche sur le Travail et le Développement, 41 rue Gay Lussac, 75005 Paris ²Naval Group, Route de la Corniche, 29200 Brest

ÉNONCÉ DU PROBLÈME

La maintenance en condition opérationnelle (MCO) navale, est touchée par une intensification du travail : réduction des temps de cycles, standardisation des tâches et pression temporelle accrue. Dans ce contexte, de nombreux travailleurs par ailleurs déjà soumis à des conditions de travail difficiles (postures pénibles, espaces contraints...) se retrouvent à opérer des arbitrages entre santé et performance. Exposés à des facteurs d'usure d'origines plurielles, et pour prévenir des effets du travail sur la santé à court, moyen et long termes (Buchmann et al., 2018), ces travailleurs tentent de déployer des « respirations » à des échelles spatio-temporelles variées.

OBJECTIF DE RECHERCHE

Cette recherche vise à comprendre, à travers l'analyse de l'activité, comment ces travailleurs construisent leurs parcours professionnels au regard des conditions de travail passées, actuelles et futures pour agir en situation, organiser une vitalité des collectifs et préserver/construire leur santé.

MÉTHODOLOGIE

Une démarche de recueil en trois étapes est mobilisée : (1) des observations situées (Guérin et al., 1997) ont été réalisées auprès de deux équipes responsables de maintenir la structure des navires, (2) des entretiens semi-directifs (Guérin et al., 1997) avec 5 opérateurs ont été conduits pour comprendre les stratégies déployées pour construire leur parcours et (3) des données quantitatives issues de l'observatoire EVREST ont été exploitées (Molinié & Leroyer, 2011).

RÉSULTATS

Trois catégories de régulations sont identifiées à l'échelle des parcours professionnels : (1) les managers de proximité orientent les travailleurs en assurant un développement des compétences ; (2) Certains travailleurs aménagent des temps au fil de leur parcours professionnel pour acquérir de nouvelles compétences ; (3) D'autres tentent de supporter des conditions de travail intensives dans l'espoir d'une promotion qui garantirait une exemption de contraintes. Ces stratégies sont pensées collectivement et individuellement sur des empan temporels variés pour (se) préserver et projeter une santé.

DISCUSSION

Différentes « respirations » au travail semblent être aménagées tant pour soutenir une activité productive que développementale. Les respirations sont représentées dans des empan temporels variés allant de l' « ici et maintenant » aux parcours professionnels. Ce phénomène participe au développement et à la construction d'une santé projetée qui est imaginée et construite tant individuellement que collectivement pour faire face aux contraintes du système de travail.

DÉCLARATION SOMMAIRE

Cette recherche, menée en maintenance navale, participe à comprendre comment les travailleurs construisent leurs parcours professionnels. Sur la base de données exploratoires récoltées à l'aide d'une triangulation de données, nous mettons en évidence des « respirations » mises en place au sein des parcours professionnels pour assurer préservation et construction de la santé.

CITATION

Buchmann, W., Mardon, C., Volkoff, S., & Archambault, C. (2018). Peut-on élaborer une approche ergonomique du « temps long » ? *Perspectives interdisciplinaires sur le travail et la santé*, 20-1, Article 20-1.

Guérin, F., Laville, A., & Daniellou, F. (1997). *Comprendre le travail pour le transformer : La pratique de l'ergonomie*. Editions de l'ANACT.

Molinié, A.-F., & Leroyer, A. (2011). Suivre les évolutions du travail et de la santé : EVREST, un dispositif commun pour des usages diversifiés. *Perspectives interdisciplinaires sur le travail et la santé*, 13-2, Article 13-2.

Measuring the effectiveness of ergonomics microlearning

Carrie Taylor¹, Adam Elsdon², Taylor Sellick²

¹Taylor'd Ergonomics Incorporated, ²Region of Waterloo

PROBLEM STATEMENT

Ergonomics training typically aims to improve employees' ability to use the best technique for the job. Ultimately, the hope is that improved techniques will reduce the risk of injury. However, the effectiveness of training, and in fact, of better work practices, is rarely measured. Research has unsurprisingly shown mixed results; some research suggests that employees can be trained to use safer techniques, while others do not (Merino-Campos, 2025, Oakman et al., 2024).

RESEARCH OBJECTIVE

The goal of this study was to quantify the effectiveness of ergonomic work strategy training provided to care providers at a long-term care facility.

METHODOLOGY

Twelve ergonomic work strategies with coaching plans were selected from a library of available material that had previously been developed in collaboration with care providers. Twenty employees completed a baseline survey which quantified their ability to identify the best way to do a task, their end-of-day comfort (by body part), and their self-perceived productivity, quality, and employee engagement. Two members of the Corporate Occupational H&S team will facilitate the training with staff on one shift. At the end of each session, employees will rate the module on its usefulness. Following the 12 sessions, employees will complete a follow-up survey. The baseline and follow-up survey results will be compared.

RESULTS

The project will be launched on June 9 and the final module will be delivered by August 29, 2025. A previous pilot study with fewer survey respondents showed encouraging but not statistically significant improvements in ability to identify appropriate work practices and end-of-day comfort scores.

DISCUSSION

The use of confidential surveys, submitted electronically to a third party, allows participants to respond to questions that probably could not be asked directly by an employer.

The questions, "To what extent does your comfort affect your productivity...quality... engagement?" allowed the researchers to explore the potential improvement that could be realized if discomfort could be abated. This potential might be realized through various interventions, of which training is only one.

One limitation of this study was that we do not have a control group. A future study should stagger the start times of two groups, in order to explore the possibility that the improvements are based on the attention provided to the employees in the study group.

Ultimately, training will be considered successful if musculoskeletal injuries are prevented; however, this lagging indicator will take a long time to develop.

SUMMARY STATEMENT / SUMMARY STATEMENT

Measuring the effectiveness of ergonomic work strategy training allows employers to understand the strengths and limitations of this approach. The use of a survey, and attendance/feedback forms, provide quantitative data that can help employers to explore the return-on-investment for such training initiatives.

CITATION / CITATION

Merino-Campos, C., Enhancing Physical Education Through Gamification and Ergonomics: A Literature Review. Theor. Appl. Ergon. 2025, 1, 3. <https://doi.org/10.3390/tae1010003>

Oakman, J., Lambert, K., Rogerson, S., and A. Bell. We know it doesn't work: Why do we still use how to lift training for the prevention of musculoskeletal disorders? Int. J. Ind. Ergo. 100 (2024) 103542. <https://doi.org/10.1016/j.ergon.2023.103542>

Ergonomics Recommendations and Musculoskeletal Risk Factors in Ophthalmology An “Eye” to Applying Ergonomics Principles to The Clinical and Surgical World of Ophthalmologists

Connor Taylor¹, Karen Hoodless¹, Dr. Rookaya Mather ²

¹Fanshawe College, ²Ophthalmologist, Associate Professor at Western University’s Schulich School of Medicine & Dentistry, Ivy Eye Institute, St. Josephs Health Care London

Ophthalmologists report musculoskeletal disorders and injury linked to the physical demands of their work. A 2018 national survey revealed that approximately 61% of Canadian ophthalmologists experience work-related musculoskeletal pain. With the neck (46% of respondents), low back (36% of respondents), and shoulders (28% of respondents) are the most affected areas. Survey respondents indicated that these injuries impacted their ability to complete key components of their occupations such as, slit lamp examinations and surgery with an operating microscope. According to the literature, 6% of ophthalmologists reported requiring spinal surgery and 13% identified MSK symptoms as a reason for retirement. These findings highlight the significant need to address the risk of injury and promote strategies that support clinician health and career longevity. This project aims to develop a Best Practices document for ophthalmologists.

Through a combination of observational assessments, interviews with ophthalmologists, and a targeted survey, the project will evaluate ergonomic risks in clinical, surgical, and office-based environments, with the goal to identifying practical, evidence-based interventions that align with ergonomic guidelines and are tailored to the specific duties of ophthalmic work. We will share a summary of the survey, and identify the risks associated with one central duty performed by ophthalmologists, evaluating the use of the surgical microscope.

A Best Practices document will translate current research and expert knowledge into actionable guidance for ophthalmologists. It will help standardize safe work practices, reduce injury risks, and promote long term wellness across ophthalmologists and ultimately be expanded to include the duties of optometrists.

Keywords: ergonomics, ophthalmology, musculoskeletal injury, best practices, clinician wellness

Working as a Ergonomist in long term care industry

Aaron Gebhardt¹, Carrie Taylor¹

¹TEI

INTRODUCTION TO CASE STUDY

Working in Long-Term Care presents a unique set of challenges to ergonomists. These challenges may affect the ergonomist's ability to efficiently collect data and complete reports. The aim of the case study is to discuss common challenges faced in this unique work environment, and how to overcome them.

PURPOSE OF CASE STUDY

The purpose of this case study is to share experiences in completing physical and cognitive demands analyses in the long-term care and retirement home industry. The case study focuses on the unique challenges and solutions for data collection and report writing.

CONTEXT OF CASE STUDY

This paper discusses:

- The challenges of measuring the force demands associated with patient handling (lifts/transfers, repositioning) and patient interaction (dressing, bathing, etc.).
- How to use force matching for certain tasks (scrubbing, lifts and transfers)
- How to address patient sensitivity during photography
- How to measure force using clips (e.g. dressing residents, making beds)

OUTCOMES OF CASE STUDY

The goal of the paper will be to share techniques with ergonomists who are unfamiliar with the industry, in order to shorten the learning curve and improve efficiency of data collection and report writing.

DISCUSSION OF CASE STUDY

- Taking force measurements: The presentation will show how to use special force gauge attachments like clamps to measure pulls (e.g. sheets, soaker pads, clothing), and scales for push forces.
- How to address variability in resident anthropometrics: The presentation will discuss how and when to use large and small residents, or to use a consistent resident "stand-in" with known anthropometrics.
- Unique tasks in the industry: The presentation will share how to capture and report tasks such as resident transfers, dressing and personal hygiene.
- Sensitivity The presentation will discuss how to address resident privacy and safety. It is important to Ask family members, as well as the resident's permission to observe and collect data on sensitive/private tasks such as morning care (getting dressed, personal hygiene and toileting). If consent is not possible, the ergonomist can use a resident "stand-in" to mock-up tasks (e.g. squatting/bending to reach someone's leg in a shower chair).

SUMMARY STATEMENT

The presentation aims to enhance the efficiency of ergonomists working in the long-term care and retirement home industry, by sharing techniques for completing physical and cognitive demands analyses, addressing unique challenges, and optimizing

Ergo@Large: Réseau de l'industrie / Industry Network Table ronde interactive / Interactive round table L'Ergonomie de produits - Laissez-vous transporter! Product Ergonomics - Let yourself be carried away!

Jeanne Guérin^{1,2}, Richard Lefebvre³, Jasmin Ten Have⁴, Émilie Ferland³, Stéphanie Viau³

¹Ergo@Large, ²Ergonovix, ³BRP, ⁴Bombardier

Ce panel, proposé par Ergo@Large dans la série des rencontres du Réseau de l'industrie, sera notre troisième panel en présentiel présenté lors du congrès ACE National.

Ce panel propose une revue des processus et des pratiques en Facteurs Humains et Ergonomie lors de la conception de véhicules dans différents contextes d'usage. Nous discuterons des méthodes utilisées lors de la conception de véhicules aériens, urbains et récréatifs motorisés.

Voyez et constatez comment les méthodes peuvent différer tout en étant similaires ou complémentaires.

Comme à notre habitude, nous permettrons à l'audience d'échanger avec nos panélistes à différents moments ciblés lors de cette séance riche en contenu.

Forts de leur expertise et de leur expérience, nos experts discuteront des sujets suivants:

- 1- Philosophie du Design (Innovation - Fonctionnalité - WOW)
- 2- Comment l'ergonomie s'inscrit dans cette philosophie
- 3- Définition de l'Ergonomie dans le domaine du Transport = Ergonomie de développement de Produits
- 4- Étapes de développement d'un produit de l'idéation à la conception à la validation
- 5- Exemples de ces étapes dans divers domaines d'application en transport (Aérospatial, Véhicule d'intervention d'urgence, Produits récréatifs et à mobilité urbaine motorisés et non motorisés, ...)
- 6- Qu'en est-il de l'Ergonomie Cognitive ou l'ergonomie d'interface Usager (HMI - UX/UI)
- 7- Outils de modélisation, de développement et de validation (incl. Mannequins virtuels, Prototypes de validation statique et de validation dynamique, AR/VR, AI, ...)
- 8- Exemples d'applications concrètes dans les contextes d'usage ciblés
- 9- Éléments clés à retenir
- 10- Sommaire et Conclusion

Vous embarquez avec nous!...

Using competition to engage workers in learning about ergonomics

[Christina Timmons¹](#), [Carrie Taylor¹](#), [Alex Da Rosa¹](#)

¹Taylor'd Ergonomics Inc

Using competition to engage workers in learning about ergonomics

INTRODUCTION TO CASE STUDY

Ergonomics can be a dull lecture topic. Most industrial workers have heard about the classic “force-posture-repetition” hazard combination, and office workers are tired of reading about the 90-90-90-degree angles. But if you can introduce learning as a competitive game, you can re-engage workers in the process and make ergonomics training fun!

PURPOSE OF CASE STUDY

The purpose of transforming “lecture-based training” and “poster-style awareness content” into competitive games was to improve engagement amongst workers and, ultimately, to create behaviour change amongst employees, by proving that ergonomics works.

CONTEXT OF CASE STUDY

This case study presents two competitive games that were used instead of traditional classroom ergonomics training: one in an office environment and another in an industrial environment.

OUTCOMES OF CASE STUDY

Office participants were asked to complete a typing task in a deliberately awkward posture, at a computer workstation that was not adjusted to fit the worker. Industrial participants were asked to perform a series of strength challenges, using a bathroom scale. The tasks were set up as a “game” to enhance the enjoyment of the exercise. After completing the tasks, participants scored their comfort, productivity, work quality, and job satisfaction, on a 10-point scale. They improved the ergonomics of their “work” environment and repeated the exercises and ratings. A spreadsheet was used to calculate the improvement in the scores, between the “bad” and “good” conditions. Over the course of the day, a leaderboard displayed the names of the players with the “most improved” scores, and at the end, the top three participants were rewarded.

DISCUSSION OF CASE STUDY

Participants can clearly recognize the impact that ergonomics has, not only on their comfort (which they expect), but also on their performance and how they feel about their jobs. In this regard, the training is very impactful. The spreadsheet created at the end of the day became a valuable piece of evidence for the safety managers, clearly displaying the potential for ergonomics to positively impact the workplace. We have learned that the success of the session does rely, to some extent, on the facilitator, who must enthusiastically draw participants into the session, clearly describe the tasks, and ensure that participants follow consistent rules. The facilitator must always ensure that participants make the mental connection between changes made to optimize game performance, and changes that could be made to optimize real-world work performance.

SUMMARY STATEMENT

Using competitive games to promote ergonomics work practices can engage more workers and demonstrate the value of ergonomics beyond musculoskeletal injury prevention. These practices can apply to management training as well.

Évaluation d'un exosquelette de soutien des membres supérieurs en chirurgie plastique: revue narrative et cadre méthodologique

Yaniel Torres^{1,2}, Alfredo Patrón¹, Ornwipa Thamsuwan², Edgar Correa³

¹Universidad de Antioquia, ²École de technologie supérieure, ³Junta Regional de Calificación de Invalidez de Antioquia

ÉNONCÉ DU PROBLÈME

Les chirurgiens plasticiens sont exposés à des contraintes biomécaniques : postures statiques, flexion du tronc, élévation des bras et gestes répétitifs. Ces facteurs sont associés à une forte prévalence de troubles musculosquelettiques (TMS), atteignant 73 % au Canada et affectant leur performance (Tobias et al., 2024). Les exosquelettes pourraient constituer une solution ergonomique prometteuse, mais leur application en milieux chirurgicale demeure peu explorée.

OBJECTIF DE RECHERCHE

Cette étude vise à proposer une méthodologie pour évaluer l'efficacité d'exosquelettes chez les chirurgiens plasticiens, à partir d'une synthèse des connaissances actuelles.

MÉTHODOLOGIE

Une revue narrative de la littérature a été réalisée à partir de bases de données scientifiques (PubMed, Scopus, ScienceDirect). Les articles sélectionnés traitaient de la prévalence des TMS chez les chirurgiens plasticiens et des essais d'exosquelettes en milieu médical. Sur cette base, un protocole expérimental a été proposé, combinant mesures objectives et mesures subjectives.

RÉSULTATS

Les essais d'exosquelettes en milieu chirurgical sont rares, mais suggèrent un potentiel de réduction de la charge physique sans compromettre la précision gestuelle. Le protocole proposé utilise l'électromyographie (EMG) comme mesure objective, ainsi que des outils subjectifs : un questionnaire de symptômes musculosquelettiques, l'échelle de Borg pour l'effort perçu et le System Usability Scale pour l'évaluation de l'utilisabilité.

DISCUSSION

L'approche proposée constitue une première étape vers une adaptation rigoureuse des exosquelettes au contexte chirurgical. Les prochaines étapes incluent un essai pilote au Canada et le test de l'exosquelette Hapo FRONT lors d'une tâche simulée de liposuccion, en Colombie.

DÉCLARATION SOMMAIRE

Le projet met en lumière la prévalence élevée de TMS chez les chirurgiens et propose un protocole pour évaluer l'efficacité des exosquelettes dans la réduction de la charge physique.

CITATION

Tobias, G., Dodd, S. X., & Wong, J. N. (2024). A Survey of Occupational Musculoskeletal Symptoms Among Canadian Plastic Surgeons and Trainees. *Plastic Surgery*, 32(4), 722-727. <https://doi.org/10.1177/22925503231169778>

Anthropometric-Based Regression Modeling for Optimal Driver Seat Adjustment

Aliyu Saifullah Vandana¹, Dr. Eunsik Kim¹

¹ Mechanical, Automotive, & Materials Engineering, University of Windsor, ON, Canada

PROBLEM STATEMENT

Suboptimal drivers posture due to misaligned seat adjustments has been linked to fatigue, poor driving performance, and increased risk of musculoskeletal disorders. Conventional seat adjustment systems do not account for individual anthropometric variations, resulting in non-ergonomic seating configurations. This study addresses the gap by investigating how anthropometric measurements can inform a systematic model for optimal seat adjustment in vehicles. The challenge is to develop a model that maps body dimensions to seating configurations while preserving optimum ergonomic joint angles and field of view (FoV) requirements.

RESEARCH OBJECTIVE

The objective of this research is to develop a regression-based model that accurately predicts optimal driver seat settings based on anthropometric measurements. The model integrates ergonomic joint angle targets and visual field constraints to establish optimal postures.

METHODOLOGY

A regression modeling approach was employed using regression techniques to map anthropometric measurements to seat adjustment constrained by ergonomically optimal joint angles and field of view. A set of derived equations accounts for optimal biomechanical joint angles and visual constraints. Experimental data were used to validate the model.

RESULTS

The regression-based mapping function produced accurate predictions of seat adjustments for given anthropometric inputs. Model outputs maintained optimal joint angles within acceptable ergonomic ranges and integrated a field-of-view constraint that effectively regulated seat height and backrest angle.

DISCUSSION

The study confirms the feasibility of using regression models to personalize seat settings based on anthropometric profiles. The primary limitation lies in the availability of labeled dataset that considers various anthropometry. Strengths include its practical relevance and integration of biomechanical constraints. Future work will focus on real-time implementation in automotive interfaces and cross-validation with experimental driver posture data.

SUMMARY STATEMENT

The proposed regression model personalizes driver seat adjustments based on body measurements and aligns posture with ergonomic joint angles and optimal eye height for safe driving. Attendees will gain insights into data-driven ergonomic modeling and its real-world automotive applications.

CITATION

- Kyung, G., & Nussbaum, M. A. (2009). Specifying comfortable driving postures for ergonomic design and evaluation of the driver workspace using digital human models. *Ergonomics*, 52(8), 939-953.
- Park, S. J., Lee, J.-W., Kwon, K., Kim, C.-B., & Kim, H. (1999). Preferred driving posture and driver's physical dimension. SAE Technical Paper Series. SAE International.
- Reed, M. P., Manary, M. A., Flannagan, C. A. C., & Schneider, L. W. (2000). Effects of vehicle interior geometry and anthropometric variables on automobile driving posture. *Human Factors*, 42(4), 541-552.

OPTIMISATION DE L'HABITACLE DES AUTO-PATROUILLES GRÂCE À L'ERGONOMIE ET AU DESIGN INDUSTRIEL

Patrick Vincent¹

¹DESS, CCPE, WELL AP

INTRODUCTION À L'ÉTUDE DE CAS

Améliorer l'ergonomie et la productivité des patrouilleurs et des équipes d'installation lors de la révision des habitacles des véhicules de patrouille.

BUT DE L'ÉTUDE DE CAS

Le but de cette intervention consistait à améliorer l'ergonomie de l'aménagement intérieur des auto-patrouilles d'un service de police d'importance au Québec, le tout à l'occasion de la révision de l'écosystème des habitacles des véhicules de patrouille.

CONTEXTE DE L'ÉTUDE DE CAS

Notre intervention a débuté par une réunion de démarrage afin de préciser les paramètres du projet. Puis, nous avons documenté les scénarios d'usage et défini les besoins généraux, fonctionnels et techniques. L'habitacle de deux modèles de véhicules a été numérisé afin d'optimiser la conception d'une console universelle. En parallèle, une étude des systèmes existants et d'organisation de référence a été réalisée. Le raffinement de la solution a été possible grâce à la fabrication de prototypes fonctionnels et la tenue d'un banc d'essai.

RÉSULTATS DE L'ÉTUDE DE CAS

Notre intervention a permis d'optimiser l'aménagement intérieur des auto-patrouilles afin de répondre autant aux besoins d'une population allant du 5^e percentile femme au 95^e percentile homme. L'étude a permis de développer un devis technique et de fabriquer une console centrale ergonomique et universelle. La console est dite universelle car elle s'adapte aux deux modèles d'auto-patrouille les plus utilisés. Le design de la console permet aussi de réduire substantiellement le temps d'installation rendant l'équipe d'installation plus productive.

DISCUSSION DE L'ÉTUDE DE CAS

La démarche combinée en ergonomie et en design industriel, appuyée par la numérisation 3D et la modélisation, a permis une solution optimale. Un essai en situation réelle aurait renforcé les résultats.

DÉCLARATION SOMMAIRE

L'intervention a amélioré les conditions de travail et la productivité grâce à une approche interdisciplinaire. Les ergonomes gagneraient à collaborer davantage avec d'autres experts pour enrichir leurs solutions.

CITATION

Vincent, P., & Thibault, E. (2013). L'aménagement du véhicule de patrouille : sous la loupe de l'ergonomie [Pdf]. Association paritaire pour la santé et la sécurité du travail, secteur « affaires municipales », APSAM, et Association paritaire pour la santé et la sécurité du travail, secteur « administration provinciale », APSSAP.

LA CERTIFICATION WELL : LEVIER OU FREIN POUR L'ERGONOMIE?

Patrick Vincent¹

¹DESS, CCPE, WELL AP

INTRODUCTION À L'ÉTUDE DE CAS

Assurer l'atteinte de prérequis en ergonomie dans le cadre de la certification WELL des futurs bureaux d'une firme d'architecture et de design.

BUT DE L'ÉTUDE DE CAS

Le but de cette intervention consistait à atteindre les prérequis en ergonomie de la certification WELL des futurs bureaux d'une firme d'architecture et de design.

CONTEXTE DE L'ÉTUDE DE CAS

La firme d'architecture et de design souhaitait revoir l'aménagement de ses futurs bureaux à l'occasion d'un déménagement. Visant notamment une certification LEED et WELL, le projet comportait plusieurs objectifs santé et environnementaux. Notre mandat consistait à valider l'ergonomie du mobilier existant et à sélectionner certains nouveaux mobiliers et accessoires. En plus d'intervenir à la conception des lieux, notre mandat consistait à mettre en place de bonnes pratiques en matière d'ergonomie durant l'opération du bâtiment.

RÉSULTATS DE L'ÉTUDE DE CAS

Notre intervention a permis de récupérer plusieurs mobiliers aidant le client à atteindre ses objectifs ergonomiques et environnementaux. Tous les mobiliers et accessoires ergonomiques, récupérés ou achetés, répondent à la norme CSA Z412-17. Une formation en ligne sur l'ergonomie au bureau a été développée afin de permettre aux utilisateurs de mieux gérer la fatigue musculosquelettique et oculo-visuelle.

DISCUSSION DE L'ÉTUDE DE CAS

L'intervention a été facilitée par les objectifs ambitieux du client et l'expérience de ce dernier dans la réalisation de ce type de projet. La conciliation des objectifs ergonomiques et environnementaux a occasionné certains compromis. La volonté de récupérer du mobilier existant et l'exigence minimale dans la certification WELL en ce qui a trait aux postes assis-debout (25% minimum) n'ont pas permis d'offrir des postes assis-debout partout.

DÉCLARATION SOMMAIRE

Les exigences des systèmes d'évaluation tel que LEED ou WELL poussent la majorité des clients vers des environnements de travail plus ergonomiques. Cependant, il arrive que les prérequis minimums à atteindre deviennent l'objectif sachant que le dépassement de ces prérequis minimums n'offre pas plus de point dans le système d'évaluation. L'ergonome doit comprendre cette dynamique d'optimisation (et non de maximisation) de l'ergonomie pour aider son client à atteindre ses multiples objectifs.

CITATION

International WELL Building Institute (IWBI). (2020). WELL Building Standard v2. Movement Concept

DEVELOPMENT AND ANALYSIS OF NONLINEAR COUPLED MODEL OF THE HUMAN HAND ARM AND GLOVE SYSTEM

Yumeng Yao¹, Subhash Rakheja¹

¹Department of Mechanical and Industrial and Aerospace Engineering, Concordia University, Canada

PROBLEM STATEMENT

Prolonged exposure to hand-transmitted vibration has been associated with array of occupational injuries such as vibration-induced white fingers and musculoskeletal disorders. Anti-vibration (AV) gloves are considered as the most convenient way to attenuate the vibration and reduce the health risk. The effectiveness of the AV gloves is generally evaluated via the standardized method defined in ISO 10819, while this method ignores the vibration transmission from tool to fingers and considers the vibration transmission to the palm only, even though the fingers' transmissibility has been reported significantly differ with that of palm.

RESEARCH OBJECTIVE

This study aims to develop a nonlinear coupled hand-arm system model with glove system to characterize the distributed vibration responses and to evaluate the vibration isolation performance of different anti-vibration gloves under different work conditions.

METHODOLOGY

A total of 10 different AV gloves were selected and their materials properties were characterized under quasi-static and dynamic conditions. The force-displacement and force-velocity curves were plotted, which are used to develop a Bouc-Wen hysteresis model of gloves. Fifteen subjects were participated in the experiments to measure the distributed vibration transmission at palm and fingers of the hand with and without AV gloves. The experimental data are used to assess the vibration attenuation performance of AV gloves and to develop a gloved-hand-arm biomechanical model. The model parameters were identified by minimizing the error between the experimental and predicted data via a Particle Swarm Optimization (PSO) algorithm.

RESULTS

The validation of the nonlinear gloved-hand-arm model against experimental data at both the palm and fingers highlights its ability to accurately capture distributed vibration responses in the coupled glove-hand-arm system.

DISCUSSION

study demonstrates the importance of considering finger-level responses, where vibration attenuation characteristics were found to differ substantially. This provides new insight into the complex dynamics of glove-mediated vibration transmission, particularly under varying work conditions.

SUMMARY STATEMENT

This study systematically developed and validated a nonlinear biomechanical model for the human arm coupled with anti-vibration gloves, starting from the nonlinear glove material modeling. This framework forms an advanced evaluation method for assessing the vibration isolation performance. The proposed model can not only improve the accuracy and reliability of predicting dynamic responses in hand-arm vibration transmission but also provide a solid theoretical foundation and technical support for performance optimization, customized design, and practical application of anti-vibration gloves.

THE EFFECT OF MEASURED LOCATIONS ON SEAT-TO-HEAD VIBRATION RESPONSES OF A SEATED HUMAN BODY

Yumeng Yao¹ Subhash Rakheja Ramin Sedaghati

¹Concordia University, Department of Mechanical, Industrial and Aerospace Engineering, Canada

PROBLEM STATEMENT

The head-transmitted vibration can result in not only short-term adverse health effects but also long-term health disorders, such as neck pain, a critical factor that can shorten the career span and compromise tracking performance of individuals exposed to WBV, such as vehicle drivers. The aircrew members of rotorcrafts are particularly exposed to WBV dominant near the fundamental vibration mode of a seated body (4-6 Hz). A number of studies have shown detrimental effects of such vibration on disorders of the head-neck complex (HNC), such as acute neck pain, apart from discomfort and compromised mission performance, which have been attributed to vibration responses of the HNC to seat vibration. The head-mounted devices, including helmet, night vision goggles, and counterweights used by the pilots/crew members further accentuate the effects.

RESEARCH OBJECTIVE

This study experimentally investigates seat-to-head vibration transmissibility (STHT) characteristics of seated human subjects exposed to vertical whole-body vibration (WBV), using various measurement systems mounted at different positions on the head.

METHODOLOGY

A novel experimental approach was designed to simultaneously measure the STHT at three different locations on the head, namely: the mouth level (Bite bar), forehead (Forehead-band), and top of the skull (Head-band). Measurements were performed with five male participants exposed to three levels of random vertical vibration (RMS acceleration: 0.25, 0.50, and 0.75 m/s²) in the 0.5 to 20 Hz frequency range, considering two sitting conditions (with and without a back support). The data were acquired and analyzed to derive STHT responses along three translational axes (fore-aft, vertical and lateral) and two rotational (pitch and roll/yaw) directions. Statistical analyses were further conducted to investigate the significance of measurement location, sitting condition and vibration excitation levels on the STHT.

RESULTS

The effects of measurement location and sitting condition were particularly significant on the fore-aft and vertical STHT, while the magnitude of vibration excitations showed only a softening tendency, with only a minor effect on STHT magnitude.

DISCUSSION

The findings showed notable effects of measurement locations on the measured STHT responses. This is likely the primary cause of wide variabilities observed among the STHT responses reported in different studies.

SUMMARY STATEMENT

This study demonstrates that vertical excitations predominantly excite sagittal plane responses, with a consistent head-neck pitch center located near the C7 vertebra. Furthermore, variations in measurement location, sitting condition, and vibration magnitude were shown to affect sagittal resonance peaks and reveal a body softening effect, underscoring the importance of accounting for posture and input level in seated human vibration studies.

L'humain : au cœur des interventions ergonomiques
The heart of ergonomic interventions: People

