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Changing the translational research landscape

a review of the impacts of Biomedical Research Units in England

Sonja Marjanovic, Bryony Soper, Sharif Ismail, Anais Reding, Tom Ling

Prepared for the Department of Health
The research described in this report was prepared for the Department of Health.

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Preface

In May 2009, the Department of Health commissioned RAND Europe to conduct a review of key stakeholders in Biomedical Research Units (BRUs) in England, to explore what impact the scheme is having on the translational research landscape. More specifically, the review investigated whether and how institutional relationships between NHS and academic partners, industry and other collaborators are changing by virtue of the scheme; how the scheme is helping develop translational research capacity in priority areas of high disease burden and/or clinical need which are currently underrepresented in National Institute for Health Research (NIHR) Biomedical Research Centres’ portfolios, and the effects of any changes on efforts to deliver the broader goals set out in *Best Research for Best Health*.

This report presents the findings of our review, based on the evidence provided by senior BRU leaders in a series of interviews. The study was a perceptions audit, and we tried, as far as possible, to ask interviewees for examples of the views they expressed and the claims they made. The views presented in this report are those of study informants only.

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For more information about RAND Europe or this document, please contact:

Dr Sonja Marjanovic

RAND Europe
Westbrook Centre
Milton Road
Cambridge
CB4 1YG
UK
01223 353 329
smarjano@rand.org
www.randeurope.org

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1 For more information on RAND Europe please see www.randeurope.org
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Summary

Study context and findings: the highlights

BRUs have an important role to play in the emerging health research landscape following Best Research for Best Health

1) Biomedical Research Centres and Biomedical Research Units as flagships in initiatives of Best Research for Best Health: In January 2006, the Department of Health’s Best Research for Best Health\(^2\) strategy (BRfBH) set out to create a health research system in which the NHS supports outstanding individuals, working in world-class facilities, to conduct leading-edge research focused on the needs of patients and public. Two of the flagship initiatives of BRfBH were the establishment of Biomedical Research Centres (BRCs) and Biomedical Research Units (BRUs). These are both partnerships between an NHS trust and a university. They share a common goal to undertake translational research in priority areas of high disease burden and clinical need, and to provide a significant contribution towards realising the broader ambitions set out in BRfBH. While the BRCs are about “making the best even better”, the BRUs aim to be “building on the best”.\(^3\) The term ‘building’ refers to the ‘developmental role’ sought for BRUs – in developing new relationships, greater capacities and improved targeting, and an enhanced responsiveness in health research.

2) The specific goals of Biomedical Research Units: BRUs were established after BRCs. Through the BRU award, the NIHR aims specifically to assist the further development of NHS and university partnerships which are at the forefront of their field internationally (but relatively small and specialised in comparison to the larger BRCs), to achieve critical mass. The awards should enable the partnerships to further strengthen research capacity in a priority area so that they are capable of submitting a credible bid for BRC status in the future. The BRU scheme supports priority research areas which are under-represented in the BRC portfolios and in which the UK has recognised research strengths. They include


\(^3\) Department of Health (Research and Development Directorate), Best Research for Best Health Implementation Plan 5.5: NIHR Biomedical Research Units, version 4, London: Department of Health, August 2008, p. 2.
cardiovascular disease; deafness and hearing problems; gastrointestinal (including liver) disease; musculoskeletal disease; nutrition, diet and lifestyle, and respiratory disease. Twelve BRUs were awarded in April 2008, a further three in July 2008, and the final award was made in April 2009.

3) **Remit of the study:** This report describes a review of the BRU scheme, undertaken for the Department of Health. This review was a perceptions audit of senior executives involved in the scheme, and explored what impact they felt the scheme is having on the translational research landscape. More specifically, we investigated whether and how institutional relationships between NHS and academic partners, industry and other health research system players are changing because of the scheme; how the scheme is helping build critical mass in specific priority disease areas; and the effects of any changes on efforts to deliver the broader goals set out in *Best Research for Best Health*. The views presented in this report are those of study informants only.

4) **Caveats of the study:** It is important to understand that this review was conducted at an early stage of BRU existence: in most cases the BRUs are just over one year old. The BRUs are intended to be responsive and to evolve in the light of developing opportunities and therefore this report offers only a ‘snap-shot’ in time. This means it is too early to assess downstream outputs from BRU activity, such as research papers, new diagnostics, treatments or changes in health policy. In addition, we interviewed the most senior executives of BRUs and so it represents a snapshot from a particular (albeit very well-informed) viewpoint. A more detailed perceptions audit would benefit from investigating the views and experiences of other participants in the initiatives, including academic researchers and clinicians engaged in research projects, and NHS managers. We are also aware that interview-based evidence collection can be subject to deliberate or unintended biases resulting from the position and experiences of the interviewees. However, we consistently tried to get evidence and examples from interviewees, to support interviewees’ views and claims. The fact that there was a broad consistency in the accounts different stakeholders produced (i.e. university and trust representatives) gives us further confidence that on balance interviewees gave dispassionate and complete accounts of where BRUs stand, and how they have evolved since they were set up. Lastly, whereas our review gathered interviewee perceptions on the changes the scheme is bringing about, we did not have a counterfactual. Therefore, although we could explore the value of the BRU scheme, we could not assess the value added, in comparison to translational research efforts being pursued by trusts and academic organisations without BRU status. In summary, the broadly very favourable account of the developing role of BRUs which we were given, and report here, should not in itself be taken as compelling proof that the BRUs are delivering all that is hoped of them in relation to boosting patient health and national wealth. These caveats should be borne in mind when drawing conclusions from this report.

5) **BRU impacts – key findings:** The information obtained through our interviews suggests that the BRU scheme is significantly helping shape the health research system to pursue translational research and innovation, with the clear goal of realising patient benefit. The BRUs are already contributing to observable changes in institutional relationships between

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4 Twelve BRUs were 14 months old at the time of the interviews, three were 13 months old, and one was less than 3 months old.

5 We conducted 38 interviews in total, at 16 BRUs.
the NHS and academic partners: trusts and medical schools are collaborating more closely than in the past, have signed up to the same vision of translational research from bench to bedside, and are managing and governing targeted research resources more professionally and transparently than in the past. There is also a stronger emphasis on engaging industry and more strategic thinking about strengthening regional and national collaboration with other hospital trusts, PCTs, research organisations, networks and development agencies. The scheme is also transforming capacity building in the health research system. This includes (i) developing and modernising facilities and equipment for translation; (ii) building a critical mass of human resources through recruitment and training, as well as improving retention of existing expertise; and (iii) helping ensure a steady flow of funds needed to sustain research activity and accelerate movement through the innovation pipeline. A number of centres are also trying to recreate the BRU model in new disease areas, with their own resources.

6) **Similarities and differences between the evolution of BRUs and BRCs – a high-level reflection:** Many of the impacts and key messages we identified through this review of BRUs, also apply to the BRC scheme. However, the emphasis is somewhat different and related to the distinction between ‘building on the best’ and ‘making the best even better’. For example, staff in many BRU locations have never had access to translational research funding of this nature or scale in the past, and for them the experience has been transformative. BRU directors are also very enthusiastic about having their own translational research patches to grow, and this enthusiasm has spilt over into capacity building efforts, and their keenness and commitment to engage with industry and other partners (including PCTs).

We elaborate on these key impacts, based on the perceptions expressed by those we interviewed, and present examples that were given in support of their views in the following sections. Table 1 then illustrates some of the key impacts of the scheme, at each individual BRU.

**Reflecting on specific areas of impact**

**BRUs are contributing to positive changes in institutional relationships between the NHS, academia, industry and other stakeholders in the health research system**

7) **NHS–academia relationships:** The BRU scheme has placed the spotlight on translational research for patient benefit. Respondents noted that NHS and academic partners are collaborating more closely than in the past, to undertake research aimed at improving patient health and the general well-being of the public. The attitudes and mind-sets of NHS and academic staff towards mutual collaboration are changing, and there is both more interest in collaboration and more opportunities to jointly take research forward. New organisational structures, divisions and functions have been established to facilitate translational research and ensure the transparency and accountability in the management and governance of BRU funds. NHS and academic stakeholders are also improving their ICT infrastructure to facilitate more effective communications. These changes are all a reflection of a more
A business-like approach to research and commitment to ensuring clear lines of responsibility and accountability for the initiatives. It is widely felt that there is a lot more professionalism in managing research as an integral and important business activity of the trust, and within academia–trust partnerships. The allocation of research resources is better targeted and matched to clinical needs than in the past. The process of applying for BRUs played an instrumental role in the establishment of better coordinated and more strategic approaches to translational research collaboration than existed in the past. (Overall, collaboration was seen to be historically less strategic and significantly more ad-hoc than it is today.)

8) **Engaging the private sector**: Our interviews showed that collaboration with industry is also higher up on the agenda of trusts and medical schools than in the past, and there is already some evidence of positive responses to the BRU initiatives from the private sector, and signs of new collaborations emerging. The NIHR expects BRUs to collaborate with industry to deliver health innovations, and central government is also promoting the importance of public–private sector relationships in biomedical and health R&D, for contributing to UK’s economic competitiveness. In addition, challenges to retaining industry in the UK (due to issues such as the costs and bureaucracy associated with clinical research, difficulties in recruiting patients into trials, and increased competition for private sector presence from emerging markets such as China and Eastern Europe) have led academic organisations and trusts to become more strategic about what they can do to establish a research, operational and regulatory infrastructure that can add value to industry for the long term (not in the least in terms of the quality and reliability of services offered).

9) **Regional and national linkage and exchange**: BRUs are also adopting a more strategic approach to engaging other regional and national organisations in efforts to move research from bench to bedside. This includes academic institutions, hospital trusts, PCTs, clinical research networks and other NIHR initiatives such as BRCs and Collaborations for Leadership in Applied Health Research and Care (CLAHRCs). In some cases, disciplines outside medical schools are also being included in BRU activities. Many hope this will enable more interdisciplinary and innovative approaches to addressing translational research challenges. Lastly, actions to increase patient and public involvement in translational research are central to all BRU strategies, and community outreach activities are gradually becoming more comprehensive.

**BRUs are supporting capacity building in health research**

10) **A holistic approach to capacity building**: One of the most significant impacts of the BRU scheme is seen in how it is transforming capacity building in the translational research landscape, through contributions to (i) improving the physical infrastructure required for moving research from bench to bedside, (ii) building up a critical mass of leading researchers capable of advancing translational research agendas over the long term, and (iii) ensuring a steady flow of funds needed to sustain research activity and accelerate movement through the innovation pipeline.

11) **Physical infrastructure**: A very significant contribution of the scheme has been the support it has provided for securing facilities and equipment. For example, BRU funding is enabling the establishment of clinical research labs, the development of imaging capacity, patient
databases, bio-repositories and tissue-retrieval banks. New physical space and equipment dedicated to translational research is bringing biomedical and clinical researchers much closer together than in the past, and facilitating more intensive communications that are expected to accelerate research translation.

12) **Building critical mass:** The status the BRU award provides, along with improved physical infrastructure, is increasing the attractiveness of BRU environments for people interested in translational research, and is helping recruit better expertise, both nationally and from overseas, than might have been possible without the scheme. Although many interviewees felt that it was too early to provide concrete evidence of the impacts of the scheme on staff retention, in two cases we were told that it is now easier to persuade people to stay at BRU locations because of the new and exciting prospects the units offer in terms of their career development. BRU funding is also being used to provide clinicians with designated research time in their job plans. We were also told that research experience and interest now weighs more heavily in decisions to hire NHS consultants.

13) **Training:** NIHR funding for BRUs is also enabling the training of future translational research leaders, and is making a particularly important contribution towards opening new opportunities for NHS clinicians to be trained in and/or engage in research activity, in a more structured manner than in the past. The training opportunities created via the scheme are complemented with support from other institutions nationally (e.g. research councils and charities). Some interviewees also felt that the take up of research training opportunities by clinicians is increasing, because the BRU has had a significant influence of elevating interest in translational research.

14) **Leveraging additional funding:** Many BRUs have also highlighted the positive effects of the initiative on obtaining funding from external sources (e.g. charities and industry). The scheme has also influenced trusts and universities to commit additional funds in support of BRU aims. In some cases, trusts are pursuing the development of BRU-like arrangements in new research areas which they wish to strengthen, supporting these from their own resources and with additional contributions from university partners.

**BRUs are part of improved resource targeting, management and governance in the health research system.**

15) **The BRU scheme has helped in transforming the way research resources are managed and governed in the NHS:** It is widely felt by those we spoke to that there is a lot more professionalism in managing research as an integral and important business activity of the trust, and within academia–trust partnerships. The allocation of research resources is better targeted and better matched to clinical needs than in the past. New structures such as joint research offices shared by academic and NHS partners and translational research steering committees are facilitating the pursuit of common agendas between universities and the NHS, and are ensuring greater transparency and probity in the allocation and monitoring of spending, and in the monitoring of progress and performance. Joint R&D offices are also providing administrative support to improve the efficiency and reduce the bureaucracy that accompanies translational research. BRU leaders feel that it is essential that individuals with administrative responsibilities are appropriately trained in business and administration.
processes, rather than being placed into such positions from a pure academic or clinical background.

**BRUs are still learning and adapting in the face of a changing environment**

16) **Learning and experimentation:** As is the case with most complex new initiatives, BRUs have been a learning experience for those involved. Integral to the learning process has been an effort to identify and implement the financial, administrative and regulatory arrangements for BRUs that are best fit for purpose. Trust and university stakeholders have devoted significant time and effort to find efficient ways of managing the flow of funds between partner organisations, establishing common science commercialisation principles, and finding creative ways to minimise the bureaucracy associated with research regulatory processes.

17) **Networks and platforms for interactive and collective learning:** The process of setting up BRUs has led NHS and university stakeholders to identify some areas where improved communication systems and infrastructures could help further increase the efficiency and long-term impact of the initiatives. Suggestions to establish an online forum to enable a more effective support network between BRUs throughout the country, as well as between BRUs and BRCs, were made. This would provide a platform for more frequent discussions, exchange of information and the sharing of best practice.

18) **Interactions with the NIHR:** Frequent engagement and transparent dialogue between the NIHR and those it funds was thought to be important for making optimal use of the resources and opportunities available in the health research system. There was widespread enthusiasm and support for the way the NIHR has supported and engaged with BRUs. Many trust chief executives, deans and directors emphasised the accessibility and open dialogue they have experienced with the NIHR. One area where further interaction would be beneficial revolves around achieving an improved clarity on different NIHR initiatives and their relationships, as well as funding streams and eligibility criteria. Although BRU leaders are aware that information on each of the new efforts is available in the public domain, many feel that it would be helpful if it could be presented in a somewhat more user-friendly and amalgamated format (such as a handbook or set of guidelines). Continued dialogue will also be important with respect to BRU renewal round criteria and specifications for the next round of BRC bids.

19) **The wider underpinnings of successful BRUs:** BRUs operate within a wider context that influences the supply of resources for research and the demand for research to inform policy and practice. Attending to their stability and sustainability, and mitigating some of their uncertainties, will also support the success of the BRUs. Interviewees identified a number of such broader policy-related issues regarding the future of the UK health research system and the evolution of their units. These included ensuring that the UK health research system is attractive to industry; planning for economic and political uncertainties; ensuring the most appropriate balance between concentration of resources and diversity; nurturing and strengthening opportunities for nurses and allied health professionals to be included in the health research system; and implementing and nurturing a fit for purpose performance evaluation framework.

20) **Lastly, BRUs are part of an ongoing and larger effort,** which includes other flagship NIHR initiatives such as BRCs and CLAHRCs, as well as other government initiatives such
as Academic Health Science Centres (AHSCs), to create a sustainable, effective health research system in which research is driven by the needs of patients and the public. The enthusiasm and commitment of leading figures within BRUs is evident from this report. There is a widespread agreement among interviewees that BRUs can make a positive contribution to the health research system in the UK and that they are already changing institutional relationships between the NHS, academia and industry. They are building capacity and are part of efforts to improve resource targeting and governance in health research.

Table 1 present some examples of the impact of the BRU scheme identified through interviews. We have shaded cells in which we present impacts that are common to more than one BRU in the same location.
<table>
<thead>
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<th>Biomedical Research Unit</th>
<th>A summary of the impact of the BRU scheme – examples at individual units</th>
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| University Hospital Birmingham NHS Foundation Trust and University of Birmingham **Gastrointestinal disease (hepatology)** | • Applying for the BRU helped strengthen the spirit of collaboration between NHS and university partners, and has led to a strong sense they can achieve better results in areas of patient benefit, through collaboration.  
• New opportunities for clinicians to engage in research have been created and are being taken up with enthusiasm (e.g. programmed activities for research in consultant job plans).  
• There is a stronger focus on the relevance of research for patients.  
• The scheme is also enabling more interdisciplinary research. There is a broad mixture of investigators involved in the BRU (e.g. endocrinologists, oncologists, immunologists).  
• Research is approached in a more business-like manner and there is an emphasis on establishing more rigorous management and governance structures to monitor research spend than in the past.  
• Establishing new relationships with industry and jointly pushing research advances through the pipeline is one of the explicit goals of the BRU Although it is difficult to provide evidence of direct attribution, interviewees felt that the BRU has already had an impact on attracting additional funding (e.g. from Novimmune and Novartis).  
• Community outreach work is improving.  
• BRU funding has been used to develop imaging capacity and to purchase an MRI scanner. The university and trust are also trying to leverage the potential of existing infrastructure (such as the Wellcome Clinical Research Facility) to contribute to advancing BRU research.  
• The BRU has successfully recruited some positions, including a researcher from industry, three clinical research fellows, and some research nurse placements.  
• There is BRU funding for three clinical research fellows. There is also additional funding for training from the trust and university sources. Training opportunities in translational research are also helpful in retaining some existing researchers. |
| United Bristol Healthcare NHS Trust and University of Bristol **Cardiovascular** | • The BRU has led to fundamental changes in the attitudes of the trust and university towards collaboration and translational research. NIHR funding is seen as something prestigious that clinical and academic researchers aspire to. There is a sense of opportunity to capitalise on the new translational research funding prospects. Research is much higher up on the trust’s agenda than in the past.  
• The BRU has re-enforced the focus of collaborative research on research for patient benefit.  
• There is a new, tailored governance structure in place. A level of flexibility in the use of BRU funding so that it can be channelled in the }
best possible direction has been supported by the NIHR, and is perceived to be very helpful.

- It is too soon to say how far the BRU had impacted on relationships with industry but a project involving the testing of a potential new drug should start very soon (with support from a company based in Oxford and in New Zealand).
- Talks are under way about developing a cardiovascular disease research strategy across Bristol, led by University Hospitals Bristol and the university. The BRU has had an impact on increasing the interest and momentum for this initiative.
- BRU funding has been used to develop imaging capacity and to create more research space for practising physicians. A dedicated cardiac imaging scanner is now being installed.
- Seven core researchers for the BRU have been appointed already.
- The Bristol BRU did not include any specific funding allocation for training; however, interviewees believe that the BRU will make them better placed to apply for grants involving PhD studentships and to secure other training awards.
- The funding provided by the NIHR for BRUs has been very important for Bristol's ability to take forward translational research in the current economic climate in which charities have less money. The trust and university have also committed additional resources to the BRU.

Common to the BRUs at Royal Brompton & Harefield NHS Trust and Imperial College:

- The purposes, management and governance of trust-based research have been revisited to ensure that all new research taking place in the NHS is relevant to clinical needs, and in line with the trust's broader business strategy. The scheme is also leading to a much more joined-up and better coordinated collaborative research programme between the trust and medical school.
- Research governance and management is approached in a more business-like manner. The trust now has greater clarity in terms of how it allocates and monitors research spend.
- Most interviewees expect new collaborations with industry to be facilitated by the BRU scheme, and the BRUs have already received a number of informal expressions of interest. However, nothing that has been initiated has come to a stage where it is ready for industry to get actively engaged.
- There is quite a lot of magnetism associated with the BRUs, and outside researchers are expressing an interest in collaboration because of the infrastructure and people associated with the BRUs. Both BRUs are also embedded in local Clinical Research Networks (CRNs).
- The cardiovascular and respiratory BRUs are joining forces to establish a biobank facility. The trust has nearly doubled or matched BRU support for infrastructure development. There has also been additional commitment from the university (e.g. for salaries).

The BRU is a centripetal force bringing academic investigators and clinicians working in cardiovascular research closer together.

- The BRU has re-enforced the focus of collaborative research on research for patient benefit.
| College London Cardiovascular disease | • The management structure enables a sufficient degree of autonomy for the BRU to pursue its goals while at the same time ensuring a requisite degree of integration and accountability to the trust and university more broadly.  
• The cardiovascular BRU is building a new CRF, a chain of cardiovascular and genetics clinics, a catheterisation lab, and state of the art MRI equipment.  
• Some positions have already been appointed (e.g. a BRU manager, a physicist, research nurses, sessions for a cardiovascular geneticist).  
• Training programs for basic scientists, clinical scientists, nurses and technicians are supported by major institutional training programs but not the BRU. |
| Royal Brompton & Harefield NHS Trust and Imperial College London Respiratory disease | • The BRU is changing the way people in the university and trust think about translational research in respiratory disease. It creates the much needed capacity for scientists and clinicians to work together more closely than in the past, talk more to each other and have the facilities they need to deliver outputs for patient benefit.  
• Physical capacity supported through the BRU scheme includes a CRF and CT scanning.  
• The respiratory BRU has been planning the staffing needs and developing a recruitment strategy for the respiratory CRF. Each consortium will have a coordinator. Some lung-function staff have been hired.  
• There will also be training for four PhDs (one with BRU funding working on stem cells and regenerative medicine). The other three are from trust parallel funding for MD and PhD posts. |
| Leeds Teaching Hospitals NHS Trust and University of Leeds Musculoskeletal disease | • The process of applying for a BRU has promoted a sense of more equitable ownership of the research agenda by the trust and university. Academic strengths, clinical service strengths and clinical need determined the priority areas to focus on in the BRU.  
• Targeted NHS-based funding for translational research has been a highly effective stimulus for increasing the scale and scope of trust–university collaboration. Research is now seen as an essential part of trust business strategy, and senior trust leaders have placed a lot of effort into communicating the importance of research to clinicians, and achieving organisation-wide buy-in. Clinicians and academics are collocated on the same site, and the scale of collaborative and multidisciplinary project is increasing.  
• The environment for translational research has become much better since the NIHR came into play. Interviewees thought that the BRU has had an impact on leveraging further funds: approximately £20 million of external funding has been attracted since receiving the award. The trust and university have also committed additional funding to the BRU.  
• The Leeds BRU leaders are very open to collaborations with other groups in the region and wants to remain inclusive. It hopes to engage PCTs in particular. At present, there is collaboration with other NIHR initiatives, for example with the Sheffield BRU and with the Leeds CLAHRCs.  
• There is patient representation and involvement within several elements of the governance structure. |
• The types of research collaborations taking place are far more translational in nature than was the case in the past. The university and trust partners are moving away from discipline-focused research to more thematic research. The BRU is increasing the levels of multidisciplinary collaboration (e.g. between medicine and engineering). Academics and clinicians from various disciplines will be collocated in the same space. BRU leaders think this to be important for the sharing of ideas and for accelerating translation.

• The BRU is a pillar for trying to strengthen research areas other than musculoskeletal disease in a similar way to the BRU model (but financed by trust and university in early phases of the effort).

• BRU funding is being used to establish an imaging facility and an integrated ICT database across the unit, linking information gathered across the research groups, and linking in the NHS data system. There is also some BRU support for developing an orthopaedic tissue retrieval bank.

• Three-quarters of the staff for the BRU have now been appointed. This includes group chairs, research fellows, and administrative and technical support staff.

• BRU funding is training six clinical research fellows. There is also additional translational research training support from other sources.

| University Hospitals of Leicester NHS Trust and University of Leicester Cardiovascular disease | • Putting together the bid for BRU status for cardiovascular disease facilitated closer and better coordinated interaction between the trust and university. NHS employees have been brought into the translational cardiovascular research agenda more than in the past. The university and the trust have signed up to the same vision of translational research from bench to bedside, and have common expectations: the point of the BRU is for the synergy between the two partners to deliver advances for patient benefit, and for both involved parties to benefit from the partnership.

• A change in the university occurred in parallel to the development of the BRU, whereby the university moved from a departmental-based system to a theme-based system. This is influencing the ethos by which research is conducted in the university, allowing for much more interdisciplinary research organisation.

• The BRU scheme is expected to extend its influence beyond those generating the research ideas or conducting research, to those who are actually putting the research advancements into practice. There is an explicit strategy to increase public engagement in the research of the BRU and to increase the percentage of patients who participate in research activities (e.g. via communicating and mobilising patient participation in studies, in a tissue repository and in a bioinformatics database).

• There have already been some expressions of interest from industry in the BRU, particularly around the clinical phenotyping unit which is to be set up.

• The whole spectrum of NIHR initiatives are getting NHS trusts and universities to think more strategically in regions, and to look more seriously at regional collaboration. There is a strong focus on increasing patient participation in research, and infrastructure to facilitate this will be developed with support from BRU funding (e.g. biorepository for tissue samples and an informatics centre). There are also plans to establish a Leicester BRU faculty whose membership can include researchers from throughout the region. Membership will enable access to BRU facilities, and is expected to be beneficial for more frequent intellectual exchange between people active in
cardiovascular research in the region.

- Leicester has never had anything like a BRU before in terms of support for translational research, and the scheme provides a huge opportunity to reform the way cardiovascular research is done in Leicester. BRU capital funding will be used to develop a bio-repository and informatics centre, a CRF and a cardiovascular research centre. The trust and university are also committing their own resources to enhance the infrastructure.

- The Leicester BRU is only 3 months old. The trust and university had in pre-BRU times taken steps to enhance the sustainability of cardiovascular research by making a number of senior appointments. It is hoped that being a BRU will help recruit new people because it is a badge of recognition for the quality of cardiovascular research happening at Leicester.

- There is BRU funding the training of MDs and PhDs.

Royal Liverpool & Broadgreen University Hospitals NHS Trust and University of Liverpool

<table>
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<tr>
<th>Gastrointestinal disease</th>
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- Although the commitment to joint working was already present prior to the BRU, the scheme has further raised the profile and importance of collaboration between the trust and the university. It led to “a better organisation” of the existing “good-will”. There is a strong sense of commitment to the BRU by all participants, and this is part of a wider dialogue about harnessing opportunities for joint research between the NHS and academic partners. Translational research is now integral to the work of the university and trust.

- The BRU has been “utterly essential” in raising the profile of translational research in cancer and pancreatic disease. One of the leadership representatives commented on pancreatic disease: “If it had not been for this investment, I don’t think that there would have been any prospect of significant advance for many years.”

- Centralisation of the process to commission research is enabling funding to be used more efficiently and effectively.

- The BRC and BRU have affected the research governance across the trust and university, not just across the directly supported specialities. A joint research office across nine local NHS organisations is being planned for the near future.

- The BRU is providing the critical mass required to enhance work with the private sector, but it is still early days. Early signals of interest are beginning to surface. Forty representatives from industry recently visited the Liverpool CRF, and this has not happened before. The event was a chance to discuss the BRU plans and to explore avenues for fruitful collaboration, including phase 1 and phase 2 trials.

- The regional environment for collaboration is improving. The BRU is creating opportunities for closer collaboration with PCTs. This is very important, particularly because alcohol abuse is a major issue in Liverpool. The relationships between the BRU and local CRN are very positive.

- BRU leaders expect significant progress with recruitment in the next few months. They have already attracted a much better class of candidates through the posts they advertised than they think would have been the case in the absence of the BRU recognition. In addition, one interviewee said that two people he thought might have moved on elsewhere have chosen to stay at Liverpool, and he sees this as a sign of the campus becoming much more competitive.

- Liverpool has been successful in securing training awards for translational and clinical research from a number of sources before being.
awarded a BRU. The BRU provides an established pathway for career progression and further personal development of the next generation of research leaders.

<table>
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<tr>
<th>Nottingham University Hospitals NHS Trust and University of Nottingham</th>
<th>Common to all three BRUs at Nottingham:</th>
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<tbody>
<tr>
<td>Gastrointestinal disease, respiratory disease, deafness and hearing</td>
<td>• The trust and university now have a much clearer vision of what each partner contributes, and of respective complementarities. The BRUs have provided clear incentives for the partners to align research priorities.</td>
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<td></td>
<td>• Obstacles to clinician engagement in research are being removed (e.g. through provisions of protected research time). Obstacles for academics to collaborate with clinicians are also being removed (e.g. by developing integrated ICT infrastructure, through the co-location of academic researchers and clinicians).</td>
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<td></td>
<td>• The management and governance of research resources is much more rigorous and transparent than in the past. There is regular monitoring of research spend, and the partners are developing a performance scorecard for each of the three BRUs to help manage performance internally.</td>
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<td></td>
<td>• All three BRUs will also be gathering patient stories as the BRUs mature, to see how patient conditions have been improved as a result of the application of translational research enabled by the BRUs.</td>
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<td></td>
<td>• There is flexibility for staff to transfer funds to the next financial year to deal with difficulties in short-term spend, which is very helpful.</td>
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<td></td>
<td>• The funding environment for translational research has been vastly improved by virtue of the BRU scheme. The scheme is also having a positive side-effect: the trust and university are working together to develop shadow BRUs in other areas outside those funded by the NIHR, and committing their own resources to this task.</td>
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<td></td>
<td>• Nottingham has won a Medical Research Council (MRC) Developmental Pathway funding scheme award. Having three BRUs was a big factor in the successful bid, because the BRUs create a channel for picking up and further developing the research outputs that will over time come from the MRC awards. The BRUs are also beginning to attract additional grants: the importance of the BRUs is often made explicit in referees’ comments.</td>
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<td></td>
<td>• Both the trust and the university are matching BRU funding support.</td>
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<td>• Informal responses to the BRU award from industry have been very positive.</td>
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<td>• The BRU has impacted on developing relationships with other local players in a number of positive ways. For example, BRUs helped catalyse the bid for AHSC between Nottingham and Leicester. Although the bid was not successful, the universities and trusts involved are pursuing efforts to establish a shadow AHSC-like centre, and think that their chances of a successful bid in future rounds will be greatly enhanced because of this. There is also collaboration with the regional development agency.</td>
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<td></td>
<td>• There is also scope for a lot of collaboration between the gastrointestinal and respiratory BRUs at Nottingham. Some collaboration already exists and is expected to be further strengthened as the BRUs mature.</td>
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</table>
The BRU scheme is having an enormous impact on improving infrastructure for translational research across all three BRUs. The trust has also committed to contribute towards the capital schemes. Improvements in physical infrastructure have acted as an early signal to staff of the benefits the scheme can deliver in terms of providing a more conducive environment for research and ultimately for patient benefit. There is also capital support from other organisations – charities, the Higher Education Funding Council for England (HEFCE) and the Capital Infrastructure Fund (CIF).

Nottingham University Hospitals NHS Trust and University of Nottingham

Gastrointestinal disease

- The BRU has led to a more formalised approach to collaboration between the trust and university, which makes it easier for academics and clinicians interested in gastrointestinal and hepatology research to identify and make use of opportunities for joint studies. The scheme has helped expand the number of clinicians and academics conducting translational research.
- The BRU scheme helped leverage additional funding from the MRC and other NIHR funding streams.
- The BRU application process led the trust and university to re-examine the research portfolio and re-focus and concentrate on a somewhat narrower range of areas of international research strength, where there is also a high clinical need for scientific advancements. Basic scientists are more engaged with patient-based research than in the past.
- BRU leaders are considering how to develop innovative and creative approaches to engage other trusts in the region to collaborate with the gastrointestinal BRU, and to facilitate access to patients in other catchment areas.
- The scheme is funding the development of a separate BRU unit and imaging capacity. This will allow academic and clinical staff to be collocated on a single site, and in this way be beneficial for the exchange of information and knowledge and for fertilising new ideas.
- Everybody planned to appoint for the BRU has been appointed, and everybody bar two people are now in post. These appointments include eight research nurse posts at various grades, two technicians, a database manager, a clinical trials support worker, a clinical lecturer and two more people who are yet to start but have been recruited (clinical associated professors, at the beginning of their consultant grade and moving into primary research).
- Four clinical research fellows who will be doing PhDs as part of (and funded through the BRU) have been appointed.

Nottingham University Hospitals NHS Trust and University of Nottingham

Respiratory disease

- The BRU scheme has put the spotlight on translational research, and the research agendas of the university and trust have been “enormously refocused” as a result. Although the flavour of the bid for BRUs was university led, the trust provided strong support and buy-in, and made additional financial commitments to the BRU from its own resources.
- The BRU has also pulled together a lot of research groups in the university which had some activity in the respiratory disease area in the past, but without respiratory disease research being their core focus. Because of the opportunities created via the BRU, respiratory research is become more and more of a focal point for these groups as well.
- Since becoming a BRU, a number of other awards have been received, including a large EU collaborative grant (Innovative Medicines Initiative).
- The respiratory BRUs nationally are talking about how they can collaborate more and work together. They have already been
collaborating in the successful bid for the Innovative Medicines Initiative collaboration. There is also collaboration between the BRU and other universities (e.g. Leicester). The BRU is organising an event where it will showcase their research and plans, and all the respiratory consultants from the other trusts in the Trent Comprehensive Local Research Network (CLRN) region are invited. The meeting is hoped to help gauge the interest of other organisations to collaborate with the Nottingham respiratory BRU.

- BRU funding is being used for the refurbishment of a lung function facility, a clinical research area, and another area for respiratory outpatients to be used in research studies (phenotyping and genotyping).
- Most of the posts needed for the BRU have now been recruited. The appointment of research nurses has been an important milestone.
- The scheme is having an impact on increasing the scale and quality of training provided in translational research. The respiratory BRU has already taken in 11 training posts, some of which are funded directly through the BRU.

**Nottingham University Hospitals NHS Trust and University of Nottingham**

**Deafness and hearing**

- The BRU has galvanised the university and trust to place hearing and deafness research higher up in their research agendas. The hearing BRU is unique in that it is a three way partnership between the university, trust and the MRC Institute for Hearing Research (IHR).
- There are four areas of research the BRU focuses on, all with patient benefit being the key driver of projects. The BRU is unique nationally, and has included some very innovative aspects into its research portfolio (e.g. studying links between the loss of audibility and speech perception and intelligibility). The research has a sociology angle, an education angle and a learning to hear better angle.
- Interviewees felt that other colleagues active in hearing research nationally are very keen to work with the BRU and access BRU resources. The university works closely with the Learning Sciences Research Institute.
- Capital funding from the NIHR was matched by the trust. The funding covers the refurbishment of facilities for the BRU on one floor of the Nottingham general hospital, and most of the equipment. They now have sound-proof booths. The clinical service is on the floor adjacent to that of the BRU.
- The BRU has already had an impact on increased capacity for hearing research in the UK because it is bringing in people from different countries and disciplines. A lot of the BRU money for posts has been transferred to the university, because all but 3.5 posts (the BRU unit manager, a secretary and 1.5 clinical scientists) are university posts. Fourteen academic staff are now in place. Recruitment has been facilitated by the fact that Nottingham has a very strong reputation in hearing research.
- There is BRU support for four training posts (PhDs and MDs). The university is also making a contribution (e.g. providing student accommodation).

**Nuffield Orthopaedic Centre NHS Trust and University of Oxford**

**Musculoskeletal**

- The BRU has developed on a foundation that was already in place. The scheme has led university and trust leaders to consider how they can further improve their ways of working, and to take new actions towards this end. Some of these actions include joint appointments of clinicians, and the possibility of buying back the time of clinicians for research rather than adding research hours onto normal working hours.
- The scheme is leading to progress towards an ever more integrated research system and infrastructure. The BRU has further formalised
### Musculoskeletal Disease

the importance of research in the trust and the common vision, through a direct and explicit programme for research flow.

- Clinical leaders are also leading in research thereby bringing all parties together.
- Musculoskeletal disease research taking place at Oxford is now driven primarily by a clinical goal, and is much more translational in nature than before. Research themes were selected for high impact in common disease and programmes with rapid delivery were been prioritised. There are regular patient forums to ensure that the research being taken forward is of relevance and benefit for patients.
- The BRU has had a significant impact on improving research governance structures. Individuals in charge of sourcing grant funding who used to sit in the old-style R&D governance have been subsumed under a new BRU structure, putting a system of scrutiny in place to ensure that those researchers doing inadequate own-account work are helped to achieve higher quality research.
- A new relationship that would not have happened without the BRU has been established with Smith & Nephew and GSK in the area of tissue engineering and regenerative biology. The trust and university are actively thinking about how to create ways for more effective interaction with industry, and this is largely driven by the Health Education and Innovation Clusters (HEICs) bid.
- There is a strong sense of community between the BRU and the CLRN and they collaborate closely. The BRU is also developing its relationship with the Kennedy Institute of Rheumatology, which could extend the scope of the translational research agenda undertaken by the BRU. BRU leaders are exploring how they can work closer with GPs (following the example of the very successful liaison that orthopaedic and rheumatology researchers at Keele have developed with their local practitioners).
- Most of the posts planned for the BRU have been appointed, around 20–25 of which 13 are full-time, including clinicians, therapy posts, research nurses and various support posts. Approximately half of these posts are part-time with the BRU, and are otherwise funded by the university or NHS. The BRU helped escalate the critical mass of qualified staff working on translational research in musculoskeletal disease.
- The BRU intends to create the next generation of clinical researchers. It has helped open up PhD training opportunities for 33 students of which 15 are surgeons. This is the largest number of PhD students doing orthopaedic surgery in the world. Half were recruited in the last year.
- The trust has leveraged an approximately 5% increase in income since becoming a BRU. Not all of this leverage is directly attributable to the BRU, but it is (according to senior leaders) reinforced by it.

### Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield

**Common to both BRUs at Sheffield:**

- The BRU has re-invigorated academic medicine. BRU funding is having a significant impact on Sheffield’s capacity to engage in translational cardiovascular research. With much of the infrastructure in place, the BRU is starting to phenotype and test people with heart attacks to inform some more upstream research about the implication of specific genes in cardiovascular biology. The trust also plans to set up a follow-up clinic for patients who participate in research.

- Resource sharing between NHS and university partners enables economies of scale to be realised. This includes the sharing of
| **disease, cardiovascular disease** | databases and a bio-repository that is being established of sample processing resources, as well as some staff (e.g. a common receptionist for the BRU).

- The success with the BRU bids has also influenced the trust board to invest money in research, which it would not have before. The trust is playing an active part in including research in consultants’ job plans.
- The trust and university are now seeking to reproduce the BRU model and impacts in areas outside musculoskeletal and cardiovascular research.
- There is a much stronger focus on public and patient involvement in research than ever before.
- The management and governance of research resources is much more transparent and better targeted than in the past. There is a far stronger emphasis on structured planning for taking research forward, and on monitoring performance; poor own-account research undertaken by NHS staff is being discouraged and a new attitude to high-quality, relevant research is being encouraged.
- Relationships with industry haven’t changed yet, but the BRU has provided a pretty strong sales pitch: it enables the partner organisations to market their research on drugs in development and their access to improved infrastructure (including equipment to evaluate drugs, and better access to patients). There is potential for some partnerships with GSK and Pfizer to develop. They are clear about what is needed and where they want to go; the next step is to develop the operational, administrative and regulatory environment that can add value to industry. The BRU governance representatives regularly meet and discuss ways of increasing collaboration with industry.
- Both BRUs are engaged with the Sheffield Medical Innovation Centre, through project officers.
- Having BRU status is enabling Sheffield to attract the required researchers. Although it is difficult to find concrete evidence, BRU leaders feel that it is now easier to persuade younger fellows to stay at Sheffield, as there are new and exciting opportunities via the BRUs. |

| **Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield**
**Musculoskeletal disease** | • The BRU has placed musculoskeletal research much higher up on the agenda of the trust than in the past.
• The Sheffield musculoskeletal disease BRU communicates with the BRC at Guy’s and St Thomas’ to learn lessons about how they have developed the BRC. This has been an evolving and very helpful relationship.
• The BRU is also developing a relationship with the School of Health and Related Research (SCHARR), and in general is strengthening relationships between the trust and all its academic partners as the new collaborative ethos is taken up by others outside the BRU.
• The BRU has helped improve imaging infrastructure (e.g. Xtreme CT for state of the art measurement of bone structure). The improved infrastructure is enabling new research and involvement in multi-centre trials (that couldn’t be done before). Patient database capacity is also improving, increasing the availability of patients for research, and facilitating the development of a bio-repository.
• They have recruited 19 staff so far (scientists, statisticians, nurses). Some of the positions are part-time. |
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<tr>
<th>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield</th>
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<tr>
<td><strong>Cardiovascular disease</strong></td>
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| • The BRU has led to a more coordinated strategy for collaboration between trust and university staff in cardiovascular research.  
• The BRU is collaborating with some new university research groups (e.g. in medical physics). Some individuals from other university departments have approached the BRU and asked to become involved (e.g. a clinical research fellow).  
• BRU funding is helping expand pre-existing CRF facilities.  
• 90% of the staff the BRU planned to appoint are now in place. Some “spectacularly good appointments which were certainly helped by BRU status”. These include the manager of the programme, an ex-PhD student, a research nurse with a cardiovascular background with health-service-related research experience, and a biometrician with a previous Wellcome Trust fellowship. One more post will be appointed in the next year, to lighten the director’s responsibilities.  
• There are now three basic science PhDs being trained to conduct translational research. Three 1-year entry-level clinical fellows should be appointed in the next few weeks. Some nurses are also in training at the BRU. |  
| • The BRUs have catalysed stronger collaboration between the clinicians and academics than existed in the past. The scheme has had a very strong impact on raising R&D right up the agenda for the trust. There is a much stronger realisation of the strategic links between research and the quality of service provision, which is partially manifested through more uptake of research opportunities by clinicians.  
• Both BRUs have created an integrated management and governance structure. The allocation of resources in a targeted and transparent manner means that there are more opportunities for NHS clinicians to get protected research time.  
• The BRUs have mobilised a stronger focus on the relevance of research for patients.  
• The BRU scheme has had an amplifying effect – it has mobilised the trust and university to invest their own funds in creating shadow BRUs in other areas (outside nutrition and respiratory disease). This included the creation of a shadow BRU in cardiovascular disease, for example.  
• The two BRUs at Southampton collaborate with each other. Collocation also facilitates collaboration between the two BRUs.  
• The BRUs magnify historical links with other players and are a stimulus for even more collaboration. There are close relationships with the regional CLRNs.  
• The involvement of patients and public is very high up in the BRU’s research strategies and plans. Involvement activities include representation on advisory boards, the engagement of research nurses with clinical nurses to promote a culture of partnership between those delivering care, receiving care and taking part in research; as well as public lectures and open days.  
• The original BRU capital bid is funding a two-floor building for translational research, in which both BRUs will be located. This has now been approved and commissioned, and they hope to move into the building by the end of next year. This building will house staff, labs and equipment (e.g. a mass spectrometer and other specialised equipment). The trust is also investing in building physical capacity for |
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<tr>
<th>Southampton University Hospitals NHS Trust and University of Southampton</th>
<th>Nutrition, diet and lifestyle</th>
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<tr>
<td>the BRUs (e.g. a 3T MRI scanner to improve imaging capacity).</td>
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<tr>
<td>• Significant progress with recruitment has been made. The majority of staff employed by the BRU have NHS contracts primarily.</td>
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<td>• There are clinical research fellowships allowing people to work between the two BRUs, doing a PhD (via synergy funding of approximately £400,000 per year over the life of the BRU).</td>
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<td>• The explicit and clear recognition of excellence that the BRU award conveys has further raised the importance of nutrition research among the different specialities in the trust, and has given a new, more concrete form to collaborations.</td>
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<tr>
<td>• The recognition of excellence that the BRU gives has also helped increase the interest of nutrition specialists throughout the country to collaborate with the BRU.</td>
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<td>• Some of the research conducted at the BRU is not very amenable to industrial exploitation: to date there has not been a major change in relationships with industry because of the scheme.</td>
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<td>• BRU-funded physical infrastructure is helping improve the ability to make good nutritional diagnoses. New technologies and modern methodologies are being implemented.</td>
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<td>• An operations manager and six research nurses have been recruited. Some university staff are also now formally employed by the BRU.</td>
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<td>• The BRU support will help train a cadre of nutrition research nurses (of which there are currently practically none in the country, and particularly not senior nurses).</td>
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<td>• Historically, near patient integrative nutrition research has not been well supported nationally. The BRU funding is helping change this.</td>
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<td>• There is more enthusiasm for putting in bids to NIHR and research councils, and since Southampton was awarded a BRU, they have been more successful in winning funding from other sources.</td>
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<td>• In addition, the trust and university &quot;do more than match&quot; the funds from NIHR BRU funding.</td>
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| Southampton University Hospitals NHS Trust and University of Southampton | • Having the BRU has created a step change in the university's relationship with the trust. Many more NHS consultants are now actively engaged in respiratory research activity.

• Interviewees felt that there are three things that help you win money and establish new collaborations with the private sector: projects, people and place. The BRU is improving all three of these enablers. Therefore, although there is no concrete evidence on this, the BRU leaders feel that it is very probable that the scheme has helped in winning recent funding from two industry players. In addition, the BRU has recently been successful - as part of a consortium - in a €23 million award from the Innovative Medicines Initiative. Southampton will receive £1.45 million.

• The respiratory BRU hopes to integrate more with other respiratory BRUs in the country. It is already collaborating with the BRUs at Nottingham and Royal Brompton and Imperial).

• The BRU building (shared also with nutrition) will be right next to the Wellcome CRF, which will help harness complementary infrastructure.

• Scientists, technicians and clinical research fellows have been appointed.

• BRU funding will support two PhD scientists and two clinical research fellows. |
CHAPTER 1  The BRU review context

**Summary:** The Department of Health’s R&D strategy (Best Research for Best Health) set out to create a sustainable, effective and internationally leading health research system in which research and innovation are driven by the needs of patients and the public. In May 2009, RAND Europe was asked to conduct a review of Biomedical Research Units (BRUs), one of the flagship initiatives of Best Research for Best Health, and to explore some of the impacts of the scheme on the translational research landscape in England. We conducted in-depth interviews with senior NHS and academic leaders of all BRUs. This report presents the findings of our review.

1.1  **Background to the BRU review**

In January 2006, the Department of Health’s Best Research for Best Health strategy (BRfBH) set out to create a health research system in which the NHS supports outstanding individuals, working in world-class facilities, to conduct leading-edge research focused on the needs of patients and public. The strategy aims to increase transparency and accountability in the use of R&D funding, improve the relevance of the research portfolio to patients and the NHS, and embrace collaboration as a means for driving improvements in the research system and realising benefits for patients. Two of the flagship initiatives of BRfBH were the establishment of Biomedical Research Centres and Biomedical Research Units. These are partnerships between an NHS trust and a university, and share a common goal to undertake translational research in areas of high disease burden and clinical need, and to provide a significant contribution towards realising the broader ambitions set out in BRfBH.

Eleven Biomedical Research Centres (BRCs) were announced in April 2007. Biomedical Research Units (BRUs) were established between April 2008 and April 2009. Through BRUs, the NIHR aims to assist the further development of NHS and university partnerships which are at the forefront of their field internationally (but relatively small and specialised in comparison with BRCs), to achieve critical mass. The awards should enable the partnerships to further strengthen research capacity so that they are capable of submitting a credible bid for BRC status in the future. The BRCs are about “making the best even better”; the BRUs are about “building on the

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The BRU scheme supports research in priority disease areas which are under-represented in the BRC portfolios and in which the UK has recognised research strengths. They include cardiovascular disease; deafness and hearing problems; gastrointestinal (including liver) disease; musculoskeletal disease; nutrition, diet and lifestyle; and respiratory disease.

Table 2 summarises all the BRU awards that have been made to date. Twelve BRUs were awarded in April 2008, a further three in July 2008, and the final award was made in April 2009. Each unit has received £750,000 in the first year, with £1 million annually to follow for the next three years. Funding is awarded to the NHS partner, and is separate from any other NHS R&D funding these organisations receive.

The BRUs were selected through open competition, with all applications peer-reviewed by an independent international selection panel. RAND Europe informed the selection process by conducting a bibliometric analysis of applicants. Selection criteria focused on the relevance of the proposed research for patients and the public; the strength of existing strategic partnerships between the NHS, academia and industry; the forward plan for the BRU and especially the strategy for generating a step change in the capacity to undertake translational clinical research in a priority area; and value for money.

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<tr>
<th>NHS organisation</th>
<th>University partner</th>
<th>Priority area</th>
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<tr>
<td>Leeds Teaching Hospitals NHS Trust</td>
<td>University of Leeds</td>
<td>Musculoskeletal disease</td>
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<td>Nottingham University Hospitals NHS Trust</td>
<td>MRC Institute of Hearing Research &amp;</td>
<td>Deafness and hearing problems</td>
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<td>University of Nottingham</td>
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<td>Nottingham University Hospitals NHS Trust</td>
<td>University of Nottingham</td>
<td>Respiratory disease</td>
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<td>Nuffield Orthopaedic Centre NHS Trust</td>
<td>University of Oxford</td>
<td>Musculoskeletal disease</td>
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<td>Royal Brompton &amp; Harefield NHS Trust</td>
<td>Imperial College London</td>
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<td>Sheffield Teaching Hospital NHS Foundation Trust</td>
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<td>Musculoskeletal disease</td>
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9 Source: [http://www.nihr.ac.uk/infrastructure/Pages/infrastructure_biomedical_research_units.aspx](http://www.nihr.ac.uk/infrastructure/Pages/infrastructure_biomedical_research_units.aspx)
1.2 **BRU review: remit and approach**

In May 2009, the DH commissioned RAND Europe to conduct a review of the BRUs to explore what impact the scheme is having on the translational research landscape in England. More specifically, the review investigated whether and how institutional relationships between NHS and academic partners, industry and other collaborators are changing by virtue of the scheme, how the scheme is helping build critical mass in specific priority disease areas, and the effects of any changes on efforts to deliver on the broader goals set out in *Best Research for Best Health*.

At each BRU we undertook semi-structured interviews with the chief executive of the trust, the dean of the academic partner institution, and the director of the BRU. 10,11 Details of those interviewed are given in Table 11 (in the Appendix).12 We recorded, took detailed notes and analysed the interviews to identify recurring themes across the BRUs, as well as to explore aspects unique to particular units. The interviews were conducted in between 10 May and 26 June 2009, and each interview lasted approximately one hour.

We are aware that interview-based evidence collection can be subject to deliberate or unintended biases resulting from the position and experiences of the interviewees. However, we consistently

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10 We conducted 38 interviews in total.
11 Some NHS trust and university partners have been awarded more than one BRU. In these cases we only interviewed the chief executives and deans once, but were asked to highlight and explain both common and unique aspects of a distinct BRU at their location.
12 In one case a BRU manager also sat in the interviews and contributed her insights.
tried to get evidence and examples from interviewees, to support their views and claims. The fact that there was a broad consistency in the accounts different stakeholders produced (university and trust representatives) gives us further confidence that on balance interviewees gave dispassionate and complete accounts of where BRUs stand, and how they have evolved since they were set up.

It is also important to bear in mind that this review was conducted at an early stage of BRU existence: in most cases the BRUs are just over one year old. This has meant that it is too early to assess downstream outputs from BRU activity, such as research papers, new diagnostics, treatments or changes in health policy. In addition, we interviewed the most senior executives of BRUs. A more detailed perceptions audit would benefit from investigating the views and experiences of other participants in the initiatives, including academic researchers and clinicians engaged in research projects, and NHS managers.

Lastly, whereas our review gathered interviewee perceptions on the changes the scheme is bringing about, we did not have a counterfactual. Therefore, although we could explore the value of the BRU scheme, we could not assess the value added in comparison with translational research efforts being pursued by trusts and academic organisations without BRU status.

These caveats should be borne in mind when drawing conclusions from the report.

1.3 Organisation of report

The contents that follow present the key findings of this study, based on the perceptions of interviewees and examples they presented in support of their views:

- We first describe how the BRU scheme has influenced change in the institutional relationships between the NHS, academia, industry and other players to strengthen translational research for patient benefit. See Chapter 2.

- We then discuss the impact of the BRU scheme, and of associated change in institutional relationships, on capacity building in the health research system, including the development and modernisation of physical infrastructure, the acquisition of new capabilities through recruitment and training, and improvement in the financial support for translational research. See Chapter 3.

- Subsequently, we show how the scheme has influenced change in organisational management and governance structures and in communications systems to promote more effective collaboration among all those involved in research. See Chapter 4.

In each of these chapters we present the key messages from the interviews. In the Appendix we provide tables with examples of the impacts of the BRU scheme on various areas of activity that

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13 Twelve BRUs were 14 months old at the time of the interviews, three were 13 months old, and one was less than 3 months old.

14 In the following chapters for stylistic reasons we have avoided a repetition of warnings about these limitations.

15 The tables provide detailed illustrations and are placed in the Appendix solely for the purposes of readability of the report.
are discussed, at each individual BRU. (Where themes are common to more than one BRU in the same location we have repeated them under the heading of each BRU. This has been done to allow any BRU to be referred to separately.)

- We conclude with a reflection on the study, including some thoughts on the lessons that have been learnt from the process of setting up the BRUs, the opportunities going forward and the broader policy issues raised by interviewees about the future of this scheme. See Chapter 5.

For the purposes of confidentiality, all quotes from the people we interviewed are not attributed to a specific informant throughout the report.
CHAPTER 2  Collaboration dynamics: changes in relationships between the NHS, academia, industry and other players

**Summary:** Collaboration between the NHS, academia, industry and other stakeholders in the health research system is central to the delivery of BRU goals. The BRU scheme has placed a spotlight on translational research for patient benefit. NHS and academic partners are collaborating more closely than in the past to undertake research aimed at improving patient health and the general well-being of the public. The attitudes and mind-sets of NHS and academic staff towards mutual collaboration are changing, and there is more interest in collaboration and more opportunities to take research forward jointly. Collaboration with industry is higher up on the agenda of trusts and medical schools than in the past, and there is already some evidence of positive responses to the BRU initiative from the private sector. This is happening in the context that the NIHR expects BRUs to collaborate with industry to deliver health innovations, in line with Government recognition of the importance to the UK’s economic competitiveness of public–private sector relationships in biomedical and health R&D. BRUs are also adopting a more strategic approach to their relations with other regional and national organisations. These include academic institutions, hospital trusts, PCTs, clinical research networks and other NIHR initiatives such as BRCs and CLAHRCs. In some cases university departments outside medical schools are being included in translational research activities for the first time, enabling innovative interdisciplinary approaches to be developed. Actions to increase patient and public involvement in translational research are central to all BRU strategies, and community outreach activities are becoming more comprehensive.

2.1 **NHS–academia relationships as an enabler of translational research and innovation: the impact of the BRU scheme on attitudes and behaviours.**

The impacts of the BRU scheme on relationships between the NHS and universities are highlighted below.

1) **NHS trusts and universities have signed up to a common vision of translational research from bench to bedside and bedside to bench, are collaborating more closely than in the past, and have common expectations.** The BRU scheme aims to develop synergies between the partners to deliver advances for patient benefit, enabling all those involved to benefit from the strengthened research relationships. Evidence of existing collaboration was a prerequisite for receiving a BRU award, and all of the trusts and academic organisations we spoke to have collaborated to varying degrees in the past.
Overall, however, collaboration has historically been less strategic and significantly more ad-hoc than it is today. At 12 BRUs we were told that previous collaborations developed opportunistically, driven by individual investigators seeking a collaborator when needed, or identifying opportunities for joint working at various events that brought trust and university staff together. A few exceptions to this existed in cases where clinical divisions were academically led, or where NHS leads had long-standing academic experience and interests and had promoted research collaboration at the organisational levels. Three interviewees emphasised the catalytic role of the BRU scheme; the combination of capital and research funding and a more joined up operational environment allows trust and university stakeholders to proceed more quickly together to develop specific translational research agendas than they could have through traditional, fragmented grant-giving mechanisms.

2) The process of applying for BRUs played an important role in establishing better coordinated and more strategic approaches to translational research collaboration. NHS and university leaders worked together to discuss, negotiate and decide on the most appropriate research themes for a BRU and the best ways of leveraging their complementary capabilities and resources to organise the existing goodwill within an explicit programme. The application processes involved consultation and planning, and often led to a sharpening of research portfolios to concentrate resources on projects that were of the highest priority and potential to make a difference to patients. There is now a sense of more equal ownership of the research agenda by trust and university partners. In most interviews, trust leaders said that they have a greater say in research strategies than in the past. BRU leaders were also keen to emphasise that the outcomes of the scheme should be seen not only in terms of research outputs and benefits to patient care, but also as the catalyst for better strategic thinking among all participants.

3) Recognition of the importance of research in the NHS has increased and research is now integral to the core business of trusts. This is a result of a broader portfolio of changes in NHS R&D, of which the BRU scheme is one important new initiative. The phasing out of Culyer funding and the move to new NIHR funding models has led many trusts to reconstitute their research strategies. This meant revisiting the purposes, management, governance and operations of trust-based research. Research has become more of a business line of trusts: research strategies are business strategies pursued with the clear aim of translating research into better quality care. Trust leaders have taken this message to clinicians. At many BRUs, we were told of a stronger awareness of the links between the quality of research and the quality of care among managers and clinicians, and of more interest among the latter in collaboration with university scientists. Increasingly in BRUs, consultants’ job plans can include dedicated time for research, and there are greater opportunities for junior doctors and other clinical staff to take up research fellowships and take part in research training.

4) Research translation is also higher up in the agenda of university partners: basic scientists are becoming more aware and interested in opportunities to work with clinicians. As one interviewee explained: “basic scientists can sometimes be a bit scared of the ‘other side’, especially if they are not familiar with it. But the BRU has made them more enthusiastic about engaging with clinicians because it has provided tangible opportunities and incentives for doing so.” Basic researchers are taking up the chance to
talk to clinicians, sit in clinics and see which questions are arising from the clinical side. Many clinicians have also said that want to see what the basic scientists are doing. Basic scientists do want to see their work followed up, but they may not necessarily want to take it to the next phase themselves. However, they are very often happy to work with others who can. The BRUs have certainly enabled this and increased communication and collaboration between the two sides.

5) **The BRU scheme has improved the relevance of research for patients and the NHS.** BRU leaders have established their research strategies on an assessment of the clinical need for specific advances in patient care, taking account of the clinical and research strengths of the trust and university partners. Some NHS and academic collaborators are moving away from discipline-focused to more thematic translational research, and this has also led to more multidisciplinary research teams and reinvigorated academic medicine.

Table 3 (in the Appendix) provides detailed examples of how relationships between trust and university partners are changing at each BRU. Immediately after, Table 4 summarises key impacts of the scheme on the nature of research portfolios that NHS and academic partners are jointly pursuing (within each BRU).
2.2 The impact of the BRU scheme on collaboration with industry

The key impacts of the BRU scheme on relationships with industry are summarised below.

1) **Collaboration with industry is higher up on the agenda of trusts and academic partners than in the past. This has not been driven solely by the BRU scheme, but has been significantly reinforced by it.** The trusts and academic organisations at all BRUs we examined have collaborated with industry in the past, but to varying degrees. In all cases bar one (where the nature of nutrition research being conducted was thought not to be conducive to industrial collaborations), efforts to attract new private sector collaborators and retain existing ones have intensified. This has been driven by a number of factors. First, the DH expects BRUs to engage industry and will take this into account in performance reviews. Second, the increased emphasis of government on the contribution that medical research and the NHS can make to GDP, and on the importance of engaging industry in science commercialisation, is having an influence. Third, increasing challenges to industry and NHS collaboration in the UK (as a result of the escalating costs and bureaucracy associated with clinical research, the difficulties in recruiting patients into trials, and increased competition from China and Eastern Europe) have led academic organisations and trusts to become more strategic. There is a greater appreciation that they need to establish a more effective research, operational and regulatory infrastructure that can add value to industry in the long term (not in the least in terms of speed of delivery of clinical trials and the quality and reliability of the research offered). BRU leaders are generally keen to tackle these issues.

2) **Most of the people we spoke to felt that the BRU scheme will have a significant impact on strengthening commercial partnerships, but that it is too early for this to have materialised. However, a number of early expressions of interest in collaboration have been received from industry, and in a few cases some new funding has been attracted.** At six BRUs we were told of positive responses from industry to news of the BRU award. The leaders of most units feel that industry is particularly interested in the new infrastructure the scheme is enabling (e.g. CRFs, biobanks, patient databases). Leaders at three BRUs said that the scheme has already had an impact on attracting new funding from the private sector. Most interviewees expect that BRU status, a critical mass of researchers, improvements in facilities, and the increased emphasis on research governance probity which the BRU scheme is leading to will further increase the attractiveness of BRU campuses to industry. BRUs are also developing more effective intellectual property exploitation strategies, and working on establishing common science commercialisation approaches for the trust and university participants.

Table 5 (in the Appendix) provides detailed examples of how relationships with industry are evolving at each BRU.
2.3 The impact of the BRU scheme on collaboration with other players

The key impacts of the BRU scheme on relationships with external stakeholders in the health research system – both in the regions in which BRUs are located and nationally – are summarised below.

1) **NIHR initiatives are influencing trusts and universities to think more strategically in regions, and to look more seriously at strengthening local, regional and national level collaborations.** All BRUs are collaborating with other health research system stakeholders and trying to adopt an inclusive approach to their translational research priorities (e.g. by engaging with local PCTs and other acute trusts where relevant, with CLAHRCs, other BRUs and BRCs, CRNs, regional development agencies and the NIHR). Substantial effort is being devoted to engage the wider research community and to increase collaboration with PCTs16 (not in the least because PCTs are an important source of patients for studies). There is a significant amount of magnetism associated with BRUs; outside researchers are increasingly approaching BRUs and wishing to collaborate because of the people and infrastructure associated with the initiatives. BRUs in similar research areas also communicate with each other and collaborate where appropriate. BRUs at the same location interact when relevant; sometimes this includes direct research collaboration, and in other cases it is limited to sharing available management, administrative and operational resources. Many BRU leadership representatives feel that physical proximity is an important facilitator of collaboration. Six of the BRUs we investigated told us of close relationships and embeddedness in local Clinical Research Networks (CRNs). In one case we were told of an explicit effort to develop a formal integrated research strategy across the region in which a BRU is located. However, the levels of collaboration between NHS trusts in a region vary across BRU contexts, and partially depend on the types of trusts in the landscape (e.g. size, degree of specialisation, interest in research).

2) **The establishment of ‘shadow BRUs’ – BRU-like partnerships outside research areas directly supported by the NIHR – has been a positive side-effect from the scheme.** At five BRUs we were told of efforts to build critical translational research excellence in additional research areas – by mimicking the BRU principles and business model, with funding from the trust (and in some cases also university resources). The anticipation is that these new ‘pillars of strength’ will help to make the case for BRC funding in future rounds.

3) **University departments outside medical schools are becoming involved in the activities of BRUs, facilitating more interdisciplinary research approaches.** At three BRUs, we were told that the scheme is engaging disciplines ranging from engineering and physics to sociology and health services research. At these campuses, it was felt that the interdisciplinary organisation of research is conducive to thinking outside the box and to innovation.

16 This has been influenced also by AHSC bids and the movement of CLAHRCs.
4) **All BRUs are placing a strong emphasis on community outreach work, and are acting as a hub for raising awareness about translational research among the general public and involving patient groups in selecting health research priorities.** Patient representatives sit on the BRU steering committees, scientific advisory groups, executive boards and/or patient panels, and are invited to attend management meetings, research away-days and other events. Some BRUs are implementing additional measures to maximise the impact of their patient and public involvement (PPI) activities, and to test their efficiency in terms of engaging patients and the public in the translational research agendas. Examples of such measures include planned formal evaluations of PPI strategies, efforts to involve schools and school children in BRU activities, the development of websites tailored to communicate information in a manner that is useful for both the patient and the professional, and plans to gather patient stories (as BRUs mature) to see how patient conditions are improved as a result of the application of the translational research enabled by the BRUs. At one campus we were told that the BRU scheme had influenced the trust and university to engage patients and the public at a scale they had never done before the BRU. Some BRUs also intend to engage patients in the preparation of a future BRC bid.

Table 6 (in the Appendix) summarises what BRU leaders feel to be the effects of the scheme on the emergence and evolution of new relationships in the health research system, with concrete examples from each initiative.
Summary: Via the BRU initiative, the NIHR is aiming to strengthen the capacity for translational research in priority disease areas that are under-represented in BRC portfolios, and where the UK has the potential to strengthen already established research excellence and ensure competitiveness for the long term. Capacity-building goals include improving the physical infrastructure required for moving research from bench to bedside, building up a critical mass of leading researchers capable of advancing translational research agendas over the long term, and ensuring a steady flow of funds needed to sustain research activity and accelerate movement through the innovation pipeline. In all three goals the BRU scheme is transforming the translational research landscape in England. One of the most significant contributions of the scheme has been support for research facilities and equipment that academic researchers and NHS clinicians are using to advance collaborative projects. NIHR funding for BRUs is also enabling the training of future translational research leaders, and is making a particularly important contribution towards opening new opportunities for NHS clinicians to be trained in and/or engage in research activity in a more structured manner than in the past. The training opportunities created via the scheme are complemented with support from other institutions nationally (e.g. research councils and charities). Many BRUs have also highlighted the positive effects of the initiative on obtaining funding from external sources (e.g. charities and industry). The scheme has also influenced trusts and universities to commit additional funds in support of BRU aims. In some cases trusts are pursuing the development of BRU-like arrangements in other research areas that they wish to strengthen, from their own resources and with additional contributions from university partners.

3.1 Physical infrastructure

1) At all of the BRUs, study informants felt that one of the most significant impacts of the scheme has been on the physical infrastructure. BRU funding has been used to create dedicated clinical research facilities, often located next to the relevant labs. It has also supported the development of imaging capacity, patient databases, bio-repositories and tissue-retrieval banks. In many cases these new facilities have been transformative. This infrastructure often exceeds anything interviewees had access to in the past. The interviewees felt that it provides the platform for the BRUs to be world class centres of excellence. These improvements in physical infrastructure have also acted as an early signal to staff of the benefits the scheme can deliver in terms of providing a more conducive environment for research. At one BRU we were told that the scheme is
also supporting the development of more integrated ICT infrastructure between the university and the trust, linking information gathered across the research groups, and linking into the NHS data system. This was seen as a very important advancement in overcoming previous blockages to information sharing.

2) **Translational research may require expensive dedicated equipment, and the lack of such equipment can create bottlenecks to translation.** Capital funding from the BRU scheme is helping overcome previous barriers in this regard, together with additional capital funding from other sources. In some cases trusts have matched the resources the NIHR has committed, and there has been additional capital support from other charities and research councils.

3) **New physical space and equipment dedicated to translational research is bringing biomedical and clinical researchers closer together, and facilitating better communications that are expected to accelerate research translation.** Although not all BRUs have facilities colocated on the same site (due to space limitations), open access to common facilities for basic science and clinical research is enabling more fruitful exchanges of knowledge and ideas and promoting greater operational efficiency.

Table 7 (in the Appendix) highlights some of the key developments in physical capacity for translational research that the BRU initiative is enabling, at each campus.
3.2  The acquisition of new capabilities

One of the core aims of the BRU scheme is to build a critical mass of researchers in places where there was already internationally recognised expertise in a priority research area, but where research groups were small compared with the scale that exists at BRCs. The scheme aims to “build on the best”\(^{17}\) so that researchers can improve their capacity to conduct translational research in disease areas under-represented in other initiatives of the NIHR portfolio (e.g. in BRCs), and prepare for a successful BRC award in a future bidding round. The BRU scheme is making important contributions to the acquisition of new capabilities for translational research through its impacts on recruitment and retention and on research training.

3.2.1  Impacts on recruitment and retention

1) **Designated BRU funding ring-fenced for translational research is being used to recruit and provide salary support for both academic and clinician researchers, as well as support staff.** All BRUs have made significant progress with recruitment in a relatively short time, filling in positions for chairs, academic researchers, clinical research fellows, research nurses and support functions (e.g. technicians, BRU managers, database and biobank managers, administrators and research coordinators). In some cases recruitment has taken longer than anticipated because of the need to find the most efficient contractual arrangements for staff (e.g. to deal with the transfer of funds from the NHS to the university to manage differences in salary bands between trusts and academic organisations) and because some appointments could not be made until the requisite physical infrastructure was in place. At present, most BRUs have appointed at least half of the positions they intend to recruit to the BRU, and in several cases more.

2) **Interviewees felt that the recognition of excellence given by BRU status, as well as the improved physical infrastructure, is increasing the attractiveness of their environment for people interested in translational research, and is helping recruit a better class of experts both nationally and from overseas than would have been possible without the scheme.** Although many interviewees felt that it was too early to provide concrete evidence of the impacts of the scheme on staff retention, in two cases we were told that it is now easier to persuade people to stay at BRU locations because of the new and exciting prospects the units offer in terms of their career development.

3) **BRU funding is being used to provide NHS clinicians with designated research time in their job plans.** At most BRUs, clinicians can now do research as part of their programmed activities. We were also told that research experience and interest now weighs more heavily in decisions to hire NHS consultants.

\(^{17}\) Department of Health (Research and Development Directorate), *Best Research for Best Health Implementation Plan 5.5: NIHR Biomedical Research Units*, version 4, London: Department of Health, August 2008, p. 2.
3.2.2 Research training and development

1) The BRU scheme is having a significant impact on improving opportunities for training in translational research in the UK health research system. At all bar three units where training is funded through other sources, we were provided with evidence of BRU funding supporting clinical research fellows, PhDs and MD training. At five BRUs, interviewees told us that the trust and/or university are committing parallel support for additional training posts. In addition to providing concrete training opportunities, the BRU scheme is, crucially, establishing a pathway for the career progression of the next generation of research leaders. At all BRUs, informal training also takes place through seminars, research forums and other events. Funding for training provided through the BRU scheme is complemented by other national training schemes which are running in parallel. These include NIHR doctoral research fellowships, post-doctoral fellowships, career development fellowships, senior research fellowships, and integrated academic training awards including academic clinical fellowships. Academic-clinician training fellowships are also supported by charities, e.g. the Wellcome Trust, British Heart Foundation (BHF), the MRC and other research councils, e.g. the Biotechnology and Biological Sciences Research Council (BBSRC) and Engineering and Physical Sciences Research Council (EPSRC).

2) Interviewees also noted the importance of research training opportunities for nurses and allied health professionals. This is an area where further developments can be pursued, but where the BRU scheme is already enabling some progress. The UKCRC Sub-Committee for Nurses in Clinical Research published a report in 2007 that outlined a number of practical approaches that would enable nurses to pursue a research career and combine clinical and academic work. At six BRUs we were told of the importance of research nurses for taking forward the BRU agendas, and of the importance of on-the-job training in developing a cadre of research nurses specialised in a distinct disease area.

Table 8 (in the Appendix) provides an overview of the roles of the BRU scheme in building a critical mass of translational research experts, through support for recruitment and training.

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3.3 The impact of the BRU scheme on improvements in the funding environment for translational research

The BRU scheme is helping improve the availability of finance for translational research endeavours.

1) There is a general agreement among the trust and university stakeholders that we spoke to that the BRU is significantly improving the funding environment for translational research. The impact of the scheme is accentuated by the current economic climate because charities have less money to invest. Most interviewees said that the scheme has significantly boosted the research funds at their disposal, and some emphasised that it is not only the amount of funding provided by the scheme that matters but also its nature – BRU funding is targeted and ring-fenced, enabling better long-term planning of research programmes.

2) At seven BRUs we were told that the scheme has already enabled additional funding to be leveraged from external sources, including charities and industry. Although it is difficult to attribute additional funding directly to the existence of a BRU, leadership representatives strongly felt that the BRU has been instrumental in success in leveraging additional funds for research and for physical capacity development. The recognition of excellence and contribution to physical capacity that the BRU scheme is enabling increases the credibility of the campuses and attractiveness for other research funders. In some cases we were told that reviewers of external grant applications have commented on the presence of a BRU as an enabling factor for achieving research goals in their peer-review feedback to applications. Overall, many BRU leadership representatives said that they have been more successful in attracting funds from external sources since receiving the BRU award.

3) At nine BRUs funding from the scheme has influenced the trust and/or university partners to commit additional financial support to the initiative. Five trusts are contributing to the establishment of shadow BRUs in other research areas that they would like to strengthen. In six cases the amount of funding added by the trust and university to support translational research matches or exceeds that provided via the BRU scheme.

Table 9 (in the Appendix) summarises the effects of the BRU scheme on improvements in the funding landscape for translational research, including impacts on leveraging additional support from sources other than the NIHR BRU scheme.
CHAPTER 4  The impact of BRUs on resource targeting, management and governance

Summary: New organisational structures, divisions and functions have been established to facilitate translational research, and NHS and academic stakeholders are improving their ICT infrastructure to improve communications. These changes are a reflection of a more business-like approach to research and of a commitment to developing clearer lines of responsibility and accountability.

1) The BRU scheme has transformed the way research resources are managed and governed in the NHS. It is widely felt that there is a lot more professionalism in managing research as an integral and important business activity of the trust, and within academia–trust partnerships. The allocation of research resources is better targeted and better matched to clinical needs than in the past. New structures such as joint research offices shared by academic and NHS partners and translational research steering committees are facilitating the pursuit of common agendas between universities and the NHS, and ensuring greater transparency and probity in the allocation of BRU funds to appropriate projects. BRUs have implemented formal processes for monitoring spending, and are developing internal mechanisms for tracking and reviewing research progress and performance. The allocation of resources in a targeted and transparent manner has also created far more opportunity for clinicians to get protected research time. A key message that trust leaders are filtering to clinicians is that they do not have a right under the BRU scheme to engage in own-account work which does not take into account translational research interests that the BRU supports.

2) Joint R&D offices are also providing administrative support to improve the efficiency and reduce the bureaucracy that accompanies translational research. Academic and clinical researchers can get help with applications for grants, ethical approvals and various aspects of commissioning. BRU leaders feel that it is essential that individuals with administrative responsibilities are appropriately trained in business and administration processes, rather than being placed into such positions from a pure academic or clinical background.

3) Most BRU leaders feel that the needs for accountability but also flexibility are well managed, and not in tension. The NIHR has been flexible in allowing BRUs to deal with difficulties in fully spending from year one budgets. BRU leaders have found this flexibility very helpful for the most efficient use of resources. In general, BRU management structures enable a sufficient degree of autonomy for BRUs to pursue their explicit remits, while at the same time ensuring a beneficial degree of integration and accountability to trust and university more broadly.

4) BRUs are bringing together a group of partners with common interests in research, and facilitating close interactions and communications. This is facilitated through research forums,
conference programmes, new multidisciplinary and multifunctional research groups, and in some cases through the establishment and modernisation of ICT systems enabling more integrated research (e.g. creation of IT systems that enable the better sharing of information between clinicians and university academics; the establishment of sophisticated electronic patient databases).

Table 10 (in the Appendix) provides examples of changes in organisational management and governance structures and communications systems that are enabling collaborative research, the better targeting of research resources and ensuring clear lines of responsibility and accountability in the health research system.
5.1 Taking stock

*Best Research for Best Health* was not an effort to create a hierarchically run research system and then to micro-manage its parts. It was an effort to use the stimulus of a clearly articulated set of policy goals with the weft of enhanced institutional capacity. Together, these were intended to strengthen a well-regulated, priority-responsive research system capable of contributing positively to the health of patients and the wealth of the nation. Consequently, any evaluation of BRUs should look first at their capacity to contribute to these goals, second to how these capacities have been used, and third at the consequences for health and wealth. We have seen that those in key positions in the BRUs widely believe that the scheme has enhanced research capacity, and they have a broadly coherent and plausible account of how these capacities will be used to deliver improved research and practice.

In short, although it is too early to expect, and therefore measure, tangible effects from BRU activity on patient health and well-being, the interview evidence suggests that the scheme is already helping create a more enabling environment for these benefits to be realised in due course. BRUs are leading to important changes in institutional relationships between the NHS and academic partners, increasing the focus of trusts and medical schools on engaging industry in innovation processes, and strengthening collaboration with other organisations (e.g. PCTs, CLAHRCs, other academic institutes and hospitals in the region in which a BRU is located and nationally). BRU funding is being used to improve physical and human resource capacity for translational research in priority disease areas and at locations which the award is supporting, and to build critical mass. The scheme has been a substantial driver of the better targeting, management and governance of research funding in the NHS. Across the board, there is a great sense of enthusiasm and commitment to the initiatives from all participants involved.

NHS trusts and universities have signed up to the same vision of translational research from bench to bedside and bedside to bench, and are interacting more closely than in the past. Even before securing funding, the process of applying for BRUs in itself played an instrumental role in the establishment of better coordinated and more strategic approaches to translational research collaboration. NHS and university leaders worked together to discuss, negotiate and decide on the most appropriate research themes for a BRU, and the best ways of leveraging their
complementary capabilities. The application processes often led to sharpening and narrowing down past research portfolios to concentrate resources on projects which were of the highest priority and potential to make a difference to patients. The relevance of research for patients has been the key concern in all BRU proposals that were put forward. There is also a stronger sense of joint ownership of research agendas by trust and university partners than in the past. The importance of research in the NHS has increased: this is a result of a broader portfolio of changes in NHS R&D, of which the BRU scheme is one important new initiative. The phasing out of Culyer funding and the move to the new NIHR funding models led many trusts to revisit the concept of trust-based research in terms of purposes, management, governance and operations. Research has become much more of a business line of trusts. There is a much stronger realisation of the links between the quality of research and the quality of care among clinicians, and more interest in collaboration with university scientists. Research translation is also higher up in the agenda of university partners: basic scientists are becoming more aware and interested in opportunities to work with clinicians.

The establishment of shadow BRUs – BRU-like partnerships outside disease areas directly supported by the NIHR – has been a positive side-effect from the scheme and a reflection of the commitment of the NHS and its academic partners towards joint working and capacity building in translational research. Some trusts and universities that have BRUs are trying to build critical mass and translational research excellence in additional disease areas essentially by replicating the BRU principles and business model with funding from the trust (and in some cases also university resources). These new ‘pillars of strength’ are hoped to be helpful in making the case for BRC funding in future rounds.

Collaboration with industry is also higher up on the agenda of trusts and medical schools than in the past. The NIHR expects BRUs to collaborate with industry to deliver health innovations, and central government is also promoting the importance of public–private sector relationships in biomedical and health R&D, for contributing to UK’s economic competitiveness. Most of the people we spoke to felt that the BRU scheme will have a significant impact on strengthening commercial partnerships, but that it is too early for this to have materialised as of yet. However, a number of early expressions of interest in collaboration have been received from the private sector, and in a few cases some new industry funding has been attracted.

BRUs are also adopting a more strategic approach to engaging other regional and national organisation in efforts to take research forward (e.g. academic institutions, hospital trusts, PCTs, clinical research networks, BRCs and CLAHRCs). In some cases, disciplines outside medical schools are being included in BRU activities. This is hoped to enable more interdisciplinary and innovative approaches to addressing translational research challenges. Lastly, actions to increase patient and public involvement in translational research are central to all BRU strategies, and community outreach activities are gradually becoming more comprehensive.

The combination of revenue and capital funding is catalysing progress in the priority research areas BRUs focus on. Via the BRU initiative, the NIHR is aiming to build critical mass and improve the capacity for translational research in priority disease areas that are under-represented in BRC portfolios, and where the UK has the potential to strengthen already established research excellence and ensure competitiveness for the long term. Capacity building goals include improving the physical infrastructure required for moving research from bench to bedside, building up a critical mass of leading researchers capable of advancing translational research.
agendas over the long term, and ensuring a steady flow of funds needed to sustain research activity and accelerate movement through the innovation pipeline. In all three dimensions, the BRU scheme is having a transformative effect on the translational research landscape in England.

One of the most significant contributions of the scheme has been support for needed research facilities and equipment that academic researchers and NHS clinicians are using to advance collaborative projects. This has included the establishment translational research space (biomedical and clinical research labs), the development of imaging capacity, patient databases, bio-repositories and tissue-retrieval banks, as examples. At some BRUs, the physical co-location of university researchers and clinicians on the same site and in the same building has been feasible, and BRU leaders feel this to be very important for more productive exchanges of knowledge and ideas, for accelerating translational research and for avoiding administrative and operational inefficiencies (e.g. duplication of effort).

Designated BRU funding ring-fenced for translational research is also being used to recruit and provide salary support for academic and clinician researchers, as well as support staff (e.g. technicians, nurses, administration). In some cases recruitment has taken longer than anticipated, but all BRUs have now made significant progress with filling in positions for chairs, academic researchers, clinical research fellows, research nurses and support functions including technicians, BRU managers, database and biobank managers, administrators and research coordinators. Most of the people we interviewed felt that the recognition of excellence the BRU gives, as well as improved physical infrastructure, is increasing the attractiveness of their environment for people interested in translational research, and is helping recruit a better class of experts both nationally and from overseas, than would have been possible without the scheme. Building a critical mass of experts and retaining them for the long term will be crucial for the sustained competitiveness in the research areas the trust–academic partnerships are pursuing.

NIHR funding for BRUs is also enabling the training of future translational research leaders, and is making a particularly important contribution towards opening new opportunities for NHS clinicians to engage in research activity in a more structured manner than before. There is financial support for clinical research fellows, PhDs and MD training, and BRU money is also being used to provide designated research time for NHS staff via programmed activities in their job plans. Training opportunities created via the scheme are complemented with support from other institutions nationally (e.g. research councils and charities).

There is a general agreement among the trust and university stakeholders we spoke to that the BRU is significantly improving the funding environment for translational research in their regions and in the disease areas they are tackling. Some interviewees felt that the scheme has significantly boosted the absolute amount of research income they have at their disposal, while others emphasised that it is not predominantly the amount of funding provided by the scheme that is the most significant improvement, but rather its nature: BRU funding is ring-fenced money awarded to the NHS partner, and this makes it unique and hugely important for motivating trusts to integrate research into their agenda more seriously than before, and for enabling NHS–academia research collaboration in areas that have a high potential to make a difference for patients. The significance of the scheme is further accentuated in light of the current economic climate in which charities have less money to invest in research. Some BRU leadership representatives feel that the scheme has already had a positive effect on attaining additional research funding from external sources (e.g. charities and industry). Trusts and
universities have themselves committed additional funds in support of BRU aims, in many cases matching the amounts provided by the NIHR.

The BRU scheme has also been successful in addressing historical inefficiencies in the targeting, management and governance of research resources. In the mid-1990s, under the Culyer reforms, NHS organisations for the first time distinguished between the costs of healthcare, R&D and training, and began to receive budgets accordingly. From 1996 trusts declared estimates of their annual R&D spend, and were allocated funds based on these estimates. R&D funds were divided into two budgets: one for research support costs and to fund ‘own account’ work, and the other to cover investigations in national priority areas not funded by other non-commercial bodies. However, it proved difficult to realise the desired levels of transparency in the costs and spend on research conducted by NHS trusts, and it gradually became clear that many trusts were cross-subsidising services with funds that were earmarked for research and/or research support. In 2004, the Department of Health called for funding recipients to make clear the exact use of their R&D budgets, and the 2006 BRfBH strategy pledged to increase transparency and accountability in the financial management and governance of NHS R&D. The conditions for receiving BRU funding were clearly specified and communicated to applicants early on in the bidding process. It was a priority in all bids to demonstrate that strengthened NHS–academic partnerships had the potential to establish more rigorous research governance and management structures to ensure better financial transparency, performance monitoring and research administration.

Most of the BRUs we examined have ambitions to become BRCs in the future, and intend to place a bid for BRC status in the next application round. However, very few BRU leadership representatives are clear about their chances of a successful bid, and some feel they are receiving informal mixed messages about the scope for becoming a BRC. More specifically, there is a perception of some lack of clarity in the differences between the remits of BRUs and specialist BRCs, beyond the fact that BRUs are more about a “new direction of travel, new build, new funding, new people” than specialist BRCs which “are building on existing programmes and capacity”.

Some BRU stakeholders see their initiatives as a pillar for future BRC bids, while others hope simultaneously to build up capacity in other disease areas in time for putting in a bid for comprehensive BRCs, or to apply for BRUs in additional disease areas in the future (should such possibilities arise).

5.2 Moving forward

BRUs are a complex scheme and part of an ambitious effort attempting not only a substantial shift in the attitudes of clinicians, academics and NHS managers, but also subtle changes in the intricate relationships between lab-based biomedical research, clinical research and the use of research results to improve clinical care. The scheme is building physical and human resource

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capacity for translational research at locations which have long been performing internationally recognised studies in specific disease areas. However, they may have lacked the critical mass, and in many cases facilities and equipment needed, to make a step-change in the scale of research they could conduct, and in the productivity and speed at which they can take research advances from the lab into the clinic. All of these ambitions take time to achieve: instant transformations cannot be expected. In addition, different BRUs have had different starting points, in terms of pre-existing resources and relationships that can facilitate translational research and innovation for patient benefit, and each is likely to be exposed to a mix of common and unique challenges and opportunities as they mature.

As is the case with most complex new initiatives, BRUs have been a learning experience for those involved. The learning process has included some experimentation to establish operational and administrative arrangements that are fit for purpose. The stage of incubating NHS-academia partnerships has also influenced BRU leaders to identify some areas where improved communication systems and infrastructures could help increase the efficiency and long-term impact of the initiatives. In addition, our interviewees expressed views on a number of broader policy related issues regarding the future of the UK health research system, which merit proactive consideration. We discuss these insights in turn in the sections below.

5.2.1 Key learning points

Integral to the learning process has been an effort to identify and implement the most effective financial, administrative and regulatory arrangements for BRUs. Trust and university stakeholders have devoted significant time and effort to managing the flow of funds between partner organisations, and finding creative ways to minimise the bureaucracy associated with research regulatory processes.

Managing the flow of funds between the NHS and university partners

Many trusts and universities have had to develop innovative ways to manage the separate flows of funding through the NHS and research, and this has been a steep learning curve.

For example, trusts and universities often have different HR policies and recruitment practices. Salary scales and employment bands sometimes differ and there are variations in the ways in which the past experience of applicants is acknowledged and weighted. This has in some cases proved challenging for recruitment. Some BRU leadership representatives from the university side of the partnerships felt that the agenda for change complicates recruitment of clinical academics into NHS posts. Most BRUs have found local ways to deal with these challenges, including the direct transfer of funds for academic salaries to the university, or the creation of parallel funding streams where one flow is managed by the trust and the other by the university. Administrative staff in joint R&D offices are also helping sort out contractual issues, are taking over the management of sub-agreements, and creating a single and streamlined channel for approving appointments.

At some trusts, gaining buy-in for the BRU vision from junior managers, accounting and finance staff was an educational effort and took time to achieve. This applies particularly strongly to BRU contexts where collaboration between the NHS and universities was historically either relatively
weak or haphazard and where operational staff had initial fears of research taking funds away from clinical service. BRU leaders and senior managers have been instrumental in successfully engaging junior operational managers and finance staff in the research agenda, in communicating the importance and relevance of research for trusts, and in training staff to have the requisite research management and governance skills.

A separate but related challenge that academic partners in particular are experiencing has to do with accounting for NIHR funding, in the context of making it accountable in the Research Excellence Framework (REF). Many universities are committing their flagship research groups and researchers to the BRU, and consider it important to ensure that NIHR income is recognised in their reviews.

**Tackling research process bureaucracy**

Many BRU leaders we interviewed recognised that there were several national initiatives trying to reduce the bureaucracy associated with clinical research and to streamline regulatory processes. The NIHR has established a series of ‘bureaucracy-busting’ implementation plans. However, there was also a degree of uncertainty expressed about when these changes would result in demonstrable easing in research process bureaucracy. To an extent, this will depend on how academic and NHS partnerships continue to adopt and implement the new initiatives NIHR is introducing, to deliver efficient and effective research management and high standards of governance.

NIHR initiatives include among others Governance Advice and Ethics Implementation; Ensuring Good Governance through Networks; the NIHR Coordinating System for Gaining NHS Permission (NIHR CSP), which standardises the process for gaining NHS Permission in England; the Integrated Research Application System (IRAS); research passports; a regulatory and governance advice service; research ethics; and NIHR Information Systems Programme implementation plans. The wider context includes Integrated Research Application System through which application for approvals from multiple bodies can be made, including applications through the NIHR CSP for permission to run studies at NHS sites working with the NIHR. It also includes the research passports which streamline the process of ensuring that non-NHS researchers have undergone appropriate checks before conducting research in the NHS, a regulatory and governance advice service, and information about training courses on issues such as research ethics, preparing for inspections and audits by regulatory bodies, GCP and the EU Directive, and standard operating procedures.

Most BRU leaders interviewed acknowledge that these efforts should help curb the external bureaucracy associated with research regulation. However, filling in application forms is still extremely resource intensive. Most trust and university leadership representatives think that well-
trained administrators to deal with these processes are essential in the staff cadre. BRUs are also trying to develop more streamlined internal processes for producing and supporting grant applications to external funders.

Despite the challenges related to research regulation, some of the BRU leadership representatives we met were also quick to highlight that the level of bureaucracy associated with BRU specific efforts is no higher than for other research endeavours, and one interviewee emphasised that it is “not even half of what it is when we get similar support form certain charities or research councils”.

5.2.2 Communication strategies to facilitate the next stages of BRU evolution

Networks for interactive and collective learning are crucial in mediating the flow of knowledge and information. The process of setting up BRUs has led NHS and university stakeholders to identify some areas where improved communication systems and infrastructures could further help increase the efficiency and long-term impact of the initiatives. Information flowing through the health research system is fundamental to its success and effective communications strategies can support this.

Communicating, sharing and learning from the experiences of others

Many of the operational and administrative issues that each BRU has been dealing with during incubation stages have been dealt with successfully elsewhere (e.g. at BRCs, international organisations and other BRUs). However, stakeholders have often not been aware of this. BRU leaders suggested that it would be very helpful to have more interaction and a greater support network between BRUs throughout the country, as well as between BRUs and BRCs – so as to learn from each other’s experiences. Many interviewees suggested that an online forum could facilitate this. Although some BRUs talk to each other informally (particularly if they are in the same disease area or in the same region), it is thought that a more formalised platform for systematically reflecting on mutual experiences across the entire health research system would be a useful aid in informing future development, and avoiding duplication of effort.

Interactions with the NIHR

Best Research for Best Health has introduced a broad range of complementary initiatives, and knowing how the various initiatives interrelate and complement each other, as well as having clarity about various funding streams and eligibility criteria, was seen as important for making optimal use of the resources and opportunities available in the health research system. Although BRU leaders are aware that information on each of the new efforts is available in the public domain, many feel that it would be helpful if it could be presented in a somewhat more user-friendly and amalgamated format (such as a handbook or set of guidelines for busy chief executives, medical school deans, and academic and clinical staff).

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There were also suggestions raised during our interviews about the possibility of the NIHR learning from BRCs and BRUs about their information requirements, and especially as they concern upcoming renewal rounds and future BRC or BRU bids. Many of the directors we spoke to felt that it would be helpful to receive slightly more detailed specifications about what is likely to be funded in future bids (particularly in terms of scientific research priorities within specific fields and disciplines), so that they can make the best possible case and focus on areas which the NIHR also sees as priorities.

There was a separate but related point raised about the relationships between BRUs and local CRNs. Many BRUs are very well embedded in local networks, but some have expressed a lack of understanding of DH policy on funding NHS service support costs and the eligibility criteria for inclusion on the NIHR CRN portfolio.

5.2.3 The wider underpinnings of successful BRUs

BRUs operate within a wider context that influences the supply of resources for research and the demand for research to inform policy and practice. Attending to their vitality and mitigating some of their uncertainties will also support the success of the BRUs. Interviewees identified a number of such broader policy related issues regarding the future of the UK health research system, which we outline below.

Retaining the pharmaceutical industry in the UK

The regulatory bureaucracy associated with clinical research, the costs of trials, difficulties in the recruitment of patients and increased competition for industry investments and collaboration from South East Asia, India and Eastern Europe all present challenges to retaining the pharmaceutical industry’s interest in the UK health R&D system.

Increased competition for retaining industry has meant that NHS and academic partners at BRUs are looking more strategically at what they can do and how they can create a research, operational and regulatory infrastructure that adds value to the pharmaceutical industry, over and above what competitors can offer. Some of the trust and academic leaders we spoke to highlighted that competing on cost is less likely (especially in the short term), but that focusing on quality, reliability and the efficiency of services offered is more likely to be a successful differentiation strategy. There was a general agreement among those we spoke to that trial sponsors need access to one-stop shops with centralised and coordinated regulatory management systems (for example, help with ethics approvals, network functions, supply of patients). Some felt that BRUs could present such one-stop shops, but others said that this infrastructure is generic and probably better suited to a larger level of aggregation than the BRU.

The DH has recently implemented several policies and initiatives to address poor coordination of clinical trials, and to reduce costs and time-delays in getting studies going. In addition to efforts like the NIHR CSP, the DH has also launched an initiative to try to double the number of NHS patients in trials over the next five years. There are efforts to create a centralised record of patients participating in trials, and to record changes in patient participation over time (e.g. as one indicator of the effectiveness of efforts by the Department of Health). Strategic health authorities
(SHAs) are now required to report annually on the number of patients that enter trials. The NIHR Clinical Research Network (CRN) services also hope to help improve the attractiveness of the UK environment for the health care industry. They aim to provide a centralised rapid point of access to the health care research infrastructure, reliable and quick assessments of study feasibility, standardised agreements and costing processes for studies adopted by members of the network, quicker patient recruitment, access to clinical and healthcare research expertise, and opportunities for faster product development through well-established collaborations.25

Mitigating uncertainties in the economic and political climate
Almost all BRUs have emphasised the importance of increasing the likelihood that the initiatives can withstand any risks to their stability and sustainability that may stem from uncertainties in the current economic and political climate. The schemes are seen as having high impact, serving as platforms for translational research in a broader range of areas than those directly supported by the NIHR and are leveraging additional funding from external sources. We were told they are transforming the capacity of many trusts and universities to engage in research and address not only national health issues but also key priorities for their local populations. One of the key policy relevant questions that has emerged from our interviews is to do with finding the most appropriate and effective ways to communicate and market importance of these initiatives to central government decision-makers, to ensure stability and sustainability. Ensuring that the momentum that is being gained continues and that the innovation pipeline is not disrupted is as important as the sustainability of initiative BRUs in the coming years.

Equally important is what BRUs themselves are doing to plan for potential uncertainties. At two BRUs we were told that commitments have been made by the partners to provide long-term posts (e.g. tenure) for senior academics who have been recruited to the BRU, in the hopefully unlikely case that funding is not renewed. Others however feel that if their funding was not renewed, they would have to change their approaches to recruitment and training (e.g. recruit less). Some interviewees were of the view that a little bit of uncertainty in the funding environment and in prospects for renewal of their BRUs may be helpful in driving improvements at their centres and encouraging all involved in the BRU to work as hard as possible to minimise any chances of the loss of funding.

Concentrating or distributing resources in the health research system
The debate around whether concentrating research resources in established centres of excellence, or redistributing resources to build capacity in regions outside the ‘golden triangle’ of London, Oxford and Cambridge, works better for social and economic well-being and UK’s long-term international competitiveness continues. It is also not surprising that there is a wide variety of views on the matter across the BRU leaders we spoke to. In particular, those in trusts and universities who are financially better off now than in the past because of the BRU initiative are generally in favour of the national redistribution of health research funding, although they were often also in favour of concentration within their own regions. There are others (particularly from established centres of excellence) who argue that the UK has for decades built international competitiveness in the global knowledge economy by concentrating resources in areas with a history of critical mass, size, scale, established networks and ability to attract leading experts. An

25 Source: http://www.ukcrn.org.uk/index/industry/benefit.html
important policy issue has to do with whether critical mass has to be in a single place or whether it can be distributed. A number of other related questions were prompted by the interviews. For example, how do we assess the value of supporting different tiers of excellence in the health research system, and when is the best time to assess this value? Is it more effective to continue to fund specialised BRUs or to encourage them to build up towards more comprehensive partnerships? What is the tipping point from BRUs to BRCs – what is the requisite critical mass? There was wider agreement that the balance between concentration and diversity needs to be carefully struck if UK research excellence is to be maintained, and that all awards of funding should be made on merit first and foremost. Some BRU leadership representatives also emphasised that it is crucial for panel committees to be able to distinguish between inherently good bids for awards in terms of content, versus well-marketed and well-sold bids.

Measuring success

As with BRCs, BRUs also raised the importance of having clear criteria and metrics to measure success. The NIHR is establishing a performance management framework and a set of performance indicators for the initiatives it funds. Key issues in the development of appropriate indicators include demonstrating relevance to the concrete aims of an initiative; avoiding the wrong incentives such as wasteful behaviour; attributing measures to specific actions and organisations; generating a balance of well-defined measures to allow consistent data collection across the spectrum of BRUs; ensuring timely data collection; encouraging realistic expectations from assessors; and having reliable sources of information. It is widely agreed that performance indicators should measure not only productivity but also the impact on health services and the difference being made for patients.

There is broad agreement among those we spoke to that new performance metrics tailored to translational research are needed in health research systems globally. At present, measures of research quality are largely based on publication volumes and bibliometric indicators, numbers of PhDs and research income. Most BRU leaders feel that these indicators do not measure translational research outputs and impacts very effectively. In leading journals it is basic research that is most often published. A lot of patient-related research does not have high-impact journal outlets. There is an acknowledgement that the NIHR is being proactive and engaging in stakeholder consultations to try establish appropriate metrics for translational research outputs and impacts. BRU leaders were keen to emphasise that it is important to consider realistic timeframes for adjudicating performance, and metrics that can take into account the unique circumstances under which individual NHS–academia partnerships have engaged in the BRU initiative. There were questions regarding the need for clarity in terms of how different units will be judged against each other, as well as what will happen during a transition period (be they successful or not). BRU leaders thinks that regular and timely feedback from the NIHR on their performance and progress is crucial for successful renewal, and that site visits are an effective way of monitoring progress and ensuring interactive feedback and dialogue (in addition to more formal metrics).

26 Because reward structures for investigators are often determined based on assessments of research quality, the metrics used to assess clinical research can also be a barrier for effective clinical trial activity. For example, multi-centre large-scale trials allow for the most conclusive results, but the rush to publish and get accredited with authorship is, in some contexts, still perpetuating smaller trials which provide less conclusive results.
Many of the directors we spoke to felt that they should be engaged in the process of determining suitable and realistic metrics and milestones for BRUs specifically together with the NIHR, and that metrics should measure process achievements as well as outputs. Some BRUs are developing their own internal performance monitoring scorecards. Most trust and university leaders involved in the BRU feel that the proposed timeframe for the delivery of benefits for patients is very short, and that setting up the foundations for BRUs in terms of physical infrastructure and recruitment has taken a bit longer than anticipated. However, taking the time to incubate the BRUs is felt to have been helpful in getting the foundations right, and has allowed trust and academic leaders to reflect on development strategies and priorities in a way that was not achieved in the past.

To help manage expectations of central government, many interviewees felt that NIHR may want to consider “ramping up the public relations machine to make clear that realism is needed when driving towards treatment”. There was a general agreement among those we spoke to that whereas “politicians want to see results and want them within a term of office, that’s not compatible with any translational research outcome in terms of definite deliverables such as a cure for cancer”.

Including nursing and allied health professionals in the health research system

The BRU scheme is about capacity building and the integration of research and service delivery, with both research advances leading to improvements in service, and service needs informing research agendas.

The UK Clinical Research Collaboration (CRC) Sub-Committee for Nurses in Clinical Research (chaired by Janet Finch) published a report that proposes practical ways forward to enable nurses to pursue a research career, and to combine clinical and academic work.27 Despite this, most interviewees emphasised the need for increasing research training opportunities for nurses and allied health professionals, and saw it as an area where further momentum can be gained and capacity in the health research system built up.

5.2.4 In conclusion

BRUs are part of an ongoing and larger effort (which includes other flagship NIHR initiatives such as BRCs and CLAHRCs, as well as other government initiatives such as AHSCs) to create a sustainable, effective health research system in which research is driven by the needs of patients and the public. The enthusiasm of leading figures within BRUs is evident from this report. There is a widespread agreement among interviewees that BRUs can make a positive contribution to the health research system in the UK and that they are already changing institutional relationships between the NHS, academia and industry. They are building capacity and are part of efforts to improve resource targeting and governance in health research. All the people we spoke to

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expressed unwavering commitment to the initiative, which is widely seen as a brave new effort on the part of the Department of Health, with significant potential for patient benefit.
Appendix of tables
### Table 3. The impact of the BRU scheme on NHS–academia relationships

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<thead>
<tr>
<th>Biomedical Research Unit</th>
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<td><strong>Cardiovascular disease</strong></td>
<td>Although relationships between the trust and the university had been improving in the years before the BRU was awarded, there was a feeling that engagement was not as synergistic as it might have been. In cardiovascular research specifically, the William Harvey Research Institute (WHRI), which is the basic science engine for the BRU, was already in existence and had very strong basic science research capacity, but few links into clinical practice. Collaboration tended to involve &quot;coming together briefly for one project and then coming together in another way for something else… in strategic terms, initiatives were somewhat random&quot;.</td>
<td>The negotiations that occurred between trust and medical school stakeholders during the application process for a BRU have been very significant for bringing the two organisations closer together around a common agenda, and improving means of communication. One interviewee felt that &quot;the mere application process thrust [the trust and university] together… in a far more cohesive way than we had ever been before…&quot; As a result of concurrent applications for BRU and AHSC status, the trust and university engaged for the first time in the development of a unified cardiovascular disease strategy.</td>
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<td><strong>Gastrointestinal disease</strong> (hepatology)</td>
<td>Historically, there was little cooperation between the NHS and its academic partners in Birmingham. Going back 5 years, the university and trust &quot;had real problems in terms of the two institutions not talking to one another… at times it felt like they were fighting…&quot; This was partially due to personality issues (in particular the adverse dispositions of the medical school dean at the time towards clinical medicine). There were a few exceptions (e.g. hepatology, endocrinology) to the overall weak collaboration landscape. In hepatology, links between the university and the hospital were strong before the BRU, partly because the liver unit had always been run by physicians and surgeons with an academic bias. In the years leading up to the BRU, organisational changes in the trust and university began to have an impact on improved relationships between the organisations. A new administrative structure was established in the medical school, and new people were put in charge of the trust. A Wellcome Trust clinical facility and the Birmingham Clinical Research Academy (a joint venture between the trust and university) were established, and have played an important role in increasing NHS–medical school collaboration.</td>
<td>The process of applying for the BRU helped strengthen the spirit of collaboration. According to trust leaders there is now a general feeling of &quot;look at what we can do when we work together&quot; among the partners, following the successful outcome of the BRU bid. Positive relationships between individuals in leadership positions at the trust and medical school have also been important in bringing the two organisations closer together within the BRU. Changes in the ways clinicians work are a reflection of the impact of the scheme. The BRU is funding clinical research fellows to spend half their time working in clinical service, and the other half of their time engaged in research studies and running trials. The BRU recruitment strategies are also strengthening the engagement of nurses in the research agenda.</td>
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Historically, there were significant problems of coordination and communication between the trust and the university, and indeed wider elements of the NHS in Bristol (for example, three acute trusts in Bristol behaved as competitors rather than collaborators). There was a fair deal of piecemeal collaboration between the NHS and the university driven by individual academics on the back of the grants they held, but the organisational level relationships were rather weak.

Significant improvements in interactions between the trust and university began to materialise in more recent years, even before the BRU. These were largely facilitated by the merger of two separate trusts (Southmead and Frenchay) into a single entity, and by changes in the divisional structure of the hospital (a conversion from 14 small directorates into five larger ones). The university and trust stakeholders started regular discussions about developing a joint research strategy for Bristol. NHS and academic leaders think that this improvement in relations facilitated a successful BRU bid.

The area of cardiovascular disease was an exception to the historically weak collaboration landscape. Interactions between the NHS and university in translational research were stronger in this area, and relationships much more amicable. There was a lot of surgically driven cardiac translational research activity. A lot of the basic science research was clinically directed.

Most of the interviewees felt that the BRU has led to fundamental changes in the attitudes of the trust and university towards collaboration and translational research, building on Bristol’s acknowledged strengths in cardiovascular disease research that were already in place. The BRU concept is helping remove some historical institutional rivalries (e.g. over use of clinical facilities), and NIHR funding is seen as something prestigious that clinical and academic researchers aspire to. There is a sense of opportunity to capitalise on the new translational research funding prospects the NIHR has brought. “Everybody from the jobbing NHS clinician running his or her clinic and wishing they could do some research, down to the basic scientist in a laboratory somewhere miles away from clinical application… both those types of people… have realised that there is a massive opportunity here, and that they won’t be able to participate in that opportunity unless they join up with other people across the spectrum.” However, there was also a sense that collaboration is happening at a somewhat slower pace than they would like, and one interviewee felt that there is still scope for improving collaboration between the partners.

Overall, a significant impact has been that of raising awareness about collaborative research opportunities and research importance among clinical staff. Research is much higher up on the trust’s agenda than in the past.
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<td>Common to both BRUs at Royal Brompton and Harefield Trust and Imperial College: The purposes, management and governance of trust-based research have been revisited to ensure that all new research taking place in the NHS is relevant to clinical needs, and in line with the trust’s broader business strategy. The trust now has much better control of the allocation of research spend, to areas in line with its clinical strategy. These changes are not attributable to the BRUs alone, but rather to broader changes in the NHS R&amp;D funding environment. The failure of an application for BRCs was a wake-up call for the trust, to revisit their relationship with the university, and where and how they can be best aligned. The result is much greater clarity around respective complementarities. The scheme is also leading to a much more joined up and better coordinated collaborative research programme. In addition: &quot;as a consequence of the BRU, percolating up at each of the institutions is a greater awareness and respect of what each brings to the other&quot;: BRUs have a catalytic effect and are helping accelerate research translation: &quot;The volume of research the BRU supports is relatively small compared to the overall body of research funding the university and trust have, but its importance and anticipated impact is very high.&quot; In cardiovascular disease studies: The BRU is a centripetal force bringing academic investigators and clinicians working in cardiovascular research closer together.</td>
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28 The NHLI was incorporated into Imperial College London 10 years ago.
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\(^{29}\) The NHLI was incorporated into Imperial College London 10 years ago.
Biomedical Research Unit | NHS–academia relationships in pre-BRU times | Changes in NHS–academia relationships driven by the BRU scheme
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Leeds Teaching Hospitals NHS Trust and University of Leeds | Research was generally seen as an added extra for the trust in the past, “like an offshore company”. The R&D department of the trust was a rudimentary research group, and their research agenda was predominantly influenced by the university’s research interests: “The trust would generally just sign off university research applications.” Collaborations between the university and trust were generally driven by individuals (rather than being promoted at an organisational level), and they were based around emergent needs and opportunities. “It was less about organisations interacting and more about the university identifying key individuals within the trust who were willing to work in collaboration… there were some really quite good links but it was on an ad-hoc, person-to-person basis… there wasn’t a managed relationship between the trust and the university.” An exception to this landscape would be in some NHS areas that were academically lead (e.g. such as rheumatology, where an academic was a clinical director). An interviewee emphasised that one of the strongest motives for clinicians taking part in research has been seeing how some musculoskeletal diseases and conditions have over the years moved from being incurable to being treatable or curable thanks to research. However, there were few opportunities to engage actively in research in the past. | The process of applying for a BRU has promoted a sense of more equitable ownership of the research agenda by the trust and university. According to two of the people we interviewed, although university academics took the lead in establishing the scientific direction for the BRU, the trust took a far more active part in determining research themes than would have been the case in the past: the application was prepared through active engagements and continued discussion between trust and university leaders. Academic strengths, clinical service strengths and clinical need determined the priority areas to focus on in the BRU. Targeted NHS-based funding for translational research has been a highly effective stimulus for increasing the scale and scope of trust–university collaboration. Research is now seen as an essential part of trust business strategy, and senior trust leaders have placed a lot of effort towards communicating the importance of research to clinicians, and achieving organisation-wide buy-in. Programmed activities for research in consultant job plans are an opportunity that is being taken up with enthusiasm. More and more clinicians are collaborating with academics in research. There is also increased academic interest in the clinical applications of their research. “There are regular meetings, seminars and presentations of research with a room full of clinicians and NHS people as well as academics and… to be honest, it’s not always easy to tell who is who. And when we’ve got the discussion at the end, it’s sometimes not easy to know whether the person who’s just asked the question is a senior clinician or a senior academic or a senior academic-clinician. I think that’s been an important part of making this work.” Clinicians and academics are colocated on the same site, and the scale of collaborative and multidisciplinary project is increasing. |
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<td>University Hospitals of Leicester NHS Trust and University of Leicester Cardiovascular disease</td>
<td>In the area of cardiovascular research, collaboration between the trust and the medical school existed in pre BRU times, but it was much more ad-hoc than it is today. Over time, the levels of collaboration and joined up thinking have increased, and this has been largely facilitated by the appointments of leaders interested in collaborative translational research, and by changes in the national funding landscape and government strategy for funding research.</td>
<td>The Leicester BRU is less than 3 months old, because it went through a deferred application process. Putting together the bid for BRU status for cardiovascular disease has undoubtedly facilitated closer and better coordinated interaction between the trust and university. The partners worked together to establish the best ways of leveraging their complementary capabilities and resources within the BRU, to remain competitive for the long term. Preparing the application was a highly worthwhile though challenging process: it was quite difficult to decide on which key research themes to select for the BRU, across a breadth of good research ideas, and how to integrate the themes into a coherent, synergistic and focused strategy. NHS employees have been brought into the translational cardiovascular research agenda more than in the past. The university and the trust have signed up to the same vision of translational research from bench to bedside, and have common expectations: the point of the BRU is for the synergy between the two partners to deliver advances for patient benefit, and for both involved parties to benefit from the partnership. A change in the university occurred in parallel to the development of the BRU, whereby the university moved from a departmental-based system to a theme-based system. This is influencing the ethos by which research is conducted in the university, allowing for a much more interdisciplinary research organisation. BRU leaders feels that this is an important enabler of translational research.</td>
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<td>Royal Liverpool &amp; Broadgreen University Hospitals NHS Trust and University of Liverpool</td>
<td>A strong commitment to the gastrointestinal disease specialty by university researchers and by clinicians has existed for a long time. Liverpool has an established strength in liver and pancreatic disease research. In this area, relationships between the university and NHS have been close for many years (and stronger than in other disease specialties). A clear research plan and strategy for achieving impact and making use of commercial opportunities was in place well before the BRU bid. The comprehensive strengths in gastrointestinal disease research ensured that collaborations between the trust and university developed sufficient critical mass over time to provide the basis for a successful BRU bid. “There was a considerably enabling framework already in place that involved the key investigators that are now part of the BRU. There was already more interface between the NHS and university in gastroenterology and especially pancreatic disease than in other specialties.”</td>
<td>Although the commitment to joint working was already present prior to the BRU, the scheme has further raised the profile and importance of collaboration between the trust and the university. It led to “a better organisation” of the existing “good-will”. There is a strong sense of commitment to the BRU by all participants, and this is part of a wider dialogue about harnessing opportunities for joint research between the NHS and academic partners. It is hoped that the scheme will help make sure that the existing critical mass of university and NHS researchers, and the scale of collaboration, is sustained and further strengthened. The clarity in funding arrangements within the BRU scheme has helped overcome some past challenges in determining who will fund collaborative endeavours. The BRU has also brought a developmental focus: it is a concrete opportunity to make major in-roads to pursue the aims that they have had in the past in a more structured way. The financial support provided by the NIHR is helping overcome gaps in national funding opportunities for translational and clinical research in the area of pancreatic disease. Translational research is now integral to the work of the university. The scheme has also helped clarify key areas for research focus and determine ways of ensuring critical mass for the long term. Although the university and trust leaders will inevitably disagree every once in a while because their jobs’ primary focus differs, the BRU is enabling them ultimately to articulate the same agenda and move it further</td>
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<td>Gastrointestinal disease</td>
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<td>Nottingham University Hospitals NHS Trust and University of Nottingham</td>
<td><strong>Gastrointestinal disease</strong> Common to all three BRUs at Nottingham: Relationships between the university and trust have historically been “reasonable”. However, collaborations in the past were more driven by individuals than by a clear organisational level strategy for collaboration. Collaborations were established informally. There were research areas where the trust had priority interests, and areas where the university was well established, but the research interests didn’t necessarily map particularly well together. Losing a BRC bid prompted the trust and university to work out how they can jointly facilitate further developing their areas of excellence, and how they can align their research better.</td>
<td><strong>Common to all three BRUs at Nottingham</strong>: The trust and university now have a much clearer vision of what each partner contributes, and of respective complementarities. The BRUs have provided clear incentives for the partners to align research priorities. The processes of applying to become BRUs and of incubating them have greatly facilitated closer relationships between the trust and university, and catalysed an increasing scale of collaboration. Organisation wide buy-in is being achieved because of the concrete provisions the scheme is enabling (financial, research-time related and infrastructure related). Obstacles to clinician engagement in research are being removed (e.g. through provisions of protected research time). Obstacles for academics to collaborate with clinicians are also being removed (e.g. by developing integrated ICT infrastructure, through the co-location of academic researchers and clinicians). In gastrointestinal disease studies: There is now a more formalised approach to collaboration between the trust and university, which makes it easier for academics and clinicians interested in gastrointestinal and hepatology research to identify and make use of opportunities for joint studies. The BRU scheme has helped expand the number of clinicians and academic researchers conducting translational research.</td>
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<td>In gastrointestinal disease studies: Most of the researchers involved in university–trust collaborations in the past were university employees with honorary contracts with the trust. They would source grant funding and then (in cases where the grant involved clinical research) pursue collaboration with the trust, with hospital patients and the hospital NHS R&amp;D department.</td>
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<td>Common to all three BRUs at Nottingham: The trust and university now have a much clearer vision of what each partner contributes, and of respective complementarities. The BRUs have provided clear incentives for the partners to align research priorities. The processes of applying to become BRUs and of incubating them have greatly facilitated closer relationships between the trust and university, and catalysed an increasing scale of collaboration. Organisation-wide buy-in is being achieved because of the concrete provisions the scheme is enabling (financial, research-time related and infrastructure related). Obstacles to clinician engagement in research are being removed (e.g. through provisions of protected research time). Obstacles for academics to collaborate with clinicians are also being removed (e.g. by developing integrated ICT infrastructure, through the co-location of academic researchers and clinicians. In respiratory disease studies: The BRU scheme has put the spotlight on translational research, and the research agendas of the university and trust have been “enormously refocused” as a result. Although the flavour of the bid for BRUs was university led, the trust provided strong support and buy-in, and made additional financial commitments to the BRU from its own resources. The BRU scheme has also pulled together a lot of research groups in the university that had some activity in the respiratory disease area in the past, but without respiratory disease research being their core focus. Because of the opportunities created via the BRU, respiratory research is become more and more of a focal point for these groups as well.</td>
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<td><em>Deafness and hearing</em></td>
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<td>In hearing and deafness research: Historically, the university didn’t have much of a research culture in hearing research. Most of the research was through the MRC Institute for Hearing (IHR) campus, and was largely basic research. Over the past 5 years, there has been a move towards engaging in the translational end of the spectrum as well. Clinicians interested in research would collaborate with the scientists at IHR, more so than with the university. Collaborations were driven by individuals getting in touch with each other. The university became interested in and committed to hearing research approximately 1.5 years before the BRU bid.</td>
<td>In hearing and deafness research: The BRU has galvanised the university and trust to place hearing and deafness research higher up in their research agendas. The hearing BRU is unique in that it is a three-way partnership between the university, trust and the MRC IHR.</td>
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<td>Nuffield Orthopaedic Centre NHS Trust and University of Oxford</td>
<td>Relationships between the trust and university have always been good, and this has partially been facilitated by the fact that some people with senior appointments at the university have also held senior positions at the trust, and have been at Oxford for a long time. This has enabled the development and nurturing of a common understanding of the clinical and academic perspectives and interests in collaboration, and facilitated communications between the two organisations. For example, the person appointed as the director of the BRU had been a professor of orthopaedics, a clinician and non-executive director on the trust board. The leaders of the trust and university have shared a sense of purpose in linking academia to clinical services. A culture of services being informed and brought forward through research is well established. For example, recruitment strategies of clinicians have for a long time considered how a person fits into not only clinical service, but also research and teaching. The trust is relatively small (approximately 200 beds, plus outpatient facilities) and specialised, and this has also helped enable collaboration with university research groups.</td>
<td>The BRU has developed on a foundation that was already in place. The scheme has led university and trust leaders to consider how they can further improve their ways of working, and to take new actions towards this end. Some of these actions include joint appointments of clinicians, and the possibility of buying back the time of clinicians for research rather than adding research hours onto normal working hours. Hybrid posts have been established with an additional commitment to ensuring their tenure (in the hopefully unlikely case that the BRU does not get renewed). The scheme is leading to progress towards an ever more integrated research system and infrastructure. The university has contributed additional resources (via its grants) to those committed via the BRU scheme. The relationships between different groups in the trust itself are also improving. Relationships between the Nuffield Orthopaedic Centre, its BRU and John Radcliffe are strengthening further by virtue of the scheme. The BRU has further formalised the importance of research in the trust and the common vision, through a direct and explicit programme for research flow. Clinical leaders are also leading in research thereby bringing all parties together.</td>
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### Biomedical Research Unit

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<th>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield Musculoskeletal disease</th>
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<td>Common to both BRUs at Sheffield: “New research governance rules (implemented between 2002 and 2003) made it crucial for the university and trust to work together.” This is because the trust started taking over responsibilities from the university as a result of the rules, including the contracting of clinical trials. For both musculoskeletal and cardiovascular disease, the trust has historically had an excellent reputation in clinical service (was awarded trust of the year two out of three times), but the reputation in research and education was less established. Administrative responsibilities and burdens of the trust R&amp;D director made it difficult to devote time to research agendas and strategy. The university always had a strong presence on the trust board. However, research undertaken by NHS consultants was unregulated, unstructured, and “anyone could do what they wanted with the notional amount of money coming in and time in the consultants’ contract”. The university and trust had very amicable relationships, but the medical school was historically responsible for most aspects of musculoskeletal and cardiovascular research (e.g. dealing with funding and costing, managing awards). The process of jointly contributing to funding (together with Wellcome Trust support), setting up and managing a clinical research facility (set up in 2001) helped bring the trust and medical school closer together in research-related activity.</td>
<td>Common to both BRUs at Sheffield: “The BRU has made [a return to research] happen.” The BRU has re-invigorated academic medicine. The two BRUs are also learning from each other and exchanging experiences. There is a degree of resource sharing between them, which enables economies of scale to be realised. This includes the sharing of databases and a bio-repository that is being established, of sample processing resources, as well as some staff (e.g. a common receptionist). The directors of each BRU are supportive of each other. The success with the BRU bids has also influenced the trust board to invest money in research, which it would not have before. The trust is playing an active part in including research in consultants’ job plans. The trust and university are now seeking to ‘reproduce’ the BRU model and impacts in other areas outside musculoskeletal and cardiovascular research. In musculoskeletal diseases; The BRU has placed musculoskeletal research much higher up on the agenda of the trust than in the past, and is having a significant influence on strengthening the relationship between the trust and academic staff in this field, organisation wide. If it works, the BRU model is likely to be adopted in other disease areas as well</td>
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| Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield  
Cardiovascular disease | Common to both BRUs at Sheffield: “New research governance rules (implemented between 2002 and 2003) made it crucial for the university and trust to work together.” This is because the trust started taking over responsibilities from the university as a result of the rules, including the contracting of clinical trials.  
For both musculoskeletal and cardiovascular disease, the trust has historically had an excellent reputation in clinical service (was awarded trust of the year two out of three times), but the reputation in research and education was less established. Administrative responsibilities and burdens of the trust R&D director made it difficult to devote time to research agendas and strategy.  
The university always had a strong presence on the trust board. However, research undertaken by NHS consultants was unregulated, unstructured, and “anyone could do what they wanted with the notional amount of money coming in and time in the consultants’ contract”.  
The university and trust had very amicable relationships, but the medical school was historically responsible for most aspects of musculoskeletal and cardiovascular research (e.g. dealing with funding and costing, managing awards). The process of jointly contributing to funding (together with Wellcome Trust support), setting up and managing a clinical research facility (set up in 2001) helped bring the trust and medical school closer together in research-related activity. | Common to both BRUs at Sheffield: “The BRU has made [a return to research] happen.” The BRU has re-invigorated academic medicine. The two BRUs are also learning from each other and exchanging experiences. There is a degree of resource sharing between them, which enables economies of scale to be realised. This includes the sharing of databases and a bio-repository that is being established, of sample processing resources, as well as some staff (e.g. a common receptionist). The directors of each BRU are supportive of each other.  
The success with the BRU bids has also influenced the trust board to invest money in research, which it would not have before. The trust is playing an active part in including research in consultants’ job plans.  
The trust and university are now seeking to ‘reproduce’ the BRU model and impacts in other areas outside musculoskeletal and cardiovascular research.  
In cardiovascular diseases: The BRU has led to a more coordinated strategy for collaboration between trust and university staff in cardiovascular research. |
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<td>Southampton University Hospitals NHS Trust and University of Southampton</td>
<td><strong>Nutrition, diet and lifestyle</strong></td>
<td>Common to both BRUs at Southampton: Collaboration between the trust and university was historically quite strong due to a mixture of personalities and the context in which the trust and university operate (specifically collocation). However, at both BRUs, collaboration was historically driven by individuals rather than an explicit organisational level strategy for collaboration. Individuals would link up with each other as appropriate, based on their own initiative. The hospital was perceived as a big district general hospital (DGH) that happened to have a university next door, and that did some research. Over the past few years, a stronger organisational level focus on collaboration has developed, largely driven by the establishment of a joint research strategy for the trust and academic partners. In nutrition research: Collaboration between the university and the trust has historically been somewhat stronger for the nutrition than respiratory research areas. This is largely attributed to differences in the nature of research activity in the two fields. Researchers at the Institute of Human Nutrition (IHN) were involved not only in research but also in training dieticians, nurses and medics. This helped develop good links with clinical service.</td>
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<td>Southampton University Hospitals NHS Trust and University of Southampton</td>
<td><strong>Respiratory disease</strong></td>
<td><strong>Common to both BRUs at Southampton:</strong> Collaboration between the trust and university was historically quite strong due to a mixture of personalities and the context in which the trust and university operate (specifically collocation). However, at both BRUs, collaboration was historically driven by individuals rather than an explicit organisational level strategy for collaboration. Individuals would link up with each other as appropriate, based on their own initiative. The hospital was perceived as a big District General Hospital (DGH) that happened to have a university next door, and that did some research. Over the past few years, a stronger organisational level focus on collaboration has developed, largely driven by the establishment of a joint research strategy for the trust and academic partners. In respiratory research: There was a lot of activity in the university in respiratory research, but less so in the trust. Respiratory studies were mostly focused on basic science and some translational research led by university academics. \n\n<strong>Changes in NHS–academia relationships driven by the BRU scheme</strong></td>
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## Table 4. Impact of the BRU on changes in the nature of the research portfolio

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| Barts & The London NHS Trust and Queen Mary, University of London  
*Cardiovascular disease* | The BRU investigates novel translational strategies for primary and secondary prevention of cardiovascular disease. This includes novel approaches to stem cell therapy for the prevention of progression to heart failure; investigating candidate molecules which may limit ischemia reperfusion injury; and studies into the effect of dietary nitrate on blood pressure and cardiac function.  
The BRU is enabling more interdisciplinary research than existed in the past. There is support for researchers from a wider variety of backgrounds, although all with experience in cardiovascular disease related research.  
Interviewees were keen to emphasise that Barts & The London has historically had a strong track record in terms of patient and public engagement. Nevertheless, a patient expert group has been founded to support the BRU’s work, and is being led by a patient who had previously been participating in clinical trials. The BRU leaders also intend to create some additional engagement and dissemination strategies for the unit to maximise patient participation. |
| University Hospital Birmingham NHS Foundation Trust and University of Birmingham  
*Gastrointestinal disease* | The BRU application process led both the trust and the medical school to identify flagship areas where they had excellence in basic science and in service delivery, and to establish a focused plan for how they could do translational that could benefit patients, together. Some important close-to-patient work in hepatology would probably not have happened if they hadn’t received the BRU. One interviewee commented: “It’s an enabling facility by putting in place dedicated people with dedicated funding, to tackle liver disease… I would have stopped trying to do any kind of cell therapy work in patients if it hadn’t been for the BRU.”  
The scheme is also enabling more *interdisciplinary* research than existed in the past. There is a broad mixture of investigators involved in the BRU (e.g. endocrinologists, oncologists, immunologists).  
Researchers in the BRU focus on the translation of the understanding of the molecular basis of liver injury into therapies for chronic liver disease. The key themes of the BRU are novel treatments for hepatitis C virus; cellular therapy of chronic inflammatory disease; and early diagnosis and treatment of hepatocellular carcinoma. |
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| United Bristol Healthcare NHS Trust and University of Bristol  
*Cardiovascular disease* | The BRU has re-enforced the focus of collaborative research on research for patient benefit. The core themes for BRU research are protecting the heart and patient during cardiac surgery; interventions to prevent vein-graft failure; clinical implications of fibrin degradation products during MI, bleeding and trauma; therapeutic angiogenesis and stem cell research; autonomic function in children undergoing cardiac surgery; and vulnerable atherosclerotic plaques. |
| Royal Brompton & Harefield NHS Trust and Imperial College London  
*Cardiovascular disease* | Common to both BRUs at Royal Brompton and Harefield NHS Trust and Imperial College: The focus of the research strategy has been established based on patient/disease area needs first and foremost, and complementary strengths and interests of the trust and university partners. Patient and public involvement (PPI) are key components of the BRU's strategies for taking forward the research agendas.  
In cardiovascular disease: The BRU has allowed provided targeted resources for research in cardiac regeneration and cardiovascular genetics. These are two areas of cardiovascular clinical research where the need for advancements is very high, and where Royal Brompton is well placed to make a difference for patients. |
| Royal Brompton & Harefield NHS Trust and Imperial College London  
*Respiratory disease* | Common to both BRUs at Royal Brompton and Harefield NHS Trust and Imperial College: The focus of the research strategy has been established based on patient/disease area needs first and foremost, and complementary strengths and interests of the trust and university partners. PPI are key components of the BRU's strategies for taking forward the research agendas.  
In respiratory disease: The BRU is developing six consortia of scientists and clinical teams to develop lead products they expect to translate into the clinic in due course. The consortia are being established around six advanced lung diseases. |
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<td>Leeds Teaching Hospitals NHS Trust and University of Leeds</td>
<td>The BRU has led to a stronger focus on how academic research strengths and clinical service strengths can be integrated into collaborative research in a way that can best benefit patients. The types of research collaborations taking place are far more translational in nature than was the case in the past. The university and trust partners are moving away from discipline focused research to more thematic research. The priority area of focus for the BRU is translational research into individually targeted, patient focused therapies across the musculoskeletal diseases. There are five key research programs and groups: musculoskeletal clinical research; bioengineering and surgical interventions; regenerative medicine; experimental rheumatology; and musculoskeletal imaging and tissue characterisation. The scale of collaborative and multidisciplinary project work is increasing largely because of the BRU. For example, researchers in the bioengineering BRU group collaborate with imaging researchers, physicists and orthopaedic surgeons.</td>
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<td><em>Musculoskeletal disease</em></td>
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<td>University Hospitals of Leicester NHS Trust and University of Leicester</td>
<td>The application process led to a sharpening of focus and ideas in terms of how the science can actually benefit patients and how basic science discoveries can translate into clinical practice. The funding strategies being promoted at the national level are influencing a greater interest in translational research by academic and clinical researchers. The BRU scheme is expected to extend its influence beyond those generating the research ideas or conducting research to those who are actually putting the research advancements into practice. There is an explicit strategy to increase public engagement in the research of the BRU and to increase the percentage of patients who participate in research activities (e.g. via communicating and mobilising patient participation in studies, in a biorepository, and in a bioinformatics database).</td>
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| Royal Liverpool & Broadgreen University Hospitals NHS Trust and University of Liverpool  
*Gastrointestinal disease*                                                                 | The BRU has been “utterly essential” in raising the profile of translational research in cancer and pancreatic disease. Historically, translational clinical pancreatic disease research was poorly funded, and this is now changing. One of the leadership representatives commented: “If it had not been for this investment, I don’t think that there would have been any prospect of significant advance for many years.”  
“...shift such that this cycle from bench-to-bedside and bedside-to-bench has really become much more clearly established and that has entrained a massive commitment not just from the university, but also the trust.” The BRU has facilitated clinical research to match the high-quality basic science which existed for a long time. It has offered a 'two-way street', firming up the links between clinical work and improvements in care, and hopefully health in the population. Previously the traffic was only one-directional, with basic science taking place on tissues from the operating theatre. “Scientists without clinical experience who are not talking to clinicians do not constitute adequate models: they cannot identify what is a suitable way to test whether or not a phenomenon observed is useful, etc.”  
The BRU also hopes to contribute to research and innovation flows by holding phase 1 and phase 2 of clinical trials.  
A PPI strategy is yet to be developed, and BRU leaders intend to apply lessons learnt from BRC experiences. There have been discussions around establishing a website that would be useful for both the patient and the professional. An effective PPI strategy for the region is pivotal for advancing pancreatic disease research. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
*Gastrointestinal disease*                                                                 | The BRU application process led the trust and university to re-examine the research portfolio and re-focus and concentrate on a somewhat narrower range of areas of international research strength where there is also a high clinical need for scientific advancements. Basic scientists are more engaged with patient based research than in the past.  
A patient representative will join the BRU Board. (In fact, all three BRUs at Nottingham will also be gathering patient stories as the BRUs mature, to see how patient conditions have been improved as a result of the application of translational research enabled by the BRUs.) |
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| Nottingham University Hospitals NHS Trust and University of Nottingham  
*Respiratory disease* | The research portfolio was determined based on an assessment of areas of unmet clinical need, areas of research strength at Nottingham, and especially how well they mapped together. Key diseases addressed in the research portfolio include asthma, chronic obstructive pulmonary disease (COPD), cystic fibrosis and pulmonary fibrosis. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
*Deafness and hearing* | There are four areas of research the BRU focuses on, all with patient benefit being the key driver of projects. The areas are: hearing and learning in childhood; cognitive aspects of auditory rehabilitation; auditory handicap in aging; and tinnitus. The BRU is unique nationally, and has included some very innovative aspects into its research portfolio (e.g. studying links between the loss of audibility and speech perception and intelligibility). The BRU research has a sociology angle, an education angle, and a learning to hear better angle. There are many strands of research, but underlying everything is the learning theme – this essentially has to do with learning how to teach people to use their hearing better (it’s like brain training). |
| Nuffield Orthopaedic Centre NHS Trust and University of Oxford  
*Musculoskeletal disease* | Musculoskeletal disease research taking place at Oxford is now driven primarily by a *clinical goal*, and is much more translational in nature than before: “The real advantage of this type of funding stream is that [someone] can go and find solutions to clinical problems that have not yet been solved… [with] an infrastructure that allows us to test to see whether or not the potential solution works”: (e.g. imaging, appropriate cohorts, access to materials with biobanks, assets in place to judge the efficacy of something new, and creation of biomarkers). Research themes were selected for high impact in common disease and programmes with rapid delivery were prioritised.  
Patient representatives are on the BRU Steering Committee, and there are regular patient forums to ensure that the research being taken forward is of relevance and benefit for patients. Patient representatives were involved in the application process.  
At a recent research evening programme 150 members of the public were told about back pain and management possibilities as well as research outcomes, and a copy of this is now on YouTube. A further series of events is planned to share what is coming out of BRU research with patients and members of the public, and solicit their feedback. |
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| Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield | Common to both BRUs at Sheffield: BRU leaders have recognised how important it is to involve patients in the research agendas and activities, and this is a significant improvement in PPI activity: “we didn’t do that at all before the BRU”. Having two BRUs has helped. There are 11 members on the patient panel for the BRU. The BRU is not yet at the stage where patients have been involved in prioritising the research; this should happen soon though, and will be facilitated either through presenting research to patients or through discussions with the Scientific Advisory Board.  
“The single biggest difference that the BRU will make and is making already will be to ensure that as well as what [the university is doing], there is a complete understanding of mission from the NHS… and that there is more engagement by academically minded NHS consultants.”  
In musculoskeletal disease: “The BRUs have reinvigorated academic medicine: “If you’re talking about strategic development of research, [two things] are terribly important: the infrastructure and generating the critical mass of people… [both] were fragmented [before the BRU] and it was very difficult to do [translational research] before we had this award.”  
The research focus areas for the BRU are anabolic agents; bone turnover markers; the attainment of peak bone mass; interactions between physical and pharmacological interventions; biochemical determinants of spine and hip fracture; and hip prosthesis loosening. |
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“The single biggest difference that the BRU will make and is making already will be to ensure that as well as what [the university is doing], there is a complete understanding of mission from the NHS… and that there is more engagement by academically minded NHS consultants.”  
In cardiovascular disease: “The BRUs have been a real acceleration [of translational research].” Prior to the BRU, there was a lack of funding for some aspects of research such as the evaluation of drugs, “which isn’t exciting for the MRC for example but it is a crucial part of what is done”. The BRU is focusing on coronary artery disease and on the causes of myocardial infarction, to enable the development of new risk assessments and treatment strategies, as well as to contribute to a better understanding of the mechanisms of action of existing therapies. |
| Southampton University Hospitals NHS Trust and University of Southampton  
*Nutrition, diet and lifestyle* | Common to both BRUs at Southampton: The BRUs have mobilised a stronger focus on the relevance of research for patient benefit. Having the two BRUs has also led to an increased focus on translational research for patient benefit in other research fields (outside nutrition and respiratory disease). This includes the creation of a shadow BRU in cardiovascular disease, for example.  
In nutrition: The BRU has two major streams of research focus: upstream proof of concept studies and studies which are closer in the pipeline to patient benefit, and where the next steps entail taking the knowledge that is already in place and finding how to translate and integrate this knowledge into patient care (the second translation gap). They have taken forward six projects in different areas of nutrition research. |
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| Southampton University Hospitals NHS Trust and University of Southampton  
*Respiratory* | Common to both BRUs at Southampton: BRUs have mobilised a stronger focus on the relevance of research for patient benefit. Having the two BRUs has also led to an increased focus on translational research for patient benefit in other research fields (outside nutrition and respiratory disease). This includes the creation of shadow a BRU in cardiovascular disease, for example.  
*In respiratory disease:* The research portfolio of the respiratory BRU hopes to lead to improved medicines for preventing and treating respiratory disease. There are five key programmes within the BRU: targeting allergic responses to prevent asthma and treat severe asthma; new therapies for exacerbations of asthma and Chronic Obstructive Pulmonary Disease (COPD); enhancing epithelial repair mechanisms in acute and chronic injury; overcoming antibiotic resistance in airway diseases; and better lung imaging. |
Table 5. The impact of the BRU scheme on collaboration with industry

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<td>Barts &amp; The London NHS Trust and Queen Mary, University of London</td>
<td>Collaboration between researchers based at the William Harvey Research Institute (WHRI) and industry had been quite strong before the BRU was won. Discussions were ongoing in two areas. First, Unigene (a US-based company) had already patented an early stage compound developed at QMUL (annexin). Researchers had shown that if annexin was injected into models of stroke, it could help reduce stroke damage. Second, there had been discussions around erythropoietin, which researchers had found could aid recovery from damage to the organs. Early discussions with an industrial partner around developing analogues of this for potential use in patients were already under way when the BRU was won.</td>
<td>Interviewees felt that it was too early for significant impacts of the BRU on strengthening relationships with industry to be seen, although it was pointed out that the BRU had helped give renewed focus to the discussions with industry around the further development of both annexin and erythropoietin analogues. It is thought that the BRU will provide for a different sort of relationship with the pharmaceutical industry than they have had in the past. As one interviewee pointed out: “What we can do – and this is what the BRU and BRC scheme really does do – is instead of going to [pharma] at the formative phase when we’ve got something on a bench in a test-tube, we can say we’ve actually taken it all the way into man, and we know it’s ok in man… it’s up to you to tell us how effective it is…”</td>
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<td>University Hospital Birmingham NHS Foundation Trust and University of Birmingham</td>
<td>Birmingham has a well-established track record of working with the pharmaceutical industry (e.g. Millennium, Pfizer, Novartis and others).</td>
<td>Although it is difficult to provide evidence of direct attribution, interviewees felt that the BRU is having an important impact on strengthening relationships with industry, and that is has already had an impact on attracting additional funding. This includes £50,000 from a Swiss biotechnology firm (Novimmune) to work on therapeutic agents, and £100,000 from Novartis to look at drug targets in different human liver diseases. Establishing new relationships with industry and jointly pushing research advances through the pipeline is one of the explicit goals of the BRU.</td>
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<td>United Bristol Healthcare</td>
<td>Some collaboration with industry existed before the BRU,</td>
<td>Interviewees felt that it is perhaps too soon to say how far</td>
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| **NHS Trust and University of Bristol**  
*Cardiovascular disease* | and was largely driven by individual investigators (most of whom are now part of the BRU). However, the scale of collaboration has historically been quite small, since the focus of translational work has been on surgical techniques where there is less scope for involving industry (e.g. vein-graft stenosis, protection of the heart and patient during surgery). | the BRU had impacted on relationships with industry, since it has only been going for a year. However, a project involving the testing of a potential new drug at Bristol should start very soon (with support from a company based in Oxford and in New Zealand). |
| **Royal Brompton & Harefield NHS Trust and Imperial College London**  
*Cardiovascular disease* | Both the trust and the university have had successful and substantial industry partnerships in the past. This included collaborations with Siemens for cardiac MR scanners; Kardia Therapeutics; and major pharmaceutical clinical trial collaborations (e.g. Pfizer, Novartis, Apotex, Menarini, Merck, Servier, Roche, Bayer, Lilly and Thoratec). | Common to both BRUs at Royal Brompton and Harefield Trust and Imperial College: All but one of the people we interviewed expect new collaborations with industry to be facilitated by the BRU scheme, once the infrastructure is built. (One interviewee emphasised that this impact cannot be speculated on at present.) However, the other informants made clear that they have already received a number of informal expressions of interest, and that they expect the BRU supported CRFs, biobank and patient database to be particularly attractive for industry. The BRUs facilitate a closer and clearer contractual relationship for collaboration with industry because they are helping establish the requisite operational, administrative and regulatory infrastructure needed to meet industry’s expectations. However, at present “nothing that has been initiated could have come through by this time to a stage where it is ready for industry to get actively engaged”. |
| **Royal Brompton & Harefield NHS Trust and Imperial College London**  
*Respiratory disease* | There has been a history of collaboration with industry via various networks and consortia: (e.g. via leads the UK Cystic Fibrosis Gene Therapy Consortium). | Common to both BRUs at Royal Brompton and Harefield Trust and Imperial College: All but one of the people we interviewed expect new collaborations with industry to be facilitated by the BRU scheme, once the infrastructure is built. (One interviewee emphasised that this impact cannot be speculated on at present.) However, the other informants made clear that they have already received a |
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| Leeds Teaching Hospitals NHS Trust and University of Leeds  
*Musculoskeletal disease* | Leeds has historically had pretty good relationships with industry, though they have been facing the same challenge other organisations in the UK face in terms of retaining the pharmaceutical involvement in the country (due to issues such as the costs of trials, bureaucracy, difficulties in patient recruitment). | It is still too early for the BRU to have had an impact on relationships with industry. BRU leaders hope to have more discussions about collaboration than they have had so far. The trust would like to increase the number of partnerships coming through their organisation (in addition to those managed by the university). |
| University Hospitals of Leicester NHS Trust and University of Leicester  
*Cardiovascular disease* | The university and the trust had established relationships with industry prior to the BRU scheme. Some of the partnerships developed in more recent times include those with Unipath (now part of Inverness Medical Innovations Inc) and Brahms AG (Germany) to capitalise on biomarker discoveries; with Omeros Corporation (US) to develop and test therapeutic molecules to reduce ischemia-reperfusion injury; and with Healthstats (Singapore) in the area of central aortic pressure. Other collaborations include those with Merck, Novartis, Medtronic and others. | The BRU is very young (including in comparison to all other BRUs nationally), but it is hoped that the new infrastructure will help attract new industrial collaborations. There have already been some expressions of interest, particularly around the clinical phenotyping unit the BRU will be setting up. |
<p>| Royal Liverpool &amp; Broadgreen University Hospitals NHS Trust and | Industry involvement has been decreasing across the country, and although it has grown in pancreatic cancer specifically, it remains low in other pancreatic disease | The BRU is providing the critical mass required to enhance work with the private sector, but it is still early days. Involving industry “requires established |</p>
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<td>University of Liverpool</td>
<td>areas. This is partially attributed to a relatively small market for drugs for some pancreatic diseases (“orphan diseases”), a lack of a well-established SME base in the northwest, and to inventions being exploited overseas rather than in the UK. There is also “a lack of signposting”: industry does not know who to contact with an idea and to get feedback from within a short-time.</td>
<td>infrastructure and a bustling research programme to muster the excitement”. Early signals of interest are beginning to surface. Forty representatives from industry recently visited the Liverpool CRF, and this has not happened before. The event was a chance to discuss the BRU plans and to explore avenues for fruitful collaboration, including phase 1 and phase 2 trials. Liverpool also needs to create consortia on pancreatic disease (on the back of other consortia) because it is difficult to hold a patient cohort of appropriate size at present.</td>
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<td>Nottingham University Hospitals NHS Trust and University of Nottingham Gastrointestinal disease</td>
<td>Common to all three BRUs at Nottingham: Nottingham has had pretty good engagement from industry across the respiratory, gastrointestinal and hearing and deafness research areas. In gastrointestinal disease: There has been close collaboration with the local innovation network (INet), which has a strong focus on healthcare, and includes industry membership. There have been over 95 industry funded grants for research in gastrointestinal disease and hepatology since 1992 (e.g. from Apton, Pfizer, Merck, Serono, GSK, Novartis, Astra Zeneca, Enigma Diagnostics, Mologic, Covatec and others).</td>
<td>Common to all three BRUs at Nottingham: At the moment it is difficult to find explicit evidence of the BRU scheme’s impact on attracting industry. However, informal responses from industry have been very positive: “The BRUs strengthen the cachet of the academic centre and trust, which is attractive for industry because of enhanced regulatory credibility, especially if their other sites are in areas such as Russia, India, Eastern Europe.” In gastrointestinal disease: It is a little bit too early to look at the impacts of the BRU scheme on changing relationships with industry. No concrete impacts can be seen at present.</td>
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## Collaboration with Industry in Pre-BRU Times and BRU Influence on Changes in Relationships with Industry

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|                          | respiratory, gastrointestinal and hearing and deafness research areas.  
**In respiratory disease:** In the past five years, respiratory research groups from the university in particular have built strong collaborations with industry. Some examples include grants from GSK, Novartis, Nycomed, AstraZeneca, Unilever and Pfizer. | areas such as Russia, India, Eastern Europe.”  
**In respiratory disease:** Since winning the BRU, the respiratory team has been approached by several pharmaceutical companies to talk about joint work. The BRU infrastructure and the researchers’ expertise are attractive to industry. However, not much collaboration has materialised yet, apart from a multicentre award from the Innovative Medicines Initiative to a consortium which also has industry representation. Interviewees strongly felt that having a BRU influenced success in this bid. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
**Deafness and hearing** | Common to all three BRUs at Nottingham: Nottingham has had pretty good engagement from industry across the respiratory, gastrointestinal and hearing and deafness research areas.  
**In hearing:** Relationships with hearing and cochlear implant manufacturers have always been good. There has been collaboration with SMEs as well as large multinationals (e.g. Microsoft, Philips, HP, Sharp and IBM). | Common to all three BRUs at Nottingham: At the moment it is difficult to find explicit evidence of the BRU scheme’s impact on attracting industry. However, informal responses from industry have been very positive: “The BRUs strengthen the cachet of the academic centre and trust, which is attractive for industry because of enhanced regulatory credibility, especially if their other sites are in areas such as Russia, India, Eastern Europe.”  
**In hearing:** The hearing and deafness BRU has arranged an event to take place end of June, with all the key manufacturers of hearing devices and also of software. The event will provide a platform for informing industry about the evolving direction and activities for the BRU, and for discussing opportunities for collaboration. |
| Nuffield Orthopaedic Centre NHS Trust and University of Oxford  
**Musculoskeletal disease** | Some good relationships with industry were established in pre-BRU times, for example in the area of orthopaedic implants. Interactions included active research collaboration, and funding from industry for research projects. The exploitation of inventions was not managed particularly well though, partially because of a degree of inertia on the part of clinicians. | A new relationship which “would not have happened without the BRU” has been established with Smith & Nephew and GSK in the area of tissue engineering and regenerative biology. The trust and university are actively thinking about how to create ways for more effective interaction with industry, and this is largely driven by the Health Education and Innovation Clusters (HEICs) bid. |
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<td>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield</td>
<td><strong>Common to both BRUs at Sheffield:</strong> Relationships with industry have historically been “haphazard”. Relationships have just grown “organically” over time – they were not stimulated or managed.</td>
<td>For now, relationships with industry haven’t really changed, but the BRU has provided a pretty strong sales pitch: it enables the partner organisations to market their research on drugs in development and their access to improved infrastructure (including equipment to evaluate drugs, and better access to patients). There is potential for some partnerships with GSK and Pfizer to develop. They are clear about what is needed and where they want to go. The next step is to develop the operational, administrative and regulatory environment that can add value to industry. Both BRUs are engaged with the Sheffield Medical Innovation Centre, through project officers. The BRU governance representatives regularly meet and discuss ways of increasing collaboration with industry.</td>
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<td><em>Musculoskeletal disease</em></td>
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<td>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield</td>
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<td>(As is the case in musculoskeletal disease research), collaboration with industry in cardiovascular research has been relatively unsystematic and disorganised. There have been some small and informal relationships.</td>
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<td><em>Cardiovascular disease</em></td>
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<td>Southampton University Hospitals NHS Trust and University of Southampton</td>
<td>In general, collaboration with industry has not been a main focus because industry interests in general have not matched the research focus and agendas of the nutrition research groups at Southampton. There have been some exceptions (a few cases of contract research).</td>
<td>The type of research conducted at the BRU is not always amenable to industrial exploitation: to date there has not been a major change in relationships with industry because of the scheme.</td>
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<td><em>Nutrition, diet and lifestyle</em></td>
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Collaboration with industry have existed for many years (e.g. links with GSK, Novartis and Astra Zeneca have been in place for over a decade).

It is difficult to attribute impacts on changes in relationships with industry to the BRU specifically. This is partially because the research teams have historically had good relationships with industry, and also because the BRU scheme is very young. However, the interviewees felt that there are three things that help you win money and establish new collaborations with the private sector: projects, people and place. The BRU is improving all three of these enablers. Therefore, although there is no concrete evidence on this, BRU leaders feel that it is very probable that the scheme has helped in winning recent funding from two major industry players.

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<td>Relationships with industry have existed for many years (e.g. links with GSK, Novartis and Astra Zeneca have been in place for over a decade).</td>
<td>It is difficult to attribute impacts on changes in relationships with industry to the BRU specifically. This is partially because the research teams have historically had good relationships with industry, and also because the BRU scheme is very young. However, the interviewees felt that there are three things that help you win money and establish new collaborations with the private sector: projects, people and place. The BRU is improving all three of these enablers. Therefore, although there is no concrete evidence on this, BRU leaders feel that it is very probable that the scheme has helped in winning recent funding from two major industry players.</td>
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<td>Barts &amp; The London NHS Trust and Queen Mary, University of London</td>
<td>A key area of impact has been on improving NHS and academic partner relationships with primary care providers. The BRU has enabled some important new connections to be formed with primary care (especially with seven PCTs across northeast London), to help in the recruitment of people into trials. This is particularly important given the cardiovascular disease profile in the trust’s catchment area (northeast London). One interviewee pointed out that they are “finding that it is possible, through the BRU ‘brand’... to improve engagement with patients at primary care level...” Interviewees acknowledged that it is very early days yet but the sense is that there is real potential to build on these new relationships. The trust also has plans to look at improving its informatics infrastructure to facilitate better exchange of information with primary care partners (although not specifically funded from BRU money).</td>
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<td>University Hospital Birmingham NHS Foundation Trust and University of Birmingham</td>
<td>The BRU has not yet had much of an impact on strengthening further relationships with other players regionally and nationally. One interviewee thought that BRUs might be too research focused to be effective tools for bringing in local NHS partners. This is especially so because the Birmingham health landscape is complicated – there are a lot of small, single-specialty trusts. However, community outreach work is improving. For example, patient representatives are on the BRU Steering Committee, and sit also on other boards (e.g. the Executive Group, the Scientific Advisory Group). The BRU intends to conduct an evaluation of patient and public involvement at 30 months post allocation of the award. The local MP was invited to a World Liver Day event, which the BRU have hosted, and representatives from a number of patients groups and the media were present.</td>
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<td>United Bristol Healthcare NHS Trust and University of Bristol</td>
<td>Talks are under way about developing a cardiovascular disease research strategy across Bristol, led by University Hospitals Bristol and the university. The North Bristol Trust, the University of West England, PCTs and commissioners are also engaged. The strategy will bring together contributions from all of these groups, and the BRU has had an impact on increasing the interest and momentum for this initiative. [There were extensive discussions with other regional actors in terms of building towards an AHSC before the BRU was won. They had established an initial alliance with Peninsula Medical School and Cardiff (inclusion of Wales caused a great deal of debate).] The University of the West of England and the University of Bristol have secured a £2 million investment to set up and operate a National Co-ordinating Centre for Public Engagement, a representative of which is invited to attend BRU management meetings and interact regularly with the BRU.</td>
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| Royal Brompton & Harefield NHS Trust and Imperial College London  
**Cardiovascular disease** | Common to both BRUs at Royal Brompton & Harefield NHS Trust and Imperial College: There is quite a lot of magnetism associated with the BRUs. They have already been approached by outside researchers (especially in the region) expressing an interest in collaboration because of the infrastructure and people associated with the BRU. Geographic location influences new collaborations, because it is easier to collaborate with those close by.  
Both BRUs are also embedded in local clinical research networks.  
The cardiovascular and respiratory BRUs are joining forces to establish a biobank facility, and they have had expressions of interest for the use of these facilities from numerous external stakeholders.  
**In cardiovascular disease:** The cardiovascular BRU at Royal Brompton communicates with the one at Sheffield but there has not been much collaboration between them to date. This is partially because their subjects of interest are quite different, and partially because of geographical distance. Outside researchers are very interested in having access to the facilities of the BRU.  
The cardiovascular disease BRU will be developing its patient and public involvement strategy as soon as the BRU manager (who has been recruited) joins. A patient representative will be on Management Committee of the BRU, and patient representatives will be involved in a future BRC application. |
| Royal Brompton & Harefield NHS Trust and Imperial College London  
**Respiratory disease** | Common to both BRUs at Royal Brompton & Harefield NHS Trust and Imperial College: There is quite a lot of magnetism associated with the BRUs. They have already been approached by outside researchers (especially in the region) expressing an interest in collaboration because of the infrastructure and people associated with the BRU. Geographic location influences new collaborations, because it is easier to collaborate with those close by.  
• Both BRUs are also embedded in local clinical research networks (CRNs).  
• The cardiovascular and respiratory BRUs are joining forces to establish a biobank facility, and they have had expressions of interest for the use of these facilities from numerous external stakeholders.  
**In respiratory disease:** The BRU is already embedded in national CRNs – “as embedded as new people can be”. For example, BRU researches attend CRN conferences, and the BRU advertises opportunities through CRN websites.  
The BRU is establishing six disease consortia, which are expected to collaborate with each other (“this cannot happen overnight because it is time to properly develop consortia”).  
The respiratory BRU is appointing patient advocates in each of the consortia and is setting up patient advocate meetings across the consortia. Patient advocates will also be part of the routine research meetings (e.g. via away days). As part of public outreach, the BRU will also engage schools into the activities of the BRU. |
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| Leeds Teaching Hospitals NHS Trust and University of Leeds  
*Musculoskeletal disease* | It is still a little bit too early to assess the impact of the BRU on materialising new relationships with organisations. The Leeds BRU leaders are very open to collaborations with other groups in the region and wants to remain inclusive. It hopes to engage PCTs in particular. At present there is collaboration with other NIHR initiatives, for example with the Sheffield BRU and with the Leeds CLAHRCs.  
The BRU has had an impact on increasing the levels of multidisciplinary collaboration within the university (e.g. between medicine and engineering).  
Other divisions in the trust and departments in the university at Leeds are trying to learn develop their own shadow BRUs in areas outside musculoskeletal disease.  
There is patient representation and involvement within several elements of the governance structure. A patient representative on the Scientific Advisory Board has a molecular science background. There is also a patient representative on the BRU Board, who played a part in the development of the BRU application and attended interviews. Patient representatives are also engaged in different steering committees. Patient representatives sit on various boards and steering committees and have an influence on the types of projects taken forward. |
| University Hospitals of Leicester NHS Trust and University of Leicester  
*Cardiovascular disease* | The whole spectrum of NIHR initiatives are getting NHS trusts and universities to think more strategically in regions, and to look more seriously at regional collaboration. There is a strong focus on increasing patient participation in research, and infrastructure to facilitate this will be developed with support from BRU funding (e.g. biorepository for tissue samples and an informatics centre). “Clinical research relies on the voluntary involvement of patients and the public. We want to encourage as much participation as we can and really put patients at the heart of the new centre.”  
The BRU is already developing collaborative relationships with other BRUs (Sheffield) and with other universities in the region to leverage complementary skills, and coordinate research efforts (i.e. avoid overlap and duplication). Structures to facilitate the involvement of external parties will be established within the BRU structure. For example, there are plans to establish a Leicester BRU faculty whose membership can include researchers from throughout the region. Membership will enable access to BRU facilities, and is expected to be beneficial for more frequent intellectual exchange between people active in cardiovascular research in the region.  
A PPI group is part of the BRU and reports to the Management Board. (There is also a historically good group of approximately 16 patient advisors to the trust.) The development of a cardiovascular patient database entailed learning from the experiences of others, most notably a group in Philadelphia. |
<p>| Royal Liverpool &amp; Broadgreen University Hospitals | The BRU is creating opportunities for closer collaboration with PCTs. This is very important, particularly because alcohol abuse is a major issue in Liverpool. An increased awareness of the PCTs’ interest in being involved with the BRU emerged during the process of preparing the AHSC bid. The relationships between the BRU and local CRN are similarly |</p>
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| NHS Trust and University of Liverpool  
Gastrointestinal disease | positive. The regional environment for collaboration is improving.  
The BRU has adopted an international orientation to collaboration as well, including in terms of recruitment. Until the BRU award, the global stage was mainly a possibility to exchange information rather than collaborate. The strategy is to increase the number of high value international collaborations: “Any collaboration is not good in and of itself since it will take time and money and should therefore be worthwhile.”  
A PPI strategy is yet to be developed, and BRU leaders intend to apply lessons learnt from BRC experiences. There have been discussions around establishing a website that would be useful for both the patient and the professional. An effective PPI strategy for the region is pivotal for advancing pancreatic disease research. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
Gastrointestinal disease | Common to all three BRUs at Nottingham: The BRUs are working with local government and the East Midlands Development Agency (EMDA) on developing a science park (Medi-park).  
The BRU has impacted on developing relationships with other local players in a number of positive ways. For example, BRUs helped catalyse the bid for AHSC between Nottingham and Leicester. Although the bid was not successful, the universities and trusts involved are pursuing efforts to establish a shadow AHSC-like centre, and think that their chances of a successful bid in future rounds will be greatly enhanced because of this.  
There is also scope for a lot of collaboration between the gastrointestinal and respiratory BRUs at Nottingham. Some collaboration already exists and is expected to be further strengthened as the BRUs mature.  
A patient representative will join the BRU Board. All three BRUs will also be gathering patient stories (as the BRU matures), to see how patient conditions have been improved as a result of the application of translational research enabled by the BRUs.  
In gastrointestinal disease: BRU leaders are considering how to develop innovative and creative approaches to engage other trusts in the region to collaborate with the gastrointestinal BRU, and to facilitate access to patients in other areas. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
Respiratory disease | Common to all three BRUs at Nottingham: The BRUs are working with local government and the East Midlands Development Agency (EMDA) on developing a science park (Medi-park).  
The BRU has impacted on developing relationships with other local players in a number of positive ways. For example, BRUs helped catalyse the bid for AHSC between Nottingham and Leicester. Although the bid was not successful, the universities and trusts involved are pursuing efforts to establish a shadow AHSC-like centre, and think that their chances of a successful bid in future rounds will be greatly enhanced because of this.  
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<td>In respiratory disease: The respiratory BRUs nationally are talking about how they can collaborate more and work together. They have already been collaborating in a successful bid for the Innovative Medicines Initiative collaboration.</td>
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<td>There is also collaboration between the BRU and other universities (e.g. Leicester).</td>
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<td>The respiratory BRU is organising an event where it will showcase their research and plans, and all the respiratory consultants from the other trusts in the Trent CLRN region are invited. The meeting is hoped to help gauge the interest of other organisations to collaborate with the Nottingham respiratory BRU.</td>
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<tr>
<td>Nottingham University Hospitals NHS Trust and University of Nottingham</td>
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<td>Nuffield Orthopaedic Centre NHS Trust and University of</td>
<td>In hearing: They BRU is seen as a leader in hearing research. Other colleagues active in hearing research nationally are very keen to work with the BRU and access BRU resources. It is relatively easy to collaborate in hearing research, because it is a niche and tight-knit national community. The university works closely with the Learning Sciences Research Institute.</td>
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<td>There is a strong sense of community between the BRU and the CLRN and they collaborate closely. For example, the department of rheumatology within the Nuffield Orthopaedic Centre has been awarded 9 hours of Thames Valley Comprehensive Local Research Network (TV CLRN) research nurse time. This research work of the nurses is expected to</td>
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<td>Oxford</td>
<td>have a synergy with their clinical roles.</td>
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<td>Musculoskeletal disease</td>
<td>The BRU is also developing its relationship with the Kennedy Institute of Rheumatology, which could extend the scope of the translational research agenda undertaken by the BRU.</td>
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<td>BRU leaders are exploring how they can work closer with GPs (following the example of the very successful liaison the orthopaedic and rheumatology researchers at Keele have developed with their local practitioners).</td>
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<td>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield</td>
<td>Common to both BRUs at Sheffield: BRU leaders have recognised how important it is to involve patients in the research agendas and activities, and this is a significant improvement in PPI activity: “we didn’t do that at all before the BRU”. There are 11 members on the patient panel for the BRU. The BRU is not yet at the stage where patients have been involved in prioritising the research: this should happen soon though, and will be facilitated either through presenting research to patients or through discussions with the Scientific Advisory Board.</td>
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<td>Musculoskeletal disease</td>
<td>In musculoskeletal disease: The Sheffield musculoskeletal disease BRU communicates with the BRC at Guy’s and St Thomas’, to learn lessons about how they have developed the BRC. This has been an evolving and very helpful relationship.</td>
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<td>The BRU is also developing a relationship with the School of Health and Related Research (SCHARR), and in general is strengthening relationships between the trust and all its academic partners as the new collaborative ethos is taken up by others outside the BRU.</td>
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<td>Cardiovascular disease</td>
<td>In cardiovascular disease: The BRU is collaborating with some new university research groups (e.g. medical physics). Some individuals from other university departments (e.g. a clinical research fellow) have approached the BRU and asked to become involved.</td>
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<td>Non-technical cellular biologist with a BHF clinical research science fellow has seen the opportunity of collaborating with the BRU, drawing on the resource to work with pulmonary patients and this stimulated another grant application.</td>
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<td>Southampton University Hospitals NHS Trust and</td>
<td>Common to both BRUs at Southampton: The two BRUs at Southampton collaborate with each other. There are also clinical research fellowships allowing people to work between the two BRUs, doing a PhD (via NIHR synergy funding).</td>
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| University of Southampton  
*Nutrition, diet and lifestyle* | Collocation also facilitates collaboration between the two BRUs.  
Leaders of the BRUs felt that having the BRUs differentiates Southampton from other organisations in the region.  
The BRUs also have close relationships with the CLRNs in the region.  
The BRUs magnify historical links with other players and are a stimulus for even more collaboration.  
Southampton is leveraging additional funding from the trust to build BRU-like pillars of research strength in other disease areas.  
Both BRUs have placed the involvement of patients and public very high up in their research strategies and plans.  
Involvement activities include representation on advisory boards; the engagement of research nurses with clinical nurses to promote a culture of partnership between those delivering care, receiving care and taking part in research; and public lectures and open days.  
In nutrition: Nationally, nutrition is a relatively small and close knit community. The recognition of excellence which the BRU gives has helped increase the interest of nutrition specialists throughout the country to collaborate with the BRU and to want to come to Southampton and consolidate within a centre of excellence. |
| Southampton University Hospitals NHS Trust and University of Southampton  
*Respiratory disease* | Common to both BRUs at Southampton: The two BRUs at Southampton collaborate with each other. There are also clinical research fellowships allowing people to work between the two BRUs, doing a PhD (via NIHR synergy funding).  
Collocation also facilitates collaboration between the two BRUs.  
Leaders of the BRUs felt that having the BRUs differentiates Southampton from other organisations in the region.  
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Southampton is leveraging additional funding from the trust to build BRU-like pillars of research strength in other disease areas.  
Both BRUs have placed the involvement of patients and public very high up in their research strategies and plans.  
Involvement activities include representation on advisory boards; the engagement of research nurses with clinical nurses to promote a culture of partnership between those delivering care, receiving care and taking part in research; as well as public lectures and open days.  
In respiratory disease: The respiratory BRU plans to integrate more with other respiratory BRUs in the country. Collaboration with the respiratory BRU at Royal Brompton and Imperial is already strong. Collaboration applies not only to... |
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<td>research activity. For example, the two BRUs are also developing performance metrics together. The Southampton respiratory BRU also collaborates with the Nottingham BRU. There is potential to strengthen collaboration with organisations that don’t have BRUs, which should help with the recruitment of patients from other catchment areas into studies.</td>
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Table 7: The impact of the BRU scheme on establishing physical infrastructure for translational research

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| **Barts & The London NHS Trust and Queen Mary, University of London**  
  *Cardiovascular disease* | The BRU has had a substantial impact on the development of new infrastructure capacity. The main impact so far has been around the development of cardiac imaging capacity, which is currently being put in place. Future developments will include investment in an informatics building. A company has been identified that can provide implementation service for a bioinformatics system, and the process is about to go to tender.  
  This comes alongside the construction of a new heart centre, plans for which were already in place before the BRU, but which the BRU is now part-funding. Interviewees suggested that the trust and university had been struggling to raise the money required to complete the building, and the BRU offered the opportunity to do this. The heart centre will bring together 3,172m² of building space, of which NIHR is paying for about 400m² through the BRU. The centre is due to open in June 2010. The overall investment in this new facility is around £24.8 million.  
  It is estimated that by July/August 2009 the trust and university will have spent about £2 million on capital projects. |
| **University Hospital Birmingham NHS Foundation Trust and University of Birmingham**  
  *Gastrointestinal disease* | BRU funding has been used to develop imaging capacity (nearly £2 million of support), and to purchase an MRI scanner. The university and trust are also trying to leverage the potential of existing infrastructure (such as the Wellcome CRF) to contribute to advancing BRU research. |
| **United Bristol Healthcare NHS Trust and University of Bristol**  
  *Cardiovascular disease* | BRU funding has been used to develop imaging capacity and create more research space for practising physicians. A dedicated cardiac imaging scanner is now being installed. |
| **Royal Brompton & Harefield NHS Trust and Imperial College London**  
  *Cardiovascular disease* | Common to both BRUs at Royal Brompton & Harefield NHS Trust and Imperial College: Both BRUs are developing crucial translational research capacity with BRU funding. This infrastructure provides the platform for the BRUs to be (and continue to be) world class centres of excellence in developing innovations of benefit to patients, in areas of respective focus.  
  The trust has nearly doubled or matched BRU support for infrastructure development. |
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<td><strong>In cardiovascular disease</strong></td>
<td>The cardiovascular BRU is building a new CRF, a chain of cardiovascular and genetics clinics, a CATH lab and state of the art MRI equipment.</td>
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| Royal Brompton & Harefield NHS Trust and Imperial College London | Common to both BRUs at Royal Brompton & Harefield NHS Trust and Imperial College: Both BRUs are developing crucial translational research capacity with BRU funding. This infrastructure provides the platform for the BRUs to be (and continue to be) world class centres of excellence in developing innovations of benefit to patients, in areas of respective focus.  
  The trust has nearly doubled or matched BRU support for infrastructure development.  
  In respiratory disease: The respiratory BRU is using almost all of the BRU funding for capacity building – either physical or staffing. Physical capacity supported through the scheme includes a CRF and CT scanning. Almost all of the BRU funding has gone to core facilities. |
| Leeds Teaching Hospitals NHS Trust and University of Leeds | BRU funding is being used to establish an imaging facility, which is about to be completed. The hospital provided one-tenth of its space for the BRU imaging facility and to house staff right next to patient services.  
  Academics and clinicians from various disciplines will be colocated in the same space; BRU leaders think this is important for the sharing of ideas and for accelerating translation. BRU funding is also to be used to help in the development of an integrated ICT database across the unit, linking information gathered across the research groups, and linking in the NHS data system. There is also some BRU support for developing an orthopaedic tissue retrieval bank. |
| University Hospitals of Leicester NHS Trust and University of Leicester | Leicester has never had anything like a BRU before in terms of support for translational research, and the scheme provides a huge opportunity to reform the way cardiovascular research is done in Leicester. BRU capital funding will be used to develop a bio-repository and informatics centre, a CRF and a cardiovascular research centre. The trust and university are also committing their own resources to enhance the infrastructure.  
  The physical co-location of academic and clinical scientists and basic biomedical and clinical research labs in the same site is expected to facilitate translational research greatly. |
<p>| Royal Liverpool &amp; Broadgreen University Hospitals NHS Trust and University of Liverpool | The 1960s physical infrastructure has made it difficult to create the facilities wanted but a CRF is in the process of being constructed (shared with the BRC). The CRF and other research facilities are becoming collocated, which BRU leaders feel will improve the laboratories’ abilities to adhere to Good Clinical Laboratory Practice (GCLP). |</p>
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| Nottingham University Hospitals NHS Trust and University of Nottingham | **Gastrointestinal disease**  
Common to all three BRUs at Nottingham: The BRU scheme is having an enormous impact on improving infrastructure for translational research across all three BRUs. The trust has also committed to contribute towards the capital schemes and to the money NIHR provided. Improvements in physical infrastructure have acted as an early signal to staff of the benefits the scheme can deliver in terms of providing a more conducive environment for research and ultimately for patient benefit. There is also capital support from other organisations (charities, the HEFCE, and CIF).  
**In gastrointestinal disease:** BRU funding is supporting the development of a separate BRU unit and imaging capacity. This will allow academic and clinical staff to be collocated on a single site, and in this way be beneficial for the exchange of information and knowledge and for fertilising new ideas. “For enabling joint up working and a feeling of joint ownership and collaboration, collocation means everything really.” |
| Nottingham University Hospitals NHS Trust and University of Nottingham | **Respiratory disease**  
Common to all three BRUs at Nottingham: The BRU scheme is having an enormous impact on improving infrastructure for translational research across all three BRUs. The trust has also committed to contribute towards the capital schemes and to the money NIHR provided. Improvements in physical infrastructure have acted as an early signal to staff of the benefits the scheme can deliver in terms of providing a more conducive environment for research and ultimately for patient benefit. There is also capital support from other organisations (charities, HEFCE and CIF).  
**In respiratory disease:** BRU funding is being used for the refurbishment of a lung function facility, a clinical research area, and another area for respiratory outpatients to be used in research studies (phenotyping and genotyping). Some facilities are already up and running; others should be ready in next 6 months. New equipment is also being purchased (e.g. lung function equipment, phenotyping devices). |
| Nottingham University Hospitals NHS Trust and University of Nottingham | **Deafness and hearing**  
Common to all three BRUs at Nottingham: The BRU scheme is having an enormous impact on improving infrastructure for translational research across all three BRUs. The trust has also committed to contribute towards the capital schemes and to the money NIHR provided. Improvements in physical infrastructure have acted as an early signal to staff of the benefits the scheme can deliver in terms of providing a more conducive environment for research and ultimately for patient benefit. There is also capital support from other organisations (charities, HEFCE and CIF).  
**In hearing:** Capital funding from the NIHR was matched by the trust. The funding covers the refurbishment of facilities for the BRU on one floor of the Nottingham general hospital, and most of the equipment. They now have sound-proof booths. The clinical service is on the floor adjacent to that of the BRU. |
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<td>Nuffield Orthopaedic Centre NHS Trust and University of Oxford</td>
<td>A good physical infrastructure was already in place and the BRU has designated space within the Nuffield Orthopaedic Centre NHS Trust main hospital. BRU funding is supporting refurbishment and conversion costs (rather than new building). The BRU is fully funding a diagnostic suite, including imaging and lab equipment. A skills lab is also being developed. It enables Oxford to do what “no one in orthopaedics (and very little in surgery in general) is doing, [that is] looking at the delivery of surgical skills [in innovative ways]”. For example, this includes integrating Wii technology into training. There is some outside interest in this; while we were there the BBC was filming in the skills lab.</td>
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<td>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield</td>
<td>The BRU has helped improve imaging infrastructure (e.g. Xtreme CT for state of the art measurement of bone structure). All equipment asked for through the scheme has arrived, and is enabling new research and involvement in multi-centre trials (that couldn’t be done before). Patient database capacity is also improving, increasing the availability of patients for research, and facilitating the development of a bio-repository. All bone researchers are now in close proximity to one another facilitating research flows.</td>
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<td>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield</td>
<td>BRU funding is helping expand pre-existing CRF facilities. “The thing that was missing before the BRUs came along for translational investigator-led research or collaborations with industry was infrastructure: you knew that every time you wanted to embark on a study you’d be starting from scratch, i.e. making a separate collection of patients, of their blood, plasma or DNA; there were no databases in place to know where the patients were or other resource to facilitate research.”</td>
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<td>Southampton University Hospitals NHS Trust and University of Southampton</td>
<td>Common to both BRUs at Southampton: Physical co-location for the BRUs is very important not only for sharing knowledge, but also for avoiding administrative and operational inefficiencies. The original capital bid was for a two-floor building for both BRUs. This has now been approved and commissioned, and staff hope to move into the building by the end of next year. This building will house staff, labs and equipment (e.g. a mass spectrometer and other specialised equipment). Subsequent funding from the NIHR and trust will permit the building of a five story facility for translational research. In nutrition: The physical infrastructure is helping improve the ability to make good nutritional diagnoses. New technologies and modern methodologies are being implemented by virtue of BRU financial support.</td>
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Table 8. The impact of the BRU scheme on the acquisition of new capabilities in the health research system

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<th>Biomedical Research Unit</th>
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| Barts & The London NHS Trust and Queen Mary, University of London Cardiovascular disease | **Recruitment**: Some senior scientific posts were recruited prior to the bid for a BRU and helped strengthen the chances of success. Recruitment of a cardiac imaging specialist has just been completed to support development of new capacity at Barts in this area. One interviewee emphasised that having the BRU has helped reputationally, and is attracting wider and higher calibre interest for positions.  

**Training**: Funding has been secured for two clinical fellowships (one supported by the MRC, the other by the BHF – in this case a senior fellowship), and a UK Stem Cell Foundation-supported PhD studentship. Two of these will contribute to stem-cell-related research. They wish to use the NIHR BRU initiative to fund 12 months’ salary for two academic clinical fellows per year to enable high cadre medical graduates to work with cardiovascular disease advanced imaging themes and generate essential pilot data toward fellowship applications. |

| University Hospital Birmingham NHS Foundation Trust and University of Birmingham Gastrointestinal disease | **Recruitment**: The BRU has successfully recruited some positions, including a researcher from industry, three clinical research fellows, and some research nurse placements. Further recruitment is expected to be completed over the coming few months.  

**Training**: There is BRU funding for three clinical research fellows. There is also additional funding from the trust for two clinical research fellows, and from the university for one. Training opportunities in translational research are also helpful in retaining some existing researchers. For example, one clinician has just completed his PhD, and the BRU scheme is providing support for him to learn some translational research skills at Birmingham and to further develop his research. |

| United Bristol Healthcare NHS Trust and University of Bristol Cardiovascular disease | **Recruitment**: BRU funding will be used to support seven core researchers (already in place) and the recruitment of a number of others. Bristol has taken an open-minded approach to trying to use existing HR capacity in such a way as to build cooperation between the trust and the university: For example, the radiology department will provide radiologists and income to help run the scanner daily, creating a hybrid business plan to make this work. This means that radiology staff have access to the equipment and can bring down their waiting times, but do not have to worry about capital investment in new equipment (since this comes from the BRU).  

One of the aims of the BRU bid is to release clinical time, rather than explicitly only recruit, but “this is proving to be one of the most difficult parts of the BRU”. BRU leadership intends to use BRU funding to cover some of the time of potential clinicians for research, and although this is now working for one cardiologist, the BRU |
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<td>has not been able to extend this into other areas yet.</td>
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<td>Training: The Bristol BRU did not include any specific funding allocation for training; however, interviewees expressed hope that with the strength of the BRU and the projects developed through the BRU they will be better placed to apply for other grants involving PhD studentships and other training opportunities.</td>
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<td>Royal Brompton &amp; Harefield NHS Trust and Imperial College London</td>
<td>Common to both BRUs at Royal Brompton &amp; Harefield NHS Trust and Imperial College: Both BRUs have not yet employed everybody they plan and want to employ: &quot;If you are putting in new infrastructure and specialist equipment there is no point in recruiting a specialist who is meant to use that equipment until the equipment/infrastructure is in place.&quot;</td>
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<tr>
<td>Cardiovascular disease</td>
<td>In cardiovascular disease:</td>
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<td>Recruitment: The cardiovascular BRU has appointed a BRU manager who brings in experience of how the NIHR thinks, which is of great help. They have also appointed a physicist to work on translational research, and three research nurses. The BRU is in the process of appointing a biobank manager and a database manager, and will also be taking over some sessions of a cardiovascular geneticist.</td>
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<td>Training: The BRU is not funding training. “We will establish training programs for basic scientists, clinical scientists, nurses and technicians as an integral part of the Cardiac Regeneration Unit. We will achieve this by appointing training positions into the Cardiac Regeneration Unit from a number of major institutional training programs supported by other sources” (e.g. BBSRC, BHF, CRC/MMC, clinical academic fellowships and lectureships, EPSRC, Wellcome Trust Clinical PhD Training Program and others)</td>
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<tr>
<td>Royal Brompton &amp; Harefield NHS Trust and Imperial College London</td>
<td>Common to both BRUs at Royal Brompton &amp; Harefield NHS Trust and Imperial College: Both BRUs have not yet employed everybody they plan and want to employ: &quot;If you are putting in new infrastructure and specialist equipment there is no point in recruiting a specialist who is meant to use that equipment until the equipment/infrastructure is in place.&quot;</td>
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<td>Respiratory disease</td>
<td>In respiratory disease:</td>
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<td>Recruitment: The respiratory BRU has been planning the staffing needs and recruitment strategy for the respiratory CRF. Each consortium will have a coordinator. Some adverts are already out for the respiratory BRU (e.g. for coordinators for the six disease consortia, for a CRF manager). Some of the lung function staff have already been hired, and some need training. The process of establishing some job descriptions included learning from the experiences of Southampton and Edinburgh in running a CRF.</td>
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<tr>
<td>Biomedical Research Unit</td>
<td>BRU influence on the acquisition of new capabilities (recruitment and training)</td>
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| Leeds Teaching Hospitals NHS Trust and University of Leeds  
Musculoskeletal disease | **Training:** They will also be training four PhDs (one with BRU funding working on stem cells and regenerative medicine). The other three are from trust parallel funding for MD/PhD posts.  
**Recruitment:** Three-quarters of the staff that were planned to be hired for the BRU have now been appointed. This includes group chairs, research fellows, administrative and technical support staff. |
| University Hospitals of Leicester NHS Trust and University of Leicester  
Cardiovascular disease | **Recruitment:** The trust and university had in pre-BRU times taken steps to enhance the sustainability of cardiovascular research by making a number of senior appointments. It is hoped that being a BRU will help recruit new people because it is a badge of recognition for the quality of cardiovascular research happening at Leicester. The improved infrastructure the BRU enables is also expected to help attract the best people.  
**Training:** There is BRU funding for the training of six clinical research fellows. There is also additional support for formal translational research training from other sources. Informal training occurs through seminars and events. |
| Royal Liverpool & Broadgreen University Hospitals NHS Trust and University of Liverpool  
Gastrointestinal disease | **Recruitment and retention:** BRU leaders expect significant progress with recruitment in the next few months. They have already attracted a much better class of candidates through the posts they advertised than they think would have been the case in the absence of the BRU recognition. In addition, one interviewee said that two people he thought might have moved on elsewhere have chosen to stay at Liverpool, and he sees this as a sign of the campus becoming much more competitive.  
**Training:** Liverpool has already been successful in securing training awards for translational and clinical research from a number of sources (e.g. Walport, Wellcome Trust, MRC, Rising Star Scheme). Approximately 15 medical PhD pathways are supported by various bodies. The BRU provides an established pathway for career progression and further personal development of the next generation of research leaders. Flexibility on the part of the university has been key: “All this links up to a very enlightened postgraduate deanery in terms of flexibility in clinical research pathways.” |
<p>| Nottingham University | Common to all three BRUs at Nottingham: |</p>
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| Hospitals NHS Trust and University of Nottingham  
 _Gastrointestinal disease_ | Recruitment: It took some time for the trust and university to sort out how the appointment processes for the BRUs could work. Most of the BRU posts have now been appointed, and BRU leaders feel they have managed to attract outstanding candidates.  
 Training: Formal training is supported by the BRU scheme (e.g. clinical research fellow posts), as well as other schemes nationally.  
 (The university and trust are working on developing a translational research training program for clinical and non-clinical PhD researchers, which would also be accessible to training posts employed by the BRU. In addition to trust and university funding, they are aiming to attract matched funding from industry.)  
 In gastrointestinal disease:  
 Recruitment: Recruiting for gastrointestinal and hepatology research has not been that difficult historically, because Nottingham has a good reputation in this field. Everybody they planned to appoint for the BRU has been appointed, and everybody bar two people is now in post. These appointments include eight research nurse posts at various grades, two technicians, a database manager, a clinical trials support worker, a clinical lecturer and two more people who are yet to start but have been recruited (clinical associated professors, at the beginning of their consultant grade and moving into primary research).  
 BRU leaders decided that it would be difficult to get clinically qualified researchers into needed posts if they were NHS posts, because they felt that professors of gastroenterology would want to and need to be employed by the university.  
 Training: Four clinical research fellows who will be doing PhDs as part of (and funded through) the BRU have been appointed. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
 _Respiratory disease_ | Common to all three BRUs at Nottingham:  
 Recruitment: It took some time for the trust and university to sort out how the appointment processes for the BRUs could work. Most of the BRU posts have now been appointed, and BRU leaders feel they have managed to attract outstanding candidates.  
 Training: Formal training is supported by the BRU scheme (e.g. clinical research fellow posts), as well as other schemes nationally.  
 (The university and trust are working on developing a translational research training program for clinical and |
### Biomedical Research Unit

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<th>BRU influence on the acquisition of new capabilities (recruitment and training)</th>
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<td>non-clinical PhD researchers, which would also be accessible to training posts employed by the BRU. In addition to trust and university funding, they are aiming to attract matched funding from industry.)</td>
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<tr>
<td>In respiratory disease:</td>
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<td>Recruitment: Most of the posts needed for the BRU have now been recruited, although the process went a little bit slower than they had hoped for. Recruiting research officers was challenging, because of a limited pool available and high demand. The appointment of research nurses has been an important milestone.</td>
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<td>Training: The BRU scheme is having an impact on increasing the scale and quality of training provided in translational research. The respiratory BRU has already taken in 11 training posts, some of which are funded directly by the scheme.</td>
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<td>Nottingham University Hospitals NHS Trust and University of Nottingham Deafness and hearing</td>
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<tr>
<td>Common to all three BRUs at Nottingham:</td>
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<td>Recruitment: It took some time for the trust and university to sort out how the appointment processes for the BRUs could work. Most of the BRU posts have now been appointed, and BRU leaders feel they have managed to attract outstanding candidates.</td>
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<td>Training: Formal training is supported by the BRU scheme (e.g. clinical research fellow posts), as well as other schemes nationally. (The university and trust are working on developing a translational research training program for clinical and non-clinical PhD researchers, which would also be accessible to training posts employed by the BRU. In addition to trust and university funding, they are aiming to attract matched funding from industry.)</td>
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<td>In hearing:</td>
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<td>Recruitment: The BRU has already had an impact on increased capacity for hearing research in the UK because it is bringing in people from different countries and disciplines. A lot of the BRU money for posts has been transferred to the university, because all but 3.5 posts (the BRU unit manager, a secretary and 1.5 clinical scientists) are university posts. 14 academic staff are now in place. Recruitment has been facilitated by the fact that Nottingham has a very strong reputation in hearing research.</td>
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<td>Training: There is BRU support for four training posts (PhD, MD). The university is also making a contribution (e.g. providing student accommodation).</td>
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<td>Nuffield Orthopaedic</td>
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| Recruitment: Most of the posts planned for the BRU have been appointed, around 20–25 of which 13 are full-
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| Centre NHS Trust and University of Oxford                    | time, including clinicians, therapy posts, research nurses and various support posts. Approximately half of these posts are part-time with the BRU, and are otherwise funded by the university or NHS.  
  Growth by two to three professorships would not have been possible without the BRU; the university has complemented BRU funding for these appointments.  
  The BRU helped escalate the critical mass of qualified staff working on translational research in musculoskeletal disease. This is unlikely to have been achieved without the BRU.  
  Training: The BRU intends to create the next generation of clinical researchers. It has helped open up PhD training opportunities for 33 students of which 15 are surgeons – this is the largest number of PhD students doing orthopaedic surgery in the world. Half were recruited in the last year.  
  “The people that [the director of the BRU] is now growing have become critical to the reinvigoration of the centre and… whatever happens with the BRU.” |
| Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield | Common to both BRUs at Sheffield:  
  Recruitment: BRU status offers a package to attract people; consultants choose at various points in their career whether to go down the consultant (DGH) or research route (teaching hospital), so having the status enables to Sheffield to attract the required researchers. The trust and university are hiring from a small pool of clinical scientists in bone research. Building a critical mass of translational researchers will help overcome the challenges they have experienced in the past in terms of fragmented research efforts.  
  Retention: Although it is difficult to find concrete evidence on how the BRU is influencing retention efforts, the BRU leaders felt that it is now easier to persuade younger fellows to stay as there are new and exciting opportunities via the BRUs.  
  Training: There is not an explicit BRU stream of formal support for training, but there is on the job training for nurses, as well research training from other sources. Staff hope to develop a Sheffield-based translational research training programme with the BRU next year through the CRF facility for all involved in clinical research (funding up to 20 individuals for a three-year course).  
  In musculoskeletal disease:  
  Recruitment: So far 19 staff (scientists, statisticians, nurses) have been recruited. Some of the positions are part-time. It has been easier to recruit from academia to the BRU, than from the NHS. |
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<td>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield Cardiovascular disease</td>
<td>Training: People are getting good fellowships that Sheffield did not previously attract (e.g. five or six new senior clinical fellowships (MRC and Wellcome Trust)).</td>
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<td>Common to both BRUs at Sheffield:</td>
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<td></td>
<td>Recruitment: BRU status offers a package to attract people; consultants choose at various points in their career whether to go down the consultant (DGH) or research route (teaching hospital), so having the status enables to Sheffield to attract the required researchers. The trust and university are hiring from a small pool of clinical scientists in bone research. Building a critical mass of translational researchers will help overcome the challenges they have experience in the past in terms of fragmented research efforts.</td>
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<td>Training: There is not an explicit BRU stream of formal support for training, but there is on-the-job training for nurses, as well a research training from other sources. Staff hope to develop a Sheffield-based translational research training programme with the BRU next year through the CRF facility for all involved in clinical research (funding up to 20 individuals for a three-year course).</td>
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<td>In cardiovascular disease:</td>
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<td>Recruitment: 90% of the staff the BRU planned to appoint are now in place. Some “spectacularly good appointments, which were certainly helped by BRU status”. These include the manager of the programme, an ex-PhD student, a research nurse from a cardiovascular background with health-service-related research experience, and a biometrician with a previous Wellcome Trust fellowship. One more post will be appointed in the next year, to lighten the director’s responsibilities.</td>
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<td>Training: There are now three basic science PhDs being trained to conduct translational research. Three one-year entry-level clinical fellows should be appointed in the next few weeks.</td>
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<td>Three to four nurses are in training at the BRU, and, more generally, the CRF has enabled common training for nurses and a common pool of experience.</td>
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<td>Southampton University Hospitals NHS Trust and University of</td>
<td>Common to both BRUs at Southampton:</td>
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<td>Recruitment: Significant progress with recruitment has been made at both BRUs. The majority of staff</td>
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| Southampton Nutrition, diet and lifestyle | employed by the BRU have NHS contracts primarily. This is because of the nature of funding flows for the scheme. Some of the BRU funding is used to buy out clinician time to get them involved in research (programmed activities). A joint BRU manager has been appointed. 
**Training:** There are clinical research fellowships allowing people to work between the two BRUs, doing a PhD (via synergy funding of approximately £400,000 per year over the life of the BRU). 
**In nutrition:** 
**Recruitment:** An operations manager and six research nurses have been recruited. Some university staff are also now formally employed by the BRU. 
**Training:** The BRU support will help train a cadre of nutrition research nurses (of which there are currently practically none in the country, and particularly not senior nurses). |
| Southampton University Hospitals NHS Trust and University of Southampton Respiratory disease | Common to both BRUs at Southampton:  
**Recruitment:** Significant progress with recruitment has been made at both BRUs. The majority of staff employed by the BRU have NHS contracts primarily. This is because of the nature of funding flows for the scheme. Some of the BRU funding is used to buy out clinician time to get them involved in research (programmed activities). A joint BRU manager has been appointed. 
**Training:** There are clinical research fellowships allowing people to work between the two BRUs, doing a PhD (via synergy funding of approximately £400,000 per year over the life of the BRU). 
**In respiratory disease:** 
**Recruitment:** Scientists, technicians and clinical research fellows have been appointed. 
**Training:** BRU funding will support two PhD scientists and two clinical research fellows. |
**Table 9. The impact of the BRU scheme in improvements in the funding environment for translational research**

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<th>Biomedical Research Unit</th>
<th>BRU influence on funding environment (include also evidence of impact on leveraging further funding)</th>
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| **Barts & The London NHS Trust and Queen Mary, University of London**  
  **Cardiovascular disease** | The BRU has helped leverage additional funding from other sources. There is about £1 million worth of work that has been won since the BRU was won, with the award of the BRU highlighted on application forms. Although direct attribution is clearly very difficult, interviewees felt that the presence of the BRU had made a big difference to success rates for further funding applications, even at this early stage. There seems to have been a notable impact on success rates for applications in support of stem cell research, with a BHF clinical training fellowship, MRC clinical training fellowship, and a UK Stem Cell Foundation PhD studentship all won since the BRU award. Other awards include a further NIHR grant (NEAT award) for £235,000 to develop cell sheet technology in experimental models to the point where it can be put into man – awarded since the BRU was won.  
  Other significant changes in the funding environment have occurred, but it is more difficult to be sure of the contribution made by the BRU in these instances. First, a strand of development of work on role of nitrite in controlling blood pressure has recently secured follow-on funding with a special project grant of £484,000 from the BHF. Second, a bid for £3.85 million was recently submitted to the Wolfson Foundation to fit out additional laboratory space in support of the research programme. |
| **University Hospital Birmingham NHS Foundation Trust and University of Birmingham**  
  **Gastrointestinal disease** | Birmingham now has a support portfolio from the NIHR of around £20 million across a range of initiatives (the BRU and others), which is five times what the trust received under the Culyer scheme.  
  The BRU leaders feel that the award has helped leverage additional funds for stem-cell work from the MRC, and from industry (Novimmune, Novartis). |
| **United Bristol Healthcare NHS Trust and University of Bristol**  
  **Cardiovascular disease** | The funding provided by the NIHR for BRUs has been very important for Bristol’s ability to take forward translational research in the current economic climate in which charities have less money, and in an environment where research is becoming increasingly expensive. The trust and university have also committed additional resources to the BRU.  
  There are some grants that were won at approximately the same time as the BRU and in the time after the award, but it is difficult to attribute this directly to the BRU. |
| **Royal Brompton & Harefield NHS Trust and Imperial College London**  
  **Cardiovascular disease** | (Cardiology has historically had the benefit of substantial charitable funding, especially from the BHF. The BHF funded basic science but also PhD and MD research fellowships, which helped translational research progress. These fellowships enabled a lot of good quality research and training to be pursued simultaneously.)  
  **Common to both BRUs at Royal Brompton & Harefield NHS Trust and Imperial College:** The BRU award has influenced the trust to commit additional resources to the cardiovascular and respiratory BRUs (the BRU funding has almost been doubled by the trust). There has also been additional commitment from the university in terms of some salary support, and support for research time in the BRU. |
| **Royal Brompton & Harefield NHS Trust and Imperial College London**  
  **Cardiovascular disease** | **Common to both BRUs at Royal Brompton & Harefield NHS Trust and Imperial College:** The BRU award has influenced |
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| Harefield NHS Trust and Imperial College London  
*Respiratory disease* | The trust to commit additional resources to the cardiovascular and respiratory BRUs (the BRU funding has almost been doubled by the trust). There has also been additional commitment from the university in terms of some salary support, and support for research time in the BRU. |
| Leeds Teaching Hospitals NHS Trust and University of Leeds  
*Musculoskeletal disease* | For Leeds, the environment for translational research has become much better since the NIHR came into play. The BRU scheme has provided funding for physical infrastructure and staff, which are needed to push forward the research themes.  
Interviewees thought that the BRU has had an impact on leveraging further funds. Approximately £20 million of external funding has been attracted since receiving the award. For example, Leeds has secured funding from other NIHR streams, the Wellcome Trust and the Arthritis Research Campaign. The trust and university have also committed additional funding to the BRU.  
The BRU is a pillar for trying also to strengthen other research areas in a similar way to the BRU model (but financed by trust and university in early phases of the effort). The university and the trust have made a circa £13 million investment into a biological health research centre they would like to grow into a formal NIHR designated centre. |
| University Hospitals of Leicester NHS Trust and University of Leicester  
*Cardiovascular disease* | There is a strong history of charitable funding of cardiovascular research at Leicester University (e.g. from the BHF and also MRC). However, charitable sources are (rapidly) becoming more difficult to access, so “the timing of BRU could not have been better – the relative value of having a BRU could never have been greater than it is now”.  
It is too early to look at the impacts of the scheme on attracting new funding. Linked to the establishment of the BRU is a plan to set up a research building dedicated to cardiovascular research adjacent to where the current BRU facilities are. The initial phase of this is being funded by the university (ultimately by the HEFCE), and staff are in the process of making applications to match that funding to bring it up to a four-storey building (for infrastructure) – they will be approaching charity for this. |
| Royal Liverpool & Broadgreen University Hospitals NHS Trust and University of Liverpool  
*Gastrointestinal disease* | The funding environment for pancreatic disease research has historically been poor; there was only one specific fund for pancreatitis *clinical* research in the UK, and funding for phase 1 and phase 2 trials has been particularly difficult to get in recent years for two reasons: the amount of funding has been reducing, and Liverpool did not have a CRF as a platform to work with.  
The BRU has significantly improved Liverpool’s capacity to conduct pancreatic research. BRU leaders feel that the award will enhance their potential to leverage further research funding, and increase their chances of being successful in an upcoming Cancer Research UK initiative to award two centres of excellence in pancreatic cancer research. |
<p>| Nottingham University Hospitals NHS Trust and University of Nottingham | <strong>Common to all three BRUs at Nottingham:</strong> The funding environment for translational research has been vastly improved by virtue of the BRU scheme The scheme is also having a positive side-effect: the trust and university are working together to develop shadow BRUs in other areas outside those funded by the NIHR, and committing their own resources to this task. |</p>
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<td><strong>Gastrointestinal disease</strong></td>
<td>Nottingham has won an MRC Developmental Pathway funding scheme award. Having three BRUs was a big factor in the successful bid, because the BRUs create a channel for picking up and further developing the research outputs that will over time come from the MRC awards. The BRUs are also beginning to attract additional grants: the importance of the BRUs is often made explicit in referees’ comments: “Attracting external funding is a direct reflection of [the] increased capacity BRUs provide.” Both the trust and the university are matching BRU funding support. In gastrointestinal disease: BRU funding is channelled into physical infrastructure development and staffing, as well as some training. Quite a lot of money has come through the BRU and this has helped bring in other money as well. This is largely because the BRU is a badge of quality and provides a new level of support for research translation. Examples include funding from the MRC and NIHR.</td>
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<td><strong>Nottingham University Hospitals NHS Trust and University of Nottingham</strong></td>
<td><strong>Respiratory disease</strong> Common to all three BRUs at Nottingham: The funding environment for translational research has been vastly improved by virtue of the BRU scheme. The scheme is also having a positive side-effect: the trust and university are working together to develop shadow BRUs in other areas outside those funded by the NIHR, and committing their own resources to this task. Nottingham has won an MRC Developmental Pathway funding scheme award. Having three BRUs was a big factor in the successful bid, because the BRUs create a channel for picking up and further developing the research outputs that will over time come from the MRC awards. The BRUs are also beginning to attract additional grants: the importance of the BRUs is often made explicit in referees’ comments: “Attracting external funding is a direct reflection of [the] increased capacity BRUs provide.” Both the trust and the university are matching BRU funding support. In respiratory disease: Since becoming a BRU, a number of other awards have been received, including a large EU collaborative grant (Innovative Medicines Initiative).</td>
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<td><strong>Nottingham University Hospitals NHS Trust and University of Nottingham</strong></td>
<td><strong>Deafness and hearing</strong> Common to all three BRUs at Nottingham: The funding environment for translational research has been vastly improved by virtue of the BRU scheme. The scheme is also having a positive side-effect: the trust and university are working together to develop shadow BRUs in other areas outside those funded by the NIHR, and committing their own resources to this task. Nottingham has won an MRC Developmental Pathway funding scheme award. Having three BRUs was a big factor in the successful bid, because the BRUs create a channel for picking up and further developing the research outputs that will over time come from the MRC awards. The BRUs are also beginning to attract additional grants: the importance of the BRUs is often made explicit in referees’ comments: “Attracting external funding is a direct reflection of [the] increased capacity BRUs provide.” In deafness and hearing: Both the trust and the university are matching BRU funding support. The BRU capital funding</td>
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| Nuffield Orthopaedic Centre NHS Trust and University of Oxford  
*Musculoskeletal disease* | The trust R&D director responsible for getting grants was previously isolated from the university and wasn’t very effective. This director is now located in the orthopaedics department, giving peer-support and a base for developing the skills of the others. The trust has supported themes that would probably not have been funded otherwise. The trust has leveraged an approximately 5% increase in income since becoming a BRU. One year ago the grant portfolio was approximately £15 million. Now it is £19 million. Annual income was under £4 million and now it is just under £5 million; (NIHR income in total is approximately 65% of total income). Not all of this leverage is directly attributable to the BRU, but it is reinforced by it. These figures also demonstrate a trajectory (in 2001, the grant portfolio was £2.5 million and the income was approximately £700,000). |
| Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield  
*Musculoskeletal disease* | In the past, universities would often seek funding from streams which direct research activity towards direct benefit for patients. The BRU has enabled Sheffield to pay more the attention to translational research. The BRU funding and status have made it a priority. |
| Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield  
*Cardiovascular disease* | The BRU funding is having a significant impact on Sheffield’s capacity to engage in translational cardiovascular research. With much of the infrastructure in place, the BRU is starting to phenotype and test people with heart attacks to inform some more upstream research about the implication of specific genes in cardiovascular biology. The trust also plans to set up a follow-up clinic for patients who participate in research. |
| Southampton University Hospitals NHS Trust and University of Southampton  
*Nutrition, diet and lifestyle* | Common to both BRUs at Southampton: The BRU scheme has had an amplifying effect – it has mobilised the trust and university to invest their own funds in creating shadow BRUs in other areas. The trust is also investing in building physical capacity for the BRUs (e.g. a 3T MRI scanner to improve imaging capacity). This extends the capabilities of the BRU, without using NIHR funds.  
In nutrition: Historically, the MRC and BBSRC have funded nutrition research, but mostly basic science. The FSA has been funding population-related nutrition research. Industry funding is largely product-based, and does not match particularly well with the major lines of research in nutrition that Southampton is active in. Historically, near patient integrative nutrition research has not been well supported nationally. The BRU funding is helping pursue translational nutrition research. The BRU leaders strongly felt that having a BRU has helped attract other funding. There is more enthusiasm for putting in bids to NIHR and research councils, and since Southampton was awarded a BRU, they have been more successful in winning funding from other sources. In addition, the university and trust “do more than match” the funds from NIHR. |
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<th>Biomedical Research Unit</th>
<th>BRU influence on new organisational structures, systems and functions to facilitate translational research</th>
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| **Barts & The London NHS Trust and Queen Mary, University of London**  
Cardiovascular disease | Management and governance: The governance and management structure was developed to deliver clear and transparent lines of accountability and responsibility. Both trust and university partners have strong involvement. The governance structure is now in place, with reporting lines direct to the trust chief executive and the dean of the medical school. A BRU board has been established and is directed by the trust’s head of R&D. Furthermore, to help ensure the quality of work undertaken within the BRU, an external scientific advisory board has been appointed, alongside two external specialist advisors on cardiovascular imaging. |
| **University Hospital Birmingham NHS Foundation Trust and University of Birmingham**  
Gastrointestinal disease | Management and governance: There is a small management group now in place, which meets once a month and includes finance officers from the NHS, managers from the university, and the BRU manager and director. There is also a steering committee that meets four times a year with a broader representation, including a patient representative. Plans to set up an advisory board have not yet been realised, but this is now an imminent prospect. It appears that a formal system for performance monitoring and assessment has not been established yet, but interviewees were keen to stress that discussions in this area are under way locally and nationally. |
| **United Bristol Healthcare NHS Trust/University of Bristol**  
Cardiovascular disease | Management and governance: There is a new, tailored governance structure in place, with a BRU board run by the BRU director and accountable to the medical school and ultimately the trust. The board includes finance and governance capacity, with clinical governance lead on the NHS side. The NIHR has allowed for flexibility in the use of BRU funding so that it can be channelled in the best possible direction and this has been very helpful. |
| **Royal Brompton & Harefield NHS Trust and Imperial College London**  
Cardiovascular disease | Management and governance:  
Common to both BRUs at Brompton and Harefield NHS Trust and Imperial College: The trust now has greater clarity in terms of how they allocate and monitor research spend. Both BRUs report to the Research Management Committee of the trust. The ability to transfer funds from year 1 to years 2 or 3 is helpful.  
In the cardiovascular BRU: The BRU management structure enables a sufficient degree of autonomy for the BRU to pursue its goals while at the same time ensuring a requisite degree of integration and accountability to the trust and university more broadly. |
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<tr>
<th>Biomedical Research Unit</th>
<th>BRU influence on new organisational structures, systems and functions to facilitate translational research</th>
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| Royal Brompton & Harefield NHS Trust and Imperial College London  
*Respiratory disease* | Management and governance:  
Common to both BRUs at Brompton and Harefield NHS Trust and Imperial College: The trust now has greater clarity in terms of how they allocate and monitor research spend. Both BRUs report to the Research Management Committee of the trust. The ability to transfer funds from year 1 to years 2 or 3 is helpful.  
In the respiratory BRU: the allocation of scientific resources (e.g. tissue) is better and more transparently managed, and prioritised based on clinical needs and scientific questions – it is much more transparent than in the past. |
| Leeds Teaching Hospitals NHS Trust and University of Leeds  
*Musculoskeletal disease* | Management and governance: The BRUs have allowed for much more formalised and more effective collaboration between the trust and the university. There is a BRU board chaired by the trust chief executive and a BRU executive group chaired by the BRU director. Both structures are made of people from the university and the trust. The BRU board also provides a link (advises and receives advice) to the Joint Governance Board of the trust and university (which was set up to coordinate a number of the joint collaborative arrangements, to help facilitate cross fertilisation and sharing of knowledge for the benefit of all initiatives (e.g. BRU, CLAHRCs). There is also a Scientific Advisory Board in place.  
Communications: BRU funding is also to be used to help in the development of an integrated ICT database across the unit, linking information gathered across the groups and linking in the NHS data system.  
There are events, seminars at which clinicians from various divisions and academics from various disciplines in the BRU can discuss opportunities to work together. “There are regular meetings, seminars and presentations of research with a room full of clinicians and NHS people as well as academics and… to be honest, it's not always easy to tell who is who. And when we've got the discussion at the end, it's sometimes not easy to know whether the person who's just asked the question is a senior clinician or a senior academic or a senior academic-clinician. I think that's been an important part of making this work.” |
| University Hospitals of Leicester NHS Trust and University of Leicester  
*Cardiovascular disease* | Management and governance: The governance of the BRU incorporates the trust and university elements. There is also lay representation on the BRU Management Board, Governance and Management Committee, and they will appoint a public liaison officer as part of the BRU. There is a fair deal of flexibility and autonomy the BRU Director has in allocating funds to projects that fit within BRU themes, and in responding to emerging opportunities. There is more funding for translational research in the UK now than in the past, and the fact that it is ring-fenced is very important.  
Communications: There are plans to establish systems to move information on patients between NHS and university IT systems and databases – working towards a far more linked up ICT infrastructure. |
| Royal Liverpool &  
Management & governance: Centralisation of the process to commission research, so that money is |
## Biomedical Research Unit

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| Broadgreen University Hospitals NHS Trust and University of Liverpool  
*Gastrointestinal disease* | The BRC and BRU have affected the research governance across the trust and university, not just across the directly supported specialities. A joint research office across nine local NHS organisations is being planned for the near future. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
*Gastrointestinal disease* | Common to all three BRUs at Nottingham:  
**Management and governance:** The BRUs are overseen by a joint University and NHS Strategy Board, chaired by the trust chief executive. Members of the board include the director of R&D from the trust, the dean of the medical school, directors of each BRU, the clinical director of research at the medical school, and a patient representative. The BRU Board also reports to the Trust Management Board and to the University Faculty Management Committee. In addition, each of the three BRUs at Nottingham has its own management board and executive. The joint BRU Board gets regular performance reports from individual BRUs. They are also in the process of developing a performance scorecard for each of the three BRUs to help manage performance internally.  
**Communications:** There is a need to get IT systems together so that academics and clinicians can communicate more efficiently. Work on this has started but there is room for further improving the ICT infrastructure. Informal events such as a new programme of conferences for all staff have been developed. They bring university and trust employees together, and the BRUs will also be invited to share and present their work. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
*Respiratory disease* | There is flexibility in transferring funds to the next financial year to deal with difficulties in short term spend, which is very helpful. Over time staff have developed local solutions to some challenges regarding the transfer of funds between the trust and university. An agreement for employing staff has been set up, whereby NHS BRU money which pays for university staff is transferred to the university. There are in essence two funding streams – one controlled by the NHS and one controlled by the university.  
**Communications:** There is a need to get IT systems together so that academics and clinicians can communicate more efficiently. Work on this has started but there is room for further improving the ICT infrastructure. Informal events such as a new programme of conferences for all staff have been developed. They bring university and trust employees together, and the BRUs will also be invited to share and present their work. |
| Nottingham University Hospitals NHS Trust and University of Nottingham  
*Deafness and hearing* | Common to both BRUs at Sheffield:  
**Management and governance:** “The single biggest difference that the BRU will make and is making...” |
| Nuffield Orthopaedic Centre NHS Trust and University of Oxford  
*Musculoskeletal disease* | Management and governance: The BRU has had a significant impact on improving research governance structures. Individuals in charge of sourcing grant funding who used to sit on the trust are now located with the orthopaedics department, which provides them with strong peer support and a base for developing the skills of the others. Old-style R&D governance has been subsumed under new BRU structure – putting a system of scrutiny in place to ensure that those researchers doing inadequate own-account work are helped to achieve higher quality research. |
| Sheffield Teaching Hospitals NHS Foundation Trust and University of | |
### Biomedical Research Unit | BRU influence on new organisational structures, systems and functions to facilitate translational research

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<tr>
<th>Sheffield</th>
<th>already will be to ensure that as well as what [the university is doing], there is a complete understanding of mission from the NHS… and that there is more engagement by academically minded NHS consultants.” The management and governance of research resources is much more transparent and better targeted than in the past. There is a far stronger emphasis on structured planning for taking research forward, and on monitoring performance; poor own-account research undertaken by NHS staff is being discouraged and a new attitude to high-quality, relevant research being encouraged.</th>
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<tbody>
<tr>
<td><em>Musculoskeletal disease</em></td>
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<tr>
<td>Sheffield Teaching Hospitals NHS Foundation Trust and University of Sheffield</td>
<td></td>
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<tr>
<td><em>Cardiovascular disease</em></td>
<td></td>
</tr>
<tr>
<td>Southampton University Hospitals NHS Trust and University of Southampton</td>
<td>Common to both BRUs at Sheffield:</td>
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<tr>
<td><em>Nutrition, diet and lifestyle</em></td>
<td>Management and governance: Both BRUs have created an integrated management and governance structure. A joint BRU executive enables communication between the BRUs and trust and university via a single line of communication.</td>
</tr>
<tr>
<td>Southampton University Hospitals NHS Trust and University of Southampton</td>
<td>The DH/NIHR has been very flexible in terms of how they use their funding (e.g. moving between capital and revenue, dealing with short-term spend) and that has been very helpful.</td>
</tr>
<tr>
<td><em>Respiratory disease</em></td>
<td>The allocation of resources in a targeted and transparent manner means that there are many more opportunities for NHS clinicians to get protected research time.</td>
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<td></td>
<td>The trust has also appointed R&amp;D directors in each clinical division, whose job is to define research strategies, make sure they account for resources properly and make sure consultants can get appropriate programmed activities for research.</td>
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<td></td>
<td>Each BRU also has a management board with representation from the trust, university and public and service users. Scientific programme leaders and the administration team report to the management board. There is also an external advisory group for each BRU.</td>
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Table 11. List of interviewees

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<thead>
<tr>
<th>BRU</th>
<th>Disease area</th>
<th>BRU director</th>
<th>Chief executive of trust</th>
<th>Dean of the academic organisation</th>
</tr>
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<tbody>
<tr>
<td>University Hospital Birmingham NHS Foundation Trust and University of Birmingham</td>
<td>Gastrointestinal disease</td>
<td>Prof. David Adams</td>
<td>Julie Moore</td>
<td>Prof. Ian Booth</td>
</tr>
<tr>
<td>United Bristol Healthcare NHS Trust and University of Bristol</td>
<td>Cardiovascular disease</td>
<td>Prof. Gianni Angelini</td>
<td>Graham Rich</td>
<td>Prof. Peter Mathieson</td>
</tr>
<tr>
<td>Leeds Teaching Hospitals NHS Trust and University of Leeds</td>
<td>Musculoskeletal disease</td>
<td>Prof. Paul Emery</td>
<td>Maggie Boyle</td>
<td>Prof. David Cottrell</td>
</tr>
<tr>
<td>University Hospitals of Leicester NHS Trust and University of Leicester</td>
<td>Cardiovascular disease</td>
<td>Prof. Nilesh Samani</td>
<td>Malcolm Lowe-Lauri</td>
<td>Prof. David Wynford-Thomas</td>
</tr>
<tr>
<td>Royal Liverpool &amp; Broadgreen University Hospitals NHS Trust and University of Liverpool</td>
<td>Gastrointestinal disease</td>
<td>Prof. Robert Sutton</td>
<td>Tony Bell</td>
<td>Prof. John Caldwell</td>
</tr>
<tr>
<td>Barts and The London NHS Trust and Queen Mary, University of London</td>
<td>Cardiovascular disease</td>
<td>Prof. Mark Caulfield</td>
<td>Peter Moris</td>
<td>Prof. Sir Nicholas White</td>
</tr>
<tr>
<td>Royal Brompton &amp; Harefield NHS Trust and Imperial College London</td>
<td>Cardiovascular disease</td>
<td>Prof. Dudley Pennell</td>
<td>Robert Bell</td>
<td>Prof. Steve Smith</td>
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<td></td>
<td>Respiratory disease</td>
<td>Prof. Eric Alton</td>
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<tr>
<td>Nottingham University Hospitals NHS Trust and University of Nottingham</td>
<td>Deafness and hearing problems</td>
<td>Dr Heather Fortnum</td>
<td>Peter Homa</td>
<td>Prof. Ian Hall</td>
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<tr>
<td></td>
<td>Gastrointestinal disease</td>
<td>Prof. John Atherton</td>
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<tr>
<td></td>
<td>Respiratory disease</td>
<td>Prof. Alan Knox</td>
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<tr>
<td>Nuffield Orthopaedic Centre NHS Trust and University of Oxford</td>
<td>Musculoskeletal disease</td>
<td>Prof. Andrew Carr</td>
<td>Jan Fowler</td>
<td>Prof. Alastair Buchan</td>
</tr>
<tr>
<td>BRU</td>
<td>Disease area</td>
<td>BRU director</td>
<td>Chief executive of trust</td>
<td>Dean of the academic organisation</td>
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<tr>
<td>Sheffield Teaching Hospital NHS Foundation Trust and University of Sheffield</td>
<td>Cardiovascular disease</td>
<td>Prof. David Crossman</td>
<td>Andrew Cash</td>
<td>Prof. Tony Weetman</td>
</tr>
<tr>
<td></td>
<td>Musculoskeletal disease</td>
<td>Prof. Richard Eastell</td>
<td></td>
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</tr>
<tr>
<td>Southampton University Hospitals NHS Trust and University of Southampton</td>
<td>Nutrition, diet and lifestyle</td>
<td>Prof. Alan Jackson</td>
<td>Mark Hackett</td>
<td>Prof. Iain Cameron</td>
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<tr>
<td></td>
<td>Respiratory</td>
<td>Prof. Ratko Djukanovic</td>
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