



East Midlands Research into Ageing Network (EMRAN) Discussion Paper Series

ISSN 2059-3341

Issue 19, May 2018

Research with *and* for Older People at Loughborough University

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East Midlands Research into Ageing Network (EMRAN) is a research collaboration across the East Midlands to facilitate collaborative applied clinical research into ageing and the care of older people. EMRAN was set up with support from NIHR CLAHRC East Midlands.

On behalf of researchers at Loughborough University:
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1. Foreword

It is with pleasure that we present this EMRAN brochure introducing research with *and* for older people at Loughborough University. The projects in this document are ongoing or have been completed across a wide range of academic disciplines at the University, including the recently established National Centre for Sport and Exercise Medicine (NCSEM).

Research with *and* for older people at Loughborough University has a growing reputation and we are proud to showcase some of our projects from the past few years. Our funders include the Economic and Social Research Council (ESRC), the National Institute for Health Research (NIHR), the Engineering and Physical Sciences Research Council (EPSRC), Arts and Humanities Research Council (AHRC), Horizon 2020 EU research and cross-council initiatives such as the New Dynamics of Aging. Several charitable trusts have also funded our research, including the Thomas Pocklington Trust, National Osteoporosis Society, Alzheimer's Research UK and Age UK.

The PhD capacity at Loughborough University for research with *and* for older people has also been increasing with funding from a number of sources (e.g. AHRC Design Star; NDA; Age UK) with specialities in design and Human Factors/Ergonomics.

There are exciting times ahead at Loughborough University which will see us develop our inter-disciplinary and international collaborations with more industrial sectors to ensure our research continues to have real world applications. One of the most exciting developments is the collaborative work we are conducting with the Building Research Establishment (BRE) to design an evidence-based dementia-friendly home to better support care and facilitate independent living for people living with dementia.

We hope you enjoy reading about our research.

Sue Hignett, Eef Hogervorst & Paula Griffiths,

2. Loughborough University Researchers and Collaborators: Who we are and what we do

Our Dementia research is part of Loughborough University Health and Wellbeing (HWB) Global Challenge (<http://www.lboro.ac.uk/research/excellence/challenges/health-wellbeing/>). This strategic approach supports multi-disciplinary research in bringing complex real world solutions to promote health and wellbeing across the life course. Other research priorities within HWB include Planetary Health and Anti-Microbial Resistance.

Research with *and* for older people in Loughborough University is carried out by a number of multi-disciplinary research units/groups with different specialist interests for example:

- Dementia research for design, diagnostics and interventions
<http://www.lboro.ac.uk/research/dementia/>
- Centre for Research in Social Policy (<http://www.lboro.ac.uk/research/crsp/>)
- Healthcare Ergonomics & Patient Safety
(<http://www.lboro.ac.uk/departments/design-school/research/environmental-ergonomics/>)
- Life Long determinants of health and wellbeing
(<http://www.lboro.ac.uk/departments/ssehs/research/lifestyle-health-wellbeing/life-course-determinants-health-wellbeing/>)

3. Research Topics and Studies

We describe our research in these five overlapping and closely-related topic areas:

- New Dynamics of Ageing
- Dementia: Diagnosis, Design and Interventions
- Getting out and about (Transport)
- Working Later
- Health, Wellbeing and Safety for Older People

3.1 New Dynamics of Aging

The New Dynamics of Ageing (NDA) programme was a multidisciplinary research initiative with the aim of improving quality of life of older people. A collaboration between 5 UK Research Councils - ESRC, EPSRC, BBSRC, MRC and AHRC, it was the largest and most ambitious research programme on ageing ever mounted in the UK. The overall aim was to advance understanding of the dynamics of ageing from a multidisciplinary perspective.

Loughborough University has an excellent track record of leading and collaborating in multi-disciplinary research, often with a very applied focus. The following 7 projects illustrate our research activities in a range of disciplines including Human Factors/Ergonomics, Psychology, Civil & Building Engineering, Computer Science and Human Biology.

Kitchen Living [<http://www.newdynamics.group.shef.ac.uk/kitchen-living.html#>]

Investigators: Prof. Sheila Peace¹, Colette Nicolle², Dr Martin Maguire², Dr Russell Marshall²

¹Open University, ²Loughborough University

Funding Body: ESRC NDA

Dates: 2009 - 2011

Summary: The aim of this research was to examine the experience of the kitchen across the life course for older people living in a variety of accommodation both 'ordinary' and 'supportive' in urban and rural locations in England. The research, carried out in England, identified a sample of 48 older people in their 60s, 70s, 80s and 90s living in both urban and rural locations of England. Interviews were held with each participant gathering basic demographic and health data alongside an oral history of kitchen living across the life course and linked to specific life events. It also included an ergonomic evaluation of the current kitchen also capturing the likes, dislikes and actions taken to adapt it to their needs. The project will develop an archive of stories and an experiences for older people, and also a guide to help people adapt their kitchen to their changing needs in later life.

For more information, please contact: Martin Maguire m.c.maguire@lboro.ac.uk

Key Words: Kitchen, physical activity, inclusive design

Publications

- **Maguire, M. C.**, Peace, S., Nicolle, C., Marshall, R., Sims, R., Percival, J., Lawton, C. (2014) Kitchen Living in Later Life: Exploring Ergonomic Problems, Coping Strategies and Design Solutions, *International Journal of Design*, 8(1).
<http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/1216>
- Maguire, M., Nicolle, C., Marshall, R., Sims, R., Lawton, C., Peace, S. and Percival, J. (2011) "A Study of User Needs for the 'Techno Kitchen'" In: C. Stephanidis (Ed.): Posters, Part II, *HCI International 2011*, CCIS 174, pp. 66-71. Springer, Heidelberg.

MAPP-MAL Multidisciplinary Approach to a Prototype for Prevention of Malnutrition in Older People; Products, Places, People and Procedures

<http://www.newdynamics.group.shef.ac.uk/mappmal.html>

Investigators: Paula Moynihan¹, Carl May¹, Lisa Methven², Alastair Macdonald³, Martin Maguire⁴, Margot Gosney², Patrick Olivier¹

¹Newcastle University, ²University of Reading, ³Glasgow School of Art, ⁴Loughborough University

Funding Body: ESRC NDA

Dates: 2008 –2011

Summary: MAPP-Mal addressed the crisis of malnutrition in older people in hospitals by devising a new prototype for products, places and procedures that encompasses a multidisciplinary approach to prevent malnutrition of older people in hospitals. Existing systems were mapped with ethnographic observations in NHS hospital settings (catering through to older people's wards). Interviews with the Food Family and key stakeholders were used to identify opportunities for intervention to prevent malnutrition with respect to products, people, places and procedures. This was followed by end user and stakeholder engagement in an IDEAS factory to initiate ideas for the new prototype of systems and the development of new food products with improved sensorial quality for older people known to be at risk of malnutrition (stroke, dementia and falls patients). Utilising innovative design & technology to optimise the Food Journey and the older patient's Eating Environment by generating novel approaches to mobile food preparation, delivery, the older patient's eating environment and monitoring of food intake through current and new technologies. Development of the prototype for the food journey and patient environment involved an iterative design and evaluation process

using scenario-building, prototyping and visualisation tools: sketch, physical mock-up simulation/enactment prototypes together with virtual 3D modelling of ward and patient environments.

For more information, please contact: Martin Maguire (m.c.maguire@lboro.ac.uk)

Key Words: i.e. Hospitals, Food provision, Older people, Malnutrition, Innovation

Publications

- Mavrommatis, Y., Gosney, M., Moynihan, P., Methven, L. (2011) Hospital catering systems and their impact on the sensorial profile of foods provided to older patients in the UK. *Appetite* 2011; 57 (1): 14-20.
- Payne, C., Gosney, M., Methven, L., Bell, A., Fairfield, C. (2011) Reducing variable consistency in thickened drinks. *Nursing and Residential Care*. 13 (10), pp. 469-473
- Payne, C., Fairfield, C., Bell, A., Methven, L. (2012) Variability of starch-based thickened drinks for patients with dysphagia in the hospital setting. *Journal of Texture Studies*. 43 (2), pp. 95-105

Sus-IT: Sustaining IT use by older people to promote autonomy and independence

<http://sus-it.lboro.ac.uk/index.html>

Investigators: Prof. Leela Damodaran¹, Wendy Olphert¹, Prof. Eef Hogervorst¹, Dr Colin Machin¹, Dr Amr Ahmed², Prof. David Frohlich³, Prof. Vicki Hanson⁴, , Prof. Irene Hardill⁵, , Leonie Ramondt⁶, , Dr Mark Shelbourn⁷

¹Loughborough University, ²University of Lincoln, ³University of Surrey, ⁴University of Dundee, ⁵Northumbria University, ⁶Anglia Ruskin University, ⁷Nottingham Trent University

Funding Body: ESRC NDA

Dates: 2009-2012

Summary: Sus-IT was a multi-disciplinary collaborative research project involving a team of academics from eight universities across the UK. The overarching aim of the research was to develop an understanding of the nature of older peoples' digital engagement and the risk factors that could lead to a reduction in use or abandonment of the technology. In particular it investigated the nature of digital engagement and the actual and potential barriers to sustained and effective use of ICTs by older people. It also explored a range of potential sociotechnical solutions to these barriers to: create an engaged community of older people exploring problems and solutions related to sustaining and enhancing ICT use; identify and investigate the implications for ICT use of age-related change; develop a method for automatically detecting and responding to changes in user capability; identify the learning and support needs associated with sustained and effective use of ICTs; inform policy, practice, design and research, and enable older people to access, creatively shape, use and adapt ICTs to maintain and enrich their autonomy, independence and quality of life.

Older people themselves were central to the research with over 1000 individuals from 33 existing groups/panels of older people in communities across the UK. Sus-IT researchers applied an innovative combination of methods, tools and techniques to achieve the project objectives. These included a survey of digital engagement involving more than 750 older people, interactive forum theatre, co-design 'sandpits', problem-solving sessions and workshops, and testing and evaluation of software and product concepts developed on the project.).



Figure 1. Older people using computers

The evidence generated showed that while many older people enjoy the benefits of ICTs, their experience as users is characterised by many challenges. Appropriate design of the technology as well as good support can mitigate the negative impact and promote successful and continued digital engagement of older people. Without support in dealing with these challenges, such problems can become overwhelming for individuals. This is especially the case for those who are coping alone or with limited and unreliable sources of assistance – which characterises the situation for many older people who are no longer in the workplace. In such circumstances, ICT usage tends to reduce over time and may cease entirely.

The findings are summarised in the following key recommendations:

1. Encouraging and supporting grass-roots solutions to meet local ICT learning support needs
2. Supporting user-led 'buy-in' of the target users by.
 - Empowering users through participation in discussions and co-design sandpits/workshops.
 - Eliciting and facilitating specification of users' ICT learning and support needs and priorities.
 - Co-designing the approach and solutions to delivering ICT learning opportunities and support.
 - Embedding ICT learning in users' interests and activities.
 - Promoting opportunities in the community to facilitate all relevant stakeholder groups (including older and disabled people) in working together.

- Facilitating sharing of established good practice in relation to the preferences and needs of older people in a learning environment and to promote widespread awareness of the needs and characteristics of older ICT users.
- 3. Enabling low cost/free access to ensure ICT help and learning support is readily available in the community and in the home through outreach provision by:
 - Providing readily available, accessible and ICT learning support and trouble-shooting assistance.
 - Utilising existing available venues and facilities (e.g. in schools, libraries, cafes, hospital waiting rooms, village halls) to provide continuity and sustainability of ICT learning support.
 - Promoting sustainability through flexible and adaptive funding models e.g. the social enterprise model.
- 4. Designing applications to serve ALL stakeholder groups not just a sub-set of them by:
 - Designing ICTs for all users to promote recognition of the significant 'grey market'; engage technology providers and developers in reducing the barriers and frustrations experienced by older ICT users'; creating awareness that many older people seek stability of the user interface and assistance in coping with uninvited and unwanted 'upgrades'; explore design options which would allow more stability of user experience
 - Reduce the impact of capability change by designing software and hardware to better match the characteristics (including impaired capabilities), requirements and preferences of older ICT users; reducing the demands of digital engagement, especially on cognitive load, by designs are 'user-friendly', accessible and intuitive; improving the adaptivity of software and hardware

For more information, please contact: Leela Damodaran (l.damodaran@lboro.ac.uk)

Key Words: Older people; ICTs; digital disengagement; digital exclusion

Publications

- Over 50 research papers and outputs : <http://sus-it.lboro.ac.uk/publications.html>
- Olphert, W. and Damodaran, L., 2013. Older people and digital disengagement: a fourth digital divide? *Gerontology*, 59(6), pp.564-570.
- Damodaran, L., Olphert, C.W. and Sandhu, J., 2014. Falling off the bandwagon? Exploring the challenges to sustained digital engagement by older people. *Gerontology*, 60(2), pp.163-173.

Working Late: Strategies to enhance productive and healthy environments for the older workforce [<http://www.newdynamics.group.shef.ac.uk/working-late.html>]

Investigators: Prof. Cheryl Haslam¹, Dr Diane Gyi¹, Prof. Roger Haslam¹, Prof. Alistair Gibb¹, Prof. Kevin Morgan¹, Colette Nicolle¹, Dr Martin Maguire¹, Dr Stacy Clemes¹, Dr Hilary McDermott¹, Dr Joanne Crawford²

¹Loughborough University, ²Institute of Occupational Medicine

Funding Body: ESRC NDA

Dates: 2008- 2013

Summary: Working Late produced new knowledge on how organisational policy and practice impacts on the employment experiences of older workers. By investigating the experiences of older job seekers, this project highlighted some of the ways employers may discriminate on the basis of age. The journey to work and the options, enablers and barriers workers may face were investigated and a travel resource was generated to help identify and manage commuting problems. The research evaluated employees' experiences of previous workplace health promotion initiatives and used the results to inform the development of a new and innovative physical activity intervention. Walking Works Wonders was evaluated over a 2 year period in 10 worksites with over 1000 participants across the UK and was shown to be effective in reducing sickness absence, increasing productivity and improving health and quality of working life. Finally a web resource: the Organiser for Working Late (OWL) was developed to support workers and managers using tools that aid communication in relation to good design and ergonomics, promoting an inclusive workplace.

For more information, please contact: Cheryl Haslam (C.O.Haslam@lboro.ac.uk)

Key Words: Later life working, workplace health promotion, inclusive workplace design

Publications

- Haslam, C., Haslam, R., Clemes, S. et al (2012) Working Late: strategies to enhance productive and healthy environments for the older workforce. *Proceedings of Human Factors & Ergonomics Annual Conference*.56, 1, 140-143
<https://doi.org/10.1177/1071181312561006>

Organising for Working Life: Workplace design and wellbeing for an ageing population (www.workinglate-owl.org)



Investigators: Diane Gyi, Alistair Gibb, Roger Haslam, Elaine Gosling

Funding Body: EPSRC NDA

Dates: 2009 – 2013

Summary: The aim of this research was to empower and support worker involvement in design decision processes especially when working into later life. This led to the co-development of the OWL resource (**O**rganiser for **W**orking **L**ife) for workers and line managers to facilitate healthy ageing

Data were collected with 719 workers (construction, office work, manufacturing and animal care) with a survey, ergonomics observations and interviews. High levels of musculoskeletal symptoms were found in both younger and older workers, and additionally, older workers expressed concerns about being able to perform their jobs and being able to remain fit and healthy for work.

Specific job tasks were explored in focus groups, personal design stories and over 200 design solutions with capturing images, audio and video recordings to highlight individual working conditions. The OWL resource evolved by incorporating input from both workers and managers, and includes participatory design tools together with personal stories, audio and video clips of design ideas to facilitate discussion of health needs with workers. It comprises 2 themes '*The body at work*' (a suite of image and word cards that consider the body, the work environment, equipment and actions when working) and '*Healthy ageing through design*' (personal stories and design influences in relation to health and age at work).

For more information, please contact: Diane Gyi (d.e.gyi@lboro.ac.uk) or Alistair Gibb (A.G.Gibb@lboro.ac.uk)

Key Words: Older workers; musculoskeletal disorders, design ergonomics

Publications

- Gosling, E.Y., Gyi, D.E., Gibb, A., Haslam, R., 2012. Ageing productively through design: A survey of cement workers. *The International Journal of Ageing in Society*, 1(4), pp.1-18.
- Gyi, D., Gosling, E.Y., Gibb, A., Haslam, R.A. 2014. "Working into later life: A tool to facilitate co-designing healthy work environments". In: Ahram T., Karwowski W., Marek T. Eds, *Proceedings of The 5th International Conference on Applied Human Factors and Ergonomics AHFE 2014*, Kraków, Poland, 19 - 23 Jul 2014.
- Williams, E.Y., Gibb, A., Gyi, D.E., Haslam, R., 2012. Building healthy construction workers. In: M. Anderson, ed. *Contemporary Ergonomics and Human Factors 2012; Proceedings of the International Conference on Ergonomics & Human Factors*, Blackpool, 16 – 19 April, 2012. London, Taylor & Francis. pp. 69-70.

SomnIA. Optimising sleep quality among older people in the community and care homes: an integrated approach

SomnIA

Sleep in Ageing

Investigators: Prof. Kevin Morgan¹, Pamela Gregory¹, Dr Maureen Tomeny¹, Dr Beverley David¹, Claire Gascoigne, Prof. Sara Arber², Prof. David Armstrong³, Prof. Roger Orpwood, Dr Debra Skene²

¹Loughborough University ²Surrey University, ³King's College London,

Funding Body: ESRC NDA

Dates: 2008-2013

Summary: This research looked at self-help treatment for insomnia symptoms associated with chronic conditions in older adults in a pragmatic 2-arm randomised controlled trial comparing supported self-help with treatment as usual (TAU). 193 self-referred patients were recruited with long-term conditions and chronic insomnia symptoms. The self-help participants received six consecutive booklets, at weekly intervals, providing structured advice on key components of cognitive behavioural therapy for insomnia (CBT-I, including self-monitoring, sleep restriction, stimulus control procedures, and cognitive strategies), plus access to a telephone helpline. Control group

participants received a single sheet of advice, detailing standard sleep hygiene measures.

The primary outcome was sleep quality, measured by the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), the subjective sleep efficiency index, and the Fatigue Severity Scale (FSS). The results found that the self-help group sleep outcomes showed significant improvements at post-treatment, 3 months and 6 months. Effect sizes were moderate (range of adjusted Cohen's $d = .51-.75$). Treatment had no effect on levels of daytime fatigue. Most treated participants (73%) said they would recommend the self-help program to others. In conclusion

Self-help CBT-I offers a practical first-line response to insomnia symptoms associated with chronic disease in primary care settings. Among these patients symptoms of daytime fatigue may be more closely associated with disease processes than to sleep quality.

For more information, please contact: Kevin Morgan (k.morgan@Lboro.ac.uk)

Key Words: i.e. Insomnia, CBT, Older People, Primary Care, Self-Help

Publications

- Morgan, K., Gregory, P., Tomeny, M., David, B.M., Gascoigne, C. 2012. Self-Help Treatment for Insomnia Symptoms Associated with Chronic Conditions in Older Adults: A Randomized Controlled Trial. *J Am Geriatr Soc* 60:1803–1810

MINA project: Bone health in UK Bangladeshi women: comparison with indigenous British women <http://www.newdynamics.group.shef.ac.uk/mina.html>

Investigators: Diane Harper (PhD student), Prof. Barry Bogin, Dr Katherine Brooke-Wavell (supervisors)

Funding Body: NDA

Dates: 2008-2011

MINA addresses ageing, migration, and nutrition across two generations of Bangladeshi women.

The Bangladeshi population is one of the fastest growing ethnic groups within the UK, and are amongst the most socially disadvantaged. They have poorer self-reported and measured health status indicated by higher rates of disability, centralised obesity and chronic diseases such as type 2 diabetes and cardiovascular disease.

Older Bangladeshi women are particularly affected as they play a lead role in caretaking for multiple generations within relatively large extended families and many struggle to cope with the complex challenges of ageing, poverty, racism, and social exclusion.

Following on from the work of the MINA project we have been studying factors influencing bone strength in Bangladeshi mothers and daughters. Osteoporosis causes an indigenous British woman aged 50 years to have a 1 in 2 lifetime risk of bone fracture. Less information exists on bone health in ethnic minority groups despite their comprising 14% of the UK population. This study measured bone strength from ultrasound and DXA measurements of the skeleton in Bangladeshi mothers and daughters living in the UK (Cardiff and Loughborough). Bone measurements and other data were collected from Bangladeshi mother-daughter pairs and indigenous British women in Loughborough with the aim of establishing the bone status of Bangladeshi women compared to their indigenous British counterparts. The inclusion of first generation women, born in Bangladesh, plus their daughters who were born and/or brought up in the UK allows exploration of the impact of migration on bone health. The outcome of this research will increase understanding of bone health in a UK ethnic minority group which in turn may lead to strategies in reducing the economic and personal burden of osteoporotic fracture in the future

For more information, please contact Katherine Brooke-Wavell (K.S.F.Brooke-wavell@lboro.ac.uk)

Key words: Migration, Nutrition, Mother-Daughter, Ageing

Publications

- Bogin, B., Harper, D., Merrell, J., Chowdhury, J., Heinrich, M., Garaj, V., Molik, B., Thompson, J.L. (2014) Influence of Adult Knee Height, Age at First Birth, Migration, and Current Age on Adult Physical Function of Bangladeshi Mothers and Daughters in the United Kingdom and Bangladesh *Journal of Anthropology*
<http://dx.doi.org/10.1155/2014/808634>
- Jennings, H.M., Thompson, J.L., Merrell, J., Bogin, B., Heinrich, M. (2014) Food, home and health: the meanings of food amongst Bengali Women in London *Journal of Ethnobiology and Ethnomedicine*.10, 44.
<http://www.ethnobiomed.com/content/10/1/44>
- Harper, D, Brooke-Wavell, K, Bogin, B, (2016). Letter to the Editor: On epidemiology of fractures and variation with age and ethnicity. *Bone*.93:232 - 232.

3.2 Dementia: Diagnosis, Design and Interventions

Our research in dementia ranges from the empirical to the applied for diagnostic, treatment and preventative projects (<http://www.lboro.ac.uk/research/dementia/>). The applied projects have an overarching theme of promoting independence from exercise to building design.

Using Non-Invasive Eye Tracking Patterns for Dementia Detection

Investigators: Prof Eef Hogervorst¹, Dr Stephan Bandelow¹, Dr Angela Clifford¹, Dr Veronika van der Wardt¹, Dr Mark Madden¹, Prof James Lindesay², Prof Alastair Gale¹

¹Loughborough University, ²University of Leicester

Funding Body: iNet CRD

Dates: 2010 - 2011

Summary: Early and accurate non-invasive diagnosis with an earlier initiation of treatment could possibly delay progression of Alzheimer's disease (AD), reduce hospitalization and result in significant human and economic cost savings. Visual impairments are common in AD (Kirby, 2010) and may affect eye movement patterns during face recognition and other visual tasks. Anecdotal evidence from the clinic often includes an early loss of recognition (faces, routes) in incipient dementia, particularly at dusk when contrasts are low. Many clinicians also report an 'Alzheimer' feel upon meeting AD patients. This may be based on the way that people with AD scan faces. We found that pairing of emotional expressions, but not naming of the emotional expressions was lower in AD cases than controls, indeed suggesting impairments in facial

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scanning which then limits recognition and matching (Burnham,2003). We developed a visual sensitivity test which incorporated detection of randomly placed low and high-contrast stimuli, as well as face and emotional recognition tasks. The advantage of the visual sensitivity test was that it was short (3 min), reliable (little learning effect) and did not provoke test anxiety as many other cognitive tests do (Bandelow, 2008). These computer-based tests yield behavioural data based on participant responses, as well as integrated eye tracking data. Our research at the Oxford Project 'To Investigate Memory and Ageing' showed that patients with Mild Cognitive Impairment (MCI, $n = 15$) took longer to detect targets than age matched controls ($n = 67$). Of particular interest was the loss of central visual field detection speed advantage in MCI participants compared to controls. Age-related visual disease (macular degeneration, cataract, glaucoma, diabetic retinopathy) were controlled for in this study. We will also present novel results from eye movement patterns during this test and the face and emotion recognition tests. The eye tracking data was analysed to identify common patterns that differ between the participant groups, and whether these patterns have sufficient discriminatory capacity to accurately diagnose MCI and dementia.

Our studies suggested that differences in eye scanning patterns may be indicative of some of the early cognitive deficits seen in AD. This approach could be used to non-invasively screen for AD. However, at the time of testing, the Tobii was no accurate for people with glasses or for people with very dark eyes.

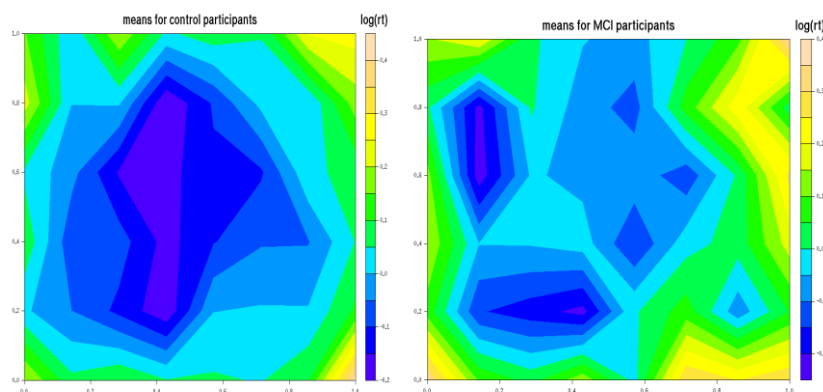


Figure 2: Relative speed of visual target detection over the screen area in controls (left) and participants at the very early stages of dementia (MCI, right). Blue indicates faster, yellow slower detection. Note the lack of a clear central field speed advantage in the MCI participants.

For more information, please contact: Eef Hogervorst e.hogervorst@lboro.ac.uk

Key Words: facial recognition -dementia- laser eye scanning

Publications

- Bandelow, S., van de Wardt, V, Clifford, A., Hogervorst, E. (2011) Accurate non-invasive diagnoses of Alzheimer's disease using eye scanning. *Alzheimer's & Dementia: The Journal of the Alzheimer's Association* 7, 4, Supplement S155-S156

Tempe to Improve Memory and prevent dementia in Elderly - TIME

Investigators: Prof. Eef Hogervorst¹, Prof. Tri Budi², Dr Atik Kridawati-Irsan², Prof. Boenjamin Setiawan³, Shelina Kassam¹

¹Loughborough University, ²University of Indonesia, ³Kalbe Farma TBK, Indonesia

Funding Body: British Council 'Global Challenges Program Grant' and Newton Fund

Dates: 2016-2018

Summary: Previous projects funded by the Alzheimer's Research UK, the Chinese Research Council, the Economic and Social Research Council and the National Institute for Health Research found that tofu (a popular food eaten in Asian countries derived from soya) was associated with increasing the risk of dementia in older people in China and Indonesia. Human observational and animal treatment studies have suggested that 'tempe', a fermented soy product containing phytoestrogens and folate, reduced dementia risk and improved memory. However, because many folate foods such as tempe are not the most palatable and can be difficult to chew with few teeth (as was the case with those Indonesians involved with this study), it was seen as desirable to produce an easier to consume tempe-based food to harness the powerful dietary effects. The aim of the project was to develop a tempe based product that is tasty and acceptable for users in the UK and in Indonesia. This would then be produced on a larger scale and incorporated in to a programme to help improve the memory in older people with memory impairments.

For more information, please contact: Eef Hogervorst (E.Hogervorst@lboro.ac.uk)

Key Words: Tempe, nutrition, cognitive impairment, dementia

Publications

- E. Hogervorst, et al (2018, in press). Nutrition and Cognition. *Proceedings of the Nutrition Society, invited after keynote for RSM symposium*
- A Kridawati, A Sulaeman, R Damanik, A Winarto, TB Rahardjo, E. Hogervorst (2016). Tempe Reversed Effects of Ovariectomy on Brain Function in Rats: Effects

of Age and Type of Soy Product. *The Journal of steroid biochemistry and molecular biology* 160, 37-42

- Soni, M., White, L. R., Kridawati, A., Bandelow, S., & Hogervorst, E. (2016). Phytoestrogen consumption and risk for cognitive decline and dementia: With consideration of thyroid status and other possible mediators. *The Journal of steroid biochemistry and molecular biology* 160, 67-77

What role do sex steroids play in improved cognition after exercise in elderly?

Investigators: Prof, Eef Hogervorst¹, Dr Stephen Bandelow¹, Dr Ana Texiera², Dr Pedro Ferreira²

¹Loughborough University, ²Coimbra

Funding Body: Alzheimer's Research UK, Horizon 2020, NIHR

Dates: 2013-2018

Summary: Our previous work at Oxford showed that high levels of oestrogens were associated with a higher risk for dementia. In a series of projects we investigated the association between sex steroid levels and exercise and their effect on cognitive improvement. We found in ELSA that women who had undergone ovariectomy had a higher risk for dementia, but if they exercised their memory functions were maintained. We also found that women who engaged in resistance exercise had better memory functions compared to yoga stretch as a control. In this study high free testosterone in women at baseline was associated with worse memory function and with resistance exercise these levels decreased. These projects suggest that high levels of sex steroids are not necessarily associated with better memory in older women.

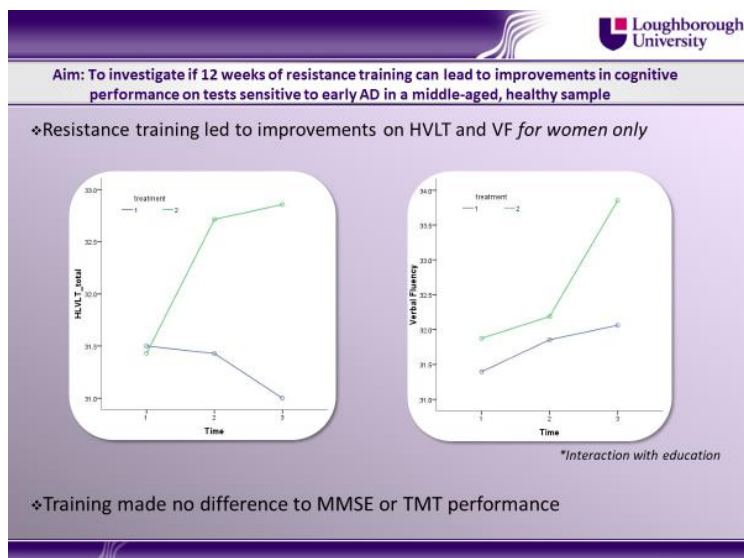


Figure 3: Effect of resistance training on cognitive performance

For more information, please contact: Eef Hogervorst (E.Hogervorst@lboro.ac.uk)

Key Words: sex steroids – testosterone- resistance exercise-memory

Publications

- Chupel, M., E.Hogervorst (2018). Exercise and taurine in inflammation, cognition, and peripheral markers of blood-brain barrier integrity in older women. *Applied Physiology, Nutrition, and Metabolism*
- Teixeira, AM, JP Ferreira, E Hogervorst, MF Braga, S Bandelow, LM Rama, ... (2016) Study protocol: Hormonal mediation of exercise on cognition, stress and immunity (PRO-HMECSI): effects of different exercise programmes in institutionalized elders. *Frontiers in Public Health* 4, 133
- Webber, L., Davies, M., Anderson, R., Braat, D., Bartlett, J., Conway, G., Hogervorst, E. & Vermeulen, N. (2015). ESHRE guideline: Management of women with Premature Ovarian Insufficiency. In Human Reproduction Oxford Univ Press. 29, 87-88
- Soni, M., Hogervorst, E. (2014). Premature ovarian insufficiency and neurological function. *Minerva Endocrinol.* 39(3):189-99.

Promoting Independence in Dementia - PRIDE

Investigators: Prof Martin Orrell¹, Prof. Eef Hogervorst², Prof. Fiona Poland³, Prof. Stephen Morris⁴, Dr. Aimee Spector⁴, Prof. David Challis⁵, Dr. Georgina Chalresworth⁴, Prof. Paul Higgs⁴, Andrew Haines⁴, Dr. Eleonara Dorsi⁴, Prof. Rumana Omar⁴, Prof. Frans

RJ Verhey⁶, Prof. Andrew Steptoe⁴, Prof. Susan Michie⁴, Dr. Greta Rait⁴, Prof. Esme Moniz-Cook⁷, Dr. André Xavier, Prof. Gail Mountain⁸

¹University of Nottingham, ²Loughborough University, ³University of East Anglia,

⁴University College London, ⁵University of Manchester, ⁶Maastricht University, ⁷University of Hull, ⁸University of Bradford

Funding Body: ESRC and NIHR

Dates: 2014-2018

Summary: The 'Promoting Independence In Dementia' (PRIDE) programme investigates how people with dementia can keep control of their own lives, stay healthy, contribute to society and feel valued and valuable. PRIDE has a number of individual programmes looking at lifestyle and health. It is also conducting interviews with people with dementia and their carers to find out what contributes to helping people stay independent when they experience memory problems. The outputs include a manual including lifestyle interventions focused on behaviours, attitudes, diet and other health promoters (sleep, blood pressure regulation), suggestions for physical and cognitive activities, and social interactions which can help promote independence and wellbeing in older people with mild to moderate dementia.

For more information, please contact: Eef Hogervorst (E.Hogervorst@lboro.ac.uk)

Key Words: Dementia, independence, autonomy, activities, manual

Publications

- McDermott O, Charlesworth G, Hogervorst E, Stoner C, Moniz-Cook E, Spector A, Csipke E, Orrell M.(2018) Psychosocial interventions for people with dementia: a synthesis of systematic reviews. *Aging & Mental Health*, 17:1-11
- Soni, M. Orrell, M., Bandelow, S., Steptoe, A., Rafnsson, S. d'Orsi, E Xavier,A Hogervorst, E.(2017) Physical activity pre-and post-dementia: English Longitudinal Study of Ageing *Aging & Mental Health*, 1-7 DOI: 10.1080/13607863.2017.1390731
- d'Orsi E, Xavier AJ, Rafnsson SB, Steptoe A, Hogervorst E, Orrell M. s use of the internet in midlife associated with lower dementia incidence? Results from the English Longitudinal Study of Ageing. *Aging & Mental Health* doi.org/10.1080/13607863.2017.1360840

My Active and Healthy Aging - my-AHA

Investigators: Dr Stephan Bandelow¹, Prof. Eef Hogervorst¹, Prof. Alessandro Vercelli², Prof. Innocenzo Rainero³, Prof. Wiebren Zijlstra⁴, Eleftheria Giannouli⁴, Prof Volker Wulf⁵, Prof Marcin Grzegorzek⁵, Dr. Rainer Wieching⁵, Daryoush Daniel Vaziri⁵, Dr. Ryuta Kawashima⁶, Prof. Mathew Summers⁷, Prof. Stuart Smith⁷

¹Loughborough University, ²University of Toronto, ³University of Torino, ⁴Institute of Movement and Sport Gerontology at the German Sport University Cologne, ⁵University of Siegen, ⁶Tohoku University, ⁷University of the Sunshine Coast

Funding Body: Horizon 2020

Dates: 2016 – Ongoing (48 months)

Summary: 'My Active and Healthy Ageing (my-AHA)' aims to reduce risk of frailty and cognitive decline by improving physical activity and cognitive function, as well as psychological state, social resources, nutrition, sleep and overall wellbeing. It will make use of digital platforms and social interactions to develop new ways of health monitoring and disease prevention through individualised and personalised recommendations, feedback and support. A digital platform will detect defined risks and provide targeted, research-based interventions to motivate users to participate in exercise, cognitively stimulating games and social networking to achieve long-term behaviour change. Early detection and intervention is crucial in sustaining active and healthy ageing and slowing or reversing further decline. The project aims to empower older adults to better manage their own health, resulting in healthcare cost savings.

The project is a collaboration between several European and Asian partners funded by the European Commission (Horizon 2020) and is part of a larger €4.3m grant. It will involve collaboration and cooperation with European healthcare organisations, SMEs and NGOs to deliver significant innovation in the area of active and healthy ageing.

For more information, please contact: Dr Stephan Bandelow

(s.bandelow@lboro.ac.uk)

Key Words: exercise- cognition-frailty- nutrition- activity

Publications

- NG Niederstrasser, E Hogervorst, E Giannouli, B Stephan (2016) Approaches to Cognitive Stimulation in the Prevention of Dementia *Journal of Gerontology & Geriatric Research* DOI: 10.4172/2167-7182.S5-005

***Defining quality home care for people with dementia: a mixed methods study
(BOUGH – Broadening Our Understanding of Good Homecare)***

Investigators: Prof Justine Schneider¹, Dr Cheryl Travers², Drs Kristian Pollock¹, Lucy Perry-Young¹, Samantha Wilkinson¹, Antony Kelly¹, Nicola Turner¹; Prof Nick Manning³; Dr Kezia Scales⁴.

¹University of Nottingham, ²Loughborough University, ³King's College London, ⁴Duke University.

Funding Body: NIHR

Dates: 2015 –2017

Summary: The primary objective was to inform home care policy, service development and workforce training by exploring home carer practice when caring for people with dementia including domestic tasks, rehabilitation, psychosocial therapeutic interventions and support for end of life. This included exploring as relationships experienced by care workers and recipients; describing and understanding the relational aspect of home care, from the perspectives of carers, relatives, home care recipients and researchers; investigating the stresses and rewards of working with people with dementia in home care; understanding what workers find stressful and rewarding; and the key factors appear to influence home care quality. The meaning of quality in home care for dementia was examined through rich, qualitative data gathered from 'insiders', taking what anthropologists might call an 'emic' approach. The data collection included a survey of local authority commissioners, participant observation, diaries and in-depth interviews with care providers and consumers. The commissioners' survey has highlighted a lack of central guidelines on commissioning home care for people with dementia with huge variation in local authority commissioning practice for this user group and that quality is a secondary goal to cost containment. An integrated approach to developing the capacity of social care as part of a wider strategy of local and regional planning would be needed to sustain the homecare market for the future.

The home care workers diaries illustrated the complexity of dementia care and their skilled relational work as well as confirming difficult terms and conditions of employment; for example zero-hour contracts, unpaid time between visits (including travelling) and cancelled visits. They reported high organisational expectations and their own self-image as carers as pressure to go beyond the requirements of the job, often at their own expense. In-depth interviews with home carers, relatives and managers generated data which was used to develop a framework for the activities, knowledge and skills of good home care. This includes a conceptualisation of the distinctive purpose of

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good home care for people with dementia as empathic engagement, which, it is suggested, demands certain higher-order ('meta-cognitive') activities. The resulting framework may be used to improve recruitment, training, support and quality monitoring of homecare for people with dementia.

For more information, please contact: Cheryl Travers (c.travers@lboro.ac.uk)

Key Words: homecare, ethnography, reflective diaries, interviews, commissioners

Technology Design for People with Dementia: A Human-Centred Design

Approach

Investigators: Ruby Allen (PhD student). Prof. Sue Hignett, Sharon Cook (supervisors)

Funding Body: Design Star (AHRC)

Dates: 2015-2018

Summary: People with dementia (PWDem) face a range of barriers when using technologies, which can be categorised into social and technological challenges. Many of the barriers faced are linked, and can affect both technology uptake and technology use. Most of the technology evaluation studies focused on assistive technologies, and thus it remained unclear which of the identified barriers may exist for PWD in everyday technologies. Identifying barriers that are encountered when using everyday technologies was highlighted as a gap in knowledge. Technologies were evaluated using a range of qualitative and quantitative methods. The perspective of PWD was not always sought, with carers' opinions and objective measures used alone in some studies. It was concluded that increased inclusion of PWD directly in technology evaluation could address some of the barriers encountered, by seeking their perspective and direct attitudes and experiences

For more information, please contact: Ruby Allen (R.S.Allen@lboro.ac.uk)

Key Words: Technology, Web accessibility Design Dementia

Publications

- Allen, R.S., Cook, S.E., Hignett, S. Jais, C.L., 2017. *Involving People with Dementia in Participatory Design: Ethical Processes and Consent for Dementia Research*. Alzheimer's Association International Conference: Technology and Dementia Preconference, London.
- Allen, R., Hignett, S., Cook, S. 201) How do People Living with Dementia Use Technology? *Proceedings of the Healthcare Ergonomics & Patient Safety (HEPS) conference*, Toulouse, 5-7 October. 410-413

A dignified death for dementia patients

Investigators: Marije de Haas (PhD student), Prof. Sue Hignett, Dr Thomas Jun (supervisors)

Funding Body: Design Star (AHRC)

Dates: 2016-2019

Summary: The fear of suffering dementia may lead to some people signing an Advance Euthanasia Directive to make provision for health care decisions in the event that, in the future, they are unable to make decisions. Euthanasia, which is only legal in a few countries, is *"the act of assisting someone who is terminally ill and whose suffering is unbearable and untreatable, to be in control of the manner of their dying"*. The euthanasia in dementia debate is at an impasse due to the complexity of issues and Advance Euthanasia Directives are rarely adhered to because the dementia symptoms may conflict with the due care criteria; whereby a person requesting euthanasia must be able to confirm the request at time of death and must be undergoing unbearable and hopeless suffering. This project uses design fiction as a thoughtful exploration of speculative scenarios to prototype other realities (Bleecker, 2009). A speculative design (including a video) was created from literature on advance euthanasia directives for dementia to stimulate discussion by illustrating the problem space as an implant that would trigger a swift and painless death once the conditions described in the Advance Euthanasia Directive were reached. The Plug is a speculative design for an implant that, once the conditions are reached with information received from sensors and medical data (see figure) as described in the Advance Euthanasia Directive, it could trigger a swift and painless death

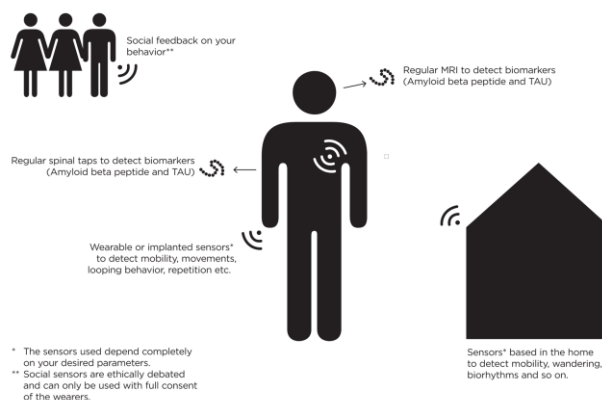


Figure 4. Speculative (fictional) design for 'The Plug'

For more information, please contact: Marije de Haas (M.De-Haas@lboro.ac.uk)

Key Words: Euthanasia, Dementia, Speculative Design

Person Centric Design Interventions for People living with Dementia (PLWD) in Residential Built-environment.

Investigators: Cyprian I Ozoh (PhD student). Prof. Andrew Price, Dr Zulfikar Adamu (supervisors)

Dates: 2017 - 2019

Summary: The current pressure on healthcare services such as rapid admission to A&E and delay discharge have resulted in adverse effects for older people with chronic conditions especially people living with dementia (PLWD). Returning to their home (Home-care) for assessment and treatment is advised as being core to the delivery of person-centred care. However, excess privacy associated with residential settings often results to loneliness and isolation, mortality and poor engagement for people with dementia. This research proposes that architectural design interventions in the physical environments can create enhanced social environments with improved health and wellbeing.

The research aims to develop person-centric design interventions pertinent to residential built-environment with data collected using life-history interviews with family carers and clinicians; semi-structured interviews with healthcare designers.

For more information, please contact Andrew Price (a.d.f.Price@lboro.ac.uk), Berkeley Young (b.d.k.young@lboro.ac.uk)

Key Words: Older people, Person-centred care, Person-centric Design

Human factors design for dementia care environments: Developing personas as a means of conveying the needs of people with dementia to designers

Investigators: Charlotte Jais (PhD student). Prof. Sue Hignett, Prof. Eef Hogervorst (supervisors)

Funding Body: Design Star (AHRC)

Dates: 2014-2018

Summary: A Human Factors and Ergonomics (HFE) approach was used to focus on the needs, limitations and abilities of users. This project describes the development and validation of a series of evidence-based dementia personas to provide an inclusive representation of the changing needs of people living with dementia (PWDem). The first

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personas were based on evidence from a systematic literature review and a scoping study on activities of daily living (ADLs). Personas V1 were reviewed and redesigned (content, layout, scope) by designers (including architects), healthcare professionals, care managers and care home developers in a series of research iterations. The final personas were validated with site visits to explore how well they represented the typical needs of care home residents with dementia. The four individual personas (Alison, Barry, Christine and David) and a couple persona (Chris and Sally) were used to bring the voices of the people living with different stages of dementia to the design process. Their changing/fluctuating symptoms were communicated in two formats (wheel and matrix) to show symptoms, care needs and design needs across good, average and bad days (and changes during the day).

This research addressed some of the issues associated with providing appropriate care environments for PWDem by creating and validating of a set of evidence-based personas using principles from HFE.

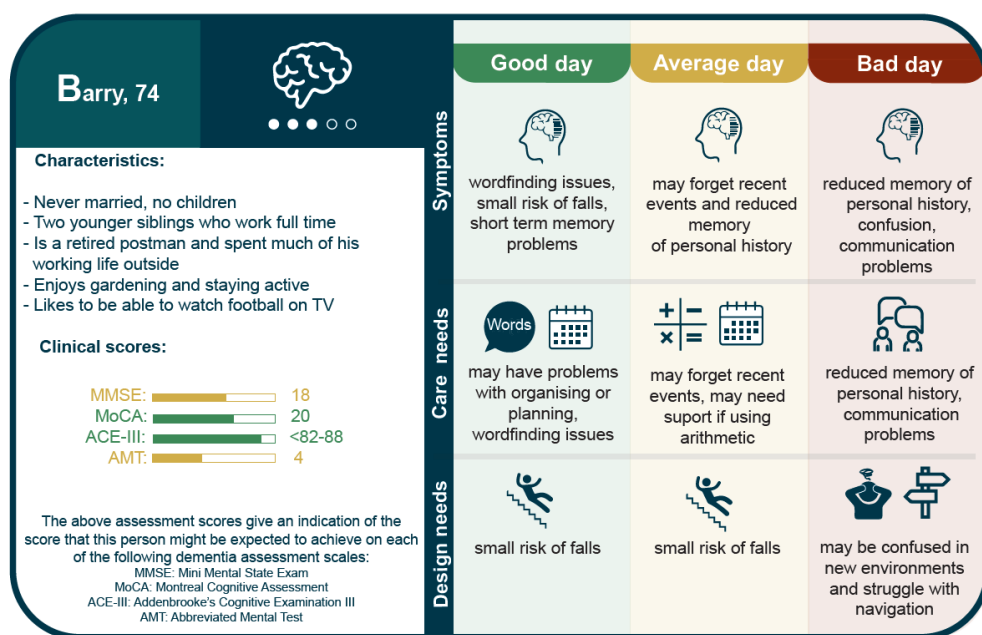


Figure 5. Persona matrix for 'Barry'

For more information, please contact: Charlotte Jais (C.Jais3@lboro.ac.uk)

Key Words: Human Factors, Building Design, Evidence-based design

Publications:

- Jais, C., Hignett, S., Galindo Estupiñan, Z., Hogervorst, E. 2017. Evidence Based Dementia Personas: Human Factors Design for People living with Dementia.

Proceedings of 18th Research-Technical International Conference: Ergonomics for People with Disabilities. Lodz, Poland. 21-22 Nov. 2017

- Jais, C., Hignett, S., Hogervorst, E. 2016. Developing personas for use in the design of dementia care environments. *Proceedings of the Healthcare Ergonomics & Patient Safety (HEPS) conference*, Toulouse, 5-7 October. 210-216
- Jais, C., Hignett, S., Habell, M., Brown, A., Hogervorst, E. 2016. Defining Activities of Daily Living for the design of Dementia Care Environment. In Sharples, S., Shorrocks, S & Waterson, P. (Eds.) *Contemporary Ergonomics 2016; Proceedings of the Annual Conference of the Chartered Institute of Ergonomics & Human Factors*. London: Taylor & Francis

Design for Dementia (BRE): Chris and Sally's house

Investigators: Prof. Jacqui Glass¹, Prof. Sue Hignett¹, Prof. Eef Hogervorst¹, Prof. Malcolm Cook¹, Dr David Kelly²

¹Loughborough University, ²Building Research Establishment

Dates: 2014-2018

Summary: Care and treatment at home presents challenges for people living with dementia (PWDem). Our research on dementia personas has been used in a demonstrator house (<https://www.bre.co.uk/>) to present evidence-based design, adaptation and support solutions to support PWDem to age well at home and maintain independence. International dementia design guidelines were critically appraised and found to be mostly based on professional consensus and stakeholder opinions rather than robust research evidence. The personas address this gap by providing integrating a systematic literature review with empirical qualitative and quantitative data from stakeholders (scoping study, focus groups, interviews, and care home observations). A Victorian house has been redesigned in collaboration with the multi-disciplinary team (Architecture, Civil & Building Engineering, Psychology; Human Factors/Ergonomics) using the personas to explore usability within a theoretical framework of inclusive design (British Standards Institute, 2005). The final layout has dementia friendly features including downstairs/upstairs toilets and a through-floor lift (rather than a stair lift) to achieve end of life care in the first floor bedroom with an adjacent carer kitchenette (for overnight support/respite carers). The research evidence incorporated includes the use of colour as a navigation aid (and cue), for example, Namazi & Johnson (1991) found that PWDem achieved better success with navigation tasks in environments using

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primary colours, improved contrast and concrete nomenclature (rather than abstract) with supporting diagrams, and indirect cues from signage placement.

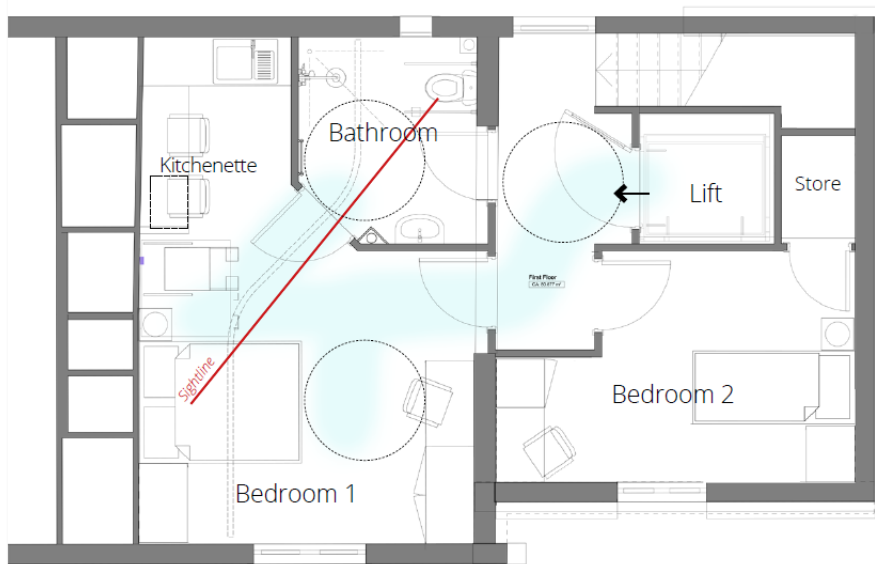


Figure 6. Layout version 5: First Floor

For more information, please contact: Sue Hignett (S.M.Hignett@lboro.ac.uk)

Key Words: Dementia, Building Design, Evidence-based design

3.3 Getting out and about

Older Public Transport Users

Investigators: Prof. Andrew Morris¹, Dr Jo Barnes¹, Dr Russell Marshall¹, Dr Steve Summerskill¹, Prof. Denise Kendrick², Prof. Avril Drummond², Prof. Pip Logan², Prof. Simon Conroy³, Prof. Brian Fildes⁴

¹Loughborough University, ²University of Nottingham, ³ University of Leicester, ⁴Monash University

Funding Body: Medical Research Council

Dates: 2011 - 2013

Summary: The increasing age of the United Kingdom (UK) population coupled with enhanced life expectancy impacts on transport-user demographics and will affect transport planning in the years ahead. Whilst passenger car use is the ultimate means of personal independence, at some point the physiological and psychological impact of age-related conditions will inevitably shift people out of their vehicles and onto public transport systems. Overall, public transport is seen to be vital for social inclusion (Lucas et al 2008) and it is considered a safe means of mobility. However, it is important that the public and, in particular, the elderly perceive it to be so. Injuries (across a spectrum of severities) do occur during public transport use from time to time. In fact, over 5,000 people are injured on UK buses each year alone with over 300 bus-users killed/seriously injured (Dept. for Transport, 2012). This study established a dataset of older public transport users and their injuries (sustained using public transport) to establish where design countermeasures could be indicated. Descriptive statistics were used to analyse linked (accident and injury) data involving a sample of older bus-users. Most incidents were non-collisions (62%) resulting in 1,381 recorded injuries in those aged 60+ years, of which 46% were 'slight' and 54% were 'serious'.

Results: the dataset had 1015 cases with the majority of passengers seated or standing when injured (75.8%), Head, upper and lower extremities most commonly injured body regions.

Focus group (n=15) data found that passengers preferred to sit in the front forward facing seats; side seats if they had to (made them feel unsafe, nothing to grab onto), with comments that 'Drivers just don't wait'. Observations of 147 passengers found that for 10% of the time bus drove off before passengers had sat down; there were numerous episodes of grabbing handrails whilst stood on the bus (usually before a bus stop) and that 75% stood up before the bus had come to a stop.



Figure 7. Older passengers sitting in front facing seats

For more information, please contact: Jo Barnes (j.barnes@lboro.ac.uk) or Andrew Morris (a.p.morris@lboro.ac.uk)

Key Words: Older Transport User, Social Inclusivity, Mobility, Injury

Publications:

- Barnes, JS, Morris, AP, Welsh, R, Summerskill, S, Marshall, R, Kendrick, D, Logan, P, Drummond, A, Conroy, S, Fildes, B, Bell, J (2015) Injuries to older users of buses in the UK, *Public Transport*, 8(1), pp.25-38, ISSN: 1866-749X. DOI: 10.1007/s12469-015-0113-8.
- Kendrick, D, Drummond, A, Logan, P, Barnes, J, Worthington, E (2015) Systematic review of the epidemiology of non-collision injuries occurring to older people during use of public buses in high-income countries, *Journal of Transport and Health*, 2(3), pp.394-405, ISSN: 2214-1405. DOI: 10.1016/j.jth.2015.06.002.
- Barnes, J and Morris, A (2014) Injuries to Older Users of Public Transport - A Neglected Problem, *Traffic Injury Prevention*, 15(Supplement 1), pp.S245-S247, ISSN: 1538-9588.

Vehicle Ergonomics and Older Drivers

PhD Student: Sukru Karali. **Supervisors:** Dr Diane Gyi, Prof. Neil Mansfield.

Funding Body: EPSRC DTG Award

Dates: 2012 - 2015

Summary: There is a growing population of older people and the population of older drivers is showing a parallel increase. Many cars also do not meet the needs of people with age-related disabilities. The research aimed to determine the requirements of older vehicle users (retired, semi-retired and working) for an improved driving experience and

to understand how the design of the vehicle cab impacts on posture, comfort, health and wellbeing in these drivers.

Initially, a large questionnaire survey of 900+ drivers was conducted together with supplementary interviews to identify key issues with the driving experiences of older compared with younger drivers. More discomfort was reported by older drivers (aged 65+) in the hips/thighs/buttocks and knees. Older drivers also reported more difficulty parallel parking, driving on a foggy day, and turning their head and body to reverse. Many also reported that their reactions were slower than they used to be. Dissatisfaction was found by all drivers with adjusting the head restraint, seat belt height and opening/closing the boot.

A second field study was conducted with drivers age 50 and over, to understand the user experience of this age group concerning the design of the vehicle cab (in their own car and a standard car) and how it impacts on posture, comfort, health and wellbeing. The findings showed that many older drivers find it difficult to get comfortable and achieve a good driving position due to difficulties with some controls (accessing, operating and the functionality). It was common for these drivers to make their own adaptations to the car e.g. adding cushions and padding to hard surfaces.

Key outcomes were design recommendations for the automotive industry concerning specific age-related challenges, for example, driving position/posture, accessing seat controls, improving ingress. Clearly, efforts are needed to ensure car design of the future is more inclusive of older drivers.

For more information, please contact: Diane Gyi (d.e.gyi@lboro.ac.uk)

Key Words: Older drivers, driving ergonomics, automotive design

Publications

- Karali, S., Gyi, D., Mansfield, N.J. (2017) Driving a better driving experience: a questionnaire survey of older compared with younger drivers. *Ergonomics*, 60:4, 533-540

3.4 Working Later

The research described in this section includes examples from occupational health for older workers (including climate change), evaluation of government guidelines, to specific challenges in the construction industry.

Evaluation of the 50+ Face to Face Guidance Pilot

Investigators: Katherine Hill, Matt Padley

Funding Body: Dept. for Work and Pensions (DWP)

Dates: 2008 -2011

Summary: A multi-method evaluation of the DWP-funded 50+ Face-to-Face Guidance Pilot scheme whereby provider organisations delivered a guidance service to people in employment aged 50 and above. The Service was provided in the context of Extending Working Life policies with the aim to address knowledge gaps of older workers and facilitate their planning for the future. It covered a range of work and retirement issues as well as directing clients to sources offering more detailed and/or more personalised information.

The Centre for Research in Social Policy (CRSP) at Loughborough University evaluated the Pilot using qualitative and quantitative longitudinal methods. Research with providers included focus groups and face-to-face interviews with managers and advisors as well as observations of guidance sessions. Other elements involved face-to-face interviews with selected clients and a telephone survey of clients (both with a longitudinal component) and analysis of providers' management Information data.

For more information, please contact. Katherine Hill (K.R.Hill@lboro.ac.uk)

Key words: Extending working lives, guidance service, evaluation

Publications:

- Perren, K., Harvey, J., Hill, K., Hartfree, Y. and Padley, M. (2011) [*Evaluation of the 50+ Face-to-Face Guidance Pilot*](#). Research Report No. 720. London: Department for Work and Pensions.

Thriving in the workplace - supporting people at the age of 55 years and over in satisfying and productive work

Investigators: Prof. John Arnold, Dr Stanimira Taneva

Funding Body: Marie Curie Intra-European Fellowship scheme

Dates: 2013 –2015

Summary: This research project is designed to test human resource management factors, job design and individual factors such as Selection, Optimisation and Compensation. The project was implemented simultaneously in two EU countries – one long-established (United Kingdom), and one new (Bulgaria). It examined two contrasting sectors: health and IT, by working with two or more organisations per sector per country. The general objectives were both theoretical and practical to identify what features of work and work environment older workers found important for their well-being and performance at work; to identify the personal and organisational strategies that were effective in helping older workers to maintain their well-being and performance at work; and to develop training and guidance materials for the development of personal and organisational strategies. This work, accentuated the positive by thinking in terms of thriving as well as surviving.

For more information, please contact: John Arnold (J.Arnold@lboro.ac.uk)., Stanimira Taneva (S.Taneva@lboro.ac.uk)

Key Words: successful ageing at work, thriving, well-being, job performance, older workers

Publications

- Taneva, S. K. and Arnold, J. (2018). Thriving, Surviving and Performing in Late Career: A Mixed-Method Study of Pathways to Successful Aging in Organizations, *Work, Aging and Retirement*, 4 (2), 189–212, doi:10.1093/workar/wax027
- Taneva, S. K., Arnold, J. and Nicolson, R. (2016). The experience of being an older worker in an organization: a qualitative analysis. *Work, Aging and Retirement*, 2(4), p.396-414, doi: 10.1093/workar/waw011
- Taneva, S. and Arnold, J. (2016). Older Workers Need to Stop Believing Stereotypes about Themselves. *Harvard Business Review*, 20.06.2016, Available at <https://hbr.org/2016/06/older-workers-need-to-stop-believing-stereotypes-about-themselves>

Ageing European workforce in the context of climate change

Investigators: Prof. George Havenith

Funding Body: European Commission

Dates: 2016 - 2020

Summary: As part of the EU project 'Heat Shield' which addresses the negative impacts of workplace heat stress on the health and productivity of workers in strategic European

industries (manufacturing, construction, transportation, tourism and agriculture) and the potential increase of these impacts as climate change progresses, this work looks at the magnitude of the impact on older workers. With age, several physiological changes take place that reduce the resilience to heat exposure. In order to come to relevant risk assessments and predictions for different age groups, this difference needs to be quantified. The studies are based in the climate chambers of the Environmental Ergonomics Research Centre, where virtually all workplace conditions that occur around the world can be simulated. Individual's work capacity is studied in different climatic conditions and performance losses (focussing on physical work) are measured. The expected outcome is a prediction model of productivity in relation to Temperature, Humidity, Solar Radiation, and Clothing worn, including the impact of age.

For more information, please contact: George Havenith (G.Havenith@lboro.ac.uk)

Key Words: Climate Change, Productivity, Ageing, Workload, Work Capacity

LUSKInS – Wearable Simulations for age-exacerbated occupational ill-health conditions in construction

Investigators: Prof. Alistair Gibb, John Richardson, Sharon Cook

Funding Body: EPSRC

Dates: 2007-2009

Summary: Developing evidence-based wearable simulations for age-exacerbated ill-health conditions typically found in the construction sector. Data were collected as interviews with health professionals to develop an appreciation of the health conditions and with construction workers.

A specification was developed covering mild, moderate and severe forms of dermatitis, hand-arm vibration syndrome, musculoskeletal disorders, noise induced hearing loss and respiratory disorders.

The wearable simulations were developed in an iterative process, driven by the specification requirements, and encompassing design considerations including: goodness of fit; ethics; cost; materials and technology; durability; and hygiene. Components were required to maintain items in the appropriate position e.g. gloves for dermatitis and hand-arm vibration syndrome (HAVS). The prototyping stage combined the individual items into an integrated simulation. The simulations are now being employed in various

training scenarios through a training licence agreement with Park Health. They have also been used across a wider range of applications, e.g. hospital equipment design.



Figure 8. LUSKInS ageing wearable simulation to evaluate hospital bed design

For more information, please contact: Alistair Gibb (A.G.Gibb@lboro.ac.uk) Sharon Cook (S.E.Cook@lboro.ac.uk)

Key Words: Construction worker; ill-health; wearable simulations

Building Healthy Construction Workers

Investigators: Stephanie Eaves (PhD student). Dr Diane Gyi, Prof. Alistair Gibb (supervisors)

Funding Body: Age UK

Dates: 2012 - 2015

Summary: The aim was to explore construction trades' workers understanding of their health and wellbeing and capture ideas on improving job and workplace design to help towards healthy ageing and fuller working lives. Construction is a male dominated industry, with workers taking early retirement due to injury and ill health because of the tough, manual nature of the work and often challenging environment it presents to older workers. Construction trades' workers were interviewed; they had a good understanding of their health at work with many suffering with work-related aches and pains. Workers of all ages and in all trades, were proactive in finding ways to make their jobs easier, safer, healthier or more comfortable, such as safer manual handling practices (e.g. careful planning or using lifting machinery); maintaining a good level of fitness (e.g. attending gyms); and eating healthily to ensure they were fit and able to work. Senior construction stakeholders recognised the value of encouraging workers to put forward suggestions and saw opportunities to develop many of their ideas for implementation in the workplace including improving Personal Protective Equipment design and closer supervision of younger workers. However, a barrier to change was a lack of communication between the workforce and managers particularly in relation to encouraging ideas, feedback and discussions. More effective and interactive toolbox talks, inductions, health and wellbeing briefing sessions and courses are needed. Ideas for guidance were captured with a participatory approaches for decision making and idea generation could enable sharing of good practices. The older (more experienced) workers in particular had a wealth of knowledge and good ideas to reduce physical and mental strain on the body. A guidance document was produced for the construction industry with a focus on health to encourage discussions around healthy design and healthy working behaviours.

<http://www.workinglate-owl.org/wp-content/uploads/2012/07/Industry-Briefing-2016-V2.pdf>

For more information, please contact: Diane Gyi (d.e.gyi@lboro.ac.uk), Alistair Gibb (a.g.Gibb@lboro.ac.uk)

Key Words: Construction worker; health

Publications

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- Eaves, S., Gyi, D. E., & Gibb, A. G. F., 2016. Building healthy construction workers: Their views on health, wellbeing and better workplace design. *Applied Ergonomics*, **54**, 10-18.
- Eaves, S., Gyi, D. E., & Gibb, A. G. F., 2015. Facilitating healthy ageing in construction: stakeholder views. In Ahram, T., Karwowski, W., & Schmorow, D. (Eds.) (2015) *Procedia Manufacturing, 6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015*, 27-30 July, Las Vegas, USA, 4681-4688.
- Eaves, S., Gyi, D. & Gibb, A., 2014. Healthy construction workers by better workplace design. In: R, Aulin (Ed.) and Å, Ek (Ed.), *Proceedings CIB W099 Achieving Sustainable Construction Health and Safety* 2-3 June 2014, Lund, Sweden, 148-156.

SPARC - Understanding the Older Worker in Construction

Investigators: Prof, Alistair Gibb¹, Dr Joanna Leaviss², Dr Phil Bust¹

¹Loughborough University, ²Sheffield University

Funding Body: EPSRC/BBSRC - SPARC

Dates: 2006-2007

Summary: The aims of this study were to examine the relationship between ageing and construction work; to understand the needs and abilities of older construction workers and how their working environment may be improved to accommodate those needs; and to explore potential interventions that may ease the physical workload of older construction workers and prevent early retirement from the industry.

A series of interviews with workers in the construction industry identified the impact of working conditions on their health and career paths. Poor working conditions coupled with widespread self-employment has created an environment where, when major physical injuries are suffered by the individual, the consequent financial burden may be largely met by the taxpayer rather than by industry. Direct employment is associated with a more supportive and favourable environment for older workers. The opportunity for designing tools and procedures more suited to the older worker has so far been largely overlooked. This is possibly in part due to the fact that workers, especially those paid on 'piece-work', often think that labour-saving equipment and safer practices will slow down productivity.

Older workers in the construction industry are committed, valued and appreciated for their skills, but, in a commercially competitive industry with a plentiful supply of cheap labour this can seem to count for little. Heavy, physical workloads added to the normal effects of ageing leads to premature physical decline and ill health, which often results in workers leaving the industry before retirement age. This research has shown that older workers in the construction industry want to remain in their jobs, but although their skills, experience and commitment are valued, there is often a trade-off between that and physical fitness.

For more information, please contact: Professor Alistair Gibb (a.g.gibb@lboro.ac.uk)

Key Words: Older construction workers; work conditions; productivity; physical fitness; experience

Publications

- Gibb A, Leaviss J and Bust P (2013) [Older construction workers: needs and abilities](#). In: Smith, S D (Ed.) and Ahiaga-Dagbui, D D (Ed.), *Proceedings 29th Annual ARCOM Conference*, 2-4 September 2013, Reading, UK, Association of Researchers in Construction Management., 261–271. www.arcom.ac.uk/res-publications.php
- Leaviss, J., Gibb, AGF & Bust, PD, (2008), Understanding the older worker in construction – meeting the challenges of an ageing society, SPARC – Strategic promotion of ageing research capacity, EPSRC/BBSRC SPARC initiative, 8pp..
- Crick, G., Leaviss, J., Gibb, AGF & Bust, PD, Bolt, H., (2009), Aging workers in the construction industry – their vulnerability and management, CONIAC Vulnerable Workers Working Group, Discussion Paper Aging Workers, April 2009, 10pp

3.5 Health, Wellbeing and Safety for Older People

Loughborough University has a long track record in research for exercise with focusses on bone health, nutrition and other Life Long determinants of health and wellbeing (<http://www.lboro.ac.uk/departments/ssehs/research/lifestyle-health-wellbeing/life-course-determinants-health-wellbeing/>).

Optimising the behavioural response of older people to early warnings of severe winter

Investigators: Prof. Kevin Morgan, Dr Harriet Gross

Funding Body: Age UK, The Met Office

Dates: 2006-2008



Summary: Building on the 'Forecasting the Nation's Health', a collaboration between the Met Office and Age UK, the project Steering Committee agreed the need to develop an 'optimal response' to severe winter weather for older people. Such a response would need to be evidence based, accessible, practical and deliverable in a public health booklet format. The study was conducted in 4 stages starting with a systematic review to identify evidence linking particular behavioural responses to severe cold weather with a likely reduction in risk from severe cold weather. An Expert Consensus Development Conference (CDC) was held to combine expertise in public health, primary care, epidemiology, physiology and human thermal environments, health psychology, and including lay representation. The CDC considered the 28 items of advice from the literature review and agreed a set of and form for the items which were then transferred to a 'mock- up' health promotion booklet. User views on the mock-up booklet, particularly in relation to accessibility, face validity and practicality were collected in focus groups with third and fourth age older people and a carers group.

Emerging themes/issues relating to the acceptability/practicality of the proposed advice, and the wording of the advice. Finally a field trial (n=37 participants) tested whether the booklet, combined with a telephone call warning of impending severe cold weather would be effective in raising awareness of cold weather related health risk and promoting optimal behavioural responses to severe winter weather among older people and carers. Results showed evidence of attitude and behaviour change arising directly from the advice. It is suggested that the large scale distribution of such a booklet among the older population and carers, when combined with the proposed Met Office severe weather warning system, could result in improved health practices and hence risk reduction among the most vulnerable.

For more information, please contact: Kevin Morgan (k.morgan@lboro.ac.uk)

Key Words: excess winter mortality, fuel poverty, health policy, public health, older people.

Publications

- Gascoigne, C., Morgan, K., Gross, H., Goodwin, J. 2009. Reducing the health risks of severe winter weather among older people in the United Kingdom: an evidence-based intervention. *Ageing & Society*, doi:10.1017/S0144686X09990298

A minimum income standard for people with visual impairment: the additional costs of severity and age

Investigators: Katherine Hill, Prof. Donald Hirsch

Funding Body: Thomas Pocklington Trust

Dates: 2013 - 2018

Summary: This research calculated the additional costs of living for people who are visually impaired across levels of impairment and life stages. It uses the Minimum Income Standard (MIS) baseline of what people need in order to reach a minimum acceptable standard of living, (i.e. not only meeting basic needs, but allowing people the opportunity to participate in society), and asked groups of working age and pension age visually impaired people about the additional needs and costs arising from sight loss; including both needs in the home, and outside e.g. travel/social life, The findings showed that both severity of sight loss and ageing bring extra costs, which increase further when combined - additional costs are greater for people of pension age than working age across degrees of visual impairment. Older people acquire sight loss later in life could

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face high extra costs even with less severe sight loss, due to the joint impact of deteriorating sight and lower mobility. A broad range of additional needs were identified, from direct aids to help with sight loss, help in the home, to travel and social activities but costs tend to be greatest where they involve regular human help, such as cleaning support or taxi journeys. A follow up study is now underway to place these findings in context. It is firstly using quantitative analysis to consider the extent to which benefits, pensions and minimum wages can provide visually impaired people with the income they need in order to meet a minimum income standard (MIS). Secondly, the experiences of visually impaired people whose incomes fall under the MIS level, are being explored to understand more about how they balance their needs with their income, the decisions and choices that they may face and how people adapt and cope in their daily lives. For more information, please contact Katherine Hill (K.R.Hill@lboro.ac.uk)

Key Words: Visual impairment, additional costs of living, minimum needs.

Publications:

- Hill, K., Horsley, N., Hirsch, D. and Padley, M. (2017) *Sight Loss and Minimum Income Standards: the additional costs of severity and age*. Loughborough: Centre for Research in Social Policy. <http://www.pocklington-trust.org.uk/project/sight-loss-minimum-income-standards-additional-costs-severity-age/>

Living on a low income in later life

Investigators: Katherine Hill, Donald Hirsch, Liz Sutton

Funding Body: Age UK, Chesshire Lehmann Fund

Dates: 2011 -2012

Summary: This research aimed to explore and understand the experiences of people aged 65 and over living on low incomes in order to raise awareness about the reality of managing in later life with restricted means. It used individual depth interviews and focus groups to illuminate the decisions and choices that older people face in managing their finances and the practical and emotional impact of living in constrained circumstances. The study found that: people found life tough living on a low income but by and largely believed they were getting by; past experience of low income made a difference as those with more affluent pasts sometimes found it harder to adjust; most were strongly averse to debt and believed that you had to live within your means; those with some form of debt noted the difficulty of getting back on track when on a fixed low

income; managing involved enormous effort, discipline and resourcefulness and the constant need for restraint and 'existing' with little prospect of a situation improvement could be emotionally draining; keeping up with household bills involved making sacrifices – people went without holidays, going out, did not replace household goods, and cutting back on heating and energy use. The combination of having poor health and mobility, living in a rural area in old housing with no or limited public or transport and with few social networks made it much harder to manage financially as well as practically. Having even small amounts of savings could also make a real difference to being able to deal with emergency expenditure or in meeting more regular payments. People were very concerned about being able to continue to manage on their incomes in the current economic climate – they were worried about rising prices, losing benefits such as free bus travel and services that were currently available and enhanced their quality of life.



Figure 9. *Getting by on a lower income*

For more information, please contact Katherine Hill, K.R.Hill@lboro.ac.uk.

Key Words: Low income, managing, resourcefulness, fuel poverty

Publications:

- Hill, K., Sutton, L. and Hirsch, D. (2012) *Living on a Low Income in Later Life*, London: Age UK. <http://web1.ageuk.org.uk/money-matters/income-and-tax/living-on-a-low-income-in-later-life/>
- Sutton, L and Hill, K. (2012) *Mediating the Risk of Fuel Poverty in Pensioner Households*, CRSP Research Report 618. Chesshire Lehmann Fund. <http://www.nea.org.uk/wp-content/uploads/2016/07/understanding-fuel-poverty-final-highres.pdf>

Sedentary Behaviour in Older Adults: investigating a new therapeutic paradigm

Investigators: Dr Thomas Yates¹, Dr Charlotte Edwardson¹, Prof. Melanie Davies¹, Prof. Kamlesh Khunti¹, Prof. Stuart Biddle², Dr Jason Gill³, Dr Danielle Morris¹, Prof. Naveed Sattar³, Dr Latha Velanyudhan¹, Prof. Alan Sinclair⁴, Dr Dale Esliger⁵, Yu-Ling Chen⁵

¹University of Leicester, ²University of Southern Queensland, ³University of Glasgow,

⁴University of Bedfordshire, ⁵Loughborough University.

Funding Body: Medical Research Council

Dates: 2013 –2017

Summary: A growing body of evidence shows potentially harmful effects on health of sedentary behaviour (sitting or lying whilst awake). There appears to be an age-related increase with older adults the most sedentary segment of the population. Previous research has used movement sensors to assess the overall amount of sedentary behaviour in older adults and other population groups but have not assessed the indoor location of sedentary behaviour which could inform intervention strategies by identifying the “sedentary hotspots”. The aim was to identify, refine and deploy (pilot) a novel technology (Actigraph movement sensor) to measure the location of older adult’s sedentary behaviour. Bluetooth Low Energy (BLE) allows detection of device proximity by assessing BLE signal strength (i.e. stronger when two devices are closer). This was deployed for 1 week in two older adult care homes to assess the “sedentary hotspots” of the care home. It measured 26 residents and 16 staff members to assess whether residents were more or less sedentary when they were near staff members. Beacon Actigraphs were placed around the care homes in resident’s rooms, in corridors and in larger, shared areas of the care home. Data are in the final stages of analyses and are currently being prepared for journal publication.

For more information, please contact: Adam Loveday (A.Loveday@lboro.ac.uk) or Dale Esliger (D.Esliger@lboro.ac.uk)

Key Words: Sedentary behaviour, Context, location, older adult, sitting

Environmental factors associated with falls in hospitalised older people

Investigators: Gina Sands (PhD student). Prof. Sue Hignett, Prof. Paula Griffiths (supervisors)

Dates: 2009-2013

Summary: Older people are a vulnerable population for falls and the risk may be increased by unfamiliar hospital environments. Using a mixed method ergonomic approach to acknowledge the complexity of contemporary hospital environments, this research explored the associations between patient characteristics and environmental causal factors of in-patient falls for older people. A series of three exploratory pilot studies were carried out, followed by two large scale research projects using nationally collected data from patient incident reports and overnight bedrail audits. It was found that patients in care of older people wards have different characteristics (higher levels of frailty and confusion) compared with same age peers in other wards. Bedrail use was higher with increasing level of confusion with staff rationale suggesting an underlying intent to restrain confused patients. Up to 92% of patients falls were reported to be un-witnessed; this may be explained by only 24% of patient beds being visible from nursing stations. Finally, there were significant differences found in the fall locations between patients who were described as frail and those who were described as confused. In conclusion, it is suggested that patients in care of older people wards will have different requirements for fall prevention in terms of layout, visibility, equipment use and facilitating independence.



Figure 10. Entrapment in hospital bed rails

For more information, please contact: Sue Hignett (S.M.Hignett@lboro.ac.uk)

Key Words: Falls, NRLS, hospital bed design, patient safety

Publications

- Hignett, S., Sands, G., Griffiths, P. (2013) In-Patient Falls: What can we learn from incident reports? *Age & Ageing*. 42, 527-531
- Hignett, S., Sands, G., Fray, M., Xanthopoulou, D., Healey, F., Griffiths, P. (2013). Which bed designs and patient characteristics increase bed rail use? *Age & Ageing*. 42, 531-535
- Hignett, S., Sands, G., Griffiths, P. (2011) Exploring the Contributory Factors for Un-witnessed In-Patient Falls from the National Reporting and Learning System database *Age & Ageing*. 40(1): 135-138

Balancing the Complexity of Patient Falls: Implementing Quality Improvement and Human Factors/Ergonomics and Systems Engineering strategies in Healthcare

Investigators: Laurie Wolf^{1,2} (PhD student). Prof. Sue Hignett, Prof. Paula Griffiths (supervisors)

¹Loughborough University, ²Barnes Jewish Corporation, USA

Funding: Barnes Jewish Corporation

Dates: 2011-2016

Summary: Falls are the leading cause of death due to injury among the elderly. Every 24 minutes an older adult dies from a fall related injury. Case studies using 3 different methods were performed at a large urban, academic medical center in the US. The aim was to understand the advantages and disadvantages of QI methodologies (Lean and Six Sigma) and HFE when applied to fall prevention in the acute care setting; develop recommendations for fall prevention. The first case study used Lean techniques such as standard work to improve fall risk assessment and intervention selection. Total falls decreased by 22% and falls with total injury decreased by 37%. At first glance this was successful but there were still 15 falls with serious injuries resulting in a longer hospital stay and increased cost of treatment (not reimbursed). The second case study used Six Sigma tools to investigate root causes of falls. An intervention called "Patient Partnering" was developed to encourage patients to call for help and participate in preventing their own falls. There were no falls with serious injury for over 14 consecutive months. However, the intervention was difficult to sustain due to resistance from nurses and patients. Falls with injuries resumed as the intervention ceased. The third case study was a qualitative study based on HFE principles to understand patient's perception of fall risk. It was found that patients did not think they would fall and felt particularly safe and

protected while in hospital. They found it difficult to get around with IV tubes and crowded spaces. They wanted information and assistance when they need it, in the format they prefer (customized for each individual patient). It was concluded that falls prevention interventions need to be designed for all the stakeholders (patients and staff). Patients think nurses will keep them safe and are willing to participate with fall prevention if they feel it is tailored to their needs. Until all perspectives are taken into account it is unlikely that there will be sustained and embedded improvements.

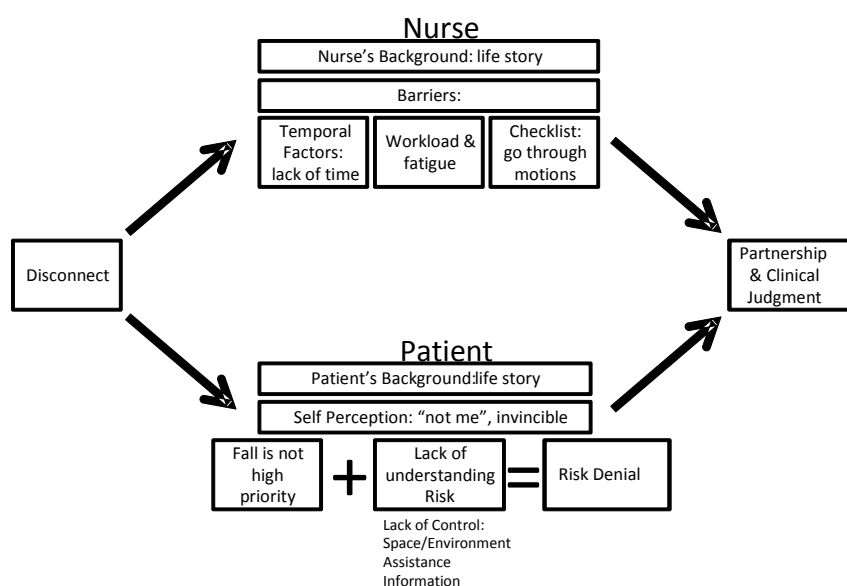


Figure 11. Disconnect between Patient and Nurse perception of Falls

For more information, please contact: Sue Hignett (S.M.Hignett@lboro.ac.uk)

Key Words: Falls, patient safety, Quality Improvement (Lean, Six Sigma)

Publications

- Wolf, L., Costantinou, E., Limbaugh, C., Rensing, K., Gabbart, P. & Matt, P. 2013. Fall prevention for inpatient oncology using lean and rapid improvement. event techniques. *HERD: Health Environments Research and Design Journal*, 7, 85-101.
- Hignett, S., Wolf, L. (2016). Reducing inpatient falls: Human Factors & Ergonomics offers a novel solution by designing safety from the patients' perspective (Editorial *International Journal Nursing Studies* 59, A1-A3.
- Hignett, S., Wolf, L., Taylor, E., Griffiths, P. (2015) Firefighting to Innovation: Using Human Factors & Ergonomics to tackle Slip, Trip and Fall Risks in Hospitals. *Human Factors* 57, 7, 1195-1207

Anticipate to Participate to Integrate: Bridging Evidence-Based Design and Human Factors Ergonomics to Advance Safer Healthcare Facility Design

Investigators: Ellen Taylor^{1,2} (PhD student), Prof. Sue Hignett, Prof. Paula Griffiths (supervisors)

¹Loughborough University, ²Center for Health Design, USA

Dates: 2013-2016

Summary: This project advanced proactive thinking in designing healthcare facilities for safety by constructing theory to bridge gaps between evidence-based design (EBD) and human factors/ergonomics (HF/E). HC facility design is complicated and complex, and the implications of decisions can be felt for decades. While architects excel at problem solving, they are not fully versed in healthcare work tasks, flow, and function, resulting in complex system interactions. The PhD thesis built on a grant to create a Safety Risk Assessment toolkit for HC facility design (SRA; <https://www.healthdesign.org/sra>) using: (1) consensus-based methods to develop built-environment considerations for falls in HC facility design, (2) a mixed methods approach to test the SRA in hypothetical scenarios, (3) a mixed methods approach to test the SRA in real-world scenarios, (4) quantitative and qualitative analysis using an inductive and abductive approach to construct grounded theory (GT) to develop a core theme and a theoretical framework for proactively considering safety in HC facility design, (5) an extended systematic literature review to identify additional system considerations of the organization and people, and (6) established thinking to advance new theoretical frameworks to achieve the thesis objectives. Two theoretical frameworks were proposed. The first framework, Safety as Complexity of the Organization, People and Environment (SCOPE) integrates HF/E design principles to reframe thinking about hospital falls (DEEP SCOPE). The second framework was constructed from SRA testing proposing safe design as a participatory process to anticipate, participate, and integrate solutions. The gap between EBD and HF/E was bridged using safety (falls) as a proactive consideration during HC facility design using theoretical frameworks.

For more information, please contact: Sue Hignett (S.M.Hignett@lboro.ac.uk)

Key Words: Falls, hospital design, patient safety

Publications

- Taylor, E., Hignett, S. (2014). Evaluating evidence: Defining levels and quality using critical appraisal mixed methods tools. *Health Environments Research & Design Journal*. 7, 3, 144–151

- Taylor, E., Hignett, S. (2016). The SCOPE of Hospital Falls: A Systematic Mixed Studies Review *Health Environments Research & Design Journal*. 9: 86-109

ProAct65+ bone study

Investigators: Dr Katherine Brooke-Wavell¹, Prof. Steve Iliffe⁵, Prof. Denise Kendrick², Prof. Tahir Masud², Prof. Dawn Skelton³, Prof. Heather Gage⁴

¹Loughborough University, ²University of Nottingham, ³ Glasgow Caledonian University,

⁴University of Surrey, ⁵University College London (UCL)

Funding Body: National Osteoporosis Society

Dates: 2008 - 2013

Summary: Background: exercise can reduce osteoporotic fracture risk by strengthening bone or reducing fall risk. Falls prevention exercise programmes can reduce fall incidence, and also include strengthening exercises suggested to load bone, but there is little information as to whether these programmes influence bone mineral density (BMD) and strength. This project aimed to evaluate the skeletal effects of home (Otago Exercise Programme, OEP) and group (Falls Exercise Management, FaME) falls prevention exercise programmes relative to usual care in older people. Men and women aged over 65 years (n=319) were recruited through primary care. They were randomised by practice to OEP, FaME or usual care. BMD, bone mineral content (BMC) and structural properties were measured in Nottingham site participants before and after the 24-week intervention. Ninety-two percentage of participants completed the trial. The OEP group completed 58(43) min/week of home exercise, while the FaME group completed 39(16) and 30(24) min/week of group and home exercise, respectively. Femoral neck BMD changes did not differ between treatment arms: mean (95% CI) effect sizes in OEP and FaME relative to usual care arm were $-0.003(-0.011,0.005)$ and $-0.002(-0.010,0.005)$ g cm⁻², respectively; P = 0.44 and 0.53. There were no significant changes in BMD or BMC at other skeletal sites, or in structural parameters. It was concluded that falls prevention exercise programmes did not influence BMD in older people. To increase bone strength, programmes may require exercise that exerts higher strains on bone or longer duration.

For more information, please contact Katherine Brooke-Wavell (k.s.f.brooke-wavell@lboro.ac.uk)

Key Words: Exercise, falls, osteoporosis prevention, bone density

Publications

- Duckham, RL; Masud, T; Taylor, R; Kendrick, D; Carpenter, H; Iliffe, S; Morris, R; Gage, H; Skelton, D; Dinan-Young, S, Brooke-Wavell K.(2015) Randomised Controlled Trial of the Effectiveness of Community Group and Home Based Falls Prevention Exercise Programmes on Bone Health in Older People: the ProAct65+ Bone Study *Age & Ageing* 44(4):573-579

The influence of high impact exercise on bone density in older men (Hiphop study)

Investigators: Sarah Allison (PhD student), Dr Katherine Brooke-Wavell¹, Dr Jonathan Folland¹, Dr Winston Rennie², Dr Greg Summers³ (supervisors)

¹Loughborough University, ²University Hospitals Leicester NHS Trust, ³Derby Hospitals NHS Trust

Funding Body: MRC interdisciplinary bridging

Dates: 2008 - 2012

Summary: There is little evidence as to whether exercise can increase BMD in older men with no investigation of high impact exercise. Lifestyle changes and individual variability may confound exercise trials but can be minimised using a within-subject unilateral design (exercise leg [EL] vs. control leg [CL]) that has high statistical power. This study investigated the influence of a 12 month high impact unilateral exercise intervention on femoral neck BMD in older men. Fifty, healthy, community-dwelling older men commenced a 12 month high impact unilateral exercise intervention which increased to 50 multidirectional hops, 7 days a week on one randomly allocated leg. BMD of both femurs was measured using dual energy X-ray absorptiometry (DXA) before and after 12 months of exercise, by an observer blind to the leg allocation. Repeated measures ANOVA with post hoc tests were used to detect significant effects of time, leg and interaction. Thirty-five men (mean \pm SD, age 69.9 \pm 4.0 years) exercised for 12 months and intervention adherence was 90.5 \pm 9.1% (304 \pm 31 sessions completed out of 336 prescribed sessions). Femoral neck BMD, BMC and cross-sectional area all increased in the EL (+0.7, +0.9 and +1.2 % respectively) compared to the CL (−0.9, −0.4 and −1.2%); interaction effect $P=0.05$. Although the interaction term was not significant ($P>0.05$), there were significant main effects of time for section modulus ($P=0.044$) and minimum neck width ($P=0.006$). Section modulus increased significantly in the EL ($P=0.016$) but not in the CL ($P=0.465$); mean change +2.3% and +0.7% respectively, whereas minimum neck width increased significantly in the CL ($P=0.004$) but not in the

EL ($P=0.166$); mean changes being +0.7% and +0.3% respectively. A 12 month high impact unilateral exercise intervention, that could be conducted at home in just a few minutes each day, was feasible and effective for improving femoral neck BMD, BMC and geometry in older men. Carefully targeted high impact exercises may be suitable for incorporation into exercise interventions aimed at preventing fractures in healthy community-dwelling older men.

For more information, please contact Katherine Brooke-Wavell (k.s.f.brooke-wavell@lboro.ac.uk)

Key Words: Exercise, bone density, older men

Publications

- Allison SJ, Poole KES, Treece GM, Gee AH, Tonkin C, Rennie WJ, Folland JP, Summers GD, Brooke-Wavell K. (2015) The Influence of High Impact Exercise on Cortical and Trabecular Bone Mineral Content and 3D Distribution across the Proximal Femur in Older Men: a Randomised Controlled Unilateral Intervention. *Journal of Bone and Mineral Research*. 30(9):1709-1716
- Allison SJ, Folland JP, Rennie WJ, Summers GD, Brooke-Wavell K. (2013) High Impact Exercise Increased Femoral Neck Bone Mineral Density in Older Men: A Randomised Unilateral Intervention *Bone* 53: 321-328.
- Allison SJ, Brooke-Wavell K, Folland J (2013) Multiple joint muscle function with ageing: The force-velocity and power velocity relationships in young and older men. *Aging Clinical and Experimental Research* 25(2):159-66.

The Influence of High-Impact Exercise on Cortical and Trabecular Bone Mineral Content and 3D Distribution across the Proximal Femur in Older Men: A Randomized Controlled Unilateral Intervention (Hiphop study extension)

Investigators: Dr Katherine Brooke-Wavell¹, Dr Sarah Allison¹, Dr Jonathan Folland¹, Dr Ken Poole¹, Dr Graham Treece¹, Dr Andrew Gee⁴, Dr Winston Rennie², Dr Greg Summers³

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Funding Body: National Osteoporosis Society

Dates: 2012 - 2013

Summary: Regular exercisers have lower fracture risk, despite modest effects of exercise on bone mineral content (BMC). Exercise may produce localized cortical and

trabecular bone changes that affect bone strength independently of BMC. We previously demonstrated that brief, daily unilateral hopping exercises increased femoral neck BMC in the exercise leg versus the control leg of older men. This study evaluated the effects of these exercises on cortical and trabecular bone and its 3D distribution across the proximal femur, using clinical CT. Fifty healthy men had pelvic CT scans before and after the exercise intervention. We used hip QCT analysis to quantify BMC in traditional regions of interest and estimate biomechanical variables. Cortical bone mapping localized cortical mass surface density and endocortical trabecular density changes across each proximal femur, which involved registration to a canonical proximal femur model. Following statistical parametric mapping, we visualized and quantified statistically significant changes of variables over time in both legs, and significant differences between legs. Thirty-four men aged mean (SD) 70 (4) years exercised for 12-months, attending 92% of prescribed sessions. In traditional regions of interest, cortical and trabecular BMC increased over time in both legs. Cortical BMC at the trochanter increased more in the exercise than control leg, whereas femoral neck buckling ratio declined more in the exercise than control leg. Across the entire proximal femur, cortical mass surface density increased significantly with exercise (2.7%; $p < 0.001$), with larger changes ($> 6\%$) at anterior and posterior aspects of the femoral neck and anterior shaft. Endocortical trabecular density also increased (6.4%; $p < 0.001$), with localized changes of $> 12\%$ at the anterior femoral neck, trochanter, and inferior femoral head. Odd impact exercise increased cortical mass surface density and endocortical trabecular density, at regions that may be important to structural integrity. These exercise-induced changes were localized rather than being evenly distributed across the proximal femur.

For more information, please contact Katherine Brooke-Wavell (k.s.f.brooke-wavell@lboro.ac.uk)

Key Words: Exercise, bone density, older men

Publications

- Allison SJ, Poole KES, Treece GM, Gee AH, Tonkin C, Rennie WJ, Folland JP, Summers GD, Brooke-Wavell K. (2015) The Influence of High Impact Exercise on Cortical and Trabecular Bone Mineral Content and 3D Distribution across the Proximal Femur in Older Men: a Randomised Controlled Unilateral Intervention. *Journal of Bone and Mineral Research*. 30(9):1709-1716

The influence of high impact exercise on bone density and articular cartilage in postmenopausal women

Investigators: Chris Hartley (PhD student), Dr Katherine Brooke-Wavell¹, Dr Jonathan Folland¹, Dr Robert Kerslake² (supervisors)

¹Loughborough University, ²Nottingham University Hospital NHS Trust

Dates: 2016 - 2019

Summary: Osteoarthritis (OA) and osteoporosis (OP) affect large numbers of the population: around 8 million people in the UK are affected by OA and over 300,000 people present with fragility fractures in the UK each year. High impact exercise has been shown to improve markers of bone health but the effect of this exercise on the cartilage is less well understood. A six month, one leg, exercise program based on hopping is being carried out by a group of post-menopausal women to explore the feasibility of this type of exercise program in this age group and the effect on cartilage. To assess changes in participants' cartilage and bone properties participants will have bone density scans and MRI scans of the knee joint. A subset will undergo high resolution bone scans that can demonstrate changes in bone structure. The intervention is a home based exercise programme lasting approximately 10 minutes per day. Initially this will be individualised to each participant with the end goal being daily exercise sessions. The programme will last for six months with supervised sessions offered throughout the trial. Using an intervention affecting just one leg will allow the research team to use the other leg as a control.

For more information, please contact Chris Hartley c.hartley@lboro.ac.uk

Key Words: Exercise, bone density, MRI, articular cartilage, postmenopausal women

Effects of vertical and side-alternating vibration training on fall risk factors and bone turnover in older people at risk of falls

Investigators: Heather Corrie (PhD student), Dr Katherine Brooke-Wavell, Dr Neil Mansfield, Prof. Tahir Masud² (Supervisors)

¹Loughborough University, ²Nottingham University Hospital NHS Trust

Funding Body: National Osteoporosis Society

Dates: 2006 - 2010

Summary: Whole-body vibration training may improve neuromuscular function, falls risk and bone density, but previous studies have had conflicting findings. This study aimed to evaluate the influence of vertical vibration (VV) and side-alternating vibration

(SV) on musculoskeletal health in older people at risk of falls. A single-blind, randomised, controlled trial was used to compare vibration training to sham vibration (Sham) in addition to usual care. The participants were 61 older people (37 women and 24 men), aged 80.2 ± 6.5 years, referred to an outpatient falls prevention service. They were randomly assigned to VV, SV or Sham in addition to the usual falls prevention programme. Participants were requested to attend three vibration sessions per week for 12 weeks, with sessions increasing to six, 1 min bouts of vibration. Falls risk factors and neuromuscular tests were assessed, and blood samples collected for determination of bone turnover, at baseline and following the intervention. The results found that chair stand time, timed-up-and-go time, fear of falling, NEADL index and postural sway with eyes open improved in the Sham group. There were significantly greater gains in leg power in the VV than in the Sham group and in bone formation in SV and VV compared with the Sham group. Conversely, body sway improved less in the VV than in the Sham group. Changes in falls risk factors did not differ between the groups. It was concluded that whole-body vibration increased leg power and bone formation, but it did not provide any additional benefits to balance or fall risk factors beyond a falls prevention programme in older people at risk of falls.

For more information, please contact Katherine Brooke-Wavell (k.s.f.brooke-wavell@lboro.ac.uk)

Key Words: Vibration, falls, bone turnover

Publications

- Corrie H, Brooke-Wavell K, Mansfield N, Cowley A, Morris R, Masud T (2015) The effects of vertical and side-alternating vibration training on fall risk factors and bone turnover in older people at risk of falls. *Age and Ageing* (2015) 44 (1): 115-122
- Brooke-Wavell, K Masud, T, (2016). Vibration therapy. *Osteoporosis Review*.23 (3):6-8
- Brooke-Wavell K, Mansfield NJ (2009) Risks and benefits of whole body vibration training in older people. *Age and Ageing*: 38(3): 254-5

Reserve Capacity, Life History Biology and Human Senescence

Investigators: Liina Mansukoski (PhD student), Prof. Barry Bogin, Dr Katherine Brooke-Wavell (supervisors)

Dates: 2016-2019

Summary: The aim of this research is to investigate whether individuals who build greater reserve capacity (RC) during the childhood and adolescent life history stages will have slower rates of biological senescence and a greater resilience to adverse life events. The study population are former participants of the Universidad del Valle de Guatemala (UVG) Longitudinal Study of Child and Adolescent Development (1953-1999). The present study follows individuals who are now 70-80 years old. We hypothesise that people with greater RC at young adulthood will have generally slower rates of ageing and a greater resilience to adverse life events. This hypothesis has not been well investigated in lower income countries and never investigated using the combination of physical, bone health and cognitive data available from the UVG study. The results of the study are likely to benefit the understanding of the relationship between human growth and ageing, and may inform the wider population of some of the preconditions for 'healthy ageing'.

For more information, please contact Katherine Brooke-Wavell (k.s.f.brooke-wavell@lboro.ac.uk)

5. Training and Researcher Development

Researchers at Loughborough University are encouraged to develop personal and professional skills with a number of places to support development, including:

- Graduate School (<http://www.lboro.ac.uk/services/doctoral-college/about/>)
 - Over 300 funded PhD studentships advertised
 - £3.8m DTP grant for doctoral training and additional £1.13m from the EPSRC National Productivity Investment Fund for doctoral training
 - 289 PhDs and EngDs graduated
 - 85 different countries represented by the PGR population
 - Over 200 researcher development workshops delivered at Loughborough University and Loughborough London
- Specialist Career Development advice (<http://www.lboro.ac.uk/research/research-staff/career/>)
- [Vitae Researcher Development Framework](#) to help map and monitor skills and skills gaps as a researcher.
- Research Integrity Online training to introduce professional responsibilities for early-career researchers.

6. Acknowledgements

We are grateful for continued support from the Pro Vice Chancellor (Research) Professor Steve Rothberg and all in the Research Office. In particular we would like to thank all the HWB Research Development Managers (Kris Clements, Laurence Gardner, Helen Tighe, Laura Dale, Chris Carter and Kate Clift). Without the RDMs the multidisciplinary activities would be difficult to both co-ordinate and track.

The catalyst for this publication was a seminar organised by EMRAN and we are grateful to Chris Craig and all at EMRAN for their interest and engagement with Loughborough University. We look forward to many more successful and enjoyable collaborations.