



# Work-related Musculoskeletal Disorders Case studies



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**HFESA**

Human Factors & Ergonomics  
Society of Australia Inc.



# Safety in design for prevention of Work-related Musculoskeletal Disorders (WMSDs)

Case Study 2 – Bindi (dump master waste bin transfer)

# Human-centred design, human factors & ergonomics



Human-centred design is an approach to interactive systems development that aims to make systems useable and useful by focusing on the users, their needs and requirements, and by applying human factors / ergonomics. And usability knowledge and techniques. This approach enhances effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance”

*Ergonomics of human-system interaction – Part 210: Human-centred design for interactive systems (ISO 9241-201:2019, pp. vi)*

“A manual task should be designed to fit the people doing the task, not the opposite where the worker has to make adjustments to fit the task. Ergonomics involves consideration of the variability in human capacity and an understanding of how people interact with the work environment, tools and equipment”

*Hazard Manual Tasks Code of Practice (SWA 2018, pp. 51)*

“The essence of human factors is design from the perspective of the user; the systems approach to ergonomics typically considers interactions between the person, the tasks being performed, the tools/equipment being used, the environment in which the work takes place, how the work is organised and ‘wider’ issues such as the culture of the company (Horberry et al., 2010). The emphasis is on changing work systems to suit people, rather than requiring people to adapt to work systems. As such, user-centred design aims to meet the needs and capabilities of end users.

*An Introduction to User Centred Safe Design 3.4.2 BoK July 2019, pp. 20*

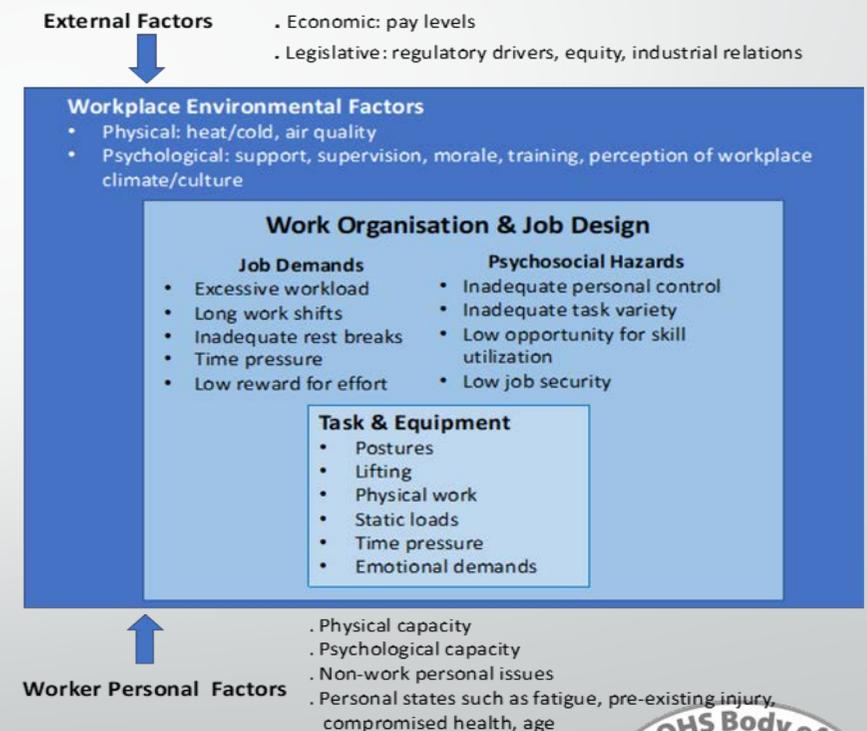
# Human Factors and Ergonomics (HFE)



- Repetitive tasks with overuse of the same muscles and ligaments while trying to adjust to static furniture or equipment can cause discomfort and strain the body over time.
- The effects of even slight visual or physical discomfort are compounded in such situations, leading to decreased user comfort and focus.
- Human factors & ergonomics is about the fit between the user and the work environment, equipment used and device installed. The intent is to reduce physical strain and maximise comfort and safety.

Examples to consider for a customer checkout include

- Visual ergonomics – team member:customer interface.
- Bench height – to accommodate user demographic.



# HFESA Position Statement



Work-related Musculoskeletal Disorders (WMSDs) may affect any worker and can result in debilitating life-changing consequences along with significant cost impacts on businesses and the Australian economy, costing billions of dollars annually.

WMSDs are a significant workplace problem, representing the highest category of serious workers' compensation claims for Australian workers.

Factors that are known to influence the development of Work-related Musculoskeletal Disorders (WMSDs) involve a combination of physical as well as psychological and / or social (psychosocial) hazards. Their level of influence varies depending on the task and equipment involved, the way in which work is designed and organised, the workplace environment and the worker profile.

Physical hazards include high force, awkward postures, repetition, long duration, fatigue and vibration. Psychosocial hazards include high job demands, low job control, high job strain, low social support, low job satisfaction and low job security. Personal characteristics such as age, pre-existing physical and psychological conditions may impact personal WMSD risk.

The Human Factors and Ergonomics Society Australia (HFESA) recommends that a holistic systems-based approach be taken to establish the workplace WMSD risk profile. In doing this, risk management strategies need to be comprehensive and include identification and then control of physical and psychosocial hazards. Participation of workers and managers in the process is fundamental to ensure the process accurately captures the most relevant hazards and the controls are appropriate for the work. A suitably qualified professional such as a Certified Professional Ergonomist can provide assistance to implement a comprehensive risk management process.

The HFESA has prepared this position statement to clarify some key issues related to WMSD management which takes into account contemporary evidence how to address this complex workplace problem and as a call to action to achieve practicable and sustainable outcomes to prevent WMSDs.

A more extensive statement provides further information and is available at <https://www.ergonomics.org.au/>.

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# Human-Centred Design: Checklist Items



- Define the challenge - is change necessary or nice to have?
- KISS principle at all design stages
- What do we know and what don't we know – the gap analysis!
- Profile the task, user, user interface, user error and work environment - do the research and benchmarking
- Identify operational tasks and key critical physical demands
- Use a holistic systems-based approach – E2E – commissioning through to end of life cycle
- List all the key HCD activities – a checklist is helpful
- Human factors & ergonomics features in the human-centred design
- Use a risk management approach – focus on all hazards that influence WMSD risk
- Maintain records of the design journey
- Use a participatory & consultative approach to meet user expectations
- Benchmark where possible
- Build in regular 7 short progress updates to all stakeholders
- Build relationships - use a RACI and communications matrix to build transparency, trust and stakeholder understanding
- Consider COVID-19 design restraints
- Have a work-in-progress plan including key milestones & time management
- Iterate through prototype testing with evaluation against design requirements
- User-centred evaluation of prototype to achieve certainty in design and suitability for the task and provide feedback to stakeholders
- Use WHS regulations and standards
- Build in learning and development and training needs analysis
- Have a back-up plan
- Enjoy the journey

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# Key Checklist Items - RACI



RACI Example only	Stakeholders																				
Action																					
STAGE 1 -	A/R	C																	C	I	I
	A/R	I	C																		
	A/R	C	C	C	C	C		C	x			C	C	C	C	C					C
	A/R	C	C	C	C	C		C	x					C	C	C					C
	A/R	C	C	C	C	I		C	x					C	C	C					C
STAGE GATE 1 - ..... Proceed to Stage 2																					
	A/R	I	I															C	I	I	I
STAGE 2 -	A	R	C																		
	A/R	C	C																		
	R	C	A	C	C	C		C	C	x			C	C	C	C	C				C
	I		C	C					A/R	x	x		C								C
	I		A					R													
	I		A					R													
	C	C	A/R					I										C			
	C	I	A/R					I													C
	A/R	C	C	C	C	C		C	C	x	x		C	C	C	C	C				C
STAGE GATE 2 - ..... Proceed to Stage 3																					
STAGE 3 -																					

### The RACI Approach

- Stakeholder cohort to be sufficiently diverse to collaborate over operational design
- Skill areas may include:
  - HFE & Ergonomics, Users, Subject Matter Experts, Engineers, Maintenance, Procurement, Systems Engineering, Human Resources, Marketing, Learning & Development, Operations, Standards, Installation Specialists,

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## Related suite of documents

- Risk Assessment – hardware & installation
- Operations Manual
- Delivery Unpacking Guide
- SWPs / SOPs
- Store Criteria Checklist
- Pre-Operation Checklist
- Training Needs Analysis
- Competency Training Pack
- Trainer Workbook
- QR Label

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# Safety in Design Solutions: Bindi



## The Challenge

- Industrial waste bins are transferred for emptying
- Exclusive reliance on Team Member manual handling
- Multiple bin transfers daily in stores
- Variation in work environments increases risk exposure to injury
- History of incidents involving acute trauma and WMSDs



# Workplace hazards & WMSD risk factors



Hazard	Task Factors
<b>Team Member Profile</b>	<ul style="list-style-type: none"> <li>• Predominantly Male team members</li> <li>• Multi age cohort</li> <li>• Variance in anthropometry</li> <li>• Variance in physical &amp; biomechanical capacities</li> <li>• Pre-existing injury &amp; personal state of stress</li> </ul>
<b>Customer Profile</b>	<ul style="list-style-type: none"> <li>• Not applicable</li> </ul>
<b>Critical physical &amp; physiological demands - team members</b>	<ul style="list-style-type: none"> <li>• Non-repetitious and short duration manual handling</li> <li>• Very high push / pull force upper limbs &amp; lower body</li> <li>• Sudden peak force push / pull load</li> <li>• Static loading (upper body) combined with forceful walk gait</li> </ul>
<b>Psychosocial demands - team members</b>	<ul style="list-style-type: none"> <li>• Low level personal control over activity</li> <li>• Poor variation in sub tasks both cognitive and manual</li> <li>• Poor opportunity for skill utilisation</li> <li>• No customer engagement</li> </ul>
<b>Role demands</b>	<ul style="list-style-type: none"> <li>• Moderate time pressure demand</li> <li>• Moderate work pace</li> <li>• General MMH awareness training</li> <li>• Multiple team members required to work together</li> <li>• No task rotation</li> </ul>
<b>Store environment</b>	<ul style="list-style-type: none"> <li>• Reasonable comfort levels – temperature, air quality, noise and lighting</li> <li>• Good level support</li> <li>• Good level morale</li> <li>• Reasonable level training</li> </ul>
<b>Fatigue</b>	<ul style="list-style-type: none"> <li>• Moderate to high local whole-body systems fatigue at task end</li> </ul>

# HFE features in user design: Bindi



## Design objectives

- Eliminate direct handling of waste bin
- Review of job content and demands to ensure reasonable physical, mental and emotional demands
- Customised solution that will accommodate any waste bin across the fleet
- Fully engineered and testing program
- Solution to be relatively low cost per store
- Solution to be low cost for PPM
- Good communication and learning & development systems integrated into the design model
- High level participation in team member feedback & consultation
- Training Trainer workbook video
- Regulatory compliance

## Design Feature

- Intuitive design
- Speed settings to dampen acceleration and max velocity
- Hitching mechanism for secure attachment to bin
- Lithium batteries
- Traffic management plan
- Dump room storage & GPO charging station
- Bin square for consistent bin position
- Waste collection mud map for collection vehicle
- Environment – the bin square

## Iterative changes in design



### The Solution - Bindi

- Eliminate exclusive reliance on manual power by multiple team members to move waste bins
- Customised solution that will accommodate any waste bin
- Address team member 'fear state'
- Fully engineered and test program
- Human factors & ergonomics integrated from concept design to rollout & beyond

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## Safety in design – functionality in today's world

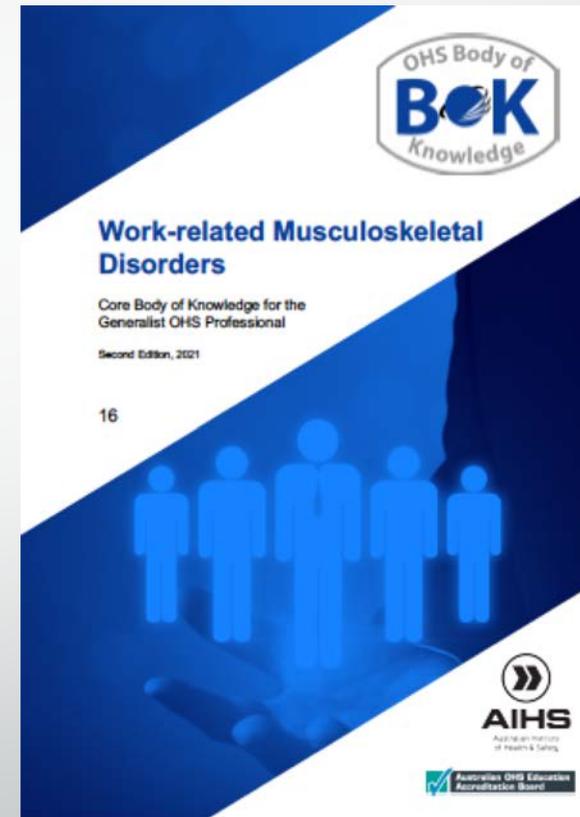


- Bindi is similar to an ~~electronic~~ electric pallet jack comprising a main body, handle and 2 tynes
- Lower and Lift buttons lower and raise tynes
- Travel switch (yellow) to control driving speed
- Horn to sound a warning signal
- Bump Stop (red)
- Bindi may also be hitched to the long side of a bin, but only over short distances



The AIHS and the OHS Body of Knowledge thanks David Trembearth and the team at *Coles Supermarkets* for making this work available as a resource for all those involved in preventing and minimising the risk of work-related musculoskeletal disorders (WMSDs).

The case studies demonstrate the practical application of the knowledge detailed in the *OHS BoK* chapter 16 *Work-related Musculoskeletal Disorders*.



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