SECTION 2.2
Policy and engagement
Policy and engagement

Translating excellent research into improved policy has never been so important. This translation occurs via many different routes, but engagement — communicating and exchanging information and expertise — between researchers, the public and policymakers is crucial. Policymakers, including politicians, regulatory organisations and arms-length bodies, have a duty to use the best possible evidence to benefit society’s health and wellbeing. And researchers are encouraged to maximise opportunities for their findings to inform policy decisions.

This is not always a straightforward pathway however and academic research is not always ready for application or can easily be put into practice by policymakers.

This is why the MRC requires researchers to consider including ways to engage with the public, policymakers and other potential beneficiaries in their research design. Extending and improving this exchange is at the heart of our strategic plan1. The MRC recognises the importance of public engagement: helping the public to understand our scientific findings, reflecting their views in our decision-making and effectively communicating these policies.

The MRC has a long history of engaging and consulting with parliamentarians. The MRC regularly submits evidence2 to inquiries and consultations by government departments and House of Commons and House of Lords Select Committees, drawing on the expertise of researchers and research boards as necessary. The MRC played an instrumental role in helping to ensure that the UK became the first country in the world to allow mitochondrial donation to prevent serious genetic diseases. The House of Lords voted in favour of the new regulations in February 2015, allowing the use of in vitro fertilisation (IVF) techniques to swap faulty mitochondrial DNA with donor egg mitochondrial DNA3. Our researchers are also often called upon as experts in particular areas of research to give advice or evidence.

MRC researchers contribute to the development and revision of clinical guidelines, including NICE and WHO guidelines. These are recommendations to clinicians on diagnosis, management and treatment in specific areas of healthcare based on systematic evidence. MRC researchers also influence policy through their membership of guideline committees, participating in national consultations, and training practitioners. The MRC has played a leading role in critical areas of research and subsequent policy and strategy development, from our public health work on obesity and smoking to the establishment of UK Biobank4.

The MRC runs a varied public engagement programme5 involving many researchers, from open days and participation in science festivals to our annual Max Perutz science writing competition6. But public engagement is not limited to these MRC-run events. The MRC encourages our scientists to engage, educate and inspire the public through various mediums, should that be taking part in exhibitions or workshops, giving lectures or being interviewed by the media. MRC researchers are often also involved in the many public engagement activities run through their own universities or research organisations.

All scientific achievements, from those arising from discovery science to those with research origins in the health sciences, require engagement with the public or policymakers to be successfully put into practice. This is the case whether they result from many years of focused research or are a moment of scientific serendipity.
This publication, comprising examples of where MRC-supported researchers have influenced policy and been involved in public engagement, is one in a series of chapters making up the 2014/15 Outputs, outcomes and impact of MRC research report. The information in this publication has largely been sourced from Researchfish.

The examples in this chapter are categorised by the following research areas:

- Global health
- Genomics
- Cardiovascular disease
- Kidney disease
- Infectious diseases
- Neurodegeneration and cognition
- Mental health
- Obesity, nutrition and physical activity
- Smoking
- Hearing

Each case study focuses on a predominant output type, but others might be referenced within it. The accompanying icons represent the relevant output types. A key to the list of output types is at the end of this chapter.

Further information on each piece of research can be found on the Research Councils UK (RCUK)'s information portal — the Gateway to Research — by entering the project reference number listed under each case study in the search field.

## Global Health

### Influence on policy: Reports on Ebola to the World Health Organization and other international stakeholders

Work at the MRC Centre for Outbreak Analysis and Modelling at Imperial College London has helped to inform and stimulate the international response to the on-going Ebola epidemic.

The Ebola outbreak was first reported to the World Health Organization (WHO) in March 2014 and can be traced back to a small village in south-eastern Guinea, where the initial infection occurred in December 2013. However, it wasn't until the summer of 2014 that there was sufficient information available to appreciate the scale of the problem. The outbreak had quickly become the deadliest occurrence of the disease since its discovery in 1976. A team of more than a dozen researchers at Imperial College conducted vital work analysing the line lists — information on where the patients lived, who they were in contact with, their demographics and symptoms. They were able to track the spread of the epidemic through time to estimate the transmission rate and incubation period. By linking the Ebola cases together, the researchers were able to determine the risk factors for transmission and to identify the most effective interventions for agencies on the ground.

This work was used to provide reports on the current Ebola epidemic to the World Health Organization (WHO), the UK Government, the US Centers for Disease Control and Prevention (US CDC) and other international stakeholders.

Based on this analysis, the WHO declared the epidemic to be a "public health emergency of international concern in August 2014”. As of 8 February 2015, the total number of reported cases was 22,894 and the number of deaths 9,177.
This work also fed into a report published in the New England Journal of Medicine (NEJM) in October 2014\textsuperscript{12} which documented current trends in the epidemic and projected expected case numbers for the following weeks if control measures were not enhanced. The report found that cases of the disease were divided equally between the sexes. Until then, one view had been that women might be harder hit because they were more likely to care for the ill; another view had been that it would be men who might be more likely to bury the dead.

The report also made various recommendations, such as reducing the length of time from symptom onset to hospitalisation to curtail transmission in the community. The individual fatality rate was also lower for hospitalised patients.

As a result of their work, staff at the MRC centre were interviewed by several media outlets, including the BBC\textsuperscript{13}, The Independent\textsuperscript{14}, Yahoo! News\textsuperscript{15} and The Guardian\textsuperscript{16,17}.

In addition to helping steer the emergency relief efforts in West Africa and controlling the epidemic, the evidence helped convey the seriousness of the situation, providing support for the public funding from Governments and charities. It is also important to note the contribution that such "real world" analysis of epidemics makes to UK resilience as the methods are also applied to monitoring and modelling disease outbreak scenarios in this country.

Project reference number: MR/K010174/1

\textbf{Influence on policy: International rabies strategies}

Part of Professor Daniel Haydon’s research at the University of Glasgow involves analysing how large-scale infectious disease interventions work and how they can be improved. He has evaluated the success of mass dog vaccination programmes as a rabies prevention measure in Africa and Asia.

Rabies is a zoonotic viral disease – a disease that can be spread from animals to humans. It affects domestic and wild animals and is transmitted to people through contact with infectious material, usually saliva, via bites and scratches. It occurs in more than 150 countries and territories worldwide and causes more than 55,000 deaths each year, mainly in Africa and Asia\textsuperscript{18}. The global cost of rabies is estimated to be more than US$6 billion including US$1.6 billion spent on post-exposure prophylaxis\textsuperscript{19} — a course of vaccination given as treatment.
Domestic dogs are the primary source of the rabies virus transmitted to humans and growing evidence suggests that elimination of canine rabies is possible through sustained annual campaigns that achieve 70 per cent coverage.

Professor Haydon and colleagues were instrumental in developing a canine vaccination strategy between 2010 and 2013 to eliminate a rabies epidemic in Bali, Indonesia that had begun in 2008. The team developed a computer model which they used to test different control strategies and to identify the key targets that would need to be met to eliminate rabies from the island. They estimated the transmission rate between dogs to be similar to cases in other countries, such as Tanzania, despite the dog population on Bali being at least 10 times higher. This finding supported evidence that aiming to control rabies spread by reducing dog population (such as through culling) would not be effective. The researchers showed that the control and elimination of rabies from the island was feasible using canine vaccination. In the first three years of the outbreak, 130 human deaths from rabies had been reported and more than 130,000 doses of post-exposure prophylaxis delivered to bite victims. The vaccination programme reduced the rate of human death by 90 per cent.

Additionally, Professor Sarah Cleaveland, also at the University of Glasgow, was a member of the committee that developed Kenya’s national strategy for controlling and eliminating rabies. The strategy, published in October 2014, is the first of its kind in Africa and aims to eliminate rabies in Kenya by 2030.

Professor Sarah Cleaveland was also a member of the World Health Organization (WHO) Expert Consultation on Rabies, which published its second report in 2013.

Project reference number: G0901135

Influence on policy: Setting WHO post-2015 global tuberculosis targets

Tuberculosis (TB) is an infection caused by the bacterium *Mycobacterium tuberculosis*. It is spread through inhaling tiny droplets from the coughs or sneezes of an infected person.

Approximately one third of the world’s population has latent TB, which means they are infected with *M. tuberculosis* but are not yet ill with the disease and cannot therefore transmit it. Around 10 per cent of people with latent tuberculosis will then go on to develop the full disease. However, this rate is higher in people with compromised immune systems, such as those with HIV, malnutrition or diabetes.

In 2013 nine million people became ill with TB and 1.5 million died from the disease. Evidence suggests that without proper treatment, up to two thirds of people with the disease could die from it. TB occurs in every part of the world; however, more than 95 per cent of cases and deaths from the disease are in developing countries.

Dr Richard White at the London School of Hygiene and Tropical Medicine was part of the WHO expert group that provided the modelling evidence used to set the targets for the WHO tuberculosis prevention, care and control after 2015 strategy. This follows on from previous strategies and aims for a 75 per cent reduction in TB deaths and a 50 per cent reduction in the incidence rate by 2025, increasing to 95 and 90 per cent respectively by 2035.
Ever since the MRC was set up to specifically tackle TB in 1913, it has played an important role in TB research. Recently, the MRC has funded global TB trials, shed light on the evolution of the disease\textsuperscript{27}, furthered knowledge of its cellular processes to identify new drug targets\textsuperscript{28}, and been instrumental in determining the best combination of treatments\textsuperscript{29,30}.

Project reference number: MR/J005088/1

Genomics

Engagement activities: Functional genome

**Professor Chris Ponting** is a professor of genomics — the study of genome structures, function, evolution and mapping — at the University of Oxford. He has contributed to many landmark genome sequencing projects, including sequencing the human, mouse, rat and chicken genomes. The primary focus of his research is using genome-scale data sets to identify or prioritise genes that are mutated in human disease.

In 2014 Professor Ponting and colleagues published research suggesting that only 8.2 per cent of the human genome was functional\textsuperscript{31}. To reach this figure, the researchers identified how much of our genome had avoided being changed over 100 million years of mammalian evolution. They took this to indicate that this DNA has important functions that need to be retained. This finding will speed up the ability to track down genetic mutations in disease as researchers can prioritise genetic differences that occur in the conserved portion of the genome. This research received media coverage, including articles published in *The Telegraph*\textsuperscript{32} and the *Daily Mail*\textsuperscript{33}.

Project reference number: MC_U137761446
Cardiovascular disease

Influence on policy: NICE guidelines on Hypertension: Clinical management of primary hypertension in adults

Hypertension — or high blood pressure — affects around 30 per cent of people in England. If left untreated, it increases a person’s risk of a heart attack or stroke. Hypertension was the leading risk factor for the overall global burden of disease in 201034.

MRC-funded researcher Professor Bryan Williams at University College London is recognised as one of the world’s leading authorities in the field of hypertension research. Taking an experimental medicine approach, he focuses on developing clinically applicable models for the human non-invasive assessment of aortic pressure — the blood pressure at the root of the aorta, the main blood vessel that takes blood away from the heart. Professor Williams led the team that conducted the Conduit Artery Functional Endpoint (CAFE) study, which suggested that central aortic blood pressure may be more predictive of cardiovascular events such as a stroke or heart attack, than the traditional peripheral blood pressure measurements, taken at the top of the arm35.

Professor Williams chaired the NICE Clinical management of primary hypertension in adults guidelines group, published in 201136. These guidelines reflected a shift in focus from the importance of diastolic (minimum) pressure towards the greater importance of systolic (maximum) pressure in people aged 60 years and older. The content of these guidelines was supported by evidence provided by Professor Williams’ research, specifically an MRC-funded study that showed that different types of hypertension at different stages of life had different cardiovascular effects, the results of which were published in 201437. This study demonstrated that diastolic blood pressure was a less powerful predictor of most cardiovascular diseases than systolic pressure.

The findings may also support the early use of treatment in younger people with mild blood pressure elevations. Professor Williams is currently leading the TREAT CASP study38, part-funded by the MRC. This study aims to determine whether it is preferable to use central aortic pressure to measure high blood pressure in young men to better identify who would be most likely to benefit from treatment and so reduce the number of people who suffer from heart attacks or strokes. This will use a pioneering device developed by Professor Williams whilst at the University of Leicester that could revolutionise the way blood pressure is measured and monitored for the first time in more than a century. The device, which is similar to a wristwatch, uses a sensor on the wrist to record the pulse wave. Using computerised mathematical modelling, scientists are able to accurately read the aortic pressure from this information. The device, which was developed in conjunction with Healthstats, a biotechnology company in Singapore, won the 2011 Times Higher Education award for ‘Outstanding contribution to innovation and technology’.

Project reference number: UD99999967
Influence on policy: American Heart Association guidelines for arteriovenous malformations of the brain

Professor Rustam Al-Shahi Salman is an academic clinician at the University of Edinburgh who studies cerebral haemorrhages, or bleeds on the brain. Cerebral haemorrhages occur when a blood vessel bursts in the brain. They cause around 15 per cent of all strokes, and affect about 10,000 adults in the UK — and about 1.5 million adults worldwide — each year.

Professor Al-Shahi Salman has recently shown that treating patients with arteriovenous malformations in the brain increases their risk of stroke when compared to not treating them. An arteriovenous malformation (AVM) is a tangle of blood vessels with the arteries directly connected to the veins. This means that blood from the arteries drains directly into the veins without stopping to supply the normal tissues in that part of the body with oxygen and nutrition.

AVMs can occur in any part of the body but most commonly in the brain or spine. They contain weakened blood vessels which may burst from the high pressure of blood flow from the arteries, causing bleeding, which in the brain can lead to brain damage and death. Brain AVMs affect approximately one in 2,000 people and around one per cent of affected adults suffer a stroke as a result of their AVM each year.

However, Professor Al-Shahi Salman has found that over a 12-year period, patients who chose not to have their AVM treated by trying to remove or block the tangle of blood vessels were less likely to have a stroke or die from related causes.

In 2014, Professor Al-Shahi Salman was appointed to the American Heart Association guidelines committee for arteriovenous malformations of the brain. The guidelines, due to be published in 2016, will include the results of his study.

Professor Al-Shahi Salman says, “There are few AVM guidelines other than those produced by the AHA, so the AHA’s guidelines tend to affect practice worldwide. This edition of the guidelines will be influenced by our population-based study and the ARUBA randomised trial that my group oversaw in the UK.”

Project reference number: G108/613
Kidney disease

Influence on policy: NICE guidelines on Eculizumab for treating atypical haemolytic uraemic syndrome (aHUS)

Research led by Professor Tim Goodship at the University of Newcastle has had a significant impact on the prognosis of patients with atypical haemolytic uraemic syndrome (aHUS). His research has benefited from a combination of MRC, Northern Counties Kidney Research Fund and other medical research charity funding.

aHUS is a rare, life-threatening progressive disease that primarily affects kidney function. It affects around 200 people in the UK, with 20-30 more people diagnosed each year. The disease causes blood vessel inflammation and blood clot formation, which damages vital organs, particularly kidneys, and eventually leads to organ failure. Eight per cent of patients die on initial manifestation of the condition and 50 per cent of surviving patients will need long-term dialysis within two years. The outcome of kidney transplantation for patients is poor due to the high risk of disease recurrence and subsequent kidney loss. The five-year transplant survival for patients is 51 per cent.

Professor Goodship and colleagues identified mutations in the genes coding for complement system proteins in 1998 and showed that genetic abnormalities caused 70 per cent of cases. The complement system is part of the body’s innate immune system. Its role is to induce inflammation to help the body remove pathogens and fight infection. However the genetic abnormalities in aHUS cause the complement system to be uncontrollably and excessively activated.

Building on this research, Professor Goodship, in collaboration with Professor Giuseppe Remuzzi from the Mario Negri Institute in Italy, showed that the underlying mutation strongly predicted the kidney transplant outcome. Indeed, the five-year survival rate for transplant patients known to have a genetic abnormality is just 30 per cent.

As a result of this research, an NHS diagnostics service has been established, which now tests for five of the genes implicated in the condition. This screening can identify those patients who do not have the gene mutations and are therefore more likely to benefit from a kidney transplant.

Professor Goodship also conducted trials into the use of monoclonal antibody and complement-inhibitor, eculizumab, to treat the genetic cases of the disease. On demonstrating its effectiveness, both the US Food and Drug Administration and the European Medicines Agency approved its use in 2011.

Based on this research and despite the high cost of treatment, the NHS approved the use of eculizumab to treat aHUS and NICE published its guidelines for use in January 2015.

“Eculizumab offers people with aHUS the possibility of avoiding end-stage renal failure, dialysis and kidney transplantation, as well as other organ damage.”

– Sir Andrew Dillon

NICE logo. Reproduced with permission from NICE.
 Outputs, outcomes and impact of MRC research: 2014/15 report

NICE chief executive Sir Andrew Dillon said: “Eculizumab offers people with aHUS the possibility of avoiding end-stage renal failure, dialysis and kidney transplantation, as well as other organ damage.”

Project reference number: G0701325

### Infectious diseases

#### Engagement activities: Antimicrobial resistance

**Professor Laura Piddock** is a professor of microbiology at the University of Birmingham. She is a leader in the field of antimicrobial resistance (AMR) research and also a prominent spokesperson on the growing concern of AMR. She is director of Antibiotic Action, an independent UK-led global initiative that aims to inform and educate about the need to discover, research and develop new treatments for bacterial infections.

Since 1928, when Sir Alexander Fleming accidentally discovered penicillin growing on a petri-dish of bacteria, antibiotics have saved the lives of countless numbers of people and animals. Their discovery is seen as one of the most important scientific achievements of the 20th century. But overuse and misuse of antibiotics has contributed to the emergence of resistance. Sir Alexander Fleming himself, on collecting a Nobel Prize for his discovery, predicted the dawn of this battle, saying, “It is not difficult to make microbes resistant to penicillin in the laboratory by exposing them to concentrations not sufficient to kill them…”

There are high proportions of antibiotic resistance in bacteria causing common infections, such as urinary tract infections, pneumonia and bloodstream infections in all regions of the world. Highly resistant bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) and multidrug-resistant Gram-negative bacteria cause a high percentage of hospital-acquired infections. There were about 450,000 new cases of multidrug-resistant tuberculosis (MDR-TB) in 2012 and extensively drug-resistant tuberculosis (XDR-TB) has been identified in 92 countries.

Professor Piddock’s research focuses on how bacteria develop resistance to antibiotics, particularly in the systems that allow antibiotics to be transported in and out of bacteria. Professor Piddock recently discovered a mutation in the gene coding for *Salmonella Typhimurium*’s efflux pump — the mechanism that enables the bacteria to expel toxins — which makes it more efficient at pumping some antibiotics out of the cell. In the international study, the researchers sequenced the genome of a *Salmonella Typhimurium* strain contracted by a patient who had failed to respond to the antibiotic ciprofloxacin. They discovered the mutation in the efflux pump gene *acrB* and that it changed the binding of drugs to the pocket of the pump. Computational studies showed that this was partly due to an altered structure. Importantly, the researchers discovered that this mutation caused an increased susceptibility to other drugs due to reduced pumping. The finding that this single mutation can cause resistance to some drugs but susceptibility to others informs those developing new antibiotics.
This research received media interest in early 2015, including articles published in *The Telegraph* and *Yahoo! News*.

Professor Piddock has been interviewed by numerous media outlets on the growing problem of antibiotic resistance, including the *BBC*, *The Guardian* and the *Daily Express*.

In 2014 the research councils launched a cross-council initiative on AMR research, which is being led by the MRC. This will see all seven councils working together to tackle AMR. A joined-up, multi-disciplinary approach is essential and so the initiative will coordinate the work of medical researchers, biologists, engineers, vets, economists, social scientists, mathematicians and designers. It is only through tackling the problem at every level and in every environment that we will be able to take the next steps towards a solution. Some of the groundwork for this initiative is showcased in a timeline of research and series of case studies.

*Project reference number: G0501415*

**Influence on policy: Participation in Acting on Campylobacter Together (ACT) campaign**

**Professor Sarah O’Brien** researches zoonoses — diseases that can be transmitted from animals to humans — at the University of Liverpool. She was part of the Food Standard Agency (FSA)’s Acting Together on Campylobacter (ACT) accelerated solutions event in June 2014 that brought together representatives from government, retailers, caterers, poultry producers and processors, and consumer organisations to agree actions that could be taken to reduce campylobacter. This event directly influenced the development of the FSA’s campylobacter risk management programme to decrease campylobacter levels in UK-produced chickens.

Campylobacter is the most common cause of food poisoning in the UK, considered to be responsible for around 280,000 cases each year, more than salmonella, *E. coli* and listeria combined.
Contaminated poultry causes around four in five cases of campylobacter poisoning in the UK. The latest report from the FSA revealed that 73 per cent of shop-bought chickens are contaminated with the bacterium, with 19 per cent testing positive at the highest level. The infection causes symptoms such as severe diarrhoea, abdominal pain, fever, and sometimes vomiting. Symptoms usually persist for between two and 10 days, but in severe cases can continue for up to three weeks. Infection can sometimes lead to other complications such as the development of irritable bowel syndrome (IBS) and rarely, Guillain-Barré syndrome – a serious and sometimes permanent condition of the nervous system.

The FSA estimates that the infection causes more than 100 deaths each year in the UK and that the annual cost to the economy is £900 million.

Project reference number: MC_U122785837

Neurodegeneration and cognition

Engagement activities: Edinburgh Fringe Festival

Dr Alan Gow is an assistant Professor of Psychology at Heriot-Watt University and part of the University of Edinburgh’s Centre for Cognitive Ageing and Cognitive Epidemiology. His research focuses on the lifestyle factors that have an impact on health and wellbeing in old age, particularly cognitive ageing, such as physical activity and social and intellectual activities.

Dr Gow took part in the 2014 Edinburgh Fringe Festival with a show called Brain training on trial, as part of the Cabaret of dangerous ideas. He reviews the top ‘brain-training’ smartphone apps in light of their unverified claims of being supported by research. He also covered this topic in a blog post for Research the headlines.

He had previously published research showing that people over 70 who took regular exercise showed less brain shrinkage over a three-year period than those who did little exercise. The study of 700 people did not however find there to be any benefit to brain health from participation in social or mentally-stimulating activities. Research has shown that greater brain shrinkage is linked to problems with memory and thinking. The researchers also showed that those who were more physically active had fewer ‘damaged’ areas in the brain’s white matter — the brain tissue consisting of nerve fibres that transmits signals from one part to another. This research received media attention in 2012, resulting in articles by the BBC and the Daily Mail.

Project reference number: MR/K026992/1
Engagement activities: Muscular Dystrophy Campaign (MDC) Duchenne and Becker impact day

Professor Steve Winder’s research at the University of Sheffield focuses on the role of the cell adhesion and signalling protein dystroglycan in diseases such as muscular dystrophy and cancer.

Professor Winder gave a talk on the use of anti-cancer drugs to treat Duchenne Muscular Dystrophy (DMD) at the Muscular Dystrophy Campaign (MDC)’s Duchenne and Becker impact day in June 2014.

The muscular dystrophies (MD) are a group of inherited genetic conditions that gradually cause the muscles to weaken, leading to an increasing level of disability. Duchenne muscular dystrophy (DMD) is one of the most common and severest forms, affecting around one in 3,500 boys in the UK. It usually affects boys in early childhood and individuals with the condition will usually only live into their 20s or 30s. There is currently no cure, though various treatment avenues are being explored by MRC researchers.

DMD is caused by a mutation in the DMD gene, the largest gene on the X chromosome. The DMD gene encodes the protein dystrophin, an important part of muscle tissue that provides structural stability. Mutations in the DMD gene result in complete loss of the protein, rendering it non-functional. The loss of the dystrophin protein ultimately leads to the degeneration of muscle fibres, progressive weakness and premature death.

Dystroglycan is a transmembrane protein that binds to a protein called laminin on the outside of the cell and dystrophin on the inside of the cell, forming the dystrophin glycoprotein complex (DGC). The loss of dystrophin leads to the loss of this complex. Professor Winder has shown that this is because the absence of dystrophin causes increased tyrosine phosphorylation of dystroglycan (adding a phosphate group to the tyrosine amino acid of dystroglycan). It is believed that this then signals the degradation of the DGC by proteasome enzymes, leading to the symptoms experienced in DMD. There are anticancer drugs that inhibit this process, which has been shown to be implicated in some forms of cancer. Drugs that work in a similar way may hold the potential to also treat DMD. Professor Winder received interest from the charity Action Duchenne to fund future research as a result of the talk he gave. Professor Winder also gave a presentation on the same topic to Action Duchenne’s International DMD Conference in London in November 2014.

Professor Winder has patented the use of tyrosine phosphorylation inhibitors as a treatment for DMD.

Further information on the MRC’s research into DMD is available in the Outputs, outcomes and impact of MRC research 2013-14 (Development of products, research materials and intellectual property pages 7-8) report and in the MRC’s film Celebrating 100 years of life-changing discoveries: Dale to Davies.

Project reference number: G0701129
Engagement activities: *The secret life of four-year olds*

Dr Sam Wass, developmental psychologist at the MRC Cognition and Brain Sciences Unit, was featured on Channel Four’s *The secret life of four-year olds*[^1], a documentary observing a group of four-year olds as they meet for the first time in a specially-adapted nursery. Dr Wass’ expertise in the development of attention during childhood was put to good use as he explored how the children made friendships, stood up for themselves and found their place in a new social group. The programme was first broadcast in February 2015.

In 2015 Dr Wass published research suggesting that frequent eye movement in babies could show differences in visual processing and be a subtle early indicator of autism spectrum disorders[^2].

*Project reference number: MC_UP_A060_1104*

Mental Health

**Influence on policy: Co-author of 2014 Chief Medical Officer (CMO) annual report on public mental health**

Dr Hind Khalifeh’s research at University College London looked at violence against adults with severe mental illness[^3]. Dr Khalifeh showed that women with severe mental illness were up to five times more likely than the general population to be victims of sexual assault and two to three times more likely to suffer domestic violence[^4]. The MRC and Big Lottery-funded study found that 40 per cent of women surveyed with severe mental illness had suffered rape or attempted rape in adulthood, of whom 53 per cent had attempted suicide as a result. In comparison, in the general population, seven per cent of women had been victims of rape or attempted rape, of whom three per cent had attempted suicide. The study also showed that 12 per cent of men with severe mental illness had been seriously sexually assaulted, compared with 0.5 per cent of the general population. The results of this study received various media coverage, including an article in the *Daily Mail*[^5].

Dr Khalifeh co-authored the chapter on *Violence and mental health* in the Chief Medical Officer (CMO) 2013 annual report, which was on mental health[^6]. This chapter included a proposal that healthcare staff need additional training, including awareness that people with mental health problems have a two to tenfold risk of being a victim of violence compared with the general population. This proposal is reflected in the CMO’s main recommendations; that there should be a period of specific mental health training in GP training and that a core part of this should include specific training for awareness about the consequences of violence on mental health across the life course.

*Project reference number: G0802434*
Engagement activities: Role of the habenula in negativity

Dr Jonathan Roiser’s research at University College London (UCL) focuses on the neurobiological mechanisms underlying psychiatric symptoms. In 2014 he published research showing that a small area of the brain — the habenula — plays a key role in how humans predict, learn from and respond to negative experiences. Animal studies had shown that the habenula fires up when subjects experience or expect to experience adverse events. However, due to the habenula’s small size (less than 3mm in diameter), this response had been difficult to see on scans. The researchers developed a high-resolution functional Magnetic Resonance Imaging (fMRI) technique which was used in conjunction with computational modelling to examine the response of the habenula during a set of reinforcement learning tests.

The 23 participants were shown several abstract images. The images followed by either punishment (electric shocks), a reward (of money), a loss (of money) or no response. For certain images, a punishment or reward followed each time but for others this varied - leaving people uncertain whether they were going to feel pain or not. The researchers found that the habenula was activated when people saw images associated with shocks. The habenula activity was stronger and faster the more certain the individual was that a particular image would result in a punishment.

The researchers propose that these responses in the habenula guide behaviour towards reward and away from punishment or negative events. This suggests a potential role for the habenula in disorders such as depression. Professor Roiser had previously reported abnormalities in habenula structure and function in patients with depression. This research received national and international media coverage, including articles by the BBC, ITV, the Daily Mail and the New York Times.

Project reference number: G0901275

Obesity, nutrition and physical activity

Influence on policy: NICE guidelines on Managing overweight and obesity in adults – lifestyle weight management services

Professor Paul Aveyard’s systematic reviews on weight management programmes were used as evidence in the NICE guidelines on Managing overweight and obesity in adults – lifestyle weight management services.

Professor Susan Jebb’s earlier research at the Human Nutrition Research (HNR) group showed that participating in commercial weight management programmes, such as Weightwatchers and Slimming World, can lead to a greater weight loss than from following the advice of a doctor. Following this, Professor Aveyard at the University of Oxford has begun a clinical trial to determine the effectiveness of two weight-loss interventions involving GPs raising the issue of weight with patients presenting to their GP for reasons other than weight management. In the control group, the GP will simply encourage weight loss by emphasising the benefits to health. In
the intervention group. GPs will advocate referral to a weight management service and make that referral immediately. The main outcome will be weight loss after one year, however, patients’ and GPs’ reactions will also be assessed.

This is an important step in translating Professor Jebb’s discovery into practice.

Project reference number: MR/J000515/1

Influence on policy: Citations in public health guidelines on physical activity

Physical inactivity is considered to be the fourth leading cause of global mortality⁷⁹, being linked to cancers, heart disease and diabetes. The World Health Organization estimates that around 3.2 million people die each year as a result of physical inactivity⁸⁰. Public Health England (PHE) cautioned in 2014 that half of women and one third of men were damaging their health through lack of physical activity⁸¹. Physical inactivity is also a huge financial burden, costing the NHS an estimated £900 million each year⁸².

The aim of the MRC’s Epidemiology Unit (EU) at the University of Cambridge is to study “the genetic, developmental and environmental determinants of obesity, type 2 diabetes and related metabolic disorders and [how this] contributes to the prevention of these disorders”. Since its establishment in 2003, research at the unit has provided key evidence demonstrating the links between both diet and physical inactivity and health. In 2009, researchers at the EU demonstrated an association between time spent physically inactive or sedentary and increased levels of insulin in the blood, a predictor of type 2 diabetes and cardiovascular disease⁸³. The following year, research undertaken at the unit shows that for each hour per day participants spent in front of the television, their risk of death from heart disease multiplied by a factor of seven per cent⁸⁴. In 2014 the unit showed, using computer modelling, that the health benefits of the London Cycle Hire scheme outweighed the negative impacts from injuries and exposure to air pollution. This has helped to make the public health case for cycle hire schemes⁸⁵.

Research at the unit has contributed to the development of many public health guidelines. Research demonstrating the link between sedentary behaviour in both adults⁸⁶ and children⁸⁷ was used as evidence in the revision of the UK Chief Medical Officers’ recommendations on physical activity⁸⁸, which places an increased emphasis on the avoidance of prolonged periods of sedentary time⁸⁹.

In October 2014 Public Health England (PHE) published Everybody active, every day, a national evidence-based strategy to support all sectors in embedding physical activity into daily life and making it an easy, cost-effective and ‘normal’ choice in every community in England⁹⁰. Several of the recommendations in this strategy are supported by, and cite, research undertaken at the Epidemiology Unit. This research includes studies showing that cycling to work increases...
in towns with town-wide cycling initiatives\textsuperscript{91}, providing new, high-quality, traffic-free cycling and walking routes encourages people to get about more by foot and by bike\textsuperscript{92}, and that campaigns to improve children’s health should be directed at whole families\textsuperscript{93}.

Much of this research has been led by the UK Clinical Research Collaboration (UKCRC) Centre for Diet and Activity Research (CEDAR)\textsuperscript{94}, hosted by the EU.

\textit{Project reference number: MC\_UP\_1001/2}

\section*{Engagement activities: Expert commentary on healthy diet}

\textbf{Dr Nita Forouhi} at the MRC Epidemiology Unit has provided expert commentary on many diet-related studies during the past year, has been quoted in numerous media articles and has given advice to various television programmes, including BBC's \textit{The One Show} and \textit{Trust me, I'm a doctor}\textsuperscript{95}.

Dr Forouhi wrote a comment piece for \textit{The Telegraph}\textsuperscript{96} on a study conducted at University College London showing the association between fruit and vegetable consumption and risk of death by cancer and heart disease. The study showed that eating seven or more portions of fruit and vegetables reduces the specific risks of death by cancer and heart disease by 25 per cent and 31 per cent respectively. Dr Forouhi commented that the study showed that eating more fruit and vegetables was beneficial and therefore supported the ‘five-a-day’ message, reassuring the public that this health recommendation is right. She advised however that it did not warrant increasing the advice to ‘seven-a-day’ or more. She highlighted that less than a third of the UK adult population and ten per cent of young people aged 11-18 eat five or more portions and so efforts would better be spent in getting the population to meet the current guidelines.

Research led by Dr Forouhi on the relationship between saturated fat and type 2 diabetes also received considerable media attention in 2014. The international EPIC-InterAct study found that saturated fatty acids can be associated with both an increased and decreased risk of developing the disease, depending on the type of fatty acids present in the blood.

The researchers analysed the blood of 12,403 people who developed type 2 diabetes and 16,154 individuals who did not, from 340,234 adults across eight European countries. Using a sophisticated method of high-speed blood analysis,
developed especially for the project by researchers at MRC Human Nutrition Research, they determined the proportion of each of the nine fatty acids in blood samples from the study participants and related this with later incidence of type 2 diabetes.

They found that saturated fatty acids with an even number of carbon atoms in their chain, such as those found in red meat and fried food, were associated with a higher risk of type 2 diabetes, while the odd-chain saturated fatty acids, found in dairy products such as yoghurt, were associated with a lower risk.

This research received media attention from The Guardian, The Telegraph, the Huffington Post and the Daily Mail.

Project reference number: MC_UP_A100_1003

Engagement activities: Alcohol consumption in pregnancy

Research by an MRC-funded PhD student at the University of Leeds on the link between light drinking by pregnant women and pre-term birth led to national media coverage and the Royal College of Obstetricians and Gynaecologists (RCOG) changing its guidance on alcohol consumption.

Evidence about the damaging effects of heavy drinking in pregnancy is well-established. However, the link between light alcohol consumption and adverse outcomes, such as pre-term labour and low-birth weight, is less clear. The current guidance issued by the Department of Health is that pregnant women and women trying to conceive should avoid alcohol altogether and never drink more than 1–2 units once or twice a week.

Camilla Nykjaer used data from the Caffeine and Reproductive Health (CARE) Study, a prospective cohort of 1,303 pregnant women aged 18–45 years. The study used questionnaires to assess alcohol consumption before pregnancy and for the three trimesters separately. She found that the association with adverse birth outcomes such as low birth weight and pre-term birth were strongest in pregnant women consuming more than two units of alcohol a week and in trimesters one and two. However, the study also showed that even women adhering to the Department of Health guidance in the first trimester still doubled their risk of giving birth to a premature or underweight baby.

Camilla gave interviews with various media outlets, resulting in national coverage including articles by the BBC, and The Times.

Following this media interest, Camilla was approached by the Royal College of Obstetricians and Gynaecologists (RCOG) to review their guidance on alcohol consumption in pregnancy. The resulting guidance, recommending that women trying to conceive and pregnant women in the first trimester do not consume any alcohol at all, was published in February 2015.

Project reference number: Not currently available.
Smoking

Influence on policy: Smoking reduction

The MRC funds the **UK Centre for Tobacco and Alcohol Studies** (UKCTAS) through the UK Clinical Research Collaboration. The UKCTAS is a leading international centre of tobacco and alcohol research and policy excellence with an extensive research programme. Work conducted by researchers at the centre has been used in various reports to steer national policy on smoking reduction.

Smoking is the biggest cause of avoidable death and health inequalities in the UK. It causes more than 100,000 deaths each year in the UK and costs the economy £14bn. Since the ground-breaking discovery in 1957 by MRC researchers Sir Richard Doll and Sir Austin Bradford Hill that smoking was a cause of lung cancer, the MRC has been at the forefront of research into the dangers of smoking. This led to national public health campaigns and a 50 per cent reduction in the number of people who smoke. However, there are still around 10 million people in the UK who continue to smoke — just over one in five of the adult population and so continued research, that can be translated into changes to policy and influential public health campaigns, are key.

Sir Cyril Chantler published his independent report *Standard packaging of tobacco* in April 2014. This report concluded that standardised packaging of tobacco products, in conjunction with the current tobacco control regime, is very likely to lead to a modest but important reduction in the uptake and prevalence of smoking and therefore a positive impact on public health. Sir Cyril substantially uses research by the UKCTAS as evidence for his report, particularly the 2012 ‘Stirling report’, led by the University of Stirling, which he considers “the most extensive and authoritative piece of work on the issue of standardised packaging”. The report found strong evidence that plain packaging would reduce the attractiveness and appeal of tobacco products, it would increase the noticeability and effectiveness of health warnings, and it would reduce the use of design techniques that may mislead consumers about the harmfulness of tobacco products. On the day the report was published, the Government announced that it was minded to introduce regulations to provide for standardised packaging.

**Professor Ann McNeill**, deputy director of the UKCTAS, was an author of the 2014 *Standard packaging for tobacco products* report, a summary of recent evidence on the effectiveness of standardised packaging as a tobacco control strategy. The report includes new data from the Australia and United Kingdom International Tobacco Control Policy Evaluation Projects (the ITC Project), for which Professor McNeill was a principle investigator. The report notes that
after implementation of standard packaging in Australia in 2013, the noticeability of health warnings doubled, from 34 to 66 per cent. Support for standard packaging among smokers and non-smokers also increased from 28 per cent to 51 per cent. The report concludes that it is clear that standardised packaging is effective and important for public health. It recommends that standardised packaging for tobacco products be introduced in the UK without delay.

Work conducted by researchers at the UKCTAS has formed a substantial part of the evidence used by the Government in their draft regulations for standard packaging. In March 2015, MPs voted in favour of standard cigarette packaging by 367 to 113. The legislation is set to be voted through by the House of Lords in Spring 2015.

Researchers at the centre have also contributed to the debate on the use of electronic cigarettes. Professor John Britton, director of the UKCTAS, and colleague Dr Ilze Bogdanovica, authored Electronic cigarettes, a report commissioned by Public Health England. They concluded that as evidence suggests that current smokers are willing to use electronic cigarettes as an alternative to tobacco, they offer vast potential health benefits. They however state that maximising those benefits, whilst minimising harms and risks to society such as ‘normalising’ smoking and promoting nicotine addiction, needs appropriate regulation, monitoring and risk management.

Professor Britton has also been consulted by various media sources because of his expertise. He featured in a 2014 BBC documentary on why thousands of young people still take up smoking despite the health risks and regulation. He has also been interviewed by media outlets including The Guardian, The Telegraph and Sky News.

Professor Britton received a CBE for his work in respiratory medicine and his research into tobacco control in the 2013 Queen’s New Year Honours.

Project reference number: MR/K023195/1

Hearing

Influence on policy: Expert witness to Commission on Hearing Loss

Professor Cornelis Kros at the University of Sussex was an expert witness for the 2014 Commission on Hearing Loss, established by the International Longevity Centre UK (ILC-UK), a leading think-tank on longevity, ageing and population change. The final report, published in July 2014, highlights the growing numbers experiencing hearing loss, the associated mental and physical health problems and the subsequent loss to the economy.

There are an estimated 10 million people in the UK with hearing loss. This number is set to increase significantly due to the rising number and proportion of older people. By 2031, it is expected that there will be 4.1 million people in the UK with hearing loss — nearly 20 per cent of the total population. Hearing loss can lead to individuals experiencing communication difficulties, becoming socially isolated and developing mental and physical health problems. Recent research has also linked hearing loss and dementia. This report estimates the cost to the economy of hearing loss-linked unemployment to be almost £25bn per year. The report reasons that many of the impacts of hearing loss both
for the individual and society could be negated by better support for those with hearing loss, including improved provision, take-up and use of hearing aids.

Professor Kros gave expert testimony to the commission, providing evidence for the need for early detection and giving examples of technology that can be used flexibly, such as in the home. He highlighted the flaws of relying on an audiogram to fully assess the intricacies of hearing loss, which was specifically quoted in the report. His evidence fed directly into the report’s recommendations.

This report may have influenced the Parliamentary early day motion on hearing loss that was tabled in February 2015 and supported by 41 MPs. The motion calls on the Government to request that the NHS asks NICE to prioritise developing a hearing loss clinical guideline to establish and maintain quality standards for patients suffering hearing loss.

The MRC is also working with other research councils and organisations to improve technology for hearing aids. The cross-council Lifelong Health and Wellbeing programme held a workshop in 2014 to bring together the NHS, Action on Hearing Loss, academic experts and hearing aid manufacturers to identify the research challenges and possible solutions to problems experienced by hearing-aid wearers. Following the workshop, £5.6m has been made available by the research councils to support the development of networks and research projects to build new multidisciplinary and cross-sector collaborations. These will further explore areas for potential multidisciplinary research to improve hearing aids.

*Project reference number: MR/K005561/1*
Key to output types

- Publications
- Collaborations and partnerships
- Further funding
- Next destination and skills
- Engagement activities
- Influence on policy, practice, patients and the public
- Research tools and methods
- Research databases and models
- Intellectual Property and licensing
- Medical products, interventions and clinical trials
- Artistic and creative products
- Software and technical products
- Spin outs
- Awards and recognition
End Notes

2. http://www.mrc.ac.uk/about/spending-accountability/accountability/
4. http://www.ukbiobank.ac.uk/
7. Researchfish is the online system used by the MRC and many other funders in the UK and worldwide to collect information on research outputs, outcomes and impact. For more information, please see http://www.mrc.ac.uk/funding/guidance-for-mrc-award-holders/researchfish/
8. http://gtr.rcuk.ac.uk/
29. http://www.ctu.mrc.ac.uk/our_research/research_areas/tuberculosis/studies/rifaquin/


Some links to articles and resources mentioned in the text:

- [http://www.nice.org.uk/guidance/cg127](http://www.nice.org.uk/guidance/cg127)
- [http://www.mrc.ac.uk/research/achievements/browse-our-achievements/tackling-antimicrobial-resistance/](http://www.mrc.ac.uk/research/achievements/browse-our-achievements/tackling-antimicrobial-resistance/)

More information on the topics mentioned in the text can be found using the provided links and resources.


62. https://www.youtube.com/watch?v=Gu211pnQapI&index=1&list=PLSus4fp7v7sReMvdpox6_ml0Jb13eA4ucp


64. Wass SA et al. Shorter spontaneous fixation durations in infants with later emerging autism. Scientific Reports Article number: 8284 doi:10.1038/srep08284

65. Dr Khalifeh moved to King’s College London in September 2014.


76. https://www.nice.org.uk/guidance/ph53


91. Centre for Diet and Activity Research (CEDAR) [http://www.cedar.iph.cam.ac.uk/](http://www.cedar.iph.cam.ac.uk/)


94. Centre for Diet and Activity Research (CEDAR) [http://www.cedar.iph.cam.ac.uk/](http://www.cedar.iph.cam.ac.uk/)

95. http://www.bbc.co.uk/iplayer/episode/b04m0bt4/trust-me-im-a-doctor-series-2-episode-1


121. http://www.mrc.ac.uk/funding/browse/joint-mrc-epsrc-call-for-hearing-aid-research-networks/
Cover image credits (from left to right): Ebola workers in Liberia. Image credit: Flickr/European Commission DG ECHO CC BY 3.0 | The printed human genome fills a book. Image credit: Stephen C Dickson CC BY-SA 4.0 | Colour-enhanced scanning electron micrograph showing Salmonella Typhimurium (red) invading cultured human cells. Image credit: Rocky Mountain Laboratories, NIAID, NIH | Fruit and vegetables. Image credit: Flickr/Christer Barregren | How a standardised packet of cigarettes might look if standardised packaging of tobacco products were introduced. Image credit: Department of Health