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Raising Awareness of the Occupational Health of Older Construction Workers

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ABSTRACT

Background

Due to demographic, political and economic pressures, there are now real benefits to be gained from retaining older workers within the construction industry. However the health of such workers, and its consequences for continued working, needs to be more widely appreciated.

Aims

The aim of the research project being undertaken by the Innovative Manufacturing and Construction Research Centre (IMCRC) at Loughborough University, UK, is to identify the key health issues affecting older construction workers and, from there, develop wearable devices which will simulate these health effects and their consequential impacts on both working and home life. When worn, such devices will enable other industry members (managers, architects, equipment designers, etc) to better appreciate the challenges faced by older workers and, through this improved awareness, contribute to an attitude-shift within the industry. This paper discusses the need to raise awareness of older construction worker health; the rationale for an approach using simulation and the research undertaken to date as well as presenting analogous case studies.

Methods

A triangulated approach combining: a review of current knowledge in this area, worker interviews and health professional consultations is proposed. From the resultant data a specification will be developed which will detail which health conditions, and what aspects of them, are to be developed into simulation devices. The devices will developed to meet the specification as closely as is possible within technological, ethical, cost and other constraints. The intention is to then pilot the devices with key groups within the industry to confirm proof-of-concept.

Results/conclusions

Whilst there are no results to date, a case study demonstrating the benefits to be obtained from changing attitudes through increased awareness, which is brought about by enabling third parties to directly experience a health condition for themselves, will be presented.

INTRODUCTION

By 2050, one in every five people globally will be aged 60 years or over, rising to one in three by 2150; this compares to just one in nine in 2006 (United Nations, 2006). Although the developed

countries tend to have greater proportions of older inhabitants, the rate of ageing in developing countries is greater which means that they will more quickly change from young to an old population structure. These facts therefore suggest that the effects of population ageing will have worldwide impacts.

One implication of ageing populations is changes to the Potential Support Ratio which measures the number of people aged 15-64 years per person aged 65 years and over and so indicates the dependency burden on the potential workforce. Globally, the PSR was 12 (1950) falling to 9 (2006) and is projected to fall to 4 (2050) suggesting that there is increasing pressure on the comparatively smaller working population (United Nations, 2006). One mechanism for alleviating this pressure is to raise the retirement age thereby inflating the size of the workforce. Initial steps in this direction have been evidenced in instances such as the call by the Confederation of British Industry, in 2004, for the retirement age to be increased to 70 years by 2030 (BBC, 2004 c).

The impact of the ageing population structure is most prominent in the manual workforce and this is reflected in the construction sector which shows an annual average increase of 2% in the number of workers aged 40 years and above since 1990; a trend which is predicted to continue (Construction Skills, 2008). In addition to the demographic and economic forces discussed above, the construction industry has also experienced a recent, high demand for its output, not seen since the 1980s. This has resulted in skilled construction trades being amongst the five occupations with the highest proportion of skills shortage vacancies in the UK (Dainty et al., 2005). In recent years, an influx of migrant workers to the UK has gone some way to reducing the severity of impact of this combination of circumstances. However in the longer term this is not a viable solution as all countries will face a relative shortage of younger workers as their population structure progressively ages. Taken together, it may therefore be reasoned that a more reliable mechanism for bridging the skills gap is to support the retention of construction workers within the industry for longer.

Whilst these factors act to 'pull' the older worker resource into the industry, the culture within the industry itself may serve to 'push' them away. Older workers are not prevalent within the construction industry since, due to the physical demands their work entails, they either move to alternative roles within the industry or out of the industry completely (Bremmer and Ahern, 2000). If the effects of the 'push' factors outweigh those of the 'pull' factors then the industry will experience a net loss in its older workforce which is likely to contribute to a potential overall skills shortage.



Figure 1: Factors affecting the older worker skill base within the construction industry

AIMS

One of the challenges for the future is therefore to develop mechanisms to facilitate the retention of older construction workers by addressing their occupational health issues within the industry and so contribute to reducing the skills gap. This is a particularly challenging area since, firstly, little research has been undertaken to date in the specific area of older construction workers and

secondly, occupational health has not received the same level of attention and development as Occupational Safety evidenced by UK Government initiatives such as 'Securing Health Together' (The Health and Safety Executive, 2000). This comparative lack of attention to both older construction workers and occupational health indicates that as well as a need to improve the Occupational Health of older construction workers there may also be an additional need to first raise awareness of the importance of this within the industry.

In recognition of this, the aim of the research project being undertaken by the Innovative Manufacturing and Construction Research Centre (IMCRC) at Loughborough University, UK, is to identify the occupational health challenges of older construction workers and incorporate these into wearable simulations of their physical capabilities. In this way, those who wear them will be able to directly experience the effects and impacts of the identified occupational health conditions.

Following proof of concept, it is intended that the simulations can be employed to:

- Change the attitudes of younger workers to poor work practices, occupational health and ageing.
- Develop better work practices for all workers.
- Improve tools, equipment and workplace and work methods design (by demonstrating limitations from age-exacerbated ill-health conditions).

Using this approach, the identified real-world challenge of reducing the skills shortage by retaining the older construction worker within the industry for longer can start to be addressed.

The aim of this paper is to discuss the rationale for a simulation-based approach to awareness-raising, presenting illustrative, analogous case studies, as well as reporting upon the progress of the research to date.

OCCUPATIONAL HEALTH OF OLDER CONSTRUCTION WORKERS

Older workers and their health – Scope of the research project

Construction workers, like the rest of the population, are subject to the physiological, sensory, perceptual, cognitive and psychological effects associated with ageing. However this study centres on health problems which are caused or exacerbated by occupational factors arising directly from working within the construction industry. Those workers with the highest exposure to these factors are likely to be those workers who have laboured for longer and so are likely to be older members of the workforce. For the purposes of the study, older construction workers are defined as being aged 45 years or above.

Key occupational health conditions

Based on the following data sources: The Health and Occupation Reporting network (THOR) 2003-05 ill-health statistics (Constructing Better Health, 2008); The Health and Safety Executive (Health and Safety Executive, 2008 a) and Constructing Better Health (Constructing Better Health, undated a), the following have been identified as key ill-health conditions:

- Dermatitis – A reaction of the skin in response to chemicals, mechanical abrasion, biological agents or prolonged/frequent contact with water. The symptoms include: redness, swelling, blistering, flaking, cracking, itching, bleeding and pus formation. Irritant contact dermatitis is a local inflammation of the skin arising from acute (single, significant) exposure or chronic (repeated and prolonged) exposure. Allergic contact dermatitis develops as an allergic response once sensitisation to an irritant has occurred (Health and Safety Executive, 2008 b).
- Hand-Arm Vibration Syndrome – Over time vibration is transmitted from work equipment/materials into the workers hands and arms which can result in vascular, sensorineural or musculoskeletal damage. Symptoms may include: tingling/numbness/pins and needles in the fingers, blanching (whitening of the skin) in the fingers; red, throbbing and painful fingers following exposure to cold/wet conditions, reduced tactile sensitivity and reduced strength. (Health and Safety Executive, 2008 c; Constructing Better Health, undated b).

- Musculoskeletal disorders (MSDs) - MSDs include problems such as low back pain, joint injuries and repetitive strain injuries of various sorts (Health and Safety Executive, undated c). Symptoms include: aches, pains and reduced range of movement of varying severities. MSDs can be caused by: repetitive and heavy lifting; lifting awkwardly; bending and twisting repeating an action too frequently; uncomfortable working position; exerting too much force; working too long without breaks; poor posture (stooping, bending or crouching); stretching, twisting and reaching; and prolonged periods in one position (Health and Safety Executive undated a, b).
- Noise-Induced Hearing Loss (NIHL) – NIHL occurs as a result of regular, frequent exposure to loud noise which can be part of a person's job (Health and Safety Executive, 2008 d). This occurs over time and may not be noticeable until significant hearing loss has occurred which cannot be recovered. Initial symptoms include: difficulty in understanding speech in crowded environments, problems in hearing high frequencies, struggling to use the phone and confusion of words containing like 't', 'd' and 's' (Health and Safety Executive, 2009) As the condition progresses, hearing loss occurs within the middle, and sometimes, lower frequencies causing greater hearing difficulties.
- Respiratory disorders – The key work-related respiratory illnesses that are caused or made worse by breathing in hazardous substances that damage the lungs, are :
 - Chronic obstructive pulmonary disease (COPD) – Irreversible obstruction of the airways, in part caused by excess mucus and thickening airway walls. Symptoms include: chronic cough, sputum production and shortness of breath (Health and Safety Executive, 2008 e).
 - Occupational asthma - An allergic reaction that can occur on exposure to substances in the workplace which causes the airways to narrow. Initial exposure can sensitise people who, following a further exposure to the substance, can suffer an attack (Health and Safety Executive, 2008 e). The symptoms include: recurring sore and watery eyes; recurring blocked or running nose, bouts of coughing, chest tightness and wheezing (Health and Safety Executive, 2006).
 - Silicosis – An irreversible disease brought about by fine particles of respirable crystalline silica (RCS) embedding in the lungs causing scar tissue to develop over time. The symptoms include: breathing difficulties/ breathlessness; rapid/shallow breathing; chronic cough; chest pain and fatigue (Health and Safety Executive, 2008 e; Wrong diagnosis, 2009).

Whilst all the sources also mentioned the growing importance of stress, it was decided to exclude this psychological condition from the study thus focussing on key physical conditions.

Data collection approach

A triangulated approach to data collection regarding the five health conditions was adopted comprising:

- Literature/research review.
- Health professional consultation – A range of professionals were consulted who either had specific knowledge of occupational health within the construction industry or were specialists in the health conditions identified.
- Workers/sufferer interviews – The intention was to interview construction workers regarding their experiences of the conditions. However accessing workers, identifying those aged 45 or over and establishing which workers had which conditions was extremely difficult and quickly revealed a preponderance to musculoskeletal disorders. As a means of ensuring that direct experiences concerning all of the conditions are collected, the sample base was widened to include sufferers from the general population who were accessed via support group meetings. Whilst the causes for their conditions were not linked to the construction industry, the consequential effects and impacts on their domestic and social activities would provide an insight into the lives of construction workers. Such activities were investigated to highlight the fact that whilst these are work-related health disorders their impact is not restricted to working hours.

For each of the five health conditions, data from the above sources was collated under the following headings:

- Description, symptoms, severity progression, frequency, impact and severity measures which would be used to inform the design of the simulations.
- Causes, risk, industry prevalence, aggravating factors, avoidance and treatment which would be used to provide context/rationale for the simulations.

SIMULATION DEVELOPMENT

Using this data, a specification was developed for each of the five health conditions to which the simulations would be designed. To reflect the variability in the severity within each condition, three levels were defined enabling each condition to be experienced in mild, moderate and severe forms. This ‘idealised’ specification (which will be tempered by ethical, technical, cost and time considerations during development) is currently being reviewed by relevant health professionals to confirm and prioritise attributes for inclusion.

Since simulation development and proof-of-concept activities are future phases in the project following specification approval, the impact of wearable simulations on awareness-raising within the construction industry cannot be reported at this stage. However through drawing upon Learning Theory and with reference to the role of wearable simulations in other sectors, the remainder of this paper will explore the rationale to using wearable simulations within the construction industry.

RAISING AWARENESS

Raising awareness is, in essence, an educational activity since it is designed to impart knowledge and encourage understanding concerning a specific topic. In the education field, there are a number of learning models such as those proposed by Kolb, Gregorc, VARK and Felder and Silverman which are discussed by Hawk & Shah (2007). Analysis of such models indicates the value to learning of allowing for opportunities which support a ‘hands-on’ / learning ‘by doing’ approach. The VARK model is summarised in Table 1.

Table 1: VARK Learning Styles (Based on Drago & Wagner 2004)

Type of Learner	Preferred method of information communication
Visual Learners:	“maps, charts, graphs, diagrams, brochures, flow charts, highlighters, different colours, pictures, word pictures, and different spatial arrangements”.
Aural Learners:	“explain new ideas to others, discuss topics with other students and their teachers, use a tape recorder, attend lectures and discussion groups, and use stories and jokes”.
Read/write Learners:	“lists, essays, reports, textbooks, definitions, printed handouts, readings, manuals, Web pages, and taking notes”.
Kinesthetic Learners:	“field trips, trial and error, doing things to understand them, laboratories, recipes and solutions to problems, hands-on approaches, using their senses, and collections of samples”.

It can be seen that the traditional education/training resources of a speaker/course leader; written materials, such as handouts, and electronic presentations support the learning styles of the Aural, Read/write and Visual learners respectively but offer less benefit to kinaesthetic learners. However, wearable simulations which are used whilst engaging in simulated everyday activities would bridge this gap by providing the kinaesthetic learners with a hands-on approach and the opportunity to use their senses.

This suggests, theoretically at least, that there is benefit to using simulations to raise awareness in order to drive change within the industry as a means for extending the working life of construction workers and assisting the retention of skills. Using the simulations key staff, and young workers in particular, will be able to indirectly experience the daily challenges faced by older construction workers and, from this starting point, it is anticipated that more sympathetic design of tools, equipment, workplaces and work methods can be initiated.

WEARABLE SIMULATIONS AS A MECHANISM FOR CHANGE

Whilst theory suggests that wearable simulations will promote learning and so assist awareness-raising, their use in practice will now be discussed.

Existing simulation suits

The design and application of wearable simulations is still a novel field with fewer than a dozen organisations producing such simulations in the international arena and only a handful undertaking this in the form of Whole- Body suits. The Ergonomics and Safety Research Institute at Loughborough University, UK, has been active in this field for 15 years and has developed three whole body simulation suits, two of which are described in Figure 2 (the third remaining confidential).

The Third Age Suit (‘Third Age’ meaning older – typically 55+)		Osteoarthritis Suit	
The Third Age suit which simulates aspects of ageing was developed in 1994 for the Ford Motor Company as a mechanism for raising awareness within the design team of Older Driver characteristics and requirements.			The Osteoarthritis suit was developed in 2006 for Napp Pharmaceuticals Ltd for raising awareness within the health profession of the condition and its impacts on daily living.

Figure 2: Loughborough University Whole-Body Simulation suits

Case study – Transport sector

Using the Simulation Suit was the first step in developing ‘trans-generational’ vehicles (those which encompass the needs and aspirations of older as well as younger drivers) thus enabling Ford to develop vehicles more compatible with its future customer base. Use of the suit was judged to be successful on two accounts. Firstly, it was considered by Ford that greater awareness had been achieved within the design team, refer to **Error! Reference source not found.**, and secondly, the impact of this improved awareness, influenced their designs. The Ford Focus has wide, high front doors; a raised "H-point" (the point at which the hips swivel) and higher seats which give better leverage when rising as you exit the car (Ford, 2000). Access/egress is further assisted by strap handles located on the inside doorframe, so drivers can grab and pull themselves into position (Ehrenman, 2003). In addition, it has the most headroom of any cars in its class and the dashboard controls are larger than those of its predecessor and have been designed to be easier to locate, grab and operate (Cambridge Engineering Design Centre, 2005).



"This is a key training and awareness tool for us. Through the suit, our engineers can understand what it's like to be in the shoes of this demographic. Our design decisions, therefore, become more in line with customer needs".

Eero Laansoo, Ergonomics Engineer¹

The Third Age Suit "lets engineers slip into another generation, and feel for themselves what changes the body goes through that impact how a driver relates to a vehicle."

Fred Lupton, North American Program Ergonomics Supervisor²

"When you're young and fit enough to leap out of a car without effort, it's hard to appreciate why an older person may need to lever themselves out of the driver's seat by pushing on the seat back and the door frame. But, try leaping out while you are wearing this Suit and you really understand the challenges we face."

Mike Bradley, Ergonomics Specialist in the UK³

Ford Motor company (1998-2009). ² Ehrenman (2003). ³ Gardin & Sheehan (1999).

Figure 3: Evidence of awareness-raising within The Ford Motor Company

Case study – Health sector

The Osteoarthritis suit was used by the NHS to enable staff to "have a real life experience to draw from when working with patients who suffer from a debilitating condition" (Calderdale and Huddersfield NHS Foundation Trust, 2009). By using the suit to undertake the daily activities of their patients including – getting in and out of bed, moving from the bed to a chair, walking, feeding and dressing, staff members quickly came to realise the effort required by their patients to undertake these tasks and the difficulties which they encountered.

A variant of the Third Age suit was also used by Architects from Capita Symonds to assist in the redesign the Derby City General Hospital since the NHS Trust acknowledged that due to the ". . . increasing ageing population we need to understand more about mobility problems encountered by patients and how we can design more appropriate facilities". As soon as the suit had been put on, the architects realised weaknesses in the design proposals, such as getting through doors, accessing patient wardrobes and reaching towels, which they were then able to change at no extra cost (BBC, 2004 c) because they were still at an early stage in the design.

Case study – Finance sector

The Third Age Suit was used by Nationwide Building Society to promote awareness and understanding of the needs of an ageing population both in terms of its employees and its members. A number of employees undertook the sort of routine activities that their colleagues and members might undertake, such as reaching for leaflets on display, getting in and out of chairs, reading promotional material, etc, whilst wearing the suit. This highlighted a number of areas worthy of further investigation including improved cash machine accessibility for members and revised workstation design for employees (Ergonomics and Safety Research Institute, 2009).

Cambridge Engineering Design Group

Independent research undertaken by the Cambridge Engineering Design Group supports the contribution of simulation to improved design. In a study of the design of domestic central heating control panels, designers were asked to assess the usability of three models, noting any problems encountered. It was observed that when using simulators of impaired physical capabilities, the number of problems identified increased substantially over the self-observation condition in which the designers directly on their own experience. Whilst use of the simulations did not identify all of the problems recorded in trials with older and disabled users nor prioritise them in the same way, it was proposed that "The physical limitations imposed by the simulators upon the designers allowed them to be more sensitive to the capability demands introduced by some actions" (Cardos et al., 2005).

SUMMARY

Since it is estimated by 2030 that: the average age of the workforce will be 43, the average retirement age will be 68, musculoskeletal disease will rise by 8% and rates of chronic obstructive pulmonary disorder (COPD) and asthma are likely to increase sharply (BBC, 2009 a); understanding and accommodating the older worker will undoubtedly become a real need within the construction industry in the future.

The benefits of wearable simulations as a mechanism for increasing awareness of the daily challenges encountered when suffering from various health conditions has been illustrated, within this paper, both theoretically and through case studies from the transport, health and finance sectors. It is therefore hypothesised that such simulations could provide a powerful means to tackle the significant challenge of integrating occupational health into some of the 'upstream activities' of building owners and design professionals – an activity identified as critical by this conference.

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