Institution: University of Southampton

Unit of Assessment: 03 Allied Health Professions, Dentistry, Nursing, Midwifery & Pharmacy

a. Overview

Research in Nursing and the Allied Health Professions at the University of Southampton (UoS) delivers world-leading applied health research that aims to improve the lives of patients and the effectiveness of health services. Our research profile has been enhanced by the integration of our School of Nursing and Midwifery and School of Health Professions as the Faculty of Health Sciences led by Corner. We are embedded in a leading research-intensive university with an outstanding record of achievement and a strong tradition of interdisciplinarity.

All research in the Faculty falls under UoA3 and all research active staff are linked, in Nursing to research groups on Cancer, End of Life, and Palliative Care, led by Richardson; and Innovative and Essential Care led by Latter; and in Allied Health Professions to the research group on Rehabilitation and Health Technologies led by Burridge. Research groups provide a supportive environment for the scientific and personal development of researchers at every level. They have active programmes of meetings, seminars, and international distinguished lectures that add value to an already stimulating intellectual environment. Interdisciplinary research beyond the Faculty is fostered through University Strategy Research Groups (USRGs). These link us to Engineering and Life Sciences (Health Technologies, led by Burridge), Social and Human Sciences (Work Futures, jointly led by Griffiths and Pope), and Medicine (Population Health, board members Rogers and May). We also make important contributions to the interdisciplinary research Institute of Life Sciences, NIHR Respiratory Biomedical Research Centre, NIHR Nutrition Biomedical Research Unit, and the MRC Lifecourse Epidemiology Research Unit (UoA1).

The outstanding RAE2008 result for Nursing has led to the further transformation of UoA3 under Corner's leadership. This has been founded on an ambitious programme of investment in world-leading new staff (8 new chairs) and development of outstanding existing staff (5 promotional chairs, 3 promotional readerships and 14 externally funded competitive Research Fellowships). Major investments in new research space, including a £1.7m investment in Clinical Academic Facilities at University Hospital Southampton NHS Foundation Trust and Portsmouth Hospitals NHS Trust, have linked our research to practice, and were recognised by the *Health Services Journal* award for Most Progressive Research Environment in 2012. These developments are reflected in an exciting and sustainable research culture that has led to internationally acknowledged research achievements and new collaborations; highly significant research income (£12.5m); a large and growing body of postgraduate research students (n=170); and to the award in 2013 of the NIHR Wessex Collaboration for Leadership and Applied Health Research and Care (CLAHRC), led by Corner and Rogers, (£18.9m).

Our strategic focus on building on recognised strengths, while implementing major transformation and growth around new areas of research excellence, is founded on a well-integrated set of strategic functions and robust processes. Within the University, the Associate Dean, Research (Fader) is accountable for research strategy and chairs the Faculty Research Executive. This group develops and implements strategy and reports to the Faculty Executive and Dean (Corner), and onwards to the University Executive Group and the Vice Chancellor. University support for research includes more than 60 staff providing dedicated support (including research intelligence, contracts and finance, application management, and support for ethics committee applications), and UoA3 has its own Research Support Office. We aim for flexibility and responsiveness in the face of a rapidly evolving policy and practice environment.

b. Research strategy

Over the next five years we intend to focus on five core areas of interdisciplinary activity.

- In Nursing, we will exploit new opportunities for clinical and applied research presented by the NIHR Wessex CLAHRC and Macmillan Cancer Support to develop major programmes of work on supportive self-care in cancer survivorship, long-term and life-limiting conditions. We will extend this to focus on health problems of older people (including dementia and stroke) with a further strategic senior appointment in this area.

- We will exploit new opportunities for fundamental and translational research presented by our investments in new research facilities and success in interdisciplinary programme grant funding. In the Allied Health Professions, we will invest in work to develop a Centre for Translational Research in Neuro-Rehabilitation. In Nursing, building on recent strategic appointments (Bader, Schoonhoven), we will invest in work to develop and extend laboratory facilities for basic and translational research on pressure ulcers, incontinence, and biofilms.

- Across both Nursing and Allied Health Professions research we will exploit new opportunities to expedite the translation of novel devices, treatment and investigation modalities, and clinical interventions into clinical trials and clinical practice, for example, in the area of infection prevention and control. This research will link to our acknowledged strengths and recent strategic senior appointments in implementation science, essential care and workforce capacity.

- New areas of translational and applied research demonstrate our responsiveness to rapidly emerging scientific priorities, but focusing on implementation, essential care, and capacity is equally important. This is work that links research to practice and policy, concentrated on the development of robust models and methods to bridge translational gaps and provide rapid routes to impact. To achieve this, we will exploit opportunities presented by the NIHR Wessex CLAHRC and the Wessex Academic Health Sciences Network's (AHSN) Centre for Implementation Science, hosted by the Faculty of Health Sciences, which will link our research to the NHS and other health providers in the region, and our wide range of international collaborations.

- We will build research capacity in Nursing and Allied Health Professions through our Clinical Academic Fellowship programme. This is already the largest of its kind in the UK (current n=31), and is internationally acknowledged as world-leading. Through it, we have become a major hub for the development of Clinical Academic Careers in Nursing and the Allied Health Professions. To support this, we have invested in purpose-built research workspaces and laboratories at the University Hospital Southampton NHS Foundation Trust and Portsmouth Hospitals NHS Trust. Underpinning this is our NIHR funded MRes programme (>40 successful completions since 2009). We now intend to extend both MRes and Doctoral Fellowship programmes, utilising £1.09m investment from the Wessex Health Community and £1.1m from NIHR in national fellowships, creating partnerships with NHS Trusts across the region, and developing international opportunities through visiting and exchange fellowships in order to further develop research capacity.

Our research is delivered through three strategic research groups:

CANCER, PALLIATIVE AND END OF LIFE CARE RESEARCH GROUP (led by Richardson, Nursing).

Cancer Survivorship Cluster. The Macmillan Survivorship Research Group (MSRG), directed by Foster, has led the way globally in research on services for growing numbers of cancer survivors. Funded since 2002 (£1.5m) and for a further 5 years in 2009 (£1.5m), this programme has revealed the need for, and has inspired, policy change and action to reorganise cancer services in the UK and internationally. Key achievements include identifying the previously unrecognised needs of people who have completed cancer treatment (Foster and Fenlon., 2011, Elliott et al., 2011); discovering the impact of psychosocial and symptom-related problems (Foster., 2009); and identifying gaps in the evidence about cancer survivorship, and recommending priorities for future funding (Richardson et al., 2011). A unique prospective cohort study of over 1000 colorectal cancer survivors has been established and self-management resources for those experiencing cancer related fatigue have been developed. The MSRG is building research capacity through more than 20 linked PhD studentships and related research project funding from NIHR, AMRC and the Health Foundation. The MSRG works across disciplines, with vibrant national and international collaborations (e.g. Girgis, Australia; Aaronson, Netherlands; Lorig, USA; Howell, Canada).

Future strategy for this cluster includes establishment of more large cohort studies to understand the needs of people living with and beyond cancer. This will link to research on self-management

and patients' experiences of cancer as a long-term condition (with Rogers, Kennedy, and May), to respond effectively to health care priorities around supported self-care for cancer survivors.

Palliative and End of Life Care Cluster. Southampton is at the forefront of global developments in palliative and end of life care, specifically in the fields of measuring and surveying the quality of end of life care, symptom management and organ and tissue donation. Led by Richardson, key achievements of this cluster include leadership of the National Cancer Research Institute Cancer Experiences Collaborative, a consortium of five universities (Southampton, Lancaster, Liverpool, Nottingham and Manchester) that has improved the quantity and quality of research in supportive and palliative care in the UK. Generating £18.7m in new grant income over its lifetime, this Collaborative has been adopted as a model in Australia and Ireland. Addington-Hall and Hunt's instrument to measure the quality of end of life care (VOICES-SF) (Hunt et al., 2011) has been adopted for annual use by the Department of Health (DH) for the NHS Outcomes Framework and is being translated and utilised internationally. The first national survey of 22,000 deaths using this measure revealed major variations in care quality (e.g. hospice versus hospital) and our results are driving improvements in NHS and international end of life care. Symptom management of breathlessness, cough and fatigue has been strongly influenced by research by Corner, Bailey and Richardson (Molassiotis et al., 2010), which has led to the first clinical guidelines for the management of cough. A novel symptom questionnaire (IPCARD), (Brindle et al., 2012), is currently being used in NIHR-funded studies for early prediction of lung cancer. Our research on tissue and organ donation has been highly influential in NHS Blood and Transplant policy. Long-Sutehall's pioneering NIHR-funded post-Doctoral Fellowship work on the critical 'conversation' with relatives about donation has been shown to increase consent from 25% to 100% and has changed policy, practice and training.

Future strategy for this cluster will involve developing methods and techniques to capture, compare and contrast outcomes and experiences of important health problems such as cancer survivorship, end of life, and ageing. It will focus on the discovery and evaluation of novel interventions and different forms of care and support to enhance self-management for those affected by cancer and other life-limiting conditions. Linking this work to the Minimally Disruptive Healthcare research theme of the NIHR Wessex CLAHRC (leads May, Richardson) will provide a platform for studies on understanding and improving patient experience and service delivery in palliative care across a range of conditions.

INNOVATIVE AND ESSENTIAL CARE RESEARCH GROUP (led by Latter, Nursing).

Continence and Skin Technology Cluster. This cluster is led by our world-leading experts in continence products and devices (Fader) and pressure ulcers (Bader). Key achievements include advancing understanding and design in the range of interventions needed for cost-effective optimum management of incontinence in men and women (Fader et al., 2008; 2012). The implementation of the choice-based mixture approach derived from this research, together with the design of new devices, is currently the focus of a programme funded by Prostate Cancer UK. We have adapted our evidence synthesis on products (Cottenden et al., 2009; 2013) in partnership with the International Continence Society and the International Consultation on Incontinence to form the only independent, not for profit, internationally focused and evidence-based website to guide patients in product selection. Our work on urinary catheters (Moore et al., 2009) has led to an NIHR Programme and HTA grants in excess of £3.5 million and an NIHR senior clinical lectureship award. This cluster's work was awarded the 2013 *Health Service Journal Patient Safety Award* for its work on reducing catheter-associated infections in acute care. We are collaborating with the UoS Institute for Life Sciences (IfLS) through a knowledge mobilization fellow (Wilks) to investigate prevention of biofilms. This has led to Wilde (University of Rochester, USA) gaining an International Continence Society Research Fellowship to work with our group. Bader and Schoonhoven's distinctive multidisciplinary approach to pressure ulcer prevention benefits from our investment in a biomechanical and cell laboratory and environmentally controlled room. They have developed models for early detection of mechanical-induced damage using imaging, computational modeling, physical sensors and biomarkers (Loerakker et al., 2011), and to evaluate intervention strategies (Schuurman et al., 2009). To support this work the Faculty has funded an early career Research Fellowship, and has two NHS Trust funded clinical academic Doctoral Fellowships.

Output from this research has already informed European Pressure Ulcer Advisory Panel international guidelines (Stekelenburg et al., 2008).

Future strategy for this research cluster will focus on exploiting new laboratories within the Clinical Academic Research Facility to extend basic and translational research on pressure ulcers, incontinence, and biofilms. Important collaborations with the UoS IfLS (UoA5) include three shared Research and Knowledge Mobilization Fellowships. We expect a new research cluster on Infection Prevention and Control to form around our award winning research in this area.

Delivering Care, Self-care, and Patient Outcomes. Led by Latter, this cluster has led on internationally renowned large-scale evaluations of innovative care delivery and the development of patient-focused outcome measures. Key achievements include Latter's world-leading research evaluating nurse and pharmacist prescribing which has significantly influenced national and international policy. Latter led the DH Policy Research Programme funded national evaluation of nurse and pharmacist independent prescribing, establishing for the first time its clinical appropriateness (Latter et al., 2012). Gerard and Latter illuminated for the first time the factors that may be critical in patient choice of prescriber (Gerard et al., 2012). Gerard has pioneered Discrete Choice Experiment research, leading to an NIHR Senior Research Fellowship in health economics, and she has advanced understanding of patients' preferences (Green and Gerard., 2009). Kennedy and Rogers' NIHR funded large scale critical evaluations of the outcomes of self-management support interventions have had impact at policy level in the UK and internationally. This work has led to an EU funded collaborative project (EU-WISE €2.9m) involving six partner countries which will draw out key elements of long term condition management to inform future health care policy, planning and commissioning. Bowling's ESRC funded work (Bowling et al., 2012) led to a unique new measure of Quality of Life (OPQOL) based on social relevance rather than expert judgment (Bowling and Stenner., 2011), and is now used internationally.

Future Strategy for this research cluster will focus on improving supported self-management for long-term conditions, and will link to the NIHR Wessex CLAHRC research theme on Patient Engagement with Self-Directed Long-Term Condition Management. This will provide a platform for new work to improve patient treatment and outcomes in complex and comorbid diseases, and new tools to support people with long term conditions.

Workforce, Innovation and Implementation Cluster. This cluster is led by Griffiths, and links clinical nursing with applied social science to advance novel explanatory models of complex structural and technological problems in healthcare delivery. Key achievements include Griffiths' research on workforce configuration which has demonstrated the quality and cost-effectiveness of nursing contributions to the primary care workforce. This has international reach, for example through Griffiths' joint leadership of the EU funded RN4CAST study of health care workforce in 14 countries. Pope, Turnbull and May's NIHR funded research work on first contact between service users and emergency services (Pope and Turnbull., 2012), has shown the vital role of high level interpretive skills and informed decisions about NHS 111 services. Strategic collaborations with the Regional Trauma Centre at University Hospital Southampton and with international researchers (Visiting Professor, Curtis, University of Sydney) are extending the scope and relevance of this work. May's NIHR and ESRC funded work has led to a novel and robust conceptual model of implementation (Normalization Process Theory) which explains the complexity and challenges of operationalizing new healthcare practices (May and Finch., 2009). Rogers' contribution to the DH funded £31m Whole System Demonstrator Trial for Telecare in the management of chronic disease, has shown that such systems do not have the benefits that their proponents have claimed, and have limited effects on disease outcomes and costs.

Future strategy for this cluster links to the NIHR Wessex CLAHRC research themes on Fundamental Care in Hospital Settings (lead Griffiths) and Minimally Disruptive Healthcare: Patient Experience and Organisational Change (lead May). These will form platforms from which we can develop research aimed at improving the quality of care, and developing robust implementation strategies for new ways of organizing and delivering care.

REHABILITATION AND HEALTH TECHNOLOGIES RESEARCH GROUP (led by Burridge, Allied Health Professions).

Neuro-Rehabilitation. This cluster is led by Burridge and Ashburn and aims to improve function and recovery through robotics and engineering. Key achievements include EPSRC grants totalling over £1m which have led to interdisciplinary research into robot therapy to improve outcomes (Burridge et al., 2008, Freeman et al., 2009); integrating peripheral electrical stimulation mediated by Iterative Learning Control to optimize performance (Hughes et al., 2009), and more recently reducing the need for expensive, non-home based robots by applying techniques to free unsupported movements. NIHR funding has supported a three-year project examining the barriers to translation of robotic and other rehabilitation technologies in stroke rehabilitation into clinical practice (Hughes et al., 2013). This work reflects interest not only in the science of rehabilitation technologies but also the practical issues of translation into clinical practice, and led to further NIHR funded research (Boger et al., 2012). In work funded by the Stroke Association, Ashburn and colleagues have demonstrated that treatment using functional electrical stimulation for standing balance is feasible for people in the early sub-acute stage after stroke (Verheyden et al., 2011). Ashburn's group has shown for the first time how sideways reaching in people with stroke differs from healthy aged matched controls. This has led to HTA funded work on prevention of falls in people with Parkinson's Disease, (£1.5m).

Future strategy for this cluster focuses on the development of a major Centre for Translational Neuro-Rehabilitation. This will be configured around a new generation of studies – including EPSRC funded SPHERE (£1m to Ashburn over four years from 2014) that will lead to the development of new rehabilitation modalities and rapid routes to practice. This work will include important collaborations with UoAs 11 and 13.

Prevention and Rehabilitation of Movement Dysfunction. Led by Stokes, this cluster draws together physiotherapy, occupational therapy, podiatry and engineering to develop health technologies for prevention, early detection and treatment of movement dysfunction. Key achievements include funding from Arthritis Research UK, NIHR and industry to support studies using ultrasound imaging to diagnose foot pathology associated with: rheumatoid arthritis (Bowen et al., 2008); muscle size and activity in conditions such as shoulder pain (O'Sullivan et al., 2009 & 2012); back pain (Whittaker & Stokes., 2011), and recovery mechanisms in response to exercise. These applications of ultrasound are being adopted in clinical practice in podiatry (Williams et al., 2011) and physiotherapy (Potter et al., 2012) and national and international military training (British Army, Royal Air Force, US Army). A study on mechanisms of shoulder pain, funded by Arthritis Research UK and NIHR, showed the efficacy of a simple, low cost exercise regime (Worsley et al., 2012). A study of resting hand splints recommended that these splints should not be used in patients with early rheumatoid arthritis (Adams et al., 2008) and has led to a current NIHR HTA trial into the effectiveness of hand stretching and strengthening exercises in rheumatoid arthritis. Investment by Southampton University and University Hospital Southampton NHS Foundation Trust in an interdisciplinary Musculoskeletal Research Unit with UoA1 (Stokes now Academic Director) led to involvement in a successful bid (£3m) to develop a multicentre Arthritis Research UK Centre of Excellence for Sport, Exercise and Osteoarthritis.

Future strategy in this cluster will extend advances in the investigation of pathological mechanisms in musculoskeletal pain and focus on new techniques for treatment and management. This will range across multiple applications: for example Stokes' joint leadership of the European Space Agency Topical Team to explore and develop rehabilitation for astronauts and people following long-term bed rest, links exciting possibilities for contributions to the new disciplines of space healthcare with practical and useful research in the NHS.

Respiratory Therapy. This is an emerging research cluster focused on changing the delivery of care in chronic respiratory disease, with promotional chairs for Conway and Bruton. Conway is joint lead of the Southampton Imaging Group and her research on cystic fibrosis and 3D imaging of the lung has enabled aerosol deposition to be accurately measured for the first time. Bruton has developed a novel Advanced Ambulatory Oxygen System, and has been awarded an NIHR Senior Research Fellowship (£777k) to further this work. This joint programme is integral to the NIHR

funded Southampton Respiratory Biomedical Research Unit (led by Djukanovic, UoA1: Bruton and Conway are senior members) and involves significant industry partners (e.g. Luxfer, Astra Zeneca, 3M, Pharmagene, Britannia Pharmaceuticals Ltd and Air Liquide).

c. People, including:

i. Staffing strategy and staff development

Staffing Strategy is at the centre of our transformational vision for the future. We have used new appointments and promotions as strategic levers to increase critical mass in our research clusters, enhance interdisciplinarity, and strengthen international networks. We created eight new chairs and appointed internationally acknowledged professors (Bader, Bowling, Drennan, Griffiths, May, Richardson, Rogers, Whittal) and made other senior appointments (Bridges, Kennedy, Hankins, Schoonhoven). These appointments provide additional intellectual leadership in clinical and non-clinical disciplines, and have increased our capability in quantitative methods and laboratory research. We have developed and supported a new generation of research leaders of exceptional talent and promise (with rapid promotion to Reader for Bruton, Foster and Pope, and from Reader to Chair for Bruton, Burridge, Fader, Latter, and Pope). We are supporting and developing the next generation of research leaders through NIHR Post-Doctoral and Career Development Fellowships (Bruton, Gerard, Long-Sutehall).

Development of Contract and Early Career Researchers. We support future research leaders through internally funded fellowships (Brindle, Hunt, Metcalf, Simon, Turnbull), that have facilitated transitions to independent investigator in the period since 2010. Effective management and mentoring are central to development of staff. All have a research mentor (normally an experienced professor) to support their development, and line managers pay special attention to appropriately balancing research, administrative and teaching workloads for established academic staff. For researchers, the University's Professional Development Unit provides dedicated training in both specialist and transferable skills aligned to a Researcher Development Framework along with key on-line resources. Contract research staff are supported by the University's commitment to implementing the principles of the Concordat for Career Development of Researchers, and in this unit of assessment implementation is led by a Faculty Champion (Bader), supported by active input from colleagues in Human Resources. Southampton won the European Commission's Human Resources Excellence in Research Award in 2012.

Equality and Diversity. The University's Equality Plan is rigorously implemented across the Faculty, and thus UoA3, with training and operational frameworks to ensure active engagement beyond compliance with Equalities legislation and University processes. The University of Southampton was a founding signatory of the Athena SWAN Charter in 2005. The Faculty of Health Sciences won Athena Swan Bronze status in 2013. We intend to achieve Silver by 2015. Infrastructures to support women and Black and Minority Ethnic researchers are well developed and have good up-take from staff (e.g. Athena SWAN events, Women in Science Engineering and Technology Group, Diversity Network).

Enhancing our interdisciplinary collaborations. We have supported staff to play leading roles on important interdisciplinary collaborations. We jointly lead cross-University Strategic Research Groups on Health Technologies (Burridge) and Work Futures (Griffiths, Pope), and collaborate with the NIHR funded Southampton Respiratory Biomedical Research Unit (Conway, Bruton), MRC Lifecourse Epidemiology Unit (Stokes, Adams, Bowen) and Medicine (Population Health USRG, board member Rogers, May); the RCUK Web Science Doctoral Training Centre (DTC) (Pope, associate director 2009-2012); Health Innovation Education Cluster (Corner, Chair) Wessex Academic Health Sciences Network (Corner, Board member) as well as the multidisciplinary Institute for Life Sciences (£55m, board members Corner, Fader). The NIHR Wessex CLAHRC is a major research investment and is led by Corner and Rogers, which will add significantly to future infrastructure by funding a methodology hub (including expertise in statistics, mathematical modelling, evidence synthesis, and database management): it includes major collaborations with Medicine (UoAs 1 and 2), Psychology (UoA4), Business and Management (UoA19), and Social Policy (UoA22).

ii. Research students

Postgraduate Research Training. We have a large and vibrant postgraduate research student population, currently numbering 170, winning a Vice Chancellor's Award for support for Postgraduate Research Students in 2013. In the Higher Education Academy Postgraduate Research Students Experience Survey 2013 95% of respondents are satisfied/highly satisfied with supervision, and 90% would recommend us to others. Our strategy for success in postgraduate research begins with linking each student to a research cluster to ensure that they have strong support from active researchers and opportunities for peer mentoring, and subsequently to first class research training opportunities. We have introduced a robust structured experience for new research students with compulsory induction, rigorous methods coursework, transferable skills training, and key assessed milestones in years 1 and 2. We lead and deliver an NIHR funded MRes centre for Nursing, Allied Health and Medicine offering 15 fully funded places per annum, helping to grow the next generation of clinically applied Doctoral Researchers. In addition to the national NIHR Clinical Academic Training Pathway, we have partnered with five NHS trusts who fund PhD studentships which incorporate a clinical practice placement to incubate exceptional talent and create early opportunities to develop a clinical academic career. This scheme is now in its third year and all 31 participating Clinical Academics, 20 of whom are Doctoral Fellows, are fully integrated within the post-graduate research community. We participate in two of the University's RCUK funded Doctoral Training Centres. Pope is associate director of the EPSRC DTC in Web Science (80 students over 5 years), and Brindle and Pope are board members of the ESRC DTC linked to the ESRC National Centre for Research Methods. (18 quota awards per year). Our Faculty currently hosts 3 DTC students. All research students are actively encouraged to attend external conferences and publish their work. We host an annual Faculty Post-graduate research conference and an electronic peer reviewed journal *Working Papers in the Health Sciences* which published its first edition in Autumn 2012.

d. Income, infrastructure and facilities

Income. We have grown income from £1.1m at RAE 2001, £8.2m at RAE 2008, to £12.5m for the current period. In excess of £10m has already been secured for research beyond 2013, demonstrating the success and sustainability of our transformational strategy. We have focused on centre and programme funding. The recently awarded £18.9m NIHR Wessex CLAHRC (Corner, Rogers, Griffiths, May) builds on centre and programme grants funded by NIHR and other bodies. Key examples include: Macmillan Cancer Support £3m (Foster, Corner); CECo £1.9m (Addington-Hall, Corner, Foster); SATRU II STARR £0.6m Stroke Association (Ashburn); BREATHE £1.2m (Bruton); ARUK £2.3m (Stokes, Adams, Bowen); NIHR Multi-Cath £1.9m (Fader).

Research Infrastructure**.** Since 2010 the Faculty has invested £1.7 million in vibrant work spaces to support clinical and applied research. This includes a suite of molecular and biochemical laboratories equipped with state-of-the-art facilities for translational research, specialist cell culture and clinical gait laboratories which support foundational and applied Nursing and Allied Health research. Our new Clinical Academic Facilities across multiple sites provide dedicated environments for research, and their location in the heart of local NHS services strengthens our capacity to deliver research with direct impact on patient care. All research staff and students have access to the full range of facilities and equipment necessary for the conduct of their work. This includes collaborative arrangements with the University Institute of Sound and Vibration Research, Electronics and Computer Science, Southampton Statistical Research Institute and Faculty of Medicine. Staff or students who are located at University Hospital Southampton have access to hot-desking facilities and equipment, including desktop workstations and centrally managed printers, at all our sites. The University provides laptop computers for Postgraduate Research Students and Staff working remotely when necessary.

Significant equipment and facilities. We have outstanding facilities, supported by state-of-art equipment. These are based at both the University Hospital Southampton and the UoS Highfield Campus. At University Hospital Southampton, our new Clinical Academic Facility offers new suites of laboratories which can accommodate testing of both physical models and human volunteers and their performance on a range of medical devices and support surfaces. This supports our recent

research activities in skin health and infection control to complement our existing research associated with continence technologies. These laboratories include equipment designed to monitor skin health and microvascular function under mechanical challenges, skin barrier function and wound healing. Techniques include transcutaneous gas tensions, scanning laser Doppler imaging and fluximetry, microdialysis, transepidermal water loss, corneometry, pH, meximetry and iontophoresis. Patient-centred research at University Hospital Southampton involves activity within a new custom-built environmentally controlled room located in the Wellcome Clinical Trials Unit. It facilitates applied and clinical research, for example, to identify specific patient groups at risk of developing pressure ulcers. Additionally, the NIHR funded Respiratory Biomedical Research Unit provides access to world-class facilities for respiratory diagnostics and imaging at University Hospital Southampton. Also at University Hospital Southampton is a clinical gait laboratory housed with equipment to provide a full biomechanical motion assessment of conditions affecting patient safety, for example, those with Stroke and Parkinson's disease both of whom have a high incidence of falls.

On the University's Highfield Campus, our laboratories house a state of the art Vicon MX T-series Motion Capture System (funded by Arthritis Research UK), a mobile Vicon 460 Motion Capture System, and a Coda MPX30 motion capture system. Synchronised with our motion analysis systems we have Kistler piezoelectric force platforms which enable full biomechanical assessment of the external forces acting on an individual, to the internal muscle and joint contact forces, using musculoskeletal modelling. Movement analysis systems are supplemented by wireless electromyography equipment that is synchronised with our motion capture systems to accurately determine the timing of muscle activation in relation to a movement task. Dynamometry equipment available in the faculty includes a Biodex System 2 multi-joint testing system. These novel technologies are being used for field testing people in elite sports in their own environment, including international footballers (Barcelona and Southampton) and rugby league players. Examples are the MyotonPRO device for testing mechanical properties of muscle to detect risk of muscle injuries and monitor recovery, ultrasound imaging of muscle size to assess atrophy, the motor task manager for measuring upper limb co-ordination and reaction times, and remote sensors for testing activity levels and analysis of joint motion.

e. Collaboration or contribution to the discipline or research base

Collaborations with NHS, industry and government agencies. We work extensively with the NHS, for example, through Corner's role as a University Hospital Southampton NHS Trust Research Strategy Board Member. These are important and successful relationships that have led to our path-breaking Clinical Academic Fellows programme, and to our successful negotiation of £10m matched funding for the NIHR Wessex CLAHRC. Our relations with Government are equally successful and highly impactful. They are described in our REF3a Impact template and in individual Impact Case Studies. Our interaction with industry partners to deliver patient-focused solutions (e.g. developing Luxfer portable oxygen cylinder: Bruton) have been equally useful. Staff are actively supported to work with industry through funded Doctoral Studentships (e.g. Ion Medical Solutions, DePuy Johnson & Johnson). These have enabled the commercial development of pioneering technologies (Hand and Wrist Kinematics, Metcalf; ActiGait stimulator for stroke rehabilitation, Burridge; SCA AB Continence Product Assessment Tool, Fader). Funding from industry and the Alfred Mann Foundation to Burridge led to the clinical application of Bion micro-stimulators for recovery of upper limb function following stroke, and then to a successful spin-out company (Bioness Ltd). Long-Sutehall was invited to join NHS Blood Transfusion Deceased Donor Family Advisory Group, European Deceased Donation Working Party to shape future interactions between research and policy; Griffiths has worked with the Health Quality Council of Saskatchewan on Lean Quality Improvement, and with Dr Foster Intelligence on nurse sensitive outcome measures. Bruton has strong links with industry including research funded by Luxfer in the UK, while Conway is part of a major international collaboration funded by Air Liquide SA (Paris). These collaborations link with large scale academic collaborations across the NHS. Our income from such sources has been £605k.

Effective academic collaboration. Nationally, this includes Stokes' leadership role as Academic Director of the Southampton Musculoskeletal Biomedical Research Unit; Vice Chair of the National

Allied Health Professions Research Network; Southampton lead for the Arthritis Research UK funded Centre of Excellence for Sport, Exercise and Osteoarthritis, and co-chair of the European Space Agency Topical Team to explore and develop rehabilitation for astronauts and people following long-term bed rest. We are involved in large scale collaborative grants, e.g. leadership and participation in NIHR Programme Grants (Fader, May, Rogers, Kennedy), CLAHRCs (in the North West, Rogers, Kennedy; and Wessex, Corner, Rogers, May, Griffiths, Pope, Latter, Fader), the EPSRC SPHERE grant (Ashburn). Internationally, our profile includes large EU funded studies (EU-WISE, Rogers, Kennedy; RN4CAST, Griffiths). May is a co-investigator on large NIHR and Agency for Healthcare Research and Quality funded clinical trials (DAD and TRICEPS) in collaboration with colleagues at the Mayo Clinic, USA, and an Australian Health and Medical Research Council funded trial of novel interventions for the management of diabetes in collaboration with Melbourne. Pope jointly leads the BARCELONA study on the implications of health informatics with colleagues in Tromso and Trondheim.

Indicators of wider influence. Our staff play a major role in developing and influencing the UK and international research environment through participation in committees, editorial positions, and grant giving bodies. Participation in major fellowship and grant giving bodies: Ashburn: NIHR (HTA Commissioning Board), Parkinsons' Disease Society (Research Advisory Panel); Bader: Chair, EPSRC Panel on Healthcare and Medical Engineering; Bowling: NIHR (Research for Patient Benefit), NIHR (Health Technology Assessment Commissioning Board); Burridge: INSPIRE Scientific Committee; Corner: Co-Chair DH Cancer Patient Experience Advisory Board, Chair, Movember Foundation Global Prostate Cancer Survivorship Advisory Group, EU FP7 Supportive and Palliative Care clinical trials and observational studies; Griffiths: NIHR (Doctoral Training Fellowships); Lathlean: Health Research Board, Ireland (Health Services Research); Latter: NIHR (Programme Grants); May: Arthritis Research UK (Scientific Committee & Fellowships Panel), DH (Policy Research Programme), Health Research Board, Ireland (Fellowships); Pope: NIHR (Research for Patient Benefit); Rogers: NIHR (Research for Patient Benefit), NIHR (Programme Grants), National Awareness and Early Diagnosis Initiative (Scientific funding committee), DH (Policy Research Programme commissioning panel), ESRC/NIHR (Dementia Programme commissioning panel), EU COST Commissioning panel; Stokes: NIHR (HTA panel), NIHR (External Devices and Physical Therapies Panel). Editorships. Bader: Editor, *Journal of Tissue Viability*; Bowling: Associate Editor, *International Journal of Ageing and Human Development*; Griffiths: Executive Editor, *International Journal of Nursing Studies*; Pope: Co-Editor, *Sociology*; Richardson: Founding Editor, *European Journal of Oncology Nursing*: Rogers: Associate Editor, *Implementation Science*, Associate Editor, *Journal of Mental Health*. Honorary Chairs, Fellowships and Awards: Our contributions to the field are reflected in international indicators of esteem. Bader: Visiting Professor, Medicine, University of Malaya; Burridge: President, International Society of Functional Electrical Stimulation; Conway: European Respiratory Society Research Fellowship; Corner: Honorary Professor, Karolinska Institute; Griffiths: Fellow, European Academy of Nursing Science; Latter: Fellow, European Academy of Nursing Science, Honorary Professor, Melbourne; May: Academician, Academy of Social Sciences, NIHR Senior Investigator, Honorary Professor, Melbourne, Honorary Professor, Victoria British Columbia, Hon President, Sociology and Social Policy Section of the British Scientific Association 2012-2013; Pope: Honorary Professor, Tromso; Roberts: President Elect of Society for Back Pain Research; Rogers: Academician, Academy of Social Sciences, NIHR Senior Investigator; Fader: International Continence Society Trustee 2008-2011.