ACE 2022 Virtual Conference notes **Completed by: Katie Lonsdale**

1. **Value Added Roles of the Science and Practice of Ergonomics and Human Factors in 2022 and Beyond – Nancy Black (Keynote Speaker)**

There are various resources available that can aid us in our ergonomic evaluations:

- Peer Reviewed Journals
    - Applied Ergonomics: Human Factors in Technology and Society
    - Ergonomics: The International Journal of Research and Practice in Human Factors and Ergonomics
    - Ergonomics in Design (highly recommended by speaker)
    - Human Factors: The Journal of the Human Factors and Ergonomics Society (HFES)
    - International Journal of Industrial Ergonomics
    - Le Travail Humain (bilingual)
    - Pistes: An Interdisciplinary Journal About Work and Health (Bilingual)
    - IISE Transactions on Occupational Ergonomics and Human Factors
    - Theoretical Issues in Ergonomics Science
    - Work: A Journal of Prevention, Assessment & Rehabilitation
- Free Online Resources
    - Ergonomics Canada Magazine
    - Chartered Institute of Ergonomics and Human Factors (CIEHF)
    - International Ergonomics Association (IEA)
        - E-posters
        - HFE Tools – https://iea.cc/ergonomics-in-practice/tools-for-assessing-and-implementing-hfe-in-the-workplace/
            - Google Spreadsheet on this website with various different resources
        - COVID-19 Resources – https://iea.cc/covid-19-resources/
- International Ergonomics Association (IEA) Publications
    - Ergonomic Checkpoints
    - Ergonomic Checkpoints in Agriculture
    - Principles and Guidelines for Human Factors/Ergonomics (HFE) Design and Management of Work Systems
    - Ergonomic Checkpoints in Health Care Work
    - EQUID Design Process Guidelines
- Anticipated Publications
    - Ergonomics in a Nutshell for Project Managers Supervisors (2023)
    - Ergonomics in a Nutshell for Labour Organizers (2024)
- Publications recognized by the IEA will be controlled for quality
    - https://iea.cc/

2. **MSD Exposure Assessment – Current Practices and What the Future May Have in Store – Steve Fischer**

- Majority of tools used for ergonomic assessments are catered to single task analysis
- The purpose of this study is to try and identify tools that can be used to analyze multi-task work and/or determine ideal qualities that these tools should have
- Study surveyed ergonomic and safety professionals to try and determine which tools are currently being used
    - NIOSH was the most commonly used tool amongst professionals
    - Snook, RULA, REBA were also in the top 5
- Current literature shows that tools used for multi-task work are related to mechanical damage (i.e. compression, shear, tension) and/or muscle damage (i.e. fatigue)
    - Damage and recovery times may be different between mechanical and muscular
- Some tools the currently assess multi-task work include:
    - LiFFT
    - DUET
    - The Shoulder Tool
    - Recommended Cumulative Recovery Allowance (RCRA)
- Conclusions
    - MSDs from mechanical damage vs. muscle fatigue may have different time dependencies
    - Tissue type and mode of loading matter when considering accumulation and recovery
        - High order "risk" metrics may be insufficient
    - There is currently limited availability of tissue/mode of loading specific tools
    - Additionally, tools that inform muscle fatigue accumulation and recovery times are limited
- Some non-invasive direct measurement tools exist (i.e. TuMeke Ergonomics, VelocityEHS AI Tools)
    - These tools use pose estimation to determine postures
    - Video-based pose estimation may play a key role in developing a multi-task tool
        - Can be used in combinations with single task evaluations (i.e. force measurements) to determine joint torque, muscle fatigue, etc.

3. **Proprioception Measures on Heavy Lifting – Daniel Armstrong (PhD Presentation)**

- Investigate different ways to reduce injuries associated with heavy lifting
- Paramedics cannot eliminate or substitute the risk
    - Engineering controls are also not always feasible
    - As a result, they typically rely on administrative controls
- Literature from 2020 found that administrative controls were not effective in reducing injury risk for lifting (i.e. instructing workers on proper lifting techniques)
- Motor control based administrative interventions may be effective in changing worker behaviour
- Wanted to investigate why some people work in ways that minimize exposure to the body
    - How can we change biomechanical exposure on the body?
- Hypothesis – Increase in proprioceptor information results in a decrease in low back loads
- Study had paramedic, trained individuals, and novice participants
    - Had participants lift weight in vertical direction to determine max strength
    - Then instructed individuals to either perform a self-selected posture, squat, or stoop
- Hypothesis was supported and it was found that an increase in proprioceptive ability seems to bias motor control on lower back loads
- Additionally, literature suggests that proprioceptive ability decreases with fatigue (i.e. repetitive lifting)

4. **Lessons Past and Future… A Journey Through Ergonomics – Gary Dennis (Keynote Speaker)**

- ManTRA – Manual Task Risk Assessment Tool
- PErforM – Participative Ergonomics Research Tool
    - Lesson learned – importance of practical training and visual engagement tools
    - Paper based tool – scale of 1-5 for force, posture, repetition
    - Provides guides for which countermeasures should be implemented
    - Originally used for coal mining
- PECivCon – Participative ergonomics tool for civil construction workers
    - Proved that paper-based tools tend to be difficult to use
    - Lesson learned – need to engage all parties at the start and define responsibilities
- Train Facilitators – Participative Ergonomic Approach
    - Lesson learned – need to engage all levels of management and have practical ongoing training for facilitators
    - Having senior management buy in is very important

- Advanced and specialized analysis can be useful for appropriate projects but is not always essential to develop controls for many tasks
- Development of ErgoAnalyst tool (risk assessment tool)
    - Having a centralized online database is essential for large companies
    - Need to select the right facilitators and embed the system within the corporate process
- In order to effectively manage MSD risks we need to consider:
    - How does an MSD injury really occur?
    - How can we use knowledge to design work that decreases the risk of injury while maximizing health and performance?
    - How can we do this easily and effectively?
- We know there are 5 factors that can cause an MSD
    - Exertion (internal force and speed)
    - Posture (awkward postures exponentially increase risk)
        - Thresholds are body part specific
    - Movements (repetitive or static)
        - Repeated identical or similar movements matter
    - Exposure (duration vs. recuperation)
    - Environment (heat, cold, vibration, etc.)
        - There is an app to measure whole body vibration using accelerometers within a phone
- Used ErgoAnalyst to evaluate risk of tasks
    - Tool can help identify high risk body areas based on risk factors
    - Sometimes we have a green risk that results in injury risk avoidance and improving health and performance (i.e. going to the gym)
- What is participative ergonomics? Who needs to be involved?
    - Maximizes the effective involvement of workers as task experts
    - Workers need to be involved with developing effective controls
    - Workers need to take ownership of controls
    - Management needs to provide support for the process and to implement controls
    - Facilitators (i.e. ergonomists) are experts who assess risks and lead the participative process
    - Manufacturers know available controls and drive (action) implementation of controls
- How do we implement participatory ergonomics as effectively as possible?
    - 6 step process
        - Training → Identify and Prioritize Hazardous Manual Tasks → Assess Risks → Develop and Evaluate Controls → Implement Controls → Assess and Review the Residual Risk
        - Cyclical process
    - It is important to share the solution to highlight before and after scenarios
- How do you measure success of an ergonomics program?

    - Lag Indicators
        - Decrease in injuries
        - Increase in productivity
        - Increase in work culture
    - Lead Indicators
        - Controls implemented (i.e. pre-post reports)
        - Job analysis reports
        - Workplace analysis reports
    - Use lead indicators to predict risk of injury rates
- How can we effectively decrease the risk of injury whilst maximizing health and performance?
    - Design controls (decrease load and/or increase tissue capacity) via participative ergonomics
- How can we get results as easily and effectively as possible?
    - Systemic approach with shared solutions

5. Integrating HFE into Healthcare Systems Simulations for Better Work and Better Care

- Nursing work is difficult to analyze with conventional human factors methods
- Study looks into stimulation as a method to analyze nursing work
- System Dynamics Modelling – Patrick Neumann
    - Constant cycle of job design (workload) impacting fatigue which impacts error
    - This model help managers understand workload results on quality
    - Results of study
        - Peak nurse fatigue increases through the work week if nurses are unable to recover in between shifts
        - Lag between peak fatigue, burnout, and absenteeism
        - Increase in work load results in a decrease in recover which results in an increase of errors
        - As more burnout nurses take time off, fewer burnt out nurses remain at work
        - A decrease in fewer burnt out nurses results in a decrease in errors and an increase in quality of care
        - Early RTW = increase in errors and burnout rates
- Discrete Event Simulation (DES) – Sadeem Qureshi
    - Represent complex structures of a system as a sequence of ordered event and stages, in which variables change at a discrete set of points
    - Quantify effects of operational decisions of workload and quality of care
    - Can factor in walking patters, layout, logic decisions, priority sequence for patients
    - Can test different scenarios (i.e. 12 hour shift with and without breaks)

        - Model found that nurses doing 14 hours of work in a 12 hour shift (pre-pandemic)
    - After COVID used the model to map out the workday
        - Found that nurses with 5 COVID positive cases spent ~6 hours a shift to don/doff PPE
        - Average nurse spends ~4 hours to don/doff PPE during a shift
        - More COVID cases = a decrease in care time and quality of care
        - Nurses now have less time during a shift to perform work tasks due to time spent donning/doffining PPE
    - Model has the capability to test different technical designs and operational policies
    - Model helps to identify impact on nurse workload and quality of care
- DES with Biomechanical Load and Fatigue – Michael Greig
    - DES shows task time and sequence information but misses biomechanical data
    - Ability to add in physical workload to the model to asses loads on joints
    - Found that there was a decrease in lumber spine compression when you increase the number of COVID patients
        - More time was spent donning/doffing PPE which put less load on the back
        - Same pattern seen in shoulders
- In summary, there are different levels of models
    - System Dynamics (macro)
    - DES (unit level)
    - Biomechanics (body of the individual)

6. The Art and Science of Ergonomics: Examples from Policing (Tanya Morose & Dwayne VanErd)

- Evidence Based Research = Practitioner + Best Available Research Evidence + Worker Experience
- We need to get creative to provide solutions to problems that don't fit guidelines and standard assessments (i.e. policing work)
- For police officers their cruiser is their office
    - Work is extremely variable
    - 8-12 hr shifts (365 days a year)
    - Have to wear heavy PPE (vest and duty belt)
- We cannot eliminate or substitute concerns
    - Engineering controls are also usually difficult to implement
    - Often left with training, stretching, and PPE
- Research study conducted – Synthesizing current RTW programs in policing
    - There are few studies regarding RTW programs in policing

    - First stage of study was to gather current RTW practices and experiences through interviewers
    - Gathered a variety of participants who had different injury types (physical, psychological, or a combination)
        - A lot of workers had a combination of physical and psychological injuries
- Results of study
    - Context
        - RTW can be challenging
        - Injuries can be complex
    - Culture
        - Hierarchical (chain of command)
        - Stoicism (injury = weakness)
        - Stigma
- 3 RTW Practice Themes
    - Accommodation
        - Takes time and effort to recover
        - Challenging to find meaningful work based on availability of work and restrictions
    - Communication
        - Genuine and timely communication is important
        - RTW process requires clarity and consistency
            - RTW process did not work well for people with mental health and psychological injuries
            - Worked better for physical injuries
        - Need to have a balance between flexibility and consistency
    - Trust Building
        - Lack of confidentiality
        - Perceived malingering (thinking people are taking advantage of the system)
        - Lack of trust (HR and wellness)
            - Fear that reporting an injury or taking time off would interrupt a career
- RTW guide for Ontario police services has been developed based on research results
    - https://www.iwh.on.ca/publications/rtw-in-policing-time-to-act
- How do we support and quantify job demands with highly variable workplace demands?
    - Need to give meaningful work (some workers don't think that desk work is meaningful work, however it could be)
    - Use JDD's to determine placement – this can be challenging based on the variability of work
- Considerations for complex, non-cyclical work
    - Document review prior to assessment
    - Staff sergeant/superintendent interviews
    - Onsite worker shadowing and interviews (multiple days)

    - Task variability (shift, division)
    - Comprehensive task descriptions
    - Report interpretation
- Use a prevention based approach to support psychological H&S and worker well being