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EXTENDED ABSTRACTS

PEER REVIEWED PAPERS

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INTEGRATING ERGONOMICS INTO THE DESIGN PROCESS: DEVELOPMENT OF AUCKLAND COUNCIL'S NEW FOOD WASTE COLLECTION SERVICE

Mark Boocock, Auckland University of Technology, mark.boocock@aut.ac.nz
Liz Ashby, Auckland University of Technology, lashby@aut.ac.nz

ABSTRACT
Auckland Council enlisted the services of the Ergonomics and Human Factors Group of Auckland University of Technology (AUT) to provide ergonomic recommendations for the design of a semi-automated collection service as part of a proposed new organic waste collection service. The aim of the project was to integrate ergonomic principles into the design of the new food waste collection service to minimise the risk of musculoskeletal injury to workers.

Interviews and observations were undertaken with operators to identify potential hazards and risks to employees of existing waste collection methods. A detailed literature review provided an evidence-based approach for identifying appropriate criteria for optimising design and minimising injury risk. Field and laboratory-based user trials were undertaken to inform food bin and vehicle receptacle design. Discussions with product designers established manufacturing and design constraints and the likely cost-benefits of the proposed designs.

Operators undertaking the current food waste collection trials varied significantly in work practices adopted. Risks included awkward and hazardous lifting postures, multiple bin handling, and the fast pace of work. Resident's behaviour (e.g. overfilling bins, placement of bins) was also considered to contribute to potentially hazardous work practices. Findings from the user trials and field visits resulted in a bin concept design and recommendations for the vehicle receptacle.

Understanding the physical and mental demands of work and their relationship to user capabilities is paramount in designing new work systems that minimise the risk of injury to workers. The project brought together service provider representatives, potential users, health and safety advisors, engineers, product designers and ergonomists. Such an integrated approach to planning and delivery of a work system is rarely seen.

KEYWORDS
Ergonomics, manual handling, equipment design, user trials, musculoskeletal disorders.

INTRODUCTION
Auckland Council's Waste Management and Minimisation Plan (WMMP) has set a long-term goal of achieving zero waste by 2040. Currently, approximately 40% or 80,000 tonnes of Auckland's domestic food or kitchen waste is sent to landfill (Craze et al., 2014). Providing a service for the collection and reprocessing of organic food waste is seen an important step in achieving the WMMP.

Under the new Health and Safety at Work Act 2015, Auckland Council as a contractor of waste disposal has a general duty to ensure, "as far as reasonably practicable", the health and safety of employees, contractors and others. This

involves providing and maintaining a safe work environment, which requires the provision of adequate facilities, information and training, and the monitoring of the health and safety of workers and conditions of the work place. Thus, prior to contracting out an organic waste collection service, Auckland Council were cognisant of the need to identify potential hazards and risks of any proposed method of food waste collection.

Following an international review of the health and safety risks and hazards of food waste collection systems (Craze et al., 2014), Auckland Council considered the implementation of a semi-automated food waste collection service (inclusive of manual handling operations) as the most appropriate method to adopt in the Auckland region. Consequently, Auckland Council approached the Ergonomics and Human Factors Group at AUT to identify potential ergonomic design criteria appropriate to such a collection service. The purpose of this project was to identify potential hazards, working practices and associated risks to operators that a collection service might present. A key objective was to propose design criteria appropriate for a waste bin and vehicle receptacle. These design criteria would provide guidelines for manufacturers and contractors of the service.

Initially, the project team was presented with an outline of the main features of the collection service. These were: a one man operation; the use of a Low Entry Vehicle (LEV – left hand drive vehicle with operator accessing/egressing vehicle to collect waste) with waste collection to the side of the vehicle (kerbside); a food waste bin with capacity of 23-25 litres; average bin weights of 4.0 kg, ranging between 3.6 to 4.8kg; and between 800 to 1000 bins collected per day.

METHODS

A detailed literature search was undertaken on eight electronic databases (Scopus, CINAHL Plus, MEDLINE, SPORTDiscus, Biomedical Reference Collection, Health Business Elite, Health Source, and Google Scholar) and was supplemented with material from known reference sources, e.g. Standards NZ, British Standards Institute, American National Standards Institute, textbooks (anthropometry and ergonomics) and international websites. A review of literature considered relevant scientific information and recommendations on manual handling practices appropriate to the task, including information on population anthropometrics, vehicle design and safe working practices.

Field visits were conducted to observe initial trials of the food waste collection service, and interviews undertaken with employees, managers and Council staff. Other waste collection services that involved single and multiple operators of LEVs (i.e. bag collections) were also observed. Observations included different localities to reflect different environments (e.g. urban and rural) and population demographics. A prototype truck for intended use as part of the collection service was observed during the trial service to determine how the vehicle design constraints impacted handling practices.

A series of laboratory and field based user trials were undertaken to inform the design of the prototype bin and vehicle receptacle. These trials simulated the pickup and emptying of waste bins and involved modifications to the bin and receptacle designs (e.g. size, shape, height of bin and handles), during which inexperienced and experienced operators provide feedback into the design process (Figure 1). Discussions with a plastic manufacturer ensured that manufacturing constraints were

considered within the design criteria. Meetings with the vehicle manufacturer ensured that proposed changes to the vehicle receptacle were feasible within the design constraints of the vehicle.

Figure 1. Field based trials of the food waste collection service involving user based feedback into the bin design.

At each prototype development stage, users were consulted to obtain feedback on the impact and ease of operation resulting from modifications to the bin and vehicle receptacle.

RESULTS

The key features of the food waste collection service impacting on the risk of injury to operators were considered to arise from: the bin weights, the structural integrity of the bin, the bin (e.g.. the height, size, and shape of the bin and handles) and vehicle design (e.g. the height and shape of the waste receptacle); work practices, work organisation, and resident's behaviour.

A random sample of bins from the trial collection service indicated a wide variation in weights, ranging between 1.2 kg and 13.6 kg. Factors considered to influence bin weights were the size of the residence and number of residents, the locality and socio-demographics, and the time of year.

The structural integrity of the trial bins not only impacted on the life expectancy of the bin, but structural failure presented a significant risk to the operator. Handling unstable and unexpected loads, and undesirable handling methods increase the risk of injury. The upper folding handle of the bin was often found detached from its hinge, which was said to occur as a result of overfilling or general wearing of the plastic hinge. Bins were said to shatter easily if forcefully struck against a fixed object, such as the side of the collection vehicle when emptying the bin contents.

The field-based trials identified the importance of bin design features (e.g. handle lengths, sizes (diameter), shape and placement) on the postures and handling techniques adopted by operators. The lack of a suitable base handle and poor handle designs (e.g. small handle diameters) limited the ability to adopt optimum hand positioning and grip. The separation between the upper folding handle and the lower handle had a significant impact on flexed and abducted upper arm posture during the initial pick-up of the bin.

Vehicle design features with the potential to increase the risk of injury to operators were: the height of the vehicle receptacle (rave height); access to the vehicle receptacle when emptying bins into vehicles and cab design when getting in and out of the vehicle. The implementation of a 'slave bin' (i.e. large, automated bin mounted on the side of the collection vehicle) on the prototype collection vehicle had the potential to mitigate hazardous handling postures, although its design had a significant impact on the behaviour and practices adopted by operators. For example, some operators elected to limit the use of the automated slave bin in preference for side openings in the vehicles body, as these enable loads to be distributed more evenly and reduced the time taken for waste collection.

Work practices varied considerably between operators. Risks typically stemmed from multiple bin handling, the risk of being struck or striking pedestrians or vehicles, and the pace of work adopted by operators. Multiple waste collection services often operated at the same time, leading to traffic congestion and increased risk of collision type accidents. Resident's behaviour and lack of appreciation of the hazards associated with food waste collection was a potential contributory factor leading to hazardous work practices, e.g. extended reaching and awkward postures from multiple stacking of bins in close proximity.

DISCUSSION AND RECOMMENDATIONS

Combining evidenced-based literature of ergonomic design principles with field evaluations and user-based trials enabled a comprehensive insight into the health and safety risks associated with a proposed new food waste collection service to be implemented in the Auckland region. Consultations with engineers, product designers and manufacturers enabled a series of recommendations for the design specifications of a waste bin and vehicle receptacle. Prototype bins have subsequently been constructed and further user-based trials are being undertaken to evaluate the design modifications.

Bin weights varied significantly between households and according to geographical location. The maximum weight recorded during the field assessment was 13.6 kg and is consistent with a maximum weight reported by Oxley et al. (2006) in a study of similar 25 litre capacity bins (11.7 kg). Assuming an average bin weight of 4 kg and 1000 bins handled per day, it was estimated that cumulative load would be approximately 4000 kg per operator, per day. This falls within current international standards on recommended cumulative loads handled per day of less than 10,000 kg (ISO 11228-1: 2003).

When considering the design of the bin, the forces a person can apply when performing manual handling tasks are determined by the location of the handle and resulting postures which a person is able to adopt (Chengular et al., 2004). The characteristics of the handle, including size, shape and coefficient of friction, influence the ability to transmit forces effectively. In accordance with recommended handle designs (Pheasant and Haslegrave, 2006), an upper handle diameter of 30 mm was proposed and changes made to the height of the handle above its base (650 mm). The latter intending to reduce trunk flexion/lateral bending on picking up the bin. Although the handle height was below recommended guidelines for optimum handle heights, the proposed height reflected other aspects of the task, i.e. the need to lift and simultaneously take hold of the bin base. Incorporating a 'waffled' or 'knurled' pattern design into its surface was seen as a means to improve grip, but still enable movement within the hand. Incorporating a handle at the base of the bin was

considered important when emptying the bin, although costs associated with manufacture and distribution (container stacking) restricted the ability to meet optimum design criteria (i.e. circular diameter). A curved handle support at the base of the bin is currently being evaluated.

The plastic construction and design of key components (e.g. hinges) were seen as important for prolonging the working life of the product and reducing the risk of sudden failure when handling the bin. In consultation with the plastic manufacturer, materials were chosen to limit environmental degradation, maintain a low overall weight to the bin and ensure durability of key components.

Recommendations for vehicle design were restricted to the vehicle receptacles, e.g. opening into the rear of the vehicle and the slave bin. It was recommended that these receptacles should be less than 800 mm above the ground. This reduces the likelihood of operators repeatedly raising their arms above shoulder height; a known risk factor for upper limb musculoskeletal complaints. It was also considered important to design the receptacle in a way that enabled lateral transfer of the bin contents. Where a slave bin is used, the depth and design of the opening was considered important to facilitate this action. Proposals were put forward for increasing the backboard of the slave bin and incorporating side walls to allow contents to be 'thrown' into the bin.

Influential in the Council's decision to adopt small waste containers (i.e. 23-25 litres) was the need to reduce waste contamination, hygiene concerns and the problems associated with the storage of large multiple bins. Automated methods (e.g. those used for wheelie bin collection) for handling small containers do not currently exist and semi-automated handling is seen as the preferred option. Further consideration should be given to automated systems for handling these types of containers.

The waste collection service presents significant health and safety challenges and there is a need for further research in this industry. Research needs to consider:

- the risk factors impacting on mental and physical fatigue of operators (e.g. work shifts, work planning);
- the influence of environmental factors and seasonal variations on working practices, work organisation and behaviour;
- factors impacting on safe working practices which may lead to unsafe behaviour and/or hazardous situations;
- vehicle design factors (e.g. driver controls and displays) impacting on safety;
- lifestyle factors and individual capabilities impacting on performance; and
- the effects of an ageing population and sustained employment within the industry.

CONCLUSIONS

Introducing new work systems brings about a series of challenges in optimising design to ensure safe systems of work. This project brought together service providers, potential users, health and safety advisors, engineers, product designers and ergonomists. The design recommendations from this project were developed through an iterative process of testing and feedback, with operators playing an integral part in the design process. Integrating ergonomics into the design and planning of a new and existing work systems should be seen as an important step in reducing the risks of injury and ill-health of workers.

REFERENCES

Chengular, S. N., Rogers, S. H. and Bernard, T. E. (2004). Kodak's ergonomic design for people at work (2nd Edition). The Eastman Kodak Company, John Wiley and Sons, Inc.

Craze, S., Wilde, S., Drewitt, T., Clarke, B. and Perrin, D. (2014). Review of health and safety risks and hazards for food waste only collection systems. Technical report for Auckland Council.

ISO 11228-1 (2003). Ergonomics - Manual handling - Part 1: Lifting and carrying. International Standards Organisation.

Oxley, L., Pinder A.D.J. and Cope, M.T. (2006). Manual handling in kerbside collection and sorting of recyclables, Health and Safety Laboratory Report#: HSL/2006/25.

Pheasant, S. and Haslegrave, C. (2006). Bodyspace: Anthropometry, Ergonomics and the Design of Work, Third Edition, CRC Press.

TRANSFORMING COMPANIES THROUGH WORKPLACE HEALTH AND SAFETY CULTURE

Heidi Börner, Orange Umbrella Ltd., heidi@orangeumbrella.co
Peter Berry, Electricity Engineers' Association, peter@eea.co.nz

ABSTRACT
The new workplace health and safety (WHS) legislation presents WHS professionals the opportunity to lead the way using culture change initiatives. The Safety Climate Project (SCP) is an original industry example of systematically achieving positive outcomes and high engagement in WHS assessment, reporting and improvement over 6 years. The average lagging incident data across participating companies has decreased 30%. Individual companies have achieved leading indicator improvement, a positive return on investment, reduced non-conformances, and improved risk management. Workers are well-engaged with the SCP with high averages for the survey response rates (90%) and action plan workshop attendance (85%).

The SCP has achieved positive buy-in from organisations as it identifies the critical risks that are created by workplace culture, so that the right solutions can be implemented at an employee work group, company and industry level. Information is gathered via surveys and workshops with front line staff to senior management, and from office to worksite. The process provides key 'culture' measures for safety, identifies and validates safety issues, and then helps operationalise the safety improvement. Aggregated SCP findings and key case studies are shared across the industry via the Electricity Engineers' Association (EEA), allowing common issues to be addressed. SCP provides participants with information to strategically manage health and safety using: leading indicators of WHS risk and mitigation impact; a collaborative approach to WHS culture improvement; and industry benchmarks.

The health and safety of people is the foundation of a strong company. The right business and culture drivers reduce risk and frustration for the people carrying out the work and optimise performance, productivity, efficiency, innovation and quality. This presentation shares SCP findings, challenges, and transformations via case studies allowing WHS professionals to consider this leading industry initiative to strengthen their own practice to support their organisation's resilience.

KEYWORDS
Health and safety performance evaluation, health and safety leading indicators, health and safety leadership, health and safety governance.

INTRODUCTION
WHS in New Zealand is undergoing significant change. WHS professionals are being looked to for leadership, strategic direction and best practice to ensure that workplaces not just comply, but also thrive as businesses and deliver risk reduction, quality improvement and performance improvement. Without the right tools health and safety professionals struggle to deliver what companies need. It is therefore worth considering the successes and lessons learned over the past 6 years of this EEA project. The SCP has challenged 32 companies in the Electricity Supply Industry (ESI) to identify and mitigate systemic risks, at both a company and an industry level. (EEA, 2016a, b).

Due to the high-risk nature of generating and supplying electricity ESI companies use well-developed health and safety systems for both staff and public safety. However, the fatality and serious injury rate remain higher than the industry goal of zero harm despite high quality audit scores, achieving ISO certification and tertiary levels in ACC's Workplace Safety Management Practices programme. EEA therefore sought to evaluate how effectively the current health and safety systems were helping staff to actually manage risk, and the impact of health and safety culture on the use of the existing health and safety systems.

The SCP uses Orange Umbrella® validated, specialised tools to evaluate, measure and monitor safety culture performance. The data is then used by the company to generate their internal improvement action plans. Employees of the business, often the company health and safety practitioners, are trained to be internal Process Leaders to lead the project inside each company. The knowledge and experience they gain in the SCP helps them to challenge the status quo and effect measurable improvements. This makes them valuable and sought-after practitioners. The new WHS legislation presents WHS professionals the opportunity to lead the way using culture performance initiatives.

METHODS

Safety Climate Project

The SCP started as a pilot project in 2010 with 11 companies taking part. Company CEOs, EEA and Orange Umbrella® signed a Tripartite Agreement outlining the terms of participation, confidentiality and sharing of data and commitment to follow through on improvements needed. Each company completed two rounds of surveys focussing on their field staff, followed by workshops to gain insight into the survey results and collaborate on improvement initiatives. The second round was 4-6 months after the first. All companies completed both rounds, and the survey and workshops participation were 90% and 96% respectively. 757 surveys were completed. All levels of each company came together in the last workshop for Action Planning improvements. All companies produced Action Plans, and these were aggregated into themes are reported back to the EEA. The EEA then used the information to inform their priorities, policy amendments, and strategy.

Beyond the pilot, the SCP has continued to use the same methodology in 2016. The SCP continues to survey field staff, and has expanded to include other roles such as supervisors, managers, senior management team and board of directors. New companies starting the SCP do their first two rounds 6 months apart, and then continue with annual rounds. As of August 2016, the SCP participants from 29 companies have completed 102 rounds and 5731 surveys. In 2016, 14 companies continue to monitor their status by completing annual rounds.

Safety Climate Project Tools

Orange Umbrella® supplies the survey tools and facilitation for the SCP. The survey is based on the Great Safety Performance (GSP®) Model, and the workshops are run according to the NewHeights™ facilitation process (Orange Umbrella®, 2016).
The GSP® model comprises seven workplace leading indicators of safety, which are quantified using the survey. Each indicator contains of a set of questions that people answer relating to:

1. *Safe Work Actions (SWAs):* Behaviours required to carry out their job/role safely.
2. *Know what to do:* The knowledge base to do their work, and SWAs.

3. *Able to do it:* The right skills and fitness to do their work and the SWAs.
4. *Equipped to do it:* The right equipment, PPE, policies and procedures to do their work and the SWAs.
5. *Want to do it:* The right system motivators to get the best performance in doing their work and the SWAs.
6. *Interactions:* Support within the workplace to complete their work and SWAs.
7. *Leadership:* Setting WHS as a top priority, and ensuring that operational decisions are consistent with safety so that SWAs can be achieved (Börner & Dyck, 2015).

GSP® Survey questions have been statistically tested for reliability using Cronbach's alpha, and Pearson correlation to determine the relationship between the leading indicators and the SWAs (Roithmayr & Dyck, 2015). In addition, Pearson correlations are tested for each survey run by Orange Umbrella®.

Immediately after the survey, the NewHeights™ workshops are completed. The company Process Leaders determine their company project plan for their workshops, so there is variation on how these are carried out. The workshop series starts with the Senior Management Team, followed by the Staff Workshops and finishing with the Action Strategy workshop. The company then continues to develop their own Action Plans, and ensures that the plans are completed and communicated. The next round of surveys and workshops quantifies the effectiveness of the Action Plan interventions. Subsequent survey and workshop rounds allow companies to track their own leading indicators to measure ongoing risk as the company changes over time. Individual companies benchmark with the SCP average to provide some context for their results.

SAFETY CLIMATE PROJECT (SCP) OUTCOMES

Individual company results

Individual company results require written permission for disclosure, and therefore SCP reporting is done using themes and in an aggregated format. Two individual companies have publically shared their case studies on the eea.co.nz, and orangeumbrella.co websites:

1. Unison Contracting Services Ltd has won two awards for health and safety improvement due to their SCP efforts, and has shared their experience publically. Since the 2012/2013 financial year Unison reports:

- GSP® scores from 1/7 GSP® indicators at the low risk level at baseline to 5/7 GSP® indicators at low risk level.
- 300% increase in near miss reporting.
- 48% reduction in the number of medical treatment injuries.
- 49% reduction in the number of incidents (e.g. vehicle or utility service damage).
- 13% improvement in employee engagement from UCSL staff satisfaction survey.
- 10% reduction in staff turnover.
- 250% return on investment.

2. Trustpower has also allowed their case study to be published and list their improvements as:

- GSP® scores from 1/7 GSP® indicators at the low risk level at baseline to 4/7 GSP® indicators at low risk level.
- Increased Near Miss reporting from 17% to 42%.

- Reduction in failed starts due to better (and cost saving) preventive maintenance.
- Improved: communication; PPE use; vehicle and plant; training; technology and safety goal setting.

3. Mainpower won a Safety Innovation Award for Lone Worker Practices which was identified as a priority item using the SCP.

Aggregated results

Aggregated outcomes across all companies include:

- Survey response rates (90%) and action plan workshop attendance (85%) indicating a high company engagement level with the SCP.
- 10 companies have completed 5 or more rounds since 2010. As a group they started with a total of 7 GSP® indicators in the low risk area, and currently have achieved 31 GSP® indicators in the low risk area.
- The EEA has measured an average decrease of 30% in the incident rate for the group of SCP participating companies.

LEADERSHIP FOLLOW-THROUGH ON ACTION PLANS AS A SUCCESS FACTOR

The SCP evaluation tools and process provide the data for companies to generate their own improvement strategies for their individual company situations. Collaboratively improving system components has been shown to be the key and has been done between company leaders, staff and supervisors. This collaboration and agreement to act is part of the SCP Tripartite Agreement, and employees are briefed on this undertaking at the commencement of the survey and improvement process. Follow-through on action plans is a key determinant for enduring staff engagement and achieving a level of low risk on the GSP® indicators.

The GSP® survey data and workshop feedback shows different relative success among the SCP companies at improving workplace culture and addressing safety risks. Where company leaders have led follow-through on the Action Plans and ensured they have been completed as promised, the changes in survey scores are much greater relative to those companies that have not followed though. For this analysis Actions Plans are considered completed when GSP® survey scores improve and feedback indicates the issue has been addressed successfully.

Common features of successful companies are that they: use information from evaluations to improve existing WHS systems and strategy; fast track improvements; collaborate with staff to ensure improvements are appropriate; follow through on their chosen improvements and promises made; communicate regularly on progress; recognise success; continue to measure and track performance; have senior leaders that demonstrate tangible commitment to improvement and action plans - they are interested, participate, follow up and remove barriers to progress.

Action plan completion: Changes in GSP® Indicators from baseline

As GSP® indicators increase, health and safety risk decreases as measured by improved audit scores, fewer incidents, better reporting and earlier mitigation of hazards and risks, and feedback from staff about improved company systems. Follow-through on Action Plans, as measured by completion of agreed Action Plans

and staff endorsement, results in increased GSP® scores as shown in Table 1. In contrast, not following through results in the same or lower GSP® scores as shown in Table 2. Of the SCP companies that demonstrated follow-through on their action plans seven (A-G) were chosen at random to compare with six companies (H-M) of the SCP companies that have demonstrated limited follow-through.

The *sum of change* differences between the two company types demonstrates the impact of following through vs limited follow-through. The SWAs for companies that follow through have a greater change (increase) and since those are the desired behaviours that keep people safe, results in lower injury risks. Those increases were achieved by ensuring that people: *Know what to do, are Able to do it, are Equipped to do it, Want to do it,* and have positive *Interactions* and *Leadership*. Compare that with companies in Table 2 which have little or no follow-through of Action Plans, and the SWAs stayed similar or worsened.

Table 1. Companies that followed through: GSP® indicator changes from baseline.

GSP® indicator	Company A	Company B	Company C	Company D	Company E	Company F	Company G
Safe Work Actions	6	5	2	3	10	4	10
Know	4	6	4	1	1	1	3
Able	11	4	7	3	5	5	5
Equipped	12	6	5	3	4	3	12
Want	15	13	17	9	9	14	12
Interactions	13	9	15	14	4	11	8
Leadership	12	12	12	11	6	8	7
Sum of Change	***74***	***54***	***60***	***43***	***38***	***45***	***55***

Blue = denotes higher risk (GSP® category less than 85/100)
Orange = denotes lower risk (GSP® category greater than 85/100)

Table 2. Companies with little/no follow through: GSP® score changes from baseline.

GSP® indicator	Company **H**	Company **I**	Company **J**	Company **K**	Company **L**	Company **M**
Safe Work Actions	-1	2	4	-2	1	2
Know	-2	0	1	-4	2	-1
Able	1	2	2	-4	3	1
Equipped	0	2	1	-4	4	-1
Want	2	2	5	-4	2	1
Interactions	3	3	3	-3	2	-1
Leadership	0	2	2	1	3	-3
Sum of Change	***3***	***13***	***18***	***-20***	***17***	***-2***

Blue = denotes higher risk (GSP® category less than 85/100)
Orange = denotes lower risk (GSP® category greater than 85/100)

Companies that followed through (Table 1) had greater GSP® indicator improvements and more scores in the lower risk (orange) range. *Want* is the positive system drivers, and *Interactions* is how people relate to each other in the company. *Want* showed the most positive change followed by *Interactions* in the companies that followed through. *Leadership* scores show how people feel about their senior management and showed more change than the companies that did not follow

through. The importance of *Leadership* is consistent feedback heard during staff workshops. SCP data indicates that leadership affects WHS by:

- Following through on actions that are designed to ensure safety. E.g. safer harnesses, better traffic management, complete information in job packs, training, equipment, better planning so there is less rushing, improved systems etc.
- Following through on actions promotes trust which supports better communication. This leads to better reporting of incidents and risks.
- Following through on actions is a foundation promise of the SCP.

Industry Involvement and Support

The SCP gives participating companies reliable and valid tools to evaluate their leading indicators of WHS risks, track the effectiveness of process improvements, and to benchmark with their SCP Group peers about proactive measures and improvements. It also enables an industry-level overview of common issues and themes among the SCP Group. These are fed back to the EEA Board and the Safety Strategy & Policy Group and assessed for new or improved WHS interventions to benefit the sector. The common issues noted include: the need to clarify allowable electricity outage time (SAIDI minutes) and their perceived impact on WHS risks for workers; incident under-reporting by workers to companies, and companies to the EEA; issues with the current incident investigation methodology; use of faulty harnesses and/or use of harnesses "not fit for the work purpose"; problems with traffic management; the need for enhanced, and more available industry training; retention and development of skilled staff; senior management leadership effectiveness; communication; work planning and design processes; network and contractor relationships; drug and alcohol programs; presence of bullying; fatigue management; supervisory skill development; and change of unsafe practices.

This feedback has been used by the EEA to focus industry-level responses such as:

- Liaison with regulators concerning perceived regulatory conflicts/submissions
- Clarifying policy and guidance around live-line work decisions
- Initiating supervisory model competencies development
- Arranging specialist training in incident investigation and analysis
- Improving safety performance indicators
- Safety in Design guidance
- Promoting industry awareness and improved knowledge about the above issues and solutions through forums and industry events, including EEA Conference and Safety Workshops.

Health and safety performance reporting

Companies that commit to the SCP use the GSP® measures to round-out their WHS reporting to boards and staff. Where previous reporting would be only incident severity/frequency and perhaps audit scores, they now also report related efficiency, quality, and performance metrics. Reporting includes items specific to the business such as rework rate, variation rate, job completions, restart rate (for electricity generation), number of "skips" for safety reasons, environmental issues, number of action improvements completed, alongside the GSP® leading indicators and the traditional WHS lagging indicators. This gives a much clearer view of the impact of WHS performance on the business, and the return on investment that is available to the business. This is a reminder to company leaders that WHS is not an "add-on" it is simply "good business".

CONCLUSION

In today's legislative and business environment, WHS practitioners are being called on to assist company leaders and boards of directors to strategically measure and manage risk. In addition to running WHS programmes and systems, WHS practitioners have to provide the data to company leaders so that they know that risks are being identified and how they are being managed. This requires new tools. The SCP for the electricity sector is a case study demonstrating the value of health and safety risk mitigation and business benefits such as improved quality and performance and positive return on investment. By measuring and tracking the right elements, companies have the data they need to target the right solutions. The SCP evaluation methods are designed to increase engagement and set the company up for success along their own chosen improvement path. The SCP illustrates how the WHS practitioner can support company leaders to achieve positive outcomes and company resilience.

REFERENCES

Börner, H., & Dyck, D. (2015). Safety Culture: Safety Climate. In D.E.G. Dyck (Ed.), *Occupational Health & Safety: Theory, Strategy & Industry Practice*, (pp. 350-373), (Third ed.): LexisNexis.

Electricity Engineers' Association. (2016a). *Electricity Supply Industry Workplace Safety Strategy to 2020.* Retrieved from http://www.eea.co.nz/Site/health-safety/esi-workplace-safety-strategy-to-2020.aspx.

Electricity Engineers' Association. (2016b). *Safety Climate Project.* Retrieved from http://www.eea.co.nz/Site/health-safety/safety-climate-project.aspx.

Orange Umbrella®. (2016). *How it works.* Retrieved from: http://www.orangeumbrella.co/health-and-safety-culture-assessment-tools/

Roithmayr, T. (2015). Great Safety Performance: A Management Approach. In D.E.G. Dyck (Ed.), *Occupational Health & Safety: Theory, Strategy & Industry Practice*, (pp. 303-341), (Third ed.): LexisNexis.

Roithmayr, T. & Dyck, D. (2015). Occupational Health and Safety: Leadership and Commitment. In D.E.G. Dyck (Ed.), *Occupational Health & Safety: Theory, Strategy & Industry Practice*, (pp. 254-302), (Third ed.): LexisNexis.

GOOD PRACTICE HEALTH AND SAFETY GOVERNANCE

Hans Buwalda, EHSconsult, Hans.Buwalda@EHSconsult.co.nz

ABSTRACT
General direction to Boards and senior managers with regard to health and safety governance is now widely available through organisations such as the Institute of Directors and WorkSafe. Boards must ensure that there are processes for strategic planning, risk management and performance review, and must obtain independent verification that these processes are effective. They must apply the same good governance principles and practices to health and safety as have been developed for achieving other organisational objectives. In fact, close alignment with their other governance processes will ensure effectiveness.

Organisations must have a health and safety strategy, and this is developed in the same way as broader organisational strategies. Significant health and safety risks must be included in enterprise risk registers. Boards must seek information from their managers that enables them to assess whether the strategy is being effectively implemented and risks mitigated as planned. Indicators of the efficacy of health and safety risk management need to be developed, (rather than a reliance on injury rate statistics alone). Boards need to be aware of serious incidents and follow-up actions. There must be direct access to expert and independent advice and verification. Directors must have knowledge of significant hazards and have direct engagement with front-line workers who are exposed to these hazards.

This paper provides specific examples of good health and safety governance in practice drawn from experience working with a number of large New Zealand organisations. It aligns these processes with other governance processes, particularly strategic planning, risk management and verification. It provides specific and proven examples of processes that have been used in these organisations to achieve improved health and safety governance.

KEYWORDS
Governance, strategy, due diligence, risk management

INTRODUCTION
The Royal Commission on the Pike River Tragedy (2012), began a discussion in New Zealand about the role of directors and senior managers of organisations with regard to health and safety management. Prior to the Commission's report, there was limited understanding of the requirements for health and safety leadership and the legal responsibilities of directors and senior managers were limited. In the case of Pike River Coal, the directors and senior managers exercised very little oversight of the critical health and safety risks within the operation. The subsequent Independent Task Force on Health and Safety (2013, page 18) also found that "…Directors and managers are not sufficiently held to account for health and safety …".

This leadership gap has been addressed by both the Government and by business organisations. The Government has introduced the Health and Safety at Work Act (2015) which, in Section 44, imposes specific duties on officers (directors and senior managers), within organisations. The Institute of Directors and the Business

Leaders Health and Safety Forum have been active in efforts to educate directors and officers on their roles.

Health and safety is no longer a peripheral consideration within organisations. It is a key concern for leaders. This provides a significant opportunity for health and safety managers. These opportunities are accompanied by challenges that will need to be explicitly addressed by health and safety professionals, if they are to effectively contribute to this new paradigm

THE CONTRIBUTION OF LEADERS TO GOOD HEALTH AND SAFETY

There is extensive literature on the topic of health and safety culture, (for example, Borys, 2012). It is often expressed as "… the way we do things around here…". That is, it is the totality of the processes and behaviours that exist within a workplace and within an organisation.

From this, it follows that a positive safety culture exists in organisations in which risks are rigorously reduced, and workers seek safe ways to carry out their tasks. Achieving such a culture is also subject to extensive literature. This notes that many organisations attempt to improve their safety culture with programmes that address individual behaviour and mindsets. This contrasts with the paradigm that leaders create culture, (for example, Hopkins, 2005, page 8). "… it is the leaders of an organisation who determine how it functions, and it is their decision-making which determines in particular, whether an organisation exhibits the practices which go to make up a culture of safety." This raises the question of how leaders create culture. Hopkins (2005, page 8) states "… Leaders create cultures by what they systematically pay attention to".

This understanding of safety culture and leadership has influenced a number of organisational practices that have developed. Many organisations advocate that health and safety should be the first item on meeting agendas, to ensure that it is given adequate priority and focus. Another common practice is that of "safety observations". In many organisations these have evolved to become an opportunity for leaders to directly engage with front-line workers and supervisors. This enables them to directly hear and understand the situations and concerns of workers, while simultaneously communicating an authentic interest in their safety and well-being.

LEGISLATING FOR EFFECTIVE LEADERSHIP

The Health and Safety at Work Act (2015) has imposed specific duties on directors and senior managers. Acknowledging that healthy and safe workplaces cannot be achieved without the active engagement of senior leaders, it imposes these as duties. It requires leaders to exercise due diligence. They must diligently apply their expertise and experience to ensure that the organisation fulfils its health and safety duties. Section 44 of the Act lists six specific duties. These require an understanding of health and safety, the organisation's risks and controls, ensuring that it has appropriate resources to control its risks, and to monitor and verify compliance and performance.

LEADERSHIP BEYOND COMPLIANCE

These new duties have triggered further activities within the offices of senior managers, and within boardrooms in New Zealand. Many organisations are increasing health and safety reporting, requesting briefings, visiting operations to specifically review risks and risk controls, and obtaining independent verification of

regulatory compliance. However, as concluded by Deloitte, (2016, page 2) following a recent survey, there are many opportunities for improvement:

> "…Board engagement with health and safety is high. … However, board discussion tends to focus on incidents and risk management. Less attention is paid to worker engagement".
>
> "CEOs express a strong commitment to health and safety. … But some are not using (and might not know about) the full range of practices that can help lift performance".

These results confirm that ad hoc safety leadership practices (prioritising health and safety on meeting agendas, safety observations) are not sufficient to visibly demonstrate leadership commitment.

A compliance-driven focus on the legislative duties of officers will not contribute to an enhanced safety culture. Most models of safety culture / maturity place compliance as an early stage. Using ad hoc tools and checklists based on the specific duties in Section 44 of the Health and Safety at Work Act, will not lead to enhanced health and safety leadership and culture.

This has been recognised by the Institute of Directors and WorkSafe which have collaborated to provide guidelines on health and safety governance. The Institute of Directors, and WorkSafe New Zealand (2016, pages 2, 10) states that:

> "The principles underpinning health and safety governance are no different than any other aspect of a governance role. … It is the role of directors to provide leadership by driving policy, including setting the direction for health and safety management and performance. Directors create expectations and exercise due diligence by holding management to account for meeting them".

The Business Leaders Health and Safety Forum has also provided direction on specific governance issues such as monitoring health and safety performance, (Business Leaders Health and Safety Forum, 2016).

Directors and senior managers are responsible for leading health and safety, developing a positive culture, and ensuring that the risks to workers are reduced to as low as is reasonably practicable. They develop strategy, delegate the strategy to operational managers, monitor performance and hold managers accountable. They will be successful if health and safety is integrated with other elements of governance and leadership.

ENABLING DIRECTORS AND SENIOR MANAGERS TO LEAD

Developing Health and Safety Capability and Knowledge for Leaders

Leaders need to be individually and collectively knowledgeable about health and safety. The knowledge required is both general and specific. A fundamental understanding of hazard and risk management, and of safety culture and leadership is required. Leaders must understand what is meant by a risk-based approach to hazard management. They need to understand the differences between high frequency-low consequence events and low frequency-high consequence events. They need to have an awareness of incident causation. They need to understand

how health and safety culture is developed, and how it is related to other aspects of organisational culture.

Leaders need to understand which are the most significant hazards in their operations, and the controls for these. The risks that leaders need to be familiar with are those that are most likely to result in serious or fatal injuries. The potential consequences should determine the number and order of hazards that leaders become knowledgeable about.

Leaders need to understand what risk controls are in place and are planned. They need to be aware of any significant risks which are managed by administrative controls alone.

Planning

Leaders need to participate in health and safety planning, so that they can approve proposals for risk reduction, and ensure that these are included in business and operational plans. Health and safety plans need to focus on specific activities and projects that will reduce safety risks and contribute to work-related health. Plans need to be about more than improving systems and delivering training. Plans need to address the highest risks and the most cost-effective opportunities. These need to be determined from evidence, with that evidence being provided to decision-makers as justification for planned activities and projects. Projects in particular need to include investment in engineering controls or alternative plant and equipment that will enable the elimination, substitution or isolation of significant hazards.

Monitoring

Leaders need to monitor the organisation's performance, and track this performance against strategies and plans. It is difficult to measure the reduction of safety risks, and achievement of work-related health opportunities. Reduction in the risk of a specific low-frequency, high consequence event, (for example entrapment and asphyxiation in a confined space) cannot be measured using injury rate lag indicators. Other specific measures will need to be developed such as achievement of planned replacement of plant and equipment, and the introduction and compliance with a new process.

Assurance

Leaders need to hold operational managers to account for achieving the objectives, activities and projects set out in plans, as well as ensuring that the organisation is compliant with legal requirements. Independent verification is required. There should be a programme of independent assessments, that should include both operational performance and risk management, as well as the systems that enable these.

CHALLENGES

Health and safety managers have an important role in enabling both their organisations and their leaders to fulfil their responsibilities. There are significant challenges. There is a fallacy that health and safety is just "common sense", This leads to leaders focusing too much on irrelevant or low value information such as injury frequency rate data. Leaders may not be aware of what is needed to develop a positive safety culture, believing that it can be achieved by changing individual mindsets.

In addition, in many cases, health and safety managers have only recently been granted access to leaders within their organisations. At an operational level, health and safety has been a compliance issue, dominated by bureaucratic systems. Health and safety managers need to overcome this history, without having much experience or exposure to the priorities and language of governance.

Ferguson (2015) provides some direction to health and safety managers that work with directors and executives:

> "In my experience, those OHS professionals who can add value to an organisation through understanding both the strategic context in which their function operates, as well as the broader environment in which their business is functioning, are better equipped to develop credibility.
>
> OHS professionals should work closely with their CEO and board on getting reporting right. It is essential that health and safety reporting focus on the right metrics and commentary, since the discussion that follows will reflect the report. For example, if your reporting focuses primarily on lag indicators then the conversation will most likely focus on minor personal injuries including slips, trips and falls, rather than the significant near miss that also happened during the month but which either wasn't included in the report or was not even captured."

Health and safety managers are responsible for providing evidence-based direction to organisations. For example, analysis of incident trends should influence priorities. Industry best practices and regulatory guidelines should determine solutions and work processes. Health and safety managers are responsible for ensuring that directors and executives continue to increase their understanding of these issues.

Not every health and safety manager will be working with directors and senior executives. Emerging professional certification schemes recognise that health and safety managers will be needed at different levels within an organisation. There will be those that are require to advise on strategy, organisational change and assurance. Others will be required to advise on operational risk controls. Not many managers will have the knowledge and skills to work in both these areas. Managers should ensure that they have a professional development pathway that fits with their role, knowledge and skills, and plan their professional development accordingly.

CONCLUSIONS

There are significant obstacles to health and safety managers being recognised as professional experts providing advice that leaders need to seriously consider.

Establishing a professional certification system for health and safety managers is a critical part of overcoming this. It means that safety knowledge will be recognised, and therefore the need for expertise will be accepted. It also means that continuing professional development will be provided, so that health and safety managers can grow into roles that have governance responsibilities.

REFERENCES

Borys, D. (2012). Organisational Culture. In HaSPA (Health and Safety Professionals Alliance), The Core Body of Knowledge for Generalist OHS Professionals. Tullamarine, VIC. Safety Institute of Australia.

Business Leaders Health and Safety Forum (2016). Monitoring What Matters. http://www.zeroharm.org.nz/assets/docs/our-work/monitoring/Monitoring-what-matters.pdf

Deloitte and Business Leaders' Health and Safety Forum (2016). Are We As Safe As We Want to Be? 2016 Health and Safety Leadership Survey. http://www2.deloitte.com/content/dam/Deloitte/nz/Documents/risk/nz-en-2016-NZ-health-and-safety-survey-report.pdf

Ferguson, K (2015). How to Engage Boards in Safety. OHS Professional. December 2015, Page 29.

Hopkins, A (2005). Safety, Culture and Risk: The Organisational Causes of Disasters. CCH Australia Ltd.

Hopkins, A., Toohey, J., Stacey, R., Else,D. (2012). The Organisation. In HaSPA (Health and Safety Professionals Alliance), The Core Body of Knowledge for Generalist OHS Professionals. Tullamarine, VIC. Safety Institute of Australia.

Independent Task Force on Health and Safety (2013). Report of the Independent Task Force on Health and Safety. http://hstaskforce.govt.nz/documents/report-of-the-independent-taskforce-on-workplace-health-safety.pdf

Institute of Directors (2014). The Four Pillars of Governance Best Practice for New Zealand Directors. Institute of Directors.

Institute of Directors, and WorkSafe New Zealand (2016). Health and Safety Guide: Good Governance for Directors. https://www.iod.org.nz/Portals/0/Governance%20resources/Health%20and%20Safety%20Guide_Good%20Governance%20for%20Directors.pdf

New Zealand Government (2015). Health and Safety at Work Act. http://www.legislation.govt.nz/act/public/2015/0070/latest/DLM5976660.html

Royal Commission on the Pike River Coal Mine Tragedy (2012). Royal Commission on the Pike River Coal Mine Tragedy Report. http://pikeriver.royalcommission.govt.nz/Final-Report

IMPROVING LEARNING FROM WORKPLACE INCIDENTS - A CASE STUDY IN THE DAIRY INDUSTRY

Justine Croft, Massey University MBA Student, justmecroft@gmail.com
Kirsten Bendix Olsen, Centre for Ergonomics Occupational Health and Safety, School of Public Health, Massey University, k.b.olsen@massey.ac,nz

ABSTRACT
The aims of this case study were to: identify the "learning from incident process" in a large dairy farming group; compare this process with a theoretical step-wise model; test a method (Drupsteen and Hasle 2014) for identifying barriers to learning from incidents, and; identify the barriers in this dairy farming group. The learning process and the barriers to learning were identified through one face-to-face semi-structured interview with the Health and Safety Manager and two focus group meetings - with farm managers and health and safety representatives. There was a difference in detail and understanding of the process between the groups, with no group or individual understanding the process in full. The process was similar to the theoretical model but some steps were missing or not fully performed. Barriers to learning from incidents were identified in several steps. The methodology was very effective in identifying differences in understandings, creating a common understanding of the process, identifying barriers in the learning process and opportunities for improvements and could be replicated in other industries.

KEYWORDS
Incident learning process; incident reporting and investigation; barriers to learning.

INTRODUCTION
The dairy farming industry has the highest number of injuries of any industry in NZ. ACC statistics show 334 years lost due to injury every year between 2008 and 2013 (Statistics NZ, 2014). At 226 injury claims per 1000 full time employees, the claim rate is 2.5 times higher than the average for all industries combined. Little research has been carried out specifically in the dairy farming industry to determine if learning from injury causing incidents occurs in the industry, or to identify what barriers to learning from incidents exist. International and national research tends to focus on industries such as manufacturing, extraction, airline and construction. Much of the focus has been on identifying causes of incidents and on investigation. Little research has focused on the full learning process from reporting an incident, to implementing change to avoid future incidents and evaluation of these changes. A stepwise model of learning from incidents was developed by Drupsteen, Groeneweg & Zwetsloot (2013) to identify and develop the learning process in organisations (Figure 1).

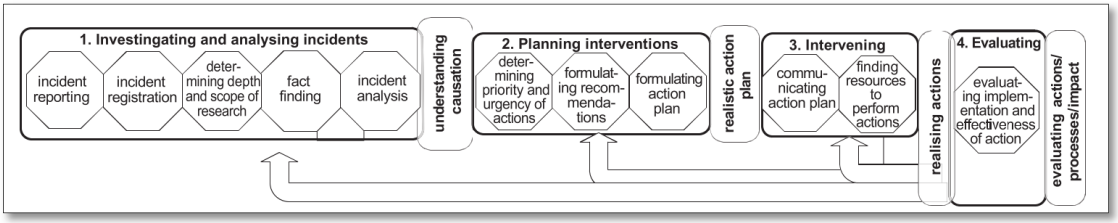

Figure 1. Process for learning from incidents. (Drupsteen, Groeneweg & Zwetsloot, 2013)

Drupsten and Hasle (2014) then developed a method for identifying barriers to learning from incidents and tested this method within the chemical industry in the Netherlands with good results.

The aims of this study were: firstly, to identify the 'learning from incident process' in a large dairy farming group and compare this process with the theoretical step-wise model (Drupsteen et al. 2013); secondly to test Drupsteen and Hasle's (2014) method for identifying barriers to learning from incidents, and; identify barriers in this dairy farming group and finally to identify what could be changed to improve learning form incidents.

METHODS

To ensure that the farming organisation had a formal 'learning from incident' process, a large dairy farming group with a reputation of having good occupational health and safety systems in place was selected. The company owned and operated nine separate dairy farms and employed 65 people, including operational managers who each supervised three to four farms and supported the farm managers. The research method followed the process identified by Drupsteen and Hasle (2014). First the Health and Safety (HS) manager was interviewed to identify the 'learning from incident' process within the organisation, identify participants for two focus group discussions, and to select two incidents for identification of incident specific barriers and facilitators for the learning process. One incident that was seen as having a successful 'learning from incident' outcome, and one seen as unsuccessful, were selected by the HS manager.

Focus groups occurred with operational and farm managers, and health and safety representatives respectively. Both the interview and each focus group identified the process for 'learning from incidents', and identified the steps being performed well or poorly. Discussion to identify why the steps were or were not performed well further identified what could improve the process. Each focus group then discussed both the successful and unsuccessful 'learning from incidents' situations that had been identified by the HS manager. The groups considered whether the organisation had learned from the incident, what they had learned, or why they hadn't learned.

RESULTS

The identified learning process for this company closely resembled the process described by Drupsteen, Groeneweg & Zwetsloot (2013) but some steps were missing (not identified). The steps identified by the participants are in the right column in Table 1. The participants who identified the steps are written in a bracket as (HS manager (HSM), Managers (M) and HS representatives (HSR). The steps identified are organised after the steps in Drupsteen et al.'s model, in the left column. However, no one individual or group was able to fully identify the process for learning from incidents within this company. In fact, each group showed little awareness of the process beyond their own involvement.

Table 1. Identified steps in the organisation's 'learning from incident' process.

Drupsteen et al. model	Learning from incident process in the organisation
1. Investigating and analysing incidents (Understanding causation)	
Incident reporting	Fill out incident report (HSM, M, HSR)
Incident registration	Manager sends report to WSM (HSM, M, HSR) HSM categorises and adds to stats (HSM, M, HSR)
Determine depth and scope of research	Manager decides if further help needed with analysis (M, HSR)
Fact finding	----
Incident analysis	Identify immediate cause & actions (HSM, M, HSR) Manager decides if further help with analysis is required (M, HSR) Managers seek help from Operations Manager, HSM if needed (M, HSR) Manager sends report to HSM (HSM, M, HSR), and discuss outcomes (M)
2. Planning interventions (Realistic action plan)	
Determine priority and urgency of actions	----
Formulate recommendations	HSM identifies if further action is required and what the action (HSM, M, HSR)
Formulate action plan	HSM add actions and "fixer" to "fix-it list" (HSM, M, HSR) WSM works with managers to formulate new policy (HSM)
3. Intervening (Realising actions)	
Communicate action plan	Manager & staff discuses incident at weekly team meetings (M, HSR) HSM creates monthly board report (summary only) (HSM) HSM decides what add to weekly noticeboard & adds reminder (HSM, M, HSR) Summary of incidents only discussed at HS meetings (HSM, M, HSR)
Find resources to perform actions	HSM emails weekly "fix-it list" to people with assigned actions (HSM, M, HSR)
4. Evaluating (Evaluating actions/process/impact)	
Evaluate implementation and effectiveness of action	HSM follows up actions (HSM, HSR). Manager and HSM follow up actions (M)

Table 2. Steps in which barriers were identified.

	Barrier identified		
Drupsteen et al.'s	HSM	Managers	Representatives
Incident reporting	X	X	X
Incident registration	X		
Incident analysis		X	
Communicating action plan		X	X
Finding resources to perform actions		X	
Evaluating implementation and effectiveness of action	X	X	X

Barriers to learning identified by the focus groups included: reluctance to report incidents (due to low priority in terms of daily work load; fear of blame, or perception of stupidity; incident not being perceived as serious enough to report; 'kiwi bloke' attitude; reluctance to have to re-train; embarrassment); lack of skills to investigate; cancellation/postponement of weekly team meetings causing lack of time for discussion; issues not shared amongst staff from other farms within the group; summary of incidents is too brief (lacking in detail and "disinfected" by the categorisation process); poor follow up process to ensure implementation of actions; policy manual too large to be effectively read and understood.

The first incident, which the HS Manager perceived as having a successful learning outcome, involved a case of Leptospirosis contracted by one of the company's managers. The HS manager wrote a policy on the prevention of Leptospirosis, based on industry best practice; circulated the policy to all staff; and issued appropriate personal protective equipment (PPE) to every shed. However, through both focus-group discussions it was identified that: the managers and workers knew about the incident but no audit or follow up occurred and no champion took up the cause. Many of the staff had no understanding of why the PPE arrived in the sheds or what their purpose was. The policy was not acted upon in any of the sheds.

The second incident, which the HS manager perceived as having an unsuccessful learning outcome, as incidents continued to occur, involved detritus being found in paddocks (fencing wire, tree branches) creating hazards for motorbikes and machinery. Through the focus groups it was identified that two senior operations managers had taken up this cause, and an existing policy called 'paddock warrant of fitness' (WoF) was championed by them and has now become a part of company procedures. All staff are aware of the WoF, and it had become a routine part of the daily farming regime within the company.

DISCUSSION

The process for 'learning from incidents' described by Drupsteen et al (2013) was almost identical to the process used within the case-study company. This supports that the model is suitable for use in a dairy farming organisation to identify the steps in the 'learning from incident' process and to identify where in the process the organisation is doing well or not so well. However further testing in a range of organisations to verify the general effectiveness of the model and method, and expanding on its relevance to the dairy farming industry may be helpful. The methodology used by Drupsteen and Hasle (2014) to identify barriers to learning from incidents was also found to be useful within the dairy farming organisation. Using the two-step process in the focus group discussion was useful. The first step identified the process and steps that were missing like fact finding in the investigation phase and determining the priority and urgency in the intervention planning phase. Using two different incidents helped identify that not all people within the organisation assessed the learning outcome to be the same. It showed the disconnect between the HS manager, managers and HS representatives. Identification of the difference in perception of the learning process was possible because the focus group for managers and for HS representatives were held separately and separate from the interview with the HS manager. Drupsteen and Hasle's method proved to be a useful and valuable exercise for this company. Prior to the production of the final report, the company had already made changes to its processes to better engage all staff in the process. Simply having focus groups lead to a shared understanding of the process by each of the participants. It was

suggested that redesigning the process to clarify each step in relation to the Drupsteen et al. model would help to further that understanding.

Many of the barriers identified related to a lack of understanding and commitment from the managers to the process of learning from incident reporting (e.g. reluctance to report incidents, lack of skills to conduct investigations and cancelation of weekly meetings). Many of the managers lacked the commitment to 'walk the talk' and lacked understanding of their ability to influence both their own staff and their company culture in relation to health and safety. These barriers related closely to the barriers identified by Kotter (2007) as being barriers to successful change management processes within organisations. Namely: establishing a sense of urgency; forming a powerful guiding coalition of senior staff prepared to champion and promote the change process; creating a vision to help steer the project; communication (including 'walk the talk'); empowering others to act on the vision; planning for and creating short term wins; consolidating the improvements and producing still more; institutionalising new approaches.

The discussions on the two identified incidents further emphasised a disconnect between the understanding of the different players within the organisation. The incident the HS manager had selected as being particularly successful was found to not have been so. Whilst new policy was written to deal with the incident, and PPE was distributed to all milking sheds, staff were not committed to making the necessary changes to their procedure. Managers were not prepared to 'walk the talk' on this issue and there was no powerful guiding coalition formed to champion and promote the new policy. It therefore failed to gain traction; the PPE remained stacked in a corner in the sheds and no change occurred to procedures in most instances. The second incident, selected as an incident that failed to establish organisational learning, nevertheless had champions in two powerful role models within the organisation and had been successful in implementing change in the way most farms did inspections of their paddocks prior to moving cattle into them. The paddock WoF had become a routine process – to the extent that the one farm that was not undertaking this new practice was noted as being an outlier who needed to be brought into line. The discussion on these incidents confirmed a lack of organisation wide understanding of the learning process in general, and the change management process in particular. It confirmed a lack follow up to ensure implementation of actions and long term learning.

CONCLUSIONS

Whilst this case-study was small (only one dairy farming company), it did show that the model of learning from incidents (Drupsteen at al. 2013) is generic and also applies to a large dairy farming company in New Zealand. The methodology developed by Drupsteen and Hasle (2014) was able to identify both the steps involved in learning from incidents and the barriers that stopped that learning from happening. Barriers were identified in many of the steps in the learning process and were particularly related to a lack of management commitment to health and safety and the 'learning from incident' process compared to their commitment to core business (production of milk). Finally, the barriers identified relate well to the barriers Kotter (2007) identified to organisational learning. Thus indicating that Kotter's suggestions for change management processes can be used to help implement health and safety changes – learnings from incidents within dairy farming organisations. Further learning could occur from repeating this approach in other industries, and extending the applications within dairy farming. The development of

methods for transferring this learning across organisations, for example between small dairy farms in New Zealand, could be valuable.

REFERENCES

Drupsteen, L., Groeneweg, J., & Zwetsloot, G. I. (2013). Critical steps in learning from incidents: using learning potential in the process from reporting an incident to accident prevention. *International Journal of Occupational Safety and Ergonomics, 19*(1), 63-77.

Drupsteen, L., & Hasle, P. (2014). Why do organizations not learn from incidents? Bottlenecks, causes and conditions for a failure to effectively learn. *Accident Analysis and Prevention*, 351.

Kotter, J.P. (2007). Leading change: why transformation efforts fail. *Harvard Business Review (1)*, 96.

Statistics NZ. (2014). *Injury Statistics – Work-related Claims: 2013* Wellington, NZ.

CATCHING ON: WORKING TOGETHER TO REDUCE MUSCULOSKELETAL INJURY RISKS IN COMMERCIAL FISHING

Marion Edwin, Optimise Ltd, marion@optimiseltd.co.nz
Darren Guard, Guard Safety, darren@guardsafety.co.nz

ABSTRACT
This paper provides an overview of recent developments in occupational health and safety and human factors/ergonomics in the New Zealand marine fishing industry. The nature of New Zealand's fishing industry is summarised, and its previous and current legislative environment is discussed to understand the challenges for maritime health and safety practitioners. The Fishing Industry Safety Forum is acknowledged as a key industry driver for improving health and safety performance. The industry's consistently high work related injury rates with prevalent musculoskeletal disorders were recognised, and sparked an ergonomics scoping assessment to identify musculoskeletal injury risk factors for fishers. The results are summarised, along with the Accident Compensation Corporation (ACC) and industry resources that were consequently developed. Ongoing musculoskeletal injury prevention efforts are occurring within industry, with injury reduction and productivity gains that highlight the potential benefits to businesses. This approach appears to be a new model for intervention in the industry internationally. This paper highlights the contributions that can be made by health and safety generalists and human factors/ergonomics professionals, and the benefits of industry and government agencies working together.

KEYWORDS
Musculoskeletal injury risks, commercial fishing, industry safety forum, productivity, injury prevention.

NEW ZEALAND'S FISHING INDUSTRY

Fishing, aquaculture and seafood is an important earner in export markets, valued at around $1.5 billion annually – an increase of 31 percent from 2002 (Statistics NZ, 2016). The market and product types are changing, with increasing earnings from the Chinese market and a focus on fresh/chilled fish as premium products, along with sustainable sourcing. The sector employs around 7,200 people in total, with 1,800 of these in fishing and around 5,000 in processing – a number that has fallen with advances in automation (Westpac Institutional Bank, 2016).

Four large fishing companies own or control approximately 80% of all New Zealand's fishing quota. These companies each operate several large deep sea fishing factory vessels of around 65m in length and crews of 45 that catch and process seafood at sea. In addition, there are approximately 1000 smaller vessels (less than 24 metre) operated either by independent fishers who own quota, or whom utilise quota owned by one of the four large fishing companies.

From an injury perspective, one in four (242 claims per 1,000 FTE) agriculture, forestry and fishery workers made a work-related injury claim in 2014 (Statistics NZ, 2015). This is the highest incidence rate by occupation in New Zealand, an unwelcome top place shared by these occupations since 2008. This rate tops 'elementary occupations' (e.g. cleaners, refuse collectors) at 238 claims per 1,000 FTE, and 'trades workers' (e.g. builders) at 209 claims per FTE.

COMPLEX MARITIME LEGISLATIVE ENVIRONMENT

The fishing industry has a very complex legislative environment and an interesting history in terms of the health and safety legislation. A working understanding of these aspects is critical for today's health and safety professionals working within the fishing sector.

Maritime Legislation

There are many maritime laws and conventions that must be adhered to by fishing companies. These include:

- International Maritime Organisation (IMO) conventions and protocols including:
  - safety of life at sea (SOLAS)
  - marine pollution (International Convention for the Prevention of Pollution from Ships) known as 'Marpol'
  - seafarer training, certification and watch-keeping
- International Maritime Dangerous Goods Code (IMDG)
- Load-line convention
- International collision regulations
- International manning requirements (IMO)
- International Labour Organisation requirements

These are interpreted by the relevant domestic authorities and used to create domestic Maritime requirements such as the Maritime Transport Act 1994. Maritime Operations are also required to comply with other domestic requirements such as:

- Food safety, via New Zealand's Food Act 2014, and requirements of the European Union's maritime rules
- Employment Relations Act 2000, and amendments
- Regional authority pollution requirements
- Health and Safety at Work Act 2015 (HSWA).

Health and Safety Legislation

Maritime New Zealand (MNZ) is the fishing industry's health and safety regulator, but it also has a range of duties that include ensuring safe and sustainable transport systems and protection of the marine environment. For the fishing industry the pathway to coverage by the HSWA was not always straightforward.

Vessels were not originally captured by the Health and Safety in Employment Act 1992 (HSE Act) when it came into force on land in 1993. The regulator believed that the maritime requirements already in force addressed many of the HSE Act requirements; hence vessels were not specifically captured by the HSE Act until 2003.

The fishing industry still had a high serious harm and fatality rate, and to address this FishSafe was introduced by ACC, the Seafood Industry Training Organisation, MNZ and the Federation of Commercial Fishermen in 2004. The industry championed FishSafe as they recognised that - despite the legislation - they had to do better. Maritime operators at that time relied on compliance with the Safe Ship Management Systems (SSMS) of MTA. Fishers had the belief that 'my boat is surveyed, and I have a safety plan' (under SSMS/MTA) and understood they had met all the requirements. The HSE Act was another layer of regulation that was all new.

An independent review of the SSMS in 2002 (Thompson Clark Shipping Pty Ltd) found that the current framework was inadequate, and recommended a number of core system changes. A limited number of changes to the SSMS system were consequently enacted, resulting in a Code of Practice for Safe Ship Management. Following the 2006 Kotuku sinking in Foveaux Straight with the loss of 6 lives, further work to improve the SSMS system was recognised and initiated by MNZ. The resultant improved Maritime Operator Safety System (MOSS) came into effect in July 2014.

These changes created the environment for confusion amongst some operators. MNZ has begun to address this via publications that clarify the HSWA and MTA requirements. In addition, there is a small number of maritime health and safety professionals and only developing recognition of the need for skills development that is specific to this sector.

Despite the history, fishing industry leaders are now grasping contemporary health and safety practice. In 2013 the industry formed the Fishing Safety Forum, which has representation from 80% of the industry (by fishing quota). The forum meets regularly, and is a vehicle for sharing safety learning and collaborating in the interests of health and safety with the mantra 'there are no secrets in safety'. Thus the fishing industry is working together to address health and safety issues.

RECOGNITION OF MUSCULOSKELETAL INJURY RISK

Whilst working in a health and safety role in a New Zealand fishing company, Guard recognised that many of the injuries sustained by fishing crew were musculoskeletal in nature. This was consistent with the 2012 'Fishing Sector Action Plan' (MNZ et al) that from ACC data identified 51% of fishing industry claims as soft tissue in nature (contusion, strain, sprain) followed by 20% 'laceration, puncture, sting' and 7% 'fracture/dislocation'. Further, Kahler and Chau's (2012) ACC funded report on New Zealand maritime injuries on under 24 metre vessels found that 'human energy' (lifting; lowering; pushing and pulling; repetition; awkward, difficult and sustained postures; caught between objects being handled; and struck by or against the object being handled and another person) was primary cause for 37% of injuries, and 'gravitational energy' (descending access systems; falls to same level; falls from height; and falling objects) was cause for a further 21% of incidents. These authors recommended a focus on human and gravitational energies to reduce the work toll on the smaller fishing vessels.

Recent 2011-2015 data from ACC (2016) confirms that musculoskeletal injury remains prevalent. For the commercial fishing sector, accepted claims for 2011-2015 years that related to manual handling (including pushing/pulling, and loss of hold) averaged 30% of the claim types. For these manual handling incidents lower back injuries were consistently the most common injury site (35% of injuries) followed by shoulder injuries (13%).

Previous work by Guard (cited in Edwin and Guard, 2014) had identified that over 24 metre vessels carry the greatest risk for injuries – with 2000-2008 data suggesting that 68% of serious harm incidents occurred on over 24 metre length vessels. Linked to the higher crewing numbers, this suggested that it would be valuable to target the largest factory fishing vessels to positively impact injury rates.

Matching these findings with observations on factory vessels suggested to Guard that a focus on musculoskeletal injury prevention on factory vessels was indicated.

ERGONOMICS EXPERTISE ON-VESSEL

In order to identify musculoskeletal injury risks for crew on working vessels, specialist input from a human factors/ergonomics professional was sought. This led to

conversations with an ergonomist, and then to discussions with ACC about the potential benefit of a study of the intervention opportunities possible for fishing crew. Improving the working environments and tasks aboard vessels fits with contemporary human factors knowledge - ergonomists aim to help prevent injury and improve work performance.

The ergonomics 'scoping assessment' of opportunities to prevent musculoskeletal injury risks aboard larger fishing vessels was approved as an ACC-funded industry project, with support from Auckland University of Technology. From the international literature, this project appeared to be a unique approach to identifying the injury risks faced by fishers. The work proceeded during 2013 with the ergonomist experiencing a total of 12 days at sea on 3 different working fishing vessels. One was a factory vessel, catching and processing fish, returning to land after up to 6 weeks at sea with market-ready product; and two smaller 'fresher' vessels bringing whole chilled fish back for processing on land.

MUSCULOSKELETAL INJURY RISKS

A wide range of opportunities to reduce injury risks were identified as discussed in Edwin and Guard (2014) and Edwin, Moore and Guard (2015). Key injury risks that were identified for fishers on factory and fresher vessels included:

- Repetitive factory tasks with long task exposures and seasonal peaks
- Heavy and awkward loads
- Poorly designed work areas with constricted and awkward work spaces
- Shifts of 6 hours on, 6 hours off, for up to 6 weeks
- Vessel motion impacts on the nature of the load and footing/posture for all activities, and contributes to physical fatigue
- Psychosocial aspects of crew living and working in close proximity on-vessel
- Poor training in injury prevention strategies, and poor training in safe work methods
- Poor understanding of the role of cardiovascular activities, stretching and general fitness for vessel crews, and limited facility for this on-vessel
- Poor organisational/management understanding of the nature of musculoskeletal injury risks and methods of intervention
- Employee selection processes with little link to the task demands of on-vessel work
- Dehydration was common and significant in fishers
- Lack of injury prevention resources specific to the fishing industry
- Poor organisational processes for incorporation of health and safety elements into planned maintenance work, including the design processes utilised.

RESOURCE DEVELOPMENT

Further discussion with ACC led to an initial project to develop industry specific resources targeting musculoskeletal injury prevention. Thus a range of injury prevention tips can be found at the ACC site http://worksmarttips.co.nz/choose-your-workplace/ (select 'fishing'). Key industry players also worked together to produce a set of stretching posters and a lifting and handling poster suited to the work tasks and environment of a working fishing vessel. These were made available via the Fishing Safety Forum (Figure 1, over), and can be found at http://www.guardsafety.co.nz/.

Figure 1. Some of the poster resources produced by industry and ACC.

INDUSTRY UPTAKE AND RESULTS

Findings were fed back to the industry via the Fishing Safety Forum. This has contributed to fishing companies having better knowledge of musculoskeletal injury risks and the range of strategies to address these. Some fishing companies have initiated interventions targeting musculoskeletal injury reduction, with one company reporting positive results from the initiation of a number of interventions (Edwin, Moore and Guard, 2015). An ergonomics training programme addressing manual handling methods, sleep hygiene, stretching, break practices for work tasks, task methods, fitness and hydration were conducted with crews in a land-based venue whilst in port. This company also addressed the physical design aspects of the factory on one vessel, and for this vessel reported a lost time injury frequency rate that dropped from 3.15 (121 injuries) for the 2013 year end, to 1.06 (55 injuries) at 2014 year end. In conjunction with this promising result the vessel also experienced a 9.3% productivity gain. Ergonomics training interventions, improved discomfort and injury reporting, factory design changes, and a more stable and effective crew mix were identified as the key changes contributing to the injury reductions and productivity gains. This verified the findings of Gaskin et al (2015), who suggested that considerable financial gains could be made by fishing companies investing in targeted injury prevention and process improvement strategies.

The nature of work on fishing vessels increases the difficulty of experts accessing the working facility, thus is logistically challenging for all involved. As crews are at sea for 6 or 12 weeks before 6 weeks on land, they are less able to participate in education or other development activities and it is challenging to coordinate all key personnel for meetings. Even more challenging for design processes is that two sets of senior officers operate each vessel - demanding work with two sets of operators, and for some companies several sets of factory/deck crew.

This novel approach to working with New Zealand's commercial fishing sector has promising results, and may be usefully expanded upon to begin to address the lack of research (Lucas et al, 2013) specific to occupational safety within the international commercial fishing industry.

CONCLUSIONS

The Fishing Safety Forum is an industry initiative that continues to drive a focus on injury reduction for the fishing industry, and is an example of the importance of industry-lead action in the health and safety space. An example of effective interaction with a government agency, this work demonstrates how ACC has added value and direction by supporting the scoping investigation that allowed the fishing industry to gain an understanding of the injury risks present within the industry, and make some progress towards interventions. Further, ACC has supported the development of resources that allow industry to more effectively address the injury risks. MNZ have indicated an interest in application of this work.

This work also highlights the benefits of engaging different health and safety professionals – in this case health and safety generalists and human factors/ergonomics professionals – to work together to address industry needs.

REFERENCES

Edwin, M. and Guard, D. (2014). *Fishing for information: Scoping for opportunities to prevent musculoskeletal disorders on New Zealand's large fishing vessels.* HFESNZ Conference Proceedings.

Edwin M., Moore, D., and Guard, D. (2015). *Dehydration in New Zealand fishing vessel crews*. Proceedings of 19th Triennial Congress of the International Ergonomics Association, 9-14 August 2015. IEA.

Gaskin, H., Edwin, M, Moore, D. and Guard, D. (2015). Exploratory *(Multi) Cost Benefit Analysis in New Zealand's fishing industry.* Proceedings of 19th Triennial Congress of the International Ergonomics Association, 9-14 August 2015. IEA.

Kahler, R., and Chau, A. (2012). *Study of Personal Damage in New Zealand Maritime Industry*. Intersafe, Brisbane, Australia.

Lucas, D., Kincl, L., Bovbjerg, V. and Lincoln, J. (2013). *Application of a translational research model to assess the progress of occupational safety research in the commercial fishing industry*. Safety Science 64:71-81.

MNZ, FishSAFE, ACC, DoL. (2012). *Fishing Sector Action Plan*

Statistics NZ. (2015). *Injury Statistics – Work-related claims: 2014.*

Statistics NZ. (2016). *Value of fisheries and aquaculture*. Downloaded 5.6.2016.

Thompson Clark Shipping PTY Limited. (2002). *Review of Safe Ship Management Systems*.

Westpac Institutional Bank. (March 2016). *'Industry Insights – fishing, aquaculture and seafood'.*

TO SIT OR NOT TO SIT? – A RANDOMISED CONTROLLED TRIAL OF ADJUSTABLE HEIGHT DESKS IN THE OFFICE

Jane Pierce, Work Recovery, jane.pierce@workrecovery.co.nz
Stephen Legg, Centre for Ergonomics, Occupational Health and Safety, School of Public Health, College of Health, Massey University, S.J.Legg@massey.ac.nz

ABSTRACT
Evidence-based literature indicates that prolonged (excessive) sitting at work may be reduced by interruption of occupational sitting and minimising prolonged periods of sedentary behaviour - such as alternating sitting/standing, active sitting, walking, cycling. Interventions which target multiple aspects of an office work system are likely to be more effective than those targeting just a single aspect. In a New Zealand case study, the use of electronic adjustable height desks was significantly associated with increases in workplace activity for average and daily pedometer step counts ($p<0.001$) and self-reported light intensity activity during work ($p<0.001$). It was therefore concluded that the introduction of electronic adjustable height desks in offices could increase physical activity levels.

KEYWORDS
Sit, Stand, Sedentary, Physical activity, Desks, Computer, Workstations.

INTRODUCTION

'*To sit or not to sit - that is the question. Whether 'tis nobler in the mind to stand or to suffer the slings and arrows of outrageous posture, or to arise and take arms against a sea of convention, and by opposing, end it?*'

Our adaptation above of the opening lines of Hamlets' (Shakespeare,1604: Hamlet, Act III Scene 1) famous speech captures the essence of the current debate about the relative health benefits of sitting, standing and physical activity – in short, the debate about 'sedentariness'.

In the original version, Hamlet's famous question: '*To be or not to be?*' is adapted by us to: '*To sit or not to sit?* Our version addresses the future of musculoskeletal and metabolic morbidity rather than death (by suicide). Nevertheless it is a very relevant question for modern society, where sitting and sedentariness is highly prevalent and its consequences are being re-assessed.

This paper summarises current evidence-based international literature about sitting (sedentariness), standing and physical activity at work and describes a case study illustrating the effects of introducing electronic adjustable height desks (AHDs) for office workers in a medium-sized company in New Zealand in order to address the populist question: 'Are adjustable height desks in offices a fad or the future?'

SUMMARY OF EVIDENCE-BASED LITERATURE ON SITTING (SEDENTARINESS), STANDING AND PHYSICAL ACTIVITY AT WORK

With the advancement of mechanisation and expansion of computerisation, particularly with changes in information technology, more workers are engaged in desk-based occupations and are becoming increasingly sedentary (Ellegast et al. 2012). Prolonged static postures have been recognised as a contributor to musculoskeletal discomfort (MSD) since Ramazzini's observations in the 17th

Century (Franco 1999). The human body requires movement both to nourish structures by increasing blood flow and to provide periodic rest for muscles to prevent fatigue. Thus standing, used alternatively as a rest from sitting, could form a basis for musculoskeletal injury prevention for desk-based workers. Since work time accounts for almost half of the daily total (Parry and Straker 2013) the workplace provides an opportunity for reducing overall sedentary time and for introducing physical activity.

The most recent evidence review of sedentary work (Straker et al 2016) identifies it as an emergent health and safety issue. It links sedentary behaviour with increased risk of premature mortality, chronic health disorders and detrimental work outcomes associated with rapid advances in technology and environmental change. Sedentariness is likely to increase but there is no clear definition of excessive occupational sitting exposure. Straker et al's (2016) report identifies multi-component interventions targeting multiple elements of work systems as most successful. There is evidence of the effectiveness of occupational exposure assessments and workplace interventions for office work but not yet for non-office settings. The report identifies ways to reduce sitting time and sedentary behaviour (Table 1). It shows potential substitution alternatives to sitting (standing, active sitting, walking, cycling), potential options to interrupt occupational sitting and minimise prolonged periods of sedentary behaviour and the effectiveness of interventions to reduce occupational sitting in office and non-office workplaces.

Table 1. Ways to reduce sitting time and sedentary behaviour (Straker et al 2016)

Potential substitution alternatives to sitting • Standing, walking and desk-based cycling • The long term feasibility and extent to which these alternatives can be used in 'white' and 'blue' collar workplaces is yet to be determined • Most 'active' sitting options probably provide little cardio-metabolic benefit, although they may provide some musculoskeletal benefit • Active commuting and being active during non-productive breaks at work • Substitution of work and non-work sitting tasks with standing and moving tasks throughout the day
Potential options to interrupt occupational sitting and minimise prolonged periods of sedentary behaviour • Keep sedentary task bouts to no longer than 20-30 minutes in order to obtain musculoskeletal and metabolic benefits • Use task variation to interrupt prolonged sitting by either the substitution of sitting with a productive or non-productive non-sedentary task, or by a brief non-sedentary activity. • Examples of substitution tasks to interrupt sedentary tasks include: switching to work on a computer at a standing or walking workstation, switching to stand to read a document, switching to a standing meeting, switching to a walk with friends at lunch time, switching to stand for some of the public transport work commute. • Examples of brief activities which can act as interruptions include: standing while talking on the phone, walking to deliver a message to a colleague rather than emailing, walking to get a drink or visit the bathroom. • Good job design can use substitution and interruption to minimise the harm from excessive occupational sitting
Effectiveness of interventions to reduce occupational sitting in office and non-office workplaces • Most intervention trials have been conducted on office workers • Interventions to reduce occupational sitting of office workers can be effective, and reduce exposure by over an hour each work day • Interventions which target multiple aspects of the office work system are likely to be more effective than those targeting just a single aspect

- Qualitative studies suggest that concern about productivity is likely to be the most significant barrier to change
- Preliminary data suggests interventions can successfully reduce sitting exposure in highly sedentary non-office based occupations such as truck drivers
- Evidence on the implementation of changes to create sustainable work systems is limited
    - Substantial work system changes are more likely to be sustainable than increasing worker education and awareness
    - Participative approaches that engage workers and develop a sense of ownership and commitment to change by managers/supervisors and employees working as a team are important in developing, implementing and promoting effective sitting reduction interventions
    - Generating a social and physical environment that supports and facilitates employees to sit less, communicating the purpose and associated evidence for the intervention and, having champions to role model and support the intervention messages appear to be important

ARE ADJUSTABLE HEIGHT DESKS (AHD) IN OFFICES A FAD OR THE FUTURE? – A CASE STUDY

Adjustable height desks (AHD) have been promoted as an environmental intervention to reduce workplace sitting. The premise is that the use of an AHD will promote movement by allowing the worker to switch between sitting and standing whilst engaged in work (Buckley et al. 2015). There is a growing body of evidence to support the beneficial effects of the use of AHDs at work (Healy et al. 2013; Neuhaus et al. 2014). This case study was to determine if the allocation of AHDs in a real world office setting would influence activity during work hours by increasing light physical activity and reducing sitting.

Methods

The study was a randomised controlled field trial of the introduction and use of AHDs in a branch of a medium sized energy company in Hastings, New Zealand. The study was approved as a Low Risk Notification by Massey University Human Ethics Committee. Before the start of the study, all staff used fixed sitting height desks (FSHDs). Twenty four (12 female, 12 male) met the inclusion criteria (< 0.8 Full Time Equivalent and ambulatory with no history of significant illness or injury) and were selected to participate. None had previously used an AHD. All were either professional or administrative staff and most of their work was computer based.

The participants were randomly divided into two groups of twelve – an Intervention group (7 females, 5 males) who were allocated AHDs (Espace Blake electronically height adjustable workstation 2000x1200x700mm with left or right hand returns) and a Control group who retained their FSHDs. The Control group comprised 5 females and males (one male withdrew due to a non-work-related injury).

Prior to the start of the trial all participants were allocated individual pedometers (Keep Walking-Stay Fit, made in China) and physical activity diaries (PADs) and briefed on how and when to use them. Pedometer and PADs data were collected on one working day at fortnightly intervals over 16 weeks. Physical activity was assessed by step counts, self-reported activity on PADs and comparison between pre- and post-trial questionnaires. Total day step counts were self-recorded for the time they were at the workplace. Average step counts were calculated for each participant and daily averages for each group. The PAD data comprised the predominant activity for the preceding 15 minutes for: sitting; standing still; standing and moving <1.5m; standing and moving >1.5m. From the PADs, frequency count was obtained for each of the activity levels.

The impact of group (Intervention or Control), gender, activity type, pre/post-desk allocation and week were analysed using R3.1.2 (R Core Team, 2014). A generalised linear model with a log link function was used for all response variables that were counts. Statistical hypotheses were deemed significant if p was <0.05. Frequency counts of the four activities were analysed with the other variables of group (Intervention or Control), gender, week and individual using Fisher's Exact Test, because of the small sample size. Mean counts were examined and proportions were calculated for group (Intervention or Control) and gender for each week.

Results

The use of AHDs was significantly associated with increases in workplace activity for average and daily pedometer step counts (p<0.001) (Table 2), self-reported light intensity activity during work (p<0.001) (Table 3).

Table 2: Mean [SD] pedometer step counts for Intervention and Control Groups

Week	Intervention AHD[1]	Control FHSD[2]
1#	3553 [678]	3114 [553]
2#	2931 [357]	4857 [1392]
Average 1# and 2#	3242 [380]	3985 [754]
3	4053 [542]	3813 [963]
4	3841 [478]	3681 [778]
5	5140 [1079]	4655 [956]
6	5072 [716]	4578 [1053]
7	3997 [483]	3542 [699]
8	3620 [452]	3701 [701]
Average 3 - 8	4287 [270]	3988 [347]

[1] Adjustable height desks, [2] Fixed height sitting desks, [#]Weeks 1 – 2: all participants used FHSD

Table 3: Proportion of work day in different activity levels for Intervention and Controls

Activity Level	Intervention Male	Intervention Female	Control Male	Control Female
Walk >1.5m				
Weeks 1-2#	26%	27%	15%	20%
Weeks 3-8	35%	28%	14%	19%
Walk<1.5m				
Weeks 1-2#	14%	5%	8%	6%
Weeks 3-8	15%	28%	6%	3%
Stand				
Weeks 1-2#	1%	1%	0	2%
Weeks 3-8	32%	14%	<1%	<1%
Sit				
Weeks 1-2#	59%	67%	77%	72%
Weeks 3-8	17%	30%	80%	77%

[1] Adjustable height desks, [2] Fixed height sitting desks *due to rounding of numbers some totals exceed 100%;
[#]Weeks 1 – 2: all participants used FHSD

CONCLUSIONS

A recent evidence review report on sedentary work identified the main ways to reduce sitting time and sedentary behaviour as substitution alternatives to sitting (standing, active sitting, walking, cycling) and options to interrupt occupational sitting and minimise prolonged periods of sedentary behaviour. Whilst the effectiveness of interventions to reduce occupational sitting in office and non-office workplaces can

be effective in reducing sitting time by over an hour for each work day, interventions which target multiple aspects of an office work system are likely to be more effective than those targeting just a single aspect.

A case study of introducing adjustable height desks as a specific intervention in a small business office environment in New Zealand was associated with increased physical activity and reduced sitting time. A more widespread knowledge and appreciation amongst companies and organisations, in New Zealand and internationally, of the outcomes of the present study and of the importance of decreasing sedentariness and its' associated cost-benefits, may strengthen their interest in increasing their use of AHD's in offices. It is concluded that the use of AHDs in office setting may have real benefits for physical activity and therefore should not be considered as merely a fad, but should be used more widely in the future.

REFERENCES

Buckley, J; Hedge, A; Yates, T; Copeland, R; Loosemore, M; Hamer, M; Bradley, G; Dunstan, D (2015). The sedentary office: a growing case for change towards better health and productivity. Expert statement commissioned by Public Health England and the Active Working Community Interest Company British Journal of Sports Medicine 0: 1-6 doi:10.1136/bjsports-2015-094618

Ellegast, R; Weber, B; Mahlberg, R (2012). "Method inventory for assessment of physical activity at VDU workplaces." *Work* 41 2355 – 2359

Franco, G (1999). "Ramazzini and workers' health." *Lancet* 354:858-61

Healy, G; Eakin, E; LaMontagne, A; Owen, N; Winkler, E; Wiesner, G; Gunning, L; Neuhaus, M; Lawler, S; Fjeldsoe, B; Dunstan, D (2013). "Reducing sitting time in office workers: Short-term efficacy of a multicomponent intervention." *Preventative Medicine* 57 43 – 48

Neuhaus, M; Healy, G; Dunstan, D; Owen, N; Eakin, E (2014). "Workplace Sitting and Height-Adjustable Workstations A Randomised Controlled Trial." *American Journal of Preventative Medicine* 4:46 (1):30 – 40

Parry, S; Straker, L (2013). "The contribution of office work to sedentary behaviour associated risk." *Biomed Central Public Health* 13: 296

Straker L, Coenen P, Dunstan D, Gilson N and Healy G (2016). Sedentary Work – Evidence on an Emergent Work Health and Safety Issue - Final Report, Canberra: Safe Work Australia, ISBN 978-1-76028-589-0

PREVENTING MUSCULOSKELETAL DISORDERS IN RESIDENTIAL CONSTRUCTION

David Tappin, School of Management, Massey University, d.c.tappin@massey.ac.nz
Darryl Forsyth, School of Management, Massey University, d.forsyth@massey.ac.nz
Bevan Catley, School of Management, Massey University, b.e.catley@massey.ac.nz
Tim Bentley, School of Management, Massey University, t.a.bentley@massey.ac.nz

ABSTRACT
The daily work of residential builders can expose them to many risk factors associated with musculoskeletal disorders (MSD). These risk factors have lead to a high prevalence of MSD, with injury data for 2009–2013 indicating that MSD were responsible for around 40% of industry claims and a similar proportion of the costs. The purpose of this study was to identify measures used by residential builders to prevent MSD, and to establish how these measures might best find their way into the hands of all builders nationally. With the assistance of the Master Builders Association, the Certified Builders Association, and ACC, 61 residential builders from Christchurch, Wellington and Auckland were interviewed to identify what measures they took to prevent MSD. From this process, 164 measures were identified and organised into 26 groups relating to the organisation of work, building practices, and work equipment. Following the release of an industry report, a further sample of four builders rated each measure on its feasibility of being implemented. A short list was then developed comprising those 57 measures rated highest by the builders as well as the researchers. This study has identified measures which some builders have applied in their work and found to be effective. The efficacy of the measures, however, is yet to be determined.

KEYWORDS
Musculoskeletal disorders, manual handling, residential construction

INTRODUCTION
Musculoskeletal disorders (MSD) have long been recognised as a problem in residential construction (e.g. Schneider, 2001; Podniece, 2008), and they are no less an issue in New Zealand. An analysis of 2005-07 data from ACC for house construction workers found that 42% of all claims were MSD (Hide, Tappin, McDonald, 2009), while a recent taxonomy report on ACC residential construction claims of significant cost found that 44% of these were soft tissue claims, most of which were MSD (Lehfeldt & Kahler, 2013). There are around 130,000 residential builders in New Zealand (M.Francis, September 2015), although this number fluctuates greatly with cycles of demand for house construction. Most builders are either self-employed or work for small building businesses, so anything that prevents them from working will directly affect income and business viability.

In residential construction, the risk factors for MSD can be numerous, given the varied, unpredictable and time-pressured nature of building project work. On the one hand this varied nature can be a protective factor in that exposure to high MSD-risk tasks may be limited, but on the other hand it can make it more difficult to provide builders with an understanding of the wide range of cumulative MSD risks they may be exposed to. The common occurrence of MSD in residential construction may also mean that they become accepted as an inevitable consequence of the work. This has implications for an ageing workforce, with exposure to risk factors over a long

period. Additionally, people who are new to the industry in particular may be unaware of cumulative MSD risks, or they may not be concerned about them.

Addressing MSD prevalence and claims costs in residential construction is therefore a high priority for ACC and the industry themselves. The purpose of the project was to canvas builders on measures that they currently take to prevent or minimise musculoskeletal disorder risks in their work. The Master Builders Association (MBA) and the Certified Builders Association (CBA), through whom participants for the project were identified, provided support for the project.

METHOD

Stage 1: identifying measures

The approach adopted for this stage was based on an earlier study in the meat processing industry (Tappin, et al., 2007) where measures taken to address MSD were collected from people working in the industry through semi-structured interviews on site. The main strength of this approach is that it identifies successful measures that are already in place, overcoming some concerns around implementation barriers, and increasing the chances of others in the industry adopting these measures by demonstrating that they are feasible and therefore worth considering.

Sixty one residential builders from Christchurch, Wellington and Auckland agreed to take part and were visited and interviewed on one occasion between March and August 2014. These cities were specified by the funder on the basis of their high volumes of housing projects and so that variations in site topography, work (new, repair, renovation) and project scale were encountered. Questions were asked of builders about their thoughts on MSD risk factors, what measures they took to address MSD in their work, the success of these measures, barriers or problems they encountered and how they dealt with these, and other plans or ideas they had for addressing MSD in residential construction. The responses from all the interviews were analysed, with similarly worded measures combined together. Further information on each measure was provided through indicating the number of builders who mentioned it, and whether support exists for the measure in published research. A rating was also given to each measure by the researchers on its potential to reduce MSD risk (high, medium, low), based on the collective opinions of the research team.

Stage 2: rating measures

The 164 measures derived from Stage one were then rated on their feasibility of being implemented by builders (high, medium, low) by an opportunity sample of four builders from MBA Northern Region in mid-2015. None of the builders had been involved in Stage 1. An initial meeting was held with the builders where the study was explained and questions answered on MSD and the measures themselves. The builders were then asked to consider each measure and apply their rating rate on the feasibility of being implemented by builders. These were returned to the researcher over the following two months. Measures that were rated high by three or four builders, and were also rated high by the researchers were categorised as ‘A’ priority measures. Those that were rated high or medium by three or four builders, and were also rated high by the researchers were categorised as ‘B’ priority measures.

FINDINGS

Data from stage one were collated into 164 separate measures. These were listed under 26 headings, within three groups – work organization (53 measures), work practices (78 measures), and work equipment (33 measures). To facilitate translation of these measures by builders they were then summarized under 8 headings (illustrated in figure 1 below). Refer to Tappin et al., 2014 for further details on the individual measures that individual builders might adopt and the evidence for them.

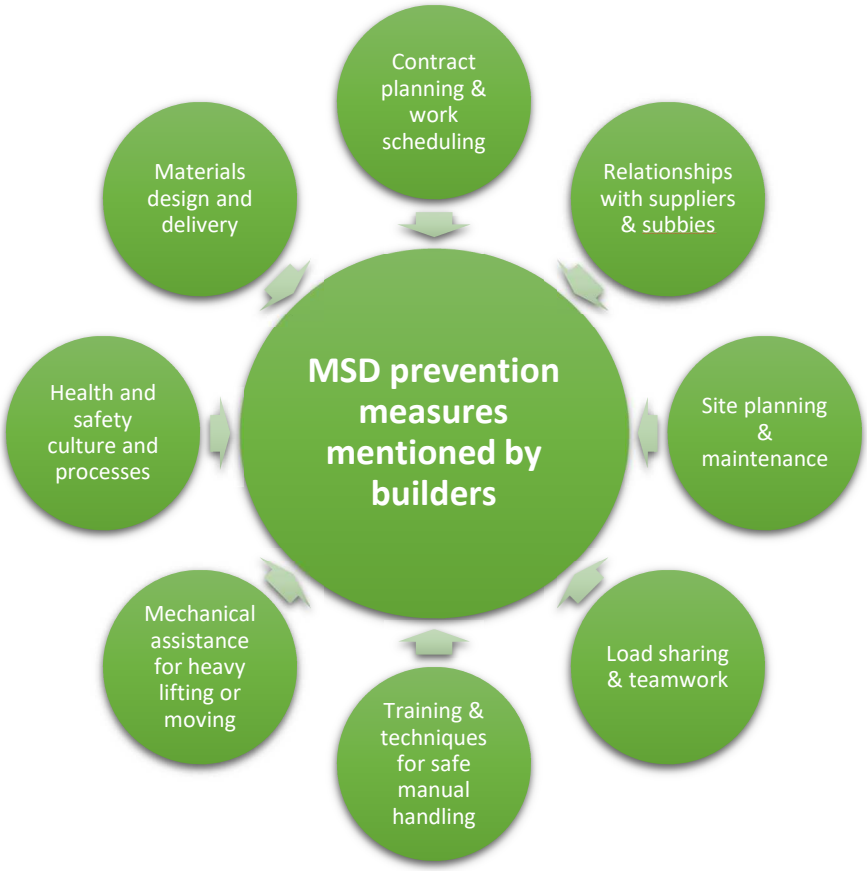

Figure 1: A summary of MSD measures most mentioned by builders and considered to have the most potential to reduce MSD risk

In stage two, 27 measures were rated as 'A' priority measures, with a further 30 measures rated 'B' priority. The 'A' priority measures are summarised in Table 1.

Table 1: 'A' priority measure identified in stage two

1. Contract planning and work scheduling
Develop a schedule of work and determine critical paths throughout each stage of building so that people, equipment, and materials can be planned ahead of time and are there when required.
2. Relationships with suppliers and subbies
Have longstanding relationships with suppliers, crane drivers, scaffolding companies, and subcontractors who can be trusted and who work to a high standard.
3. Site planning and maintenance
Keep the building site tidy. Helps to: reduce tripping/stumbing risks, saves time finding things, can reduce travel distances and time, makes moving equipment easier and reduces waste through reusing offcuts.
Work with the scaffolding company to discuss the design and ensure it meets the builder's requirements. Meet with scaffolding company on site before it is erected to reach agreement, ensure that the scaffolding is checked weekly and plan to make any changes around this visit.
Planning has been the most successful way of addressing manual handling risks. Plan ahead to identify potential hazards and work out how they will be best managed. Make sure that people &/or equipment are available at that time.
Would like to be able to adjust scaffolding temporarily so that it is easier/possible to install joinery.
Plan site layout beforehand, giving consideration to: ease of access for suppliers/builders/subbies, site security, hygiene, storage of materials, minimising travel distances/travel time, and minimising double handling.
Build a loading platform on the second level of scaffolding so that timber/sheeting/tiles and other materials can be placed there by hiab, reducing the amount of manual handling and time required to physically move it there.
Have hazard/toolbox meetings once a week to discuss what's happening, what new risks need to be managed, and the best solutions for doing this. It is participative - everyone contributes. Meetings also occur before difficult tasks.
Plan housekeeping into regular work routines so that it does happen: 10-15 minutes every day, before or after meetings, uses time between other tasks to clean up on site, a bigger clean-up in the last hour of work on Friday.
4. Health and safety culture and processes
The person in charge on site sets the standard and are the key to reducing risk. When they have a safety focus then they see more safe work practices on site. Part of setting an example also includes making decisions that consider safety, instilling safety awareness, and enforcing rules
There is encouragement to raise safety issues, knowing that you will be supported and that something will be done about it. Toolbox meetings help as safety issues are discussed. No expectations to hurt yourself rather than ask for help.
5. Load sharing and teamwork
They realise the value in having more people on site to help with heavy handling - reducing weight and risk. Employ people to help if required with heavy tasks (framing, joinery, roof trusses, heavy or large sheets).
Hires hiab to lift beams, trusses, windows, frames, materials.
Always work in pairs on site, with good teamwork and technique. Two people handle items such as sheeting. It is usually easier, as well as much quicker and safer. For some tasks they need to be similar heights to work well.

6. Materials design and delivery
Get windows delivered unglazed and glaze once installed.
Deliver materials as close as possible to where they are needed - reduce double handling and travel distances.
Get framing assembled in smaller pieces that are easier to handle with less people (as both weight and size are reduced). Particularly important with larger timber dimensions (140mm x 50mm cross section).
Mark out on the floor where the frames are to go - saves time and reduces double handling through mistakes.
7. Training and techniques for safe manual handling
Using leverage to increase the mechanical advantage and reduce the effort required (e.g. using a fulcrum to lift wallboard sheets into place on walls, using ropes and levers when handling trusses, using a crowbar to create leverage).
Stop and think about what is to be done before starting heavy tasks.
8. Mechanical assistance for heavy lifting or moving
Use a hiab or larger crane wherever possible to reduce the need to handle heavy, large items, and to lift them into place or closer to where they are needed, or as a brace (trusses, frames, beams, materials, lifting roofs on/off).
Uses gib lifter - saves time when only one person.
Uses diggers for footings/foundations wherever possible.
Gets the hiab to place timber and other building materials on the same level of scaffolding as it is used to reduce handling of lengths of timber between levels.
Hires a hiab/crane when required and schedules work for it to do (e.g. timber packet or waste bin placement to reduce travel distances and double handling).
Leaves one window out and hiab materials into where they are to be used (pre-lined inspection prevents this in some cases).

DISCUSSION & CONCLUSIONS

The findings from both stages of this project represent the voice of builders, recognising them as subject matter experts rather than relying on more traditional approaches to assessing and managing MSD risks. Critically, builders mentioned these measures because they had found them to be effective or perceived that that they would be. Risk reduction was secondary to saving time, money, or materials and in most situations safety ideas had to make business sense to be considered at all. This arguably makes their application to the wider industry more feasible. Since completion of the report, ACC and the residential building Associations have discussed the next steps for developing and implementing findings from the report. This includes recognition of the variations in work arrangements, work activities and work sites that builders are exposed to, as well as the need to tailor the measures to match the needs and expectations of the builders.

There are obvious limitations to these findings including: the small sample of urban builders involved in the project and how representative they are of the wider industry, the scope of the measures being limited by the builder's knowledge of MSD, a lack of data on the efficacy of the measures mentioned, and as builders were invited to participate it is likely that the sample was biased towards people already considering MSD (Village and Ostry, 2010). Finally, the measures should not be judged in isolation as the most effective way to address MSD is with a collective approach involving the implementation of multiple measures.

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REFERENCES

Hide, S., Tappin, D., McDonald, B. (2009). Construction initiative: evaluation of the 2005-7 ACC injury and claim descriptions for house construction workers. *COHFE Report*, 10(3). Scion: Albany.

Lehfeldt, P., Kahler, R. (2013). *Report – study of personal damage in the New Zealand Residential Construction Industry*. ACC: Wellington.

Podniece, Z. (2008). *Work-related musculoskeletal disorders: prevention report*. European Agency for Safety and Health at Work: Luxembourg.

Schneider, S. (2001). Musculoskeletal injuries in construction: a review of the literature. *Applied Occupational and Environmental Hygiene*, 16(11), 1056-1064.

Tappin, D., Bentley, T., Ashby, L., Tedestedt-George, C., Tedestedt, R. (2014). Identifying measures to reduce musculoskeletal disorder risks in residential construction: findings from interviews with 61 builders in Christchurch, Wellington and Auckland. A report for industry from the 2014 ACC funded Residential Construction Intervention Design Project (September 2014). Massey University.

Tappin, D., Moore, D., Bentley, T., Parker, R., Ashby, L., Vitalis, A., Riley, D., Hide, S. (2007). Industry interventions for addressing musculoskeletal disorders (strains/sprains) in New Zealand meat processing. *COHFE Report 8(5)*. Scion: Albany.

Village, J., Ostry, A. (2010). Assessing attitudes, beliefs and readiness for musculoskeletal injury prevention in the construction industry. Applied Ergonomics, 41, 771-778.

THE EVALUATION OF RISK ASSOCIATED WITH MOVING AND HANDLING IN A RESIDENTIAL CARE HOME

Fiona Trevelyan, Auckland University of Technology NZ, fiona.trevelyan@aut.ac.nz
Liz Ashby, Auckland University of Technology NZ, lashby@aut.ac.nz
Mark Boocock, Auckland University of Technology NZ, mboocock@aut.ac.nz
Mike Fray, Loughborough University UK, M.J.Fray@lboro.ac.uk

ABSTRACT
The proportion of the population aged over 65 years is rising at an unprecedented rate and is predicted to increase from 15 to 25% by 2050 (Chang et al, 2013). Caring for an aging population presents a major challenge particularly as the workforce caring for them are typically over the age of 45 years, and experience high injury rates and staff shortages (Ravenswood et al, 2014). Multifactorial interventions are considered the most effective way of reducing nurses' exposure to the risk factors present in nursing work (Dawson et al, 2007) however such interventions are complex and difficult to evaluate. The Tool for Risks Outstanding in Patient Handling Interventions (TROPHI) is comprised of 12 outcome measures and was developed in an attempt to measure the effectiveness of complex interventions implemented in health care (Fray and Hignett, 2013).

The study aimed to determine the profile of risk factors associated with moving and handling in a residential care home. Baseline measures were recorded and areas of high risk identified. The study used the TROPHI tool to collect data about the organisation and included staffing levels, workload, sickness absence and management systems. Safety culture was assessed using interview and written questionnaire and a self-report questionnaire administered to employees to collect data about musculoskeletal health and wellbeing. Direct observation was used to evaluate patient transfers and nursing home residents asked for feedback about their experience of being assisted to move.

Results from this study inform current risk management practice and highlight where future investment should be targeted. The organisational risk profile was compared against an international data set which provided contextual interpretation of the findings. The study informs about the methodology and its suitability for assessing health care interventions in the NZ healthcare sector.

KEYWORDS
Patient handling; healthcare; residential care, risk assessment

INTRODUCTION
The proportion of the population aged over 65 years is rising at an unprecedented rate and is predicted to increase from 15 to 25% by 2050 (Chang et al, 2013). Caring for an aging population presents a major challenge with projections indicating services supporting the older adult will come under operational pressure as they attempt to meet this increasing demand (Ravenswood et al, 2014).

The workforce employed in residential care in New Zealand (NZ) has doubled in the last 20 years and currently stands at approximately 33,500 persons, who have an average age of over 45 years (Ravenswood et al, 2014). Healthcare workers experience high injury rates and staff shortages (Harcombe et al, 2014) and report

more musculoskeletal disorders (MSD) than any other injury type (Thomas & Thomas, 2014). The high incidence of MSDs is identified as a factor that impacts the delivery of health care service (Harcombe et al, 2014).

Patient handling interventions tend to be evaluated using musculoskeletal disorders (MSDs) incidence and prevalence data and until recently complex interactions that exist between organisational and physical factors have not been considered (Fray & Hignett, 2013). The association between physical and psychosocial risk factors and work related musculoskeletal disorders (WRMSDs) in nursing is widely accepted (Yassi & Lockhart, 2013) with multifactorial interventions identified as the most effective way of reducing nurses' exposure to these risk factors (Dawson et al, 2007). The Moving and Handling People: The NZ Guidelines (ACC, 2012) are an example of a multi-factorial programme designed to reduce exposure to MSD risk factors in healthcare workers. The core components of this programme are outlined in Figure 1.

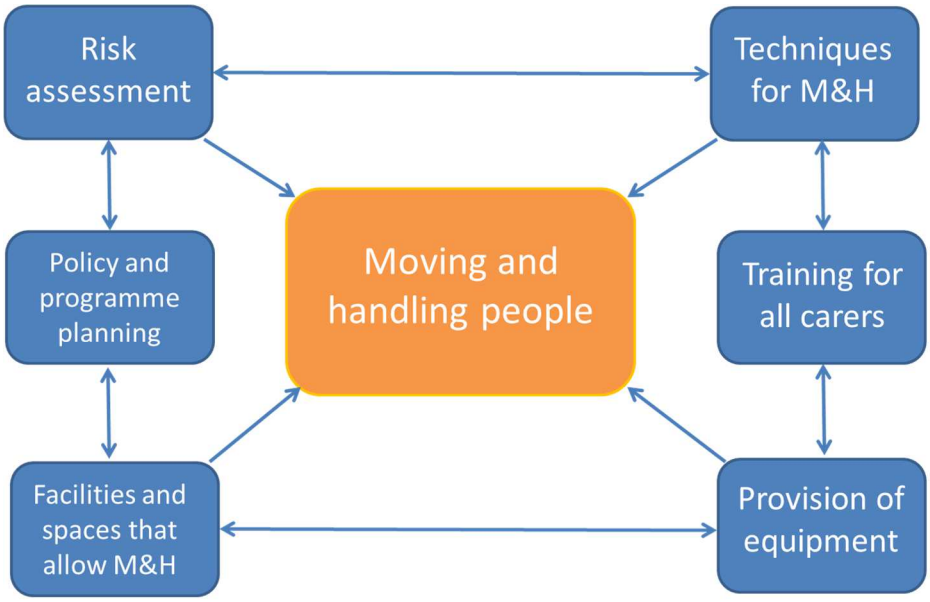

Figure 1. Core Components of a Moving and Handling programme (ACC, 2012)

Very little evidence exists to show complex interventions result in a reduction in the rate of MSDs (Bos et al, 2006; Dawson et al, 2007). This, combined with difficulties proving the effect of workplace interventions suggests that complex work systems need to be evaluated using a range of outcome measures (Fray & Hignett, 2013). This project evaluated the risk factors associated with moving and handling in a residential care home. Baseline measures were recorded and areas of high risk identified. The ongoing impact of MSDs on an aging workforce in a residential aged care home as a result of manual handling activities was considered.

METHODS

Prior to the commencement of the study, a residential care home was identified and an ethics application approved. The residential care home management team were briefed on the study objectives and data collection timeframes. The care home employees home were informed about the study at a scheduled monthly workplace

meeting where they were given an opportunity to ask questions about what it involved.

The Tool for Risks Outstanding in Patient Handling Interventions (TROPHI) was used in this study as it incorporates a range of measures suited to the evaluation of a complex health based work system. TROPHI is a performance metric with 12 section scores and an overall TROPHI total that measures patient handling safety performance. The outcome measures included in TROPHI are: safety culture; musculoskeletal measures; competence compliance; staff health/absence; quality of care; accident numbers; psychological wellbeing; patient condition; patient perception; musculoskeletal exposure measures and patient injuries. The researchers were trained in the use of TROPHI by the tool author during the inaugural running of the postgraduate Occupational Ergonomics: Concepts of Moving and Handling paper at AUT, 2015.

The TROPHI tool requires the collection of four data sets, namely organisational review, safety culture audit, patient handling transfer observation and ward/unit survey. The organisational review and safety culture data sets were collected by semi-structured interview with the rest home manager. Information with supporting evidence was required in response to questions about work practices at the residential care home. The organisational review data set incorporated The Care Thermometer (Knibbe & Knibbe, 2012), while the safety culture data set comprised the Patient Handling Observations Questions Set (PHOQS) (Hignett & Crumpton, 2005).

The patient handling transfer observation data set was collected using the Direct Nursing Observation (DiNO) tool (Johnsson et al, 2004). Prior to on-site data collection, the two researchers, who were both physiotherapists/ergonomists experienced in moving and handling education used the tool key, which defines each of the 16 items included in DINO, to calibrate their scoring (Johnsson et al, 2004). The researchers observed, discussed and used the DINO tool key to agree a score for each item of four patient handling transfers recorded on videotape. The researchers then scored a further six transfers independently after which they compared scores for each item with each other. The patient transfer videotape clips were re-ordered and repeat scoring undertaken by the researchers one week later.

Prior to collecting DINO observation data in the workplace, consent was obtained from employees and residents scheduled to work on the day designated for data collection. The researchers observed the first patient transfer together and compared their scores to ensure agreement existed between them before observing transfers separately. The staff indicated to the researchers when a transfer was to take place and in this way a convenience sample of patient transfers was obtained. Following each transfer the researchers asked the observed staff member whether they thought the transfer had gone well and according to plan. The researchers also asked the resident about their experience of being assisted to move in terms of safety, comfort and dignity.

The ward/unit survey data set required both care home employees and residents to complete a survey. All employees were asked to fill in a self-report questionnaire which included questions about musculoskeletal health, well-being and their patient handling experience. The employees were informed that the questionnaires were anonymous and completing it was voluntary. The resident survey was undertaken in

the rest home lounge where residents were asked about their experience when assisted to move in terms of security, comfort, informed consent and dignity.

RESULTS

The residential care home workforce included 130 staff who worked a combination of early, late and night shifts. The residential care home has 63 residents of whom, 32 require varying levels of assistance to move. The organisational data review involved sighting of the incident report form, risk management audit, moving and handling policy and risk assessment forms used by the organisation. Fifteen patient transfers were evaluated using the DINO observation tool on two early shifts. The transfer method observed was compared with that recorded in the patient notes. The DINO observations involved a range of transfers, which included sitting to sitting, sitting to standing, lying to sitting, move up bed and assist to walk. Varying levels of assistance were required in accordance with differences in the dependency level of residents, which ranged from supervision only to two person assist. The employee survey required follow-up to achieve the 50% percent minimum response rate required by TROPHI. A minimum number was reached for the resident survey.

The range of data collected in this study supports the literature which recommends complex work systems, such as health care be evaluated using a range of outcome measures. TROPHI is a relatively new tool that until now has been untested in the NZ context. The results provide evidence to inform the appropriateness of its use in the NZ residential care sector. Findings from this study were reviewed against a data base of other worldwide scores and used to provide managers with an evidence based risk profile about risk management practice and recommend where future intervention is indicated.

CONCLUSIONS

This study informs current risk management practice and highlights where future investment should be targeted. The organisational risk profile was compared against an international data set which provides contextual interpretation of the findings. The study informs the methodology and its suitability for assessing health care interventions in the NZ healthcare sector.

REFERENCES

Accident Compensation Corporation (2012). Moving and Handling People: The New Zealand Guidelines. Wellington, New Zealand: Accident Compensation Corporation.

Bos, E. H., B. Krol, A. Van Der Star, and J. W. Groothof. 2006. “The Effect of Occupational Interventions on Reduction of Musculoskeletal Symptoms in the Nursing Profession.” Ergonomics 49 (7): 706–723.

Chang, V., Hiller, C., Keast, E., Nicholas, P., Su, M., & Hale, L. (2013). Musculoskeletal disorders in support workers in the aged care sector Physical Therapy Reviews. 18 (3): 185 – 206.

Dawson, A., McLennan, S., Schiller, S., Jull, G., Hodges, P., & Stewart, S. (2007). Interventions to prevent back pain and back injury in nurses: a systematic review. Occupational and Environmental Medicine 64: 642-650.

Fray, M. & Hignett, S. (2013) TROPHI: development of a tool to measure complex, multi-factorial patient handling interventions, Ergonomics, 56:8, 1280-1294,

Hignett, S. & Crumpton, E. (2005). Development of a patient handling assessment tool. International Journal of Therapy and Rehabilitation. Vol 12 (4) 178 – 181.

Johnsson, C., Kjellberg, K., Kjellberg, A., Lagerstrom, M. (2004) A direct observation instrument for assessment of nurses'patient transfer technique (DINO) Applied Ergonomics 35: 591–601.

Knibbe, J & Knibbe N. (2012). An international validation study of the care thermometer: a tool supporting the quality of ergonomics policies in health care. Work (41) 5639 – 5641.

Ravenswood, K., Douglas, J., & Teo, S. (2014). The New Zealand Aged Care Workforce Survey – a Future of Work Programme Report. The NZ Work Institute, AUT. ISBN: 978-1-927184-28-8

Thomas, D., & Thomas, Y (2014). Interventions to reduce injuries when transferring patients: A critical appraisal of reviews and a realist synthesis. International Journal of Nursing Studies 51: 1381–1394.