HOUSE OF LORDS

Science and Technology Select Committee

Corrected oral evidence: Ageing: Science, Technology and Healthy Living

Tuesday 15 October 2019

11.20 am

Watch the meeting

Members present: Lord Patel (The Chair); Lord Borwick; Lord Browne of Ladyton; Baroness Hilton of Eggardon; Lord Hollick; Lord Kakkar; Baroness Manningham-Buller; Viscount Ridley; Baroness Sheehan; Baroness Walmsley; Baroness Young of Old Scone.

Evidence Session No. 2 Heard in Public Questions 11 - 21

Witnesses

Professor James Nazroo, Professor of Sociology, University of Manchester; Professor Marcus Richards, Programme Leader at the MRC Unit for Lifelong Health and Ageing, University College London; Dr Stuart Ritchie, King's College London.

USE OF THE TRANSCRIPT

1. This is a corrected transcript of evidence taken in public and webcast on www.parliamentlive.tv.

Examination of witnesses

Professor James Nazroo, Professor Marcus Richards and Dr Stuart Ritchie.

Q11 **The Chair:** Good morning, gentlemen, and thank you all for coming today to help us with our inquiry. We are on livestream broadcast, so if you have a private conversation it will be picked up. That applies to Committee Members, too. Before we start with questions, please introduce yourselves from my left, if you do not mind, so that we get you on the record. If you want to make any opening statement, please feel free to do so; otherwise, we will progress to the questions.

Professor James Nazroo: I am a professor of sociology at the University of Manchester, where I am also the founding director, and now co-director, of the Manchester Institute for Collaborative Research on Ageing. I am also one of the team who founded the English Longitudinal Study of Ageing, and I am co-PI of that study. My research interests are using interdisciplinary methods to facilitate and understand inequalities in later life.

Professor Marcus Richards: I am a professor at University College London. I am a psychologist by background but in practice an epidemiologist. I lead the mental ageing programme for the MRC Unit for Lifelong Health and Ageing at UCL. By mental ageing I mean cognitive function and psychiatric state. One of the main things the unit does is direct the oldest of the British birth cohorts, born in 1946, the MRC National Survey of Health and Development.

Dr Stuart Ritchie: I am a lecturer at King's College London at the Social, Genetic and Developmental Psychiatry Centre. I am interested in cognitive developments across lifespan; I am also a psychologist, like Marcus. I am interested particularly in cognitive decline and normal cognitive ageing—not necessarily dementia, but the normal cognitive ageing that everyone experiences from their late 20s onwards but particularly in later life—and I have worked for many years on the Lothian birth cohort, which is one of the longitudinal cohorts based at the University of Edinburgh in Scotland.

Q12 **The Chair:** Thank you very much. Can you explain to us what cohort studies you do, why you do them, what you intend to get out of them and how they can be used practically to help with ageing and healthy ageing?

Professor James Nazroo: I am one of the co-investigators—a co-PI—of the English Longitudinal Study of Ageing, as I said. This was established in 2000, and the first wave of data collection was in 2002. We interview people aged 50 and older every two years, and every four years we also give them a biomedical assessment.

The Chair: What are the numbers?

Professor James Nazroo: The sample ranges from 8,500 to 11,500 each time we do the data collection. That is because, as the sample gets older, we add new people in. The study is multidisciplinary, so it covers

economics, health, cognition, social and psychological factors, including, as I indicated, actual direct measurements of health and biology. It covers people 50 and over, as I said, so we cover numerous cohorts over time.

The purpose of the longitudinal study is really to understand the dynamics of ageing processes and how they change over time and with different cohorts. It answers questions about the economics of ageing—retirement, pensions and so on; and about cognition—cognitive decline, resilience in relation to cognition, and a whole range of health factors. Importantly, and perhaps quite uniquely across a number of studies, it also covers social well-being, social activity and social engagement—things such as digital exclusion, volunteering and so on.

The other unique thing about the English Longitudinal Study of Ageing is that it is a member of an international body of studies, which means that we can understand the English context in comparison with Ireland, Northern Ireland and Scotland, but also more broadly internationally the United States and mainland Europe, because the studies have very, very similar designs, which means that you can make direct comparisons across the studies.

We hope through the studies to inform scientific understanding within and across disciplines, but, most importantly, the studies are intended to inform policy.

The Chair: Okay. Hitherto, has any of the data been used by policymakers?

Professor James Nazroo: Yes. The study has been used by the Treasury, the Department of Health and the Department for Work and Pensions—three very simple government examples—and by the Centre for Ageing Better; it is a core dataset for the centre. It is used by Age UK and so on, and local government also uses the data.

Professor Marcus Richards: It is worth saying that a cohort is simply a group of people who have something in common. I work mainly with the birth cohorts, and the thing that these cohorts all have in common is that they are all born at almost exactly the same time. They are all born in the same week of the same month of the same year; 1946 is the oldest one, then 1958, 1970, and the millennium cohort. So, by design, any differences in medical outcomes, for example, cannot be due to differences in age. It has to be something else, and it is that something else—whether it is genetics, behaviours, earlier or later exposures—which we set out to try to isolate.

Following James, I will say a bit more about the 1946 birth cohort. This is a multidisciplinary study focusing on mental ageing, i.e. cognitive and psychiatric health, cardiometabolic health, physical capability, and physiological resilience. We collect information on health status at every wave, but we also measure people's height, weight, blood pressure, lung function and so on. Behind all that information are detailed updates on

social status, family composition, housing tenure, retirement status and so on.

Dr Stuart Ritchie: The study that I am working on—the Lothian birth cohort 1936—is also, as the name suggests, the cohort who were all born in 1936. The particularly interesting thing about them is that when they were 11 years old they all completed an IQ test as part of the Scottish mental health survey of 1947. Every 11 year-old in the country had an IQ test.

So the unique thing that we can do with our study, having followed them up in old age, starting at age 70, is that we know their level of cognitive ability when they were 11 years old and can compare their cognitive abilities later in life to that baseline. We can ask questions such as whether there are still correlations with lifestyle factors, health factors, educational factors, socioeconomic factors in later life, after one controls for—adjusts for—the place where that person started in terms of their cognitive abilities.

We also measure within old age, so we have measured every three years from age 70. We are up to 82 now, and we are continuing. We have had MRI scans, very detailed blood biomarker assessments, as well as social, socioeconomic and personality assessments, and genetics and epigenetics. We have a wide range of data to answer many different questions about ageing.

The Chair: How big is your cohort?

Dr Stuart Ritchie: The Lothian birth cohort started with 1,091 people, so it is a relatively small cohort compared to some of the larger ones here, but it is unique because of the initial test at age 11. It is selected on that age 11 test.

The Chair: Is that size of cohort adequate to give you some of the answers related to life expectancy, such as healthy ageing, or to any other issues?

Dr Stuart Ritchie: Yes. It really depends on the effect size of the question—how large the question that you are looking at is. But we have adequate statistical power—that is, the power to detect the effects—to detect many different correlations with brain, behaviour and other aspects.

There are some smaller effects in the realm of genetics, epigenetics and other blood biomarkers that we need to combine our sample with other samples in large consortia. The Lothian birth cohort has been a very enthusiastic participant in many different consortia projects where we put our data together with other similar cohorts from all over the world and do large-scale genome-wide association studies, which are trying to find the effects of particular genetic variants on health outcomes, and we form part of those consortia.

Q13 **Lord Borwick:** There have been lots of ways of testing intelligence that

have varied enormously between 1957 and nowadays. How good do you think your predecessors' way of doing it in 1957 was relative to now?

Dr Stuart Ritchie: That is a very good question. We have the validation back from when they were 11 years old, when the test they were given was compared to the state-of-the-art intelligence test at the time, and it correlates very strongly with it. But it also, we find, correlates strongly with the IQ tests that we give nowadays. The Wechsler adult intelligence scale, which is the gold standard intelligence test, correlates fairly strongly with that position. One of the interesting results in fact is that we were able to look at the stability of intelligence and intellectual abilities across such a wide range of age, from age 11 all the way to age 82 now. In our older cohort we have another cohort, the Lothian birth cohort 1921, who are now over 90, and we can assess the correlation there.

We find that about half of the people's differences in cognitive abilities remain stable across the lifespan. But, yes, we do find that the intelligence test that was done in the Scottish mental health surveys back at the start of the 20th century was a decent measure of intelligence compared to what we use nowadays.

Professor Marcus Richards: Perhaps I might I comment on that, too, because of course this has been a controversial issue. Are cognitive tests and IQ tests capturing the functionality that we assume is behind them? Should we focus on other things, too, such as emotional intelligence or particular kinds of practical intelligence such as literacy and numeracy?

One answer, of course, is yes, but another answer is that these things correlate anyway. No matter what different kinds of cognitive tests we give people, they tend to correlate within a person, so a particular test, the kind that we have used, might be quite a good marker.

Dr Stuart Ritchie: We give a wide range, a whole battery, of cognitive tests, and the people who score very highly on the reasoning tests tend on average to score highly on the processing speed tests, where they are pressing a button and a light goes on, and on the memory tests, the tests of vocabulary knowledge, and so on. As you just heard, these tests tend to correlate positively together.

So there is this general ability that we measure, but we are also interested in the specific abilities that change.

The Chair: Viscount Ridley has a question.

Viscount Ridley: I will raise it later. It is about the details.

Q14 **Baroness Sheehan:** I have a series of questions about the key findings and trends across your cohorts. First, were there any similarities or differences across your cohorts and other cohorts, and why do you think that might be? Secondly, have there been any surprising results from your cohort studies, particularly with respect to health in older age? Thirdly, can you quickly compare your cohort studies with those in other countries?

Professor James Nazroo: Perhaps not surprisingly, there is great similarity in the findings from across cohorts. The different cohorts have different specialisms, a different focus, so there is some variation in what they concentrate on, but the broad pattern of finding is very similar. That is because most of these cohorts in some way represent the population from which they are drawn and consequently produce findings that are coherent across them.

On the question of surprising findings, I could probably list a lot, and I will try to focus on just two or three. One surprising finding that might not surprise us now but certainly did when it emerged was that more recent cohorts have the same or worse health than more distant cohorts. That means that the population is not getting healthier across younger cohorts. If anything, the health of more recent cohorts is worse than that of older cohorts. That emerged in the English Longitudinal Study of Ageing, but it has also been replicated in other studies and in government statistics from mortality data and so on.

That is one surprising finding. The second surprising finding for me was the extent of inequality in later life. There are very dramatic differences in the health of the richest and the poorest in the population that account for something like 15 to 20 years' difference in the health experience, so that those who are 50 in the poorest segment of the population have health that is similar to that of those who are 65 or 70 in the richest segment of the population. These are relative indices, so they are not about the extremely rich and the extremely poor. Related to that is the fact that the failure to improve the health of the population seems to be driven largely by the increasing poorer health of the poorest segments of our population.

That is one. Another finding, which may not be novel any more but certainly was, is the U-shaped relationship between age and well-being. It has been observed cross-sectionally, and we have now demonstrated it longitudinally, that as people head towards their mid-60s their well-being decreases, and as they move out of their mid-60s their well-being improves until they become ill, their partners die, or other adverse later-life events happen to them.

The third finding, which is more sociological, is the significance to people of meaningful roles as they grow older. This includes meaningful work roles, so it is not just meaningful roles more broadly but work, volunteering, caring, and so on. Meaningful, valued roles improve the health and well-being of older people. I will stop there, although I could say more, as I said.

Professor Marcus Richards: One of the key things that we concentrate on are chronic non-communicable diseases—hypertension, diabetes, and so on. They are driven largely by key-behaviour risk factors such as tobacco use, unhealthy diet, insufficient physical activity and hazardous drinking.

One of the key differences across the cohorts is in the growth of obesity, the major driver of which is obesity. Since 1946, every generation has been heavier than the previous one, and people are becoming overweight

at an earlier stage. In the 1946 generation, people reached overweight around the mid-40s. In the cohort of people born in 1970, that has dropped down to about 35. That means that people are living longer with these conditions, which will almost certainly impact on coronary heart disease, diabetes and arthritis, and that is projected to cost the NHS about £23 billion per year.

On the other hand, the proportion of untreated hypertension is decreasing, which is probably a cause of the reduction in the prevalence of dementia that is being observed not only in this country, with Carol Brayne's Cognitive Function and Ageing Study (CFAS), but in Sweden and the Netherlands. That reduction in untreated blood pressure, and improvements in access to education, are probably estimated to translate to about a 24% decrease in the prevalence of dementia.

One of the findings that surprised us most of all with the 1946 birth cohort was when we looked at the number of illnesses and medical conditions that people had at age 60 to 64. Like all these longitudinal cohorts, there is a retention of the more socially advantaged and the healthier, and a selective dropout over time of people who are less healthy, so we were surprised to see that on average, at age 60 to 64, people had two conditions. Only about 15% were disorder-free, about 20% had four or more disorders, and about 10% had five or more disorders: the most common were hypertension, obesity, raised cholesterol and diabetes or impaired fasting glucose. There is a small cluster with a very high probability of those conditions; another key factor was that they were in the poorest health in their mid-30s.[1]

Dr Stuart Ritchie: One of the key findings, which I have already mentioned, which is that people's differences in cognitive abilities remain relatively stable across the lifespan from 11 to later life. So people who tend to be at the top of the distribution of cognitive abilities tend, on average, to remain in that rank order of ability.

But there is some churn as well. One thing that we remain interested in is why some people age better than others. Within old age, we see trends with maybe one standard deviation of a decline of about 15 IQ points in cognitive abilities across the eighth decade of life from 70 to 79.

We have been able to couple that with changes in the brain, so we can study simultaneous changes in the brain; for instance, in the integrity of the white-matter tracts and in the brain's volume, surface area and thickness of the cortex—the outer layer of the brain. We have shown that those correlate with changes in cognitive ability, so we are trying to map out the patterns of where that is occurring in the brain and work out the exact biological basis of that cognitive decline.

We also find that very many factors throughout the lifespan, such as education and the complexity of someone's job, correlate with later cognitive ability. Perhaps one of the surprising findings is due to our ability to correct for the age 11 intelligence. For instance, we find that

[1] A cluster of one in five individuals had a high probability of cardio-metabolic disorders and were twice as likely than others to have been in the poorest health at 36 years.

quite a few factors correlate with IQ at age 70. Drinking more alcohol correlates with having a higher IQ at age 70, which seems like potentially good news, for some people, but when one corrects for the age 11 intelligence, that correlation goes away.

Our interpretation of that generally is that people of certain cognitive ability can select into certain social strata and tend to drink more alcohol perhaps because they go to more dinner parties, or whatever it happens to be, and it is not that the alcohol is causing them to have higher cognitive ability in later life; it is just that they had a higher cognitive ability all along.

That is one of the unique things that we can see with our particular, rare dataset. It is also the same for coffee, by the way, but it is not the same for education; people who stay in education for longer—they report how many years they stayed in formal full-time education—have a higher IQ in older age, even taking into account how smart they were when they were age 11.

We find this potentially positive effect of education, which is consistent with quite a lot of other studies, such as natural experiments. There is a really good study from Norway; the Government raised the school leaving age by a couple of years and forced people to stay in school for longer, which seemed to have a positive effect on later IQ. Our study hangs together with that, in that there are these educational effects, which is a really important priority that we can talk about.

Baroness Sheehan: As a quick follow-up on that, could each of you say whether you have found anything surprising in UK cohort studies compared with other countries' cohorts?

Professor James Nazroo: Apologies, I completely failed to answer the question about other countries' cohorts. I will answer indirectly to start off with.

Indirectly, the value of examining across other countries, using data from other countries, is great because there are differences in demography, culture, health and social care, and financial systems, so you can at least begin to investigate whether those systems make a difference.

A simple example is healthcare and thinking about something like hypertension, which Marcus mentioned. Within some of these cohorts, we have the ability to see whether someone has a diagnosis of hypertension, whether they have hypertension but it has not been diagnosed, and, if they have a diagnosis and treatment, whether the hypertension is well controlled. We can then compare across different countries and begin to examine whether there are important things about the provision of healthcare or other factors that might explain variations in the management of a condition such as hypertension or other non-communicable diseases such as diabetes, or whatever it may be.

We see, for example, differences between the UK and the US in the management of hypertension. Surprisingly, the US seems to do better than the UK, but we believe that this is driven largely by access, above

the age of 65, to healthcare without cost in the United States through the Medicaid system. Is it Medicaid or Medicare? I cannot remember which one, but it is one of those two systems.

The Chair: It might be that the monitoring system of diseases, including hypertension, is better.

Professor James Nazroo: The argument is that once you get above 65 in the United States, you get free access to healthcare, and the more intensive treatment in the United States may lead to greater control of hypertension.

Baroness Sheehan: That compares with our NHS, presumably. Do we not follow through with care for hypertension?

Professor James Nazroo: No, that is not the interpretation I would lay on what I have just described. Rather, it is the standard that we get in the NHS is equitable across age ranges. In the United States, it is not, but once you get above 65 you get free access, and in a culture where medical treatment is much more proactive you get better control once you get to see the doctor.

The Chair: The way the diseases are monitored is quite different. That might reflect on the outcomes that you referred to.

To go back to what you were saying, Professor Richards and Dr Ritchie, in your attempt to clarify I am not sure that you did not confuse me more. It might be me and the others got your message quite clearly. Did I hear you suggest, Professor Richards, that the incidence of dementia is likely to fall?

Professor Marcus Richards: If you correct for age. The risk of dementia doubles every five years after the age of 65, so we expect to see it going up exponentially.

The Chair: So the numbers will increase, but the incidence will fall.

Professor Marcus Richards: The absolute numbers are increasing as the older population is growing in size, but the age-specific incidence seems to be falling.

The Chair: Dr Ritchie, vis-à-vis that, I thought you suggested that IQ levels are falling, which is related to subsequent cognitive function in later life. If that is the case, we would expect the incidence of dementias to be rising.

Dr Stuart Ritchie: I mentioned that we have two cohorts and that there were two mental health surveys in Scotland, one in 1932 and one in 1947. If you compare them, actually the IQ level had increased across that time, because they were given exactly the same test. That is one of the findings in the literature in the 20th century: IQ has been progressively increasing across the generations about three IQ points per decade, if you count a decade as a generation.

One of the particularly fascinating questions is: if people start from a higher level, does that mean that it takes them longer to decline to a point where there is a functional impairment and they would be classed as having dementia on the basis of their cognitive abilities, and is there anything we can do to continue that rising IQ, which is called the Flynn effect after the research by James Flynn? Education, as I just mentioned, is probably one of the best-evidenced ways of doing that.

So it is not necessarily staving off or slowing the decline that people see in old age; there does not seem that much that we can do to stave that off, but there may be some aspects that we can discuss a little there. Raising people's IQ to begin with would probably have the largest effect on the levels of cognitive impairment and on the dementia that occurs later as people decline further.

The Chair: How strong is this correlation with education?

Dr Stuart Ritchie: For an extra year of education, we are talking of somewhere between one and four additional IQ points on people's levels. That presumably levels off; it is not as if, if you made someone stay in school for ever, they would become a genius from an average position. But we think from our research that is about between one and four IQ points for an extra year.

Professor Marcus Richards: We found something similar in the 1946 birth cohort, with people who went back into the educational system for whatever reason. Whether it was adult evening classes or job training, their cognitive function, even allowing for school-based education, was slightly improved.

Baroness Walmsley: Have you made a correlation with whether or not people living in an area with clean air? I understand that that can have an effect of cognitive ability, particularly in the very young child. Is there any correlation?

Professor Marcus Richards: We have certainly started to look at neighbourhood characteristics. Our focus so far has been more on mental health, but I would be very surprised if cognitive function does not behave in a similar way. Certainly living in a more deprived area there will be all kinds of negative influences. Atmospheric pollution, problems with the built environment, and so on, are from an early age associated with growth in anxiety, for example. That is taking account of one's own occupational and social status. Even with that control, there still seem to be residual effects of neighbourhood characteristics. Atmospheric pollution is becoming an increasingly big topic now, particularly in relation to later dementia.

Viscount Ridley: Before asking my main question I want to follow up particularly on the point about cognitive ability being relatively stable over the lifespan and the effect on it of education.

I can see that if you start with a higher IQ you will have a higher IQ at a

later point, but does that imply that dementia is not a disease that some people get and that it is a general decline? Surely what we know about vascular dementia, Alzheimer's, et cetera, is that they hit some people harder than others. Is there any evidence that starting with a higher IQ or having many more years in education are protective against these kinds of dementias?

Dr Stuart Ritchie: The concept in literature is called cognitive reserve: you start with a cognitive reserve, a higher cognitive ability, which means that you can decline for a longer period of time without getting to the point where there is functional impairment. This has been discussed a great deal. There is large debate in the literature among scientists as to exactly how one should define that concept. We were at a conference a few weeks ago where academics argued for several days about how to define the concept of reserve and resilience to cognitive decline and other related aspects.

But, yes, the evidence, as far as I can see, is that starting with a higher ability can be protective against the later diagnosis.

Q15 **Viscount Ridley:** That is interesting, I have to say.

I think that, in answer to the last question, you have answered fairly comprehensively a lot of the main question that I was going ask. It is: what are the main conditions or diseases covering physical and mental health that affect older people in your cohorts? How has this changed over time? What proportion are suffering from multiple morbidities? What are the links between those and lifestyle and genetics?

Unless you want to add anything to those issues, can I focus on the question of multiple morbidities? Professor Richards, you mentioned that, and it was brought up in the previous session with Professor Whitty. How striking is the difference that you are seeing, as these cohorts come through, in multiple morbidities turning up, in this generation as opposed to previous generations—if that is the right way of putting it; it might not be?

Professor Marcus Richards: First, multimorbidity itself is, again, like dementia, very age-specific. The risk of multimorbidity strongly increases with age.

The precise nature of the combination of different conditions is changing in different ways. Again, that is driven partly by changes in health behaviour. I mentioned obesity. The growth of obesity will be a huge driver of increased risk of cardiovascular and cardiometabolic diseases.

On the other hand, the prevalence of hazardous drinking has been falling, particularly in younger people, but not among older people. We will come on to messaging later, but that will be a particularly important target. Smoking, of course, is one of the biggest public health success stories in middle- and high-income countries. That has had a huge effect on respiratory diseases and, of course, lung cancer.

Viscount Ridley: Professor Nazroo, you talked about a U-shaped curve. Then I was rather surprised to hear you say that in your mid-60s you feel better. As I am heading that way, I am looking forward to that—

Baroness Manningham-Buller: You are a young person in this Room.

Viscount Ridley: —and then you feel worse again.

The Chair: Not in every way.

Viscount Ridley: Can you explain that? Is there an improvement in well-being as late in life as that?

Professor James Nazroo: We see an improvement in well-being as people head into their 60s and mid-60s, and then a decline. The decline appears to be driven entirely by the bad things that happen to you as you get older; you become ill—

Viscount Ridley: What explains the improvement, because surely you are okay in your 50s?

Professor James Nazroo: This is an interesting question. I do not think we know what explains that improvement, whether it is a kind of development of well-being that relates to looking back over your life and being satisfied with what has happened over your life, whether it relates to well-being in terms of personal development and the opportunities to develop personally as you grow older and are free from other kinds of responsibilities.

It is also interesting that the level of well-being is very strongly graded by socioeconomic position; again, the richest fifth of the population have much higher levels of well-being throughout that period than the poorest fifth of the population. The poorest fifth of the population, even at their best time, do not get to the levels of well-being of the richest fifth of the population at their hardest time.

Those are very interesting observations. As I say, the causes of this are not entirely clear. The causes for the decline in later life are, I think, straightforward.

Perhaps I might add to the multimorbidity theme and the question of whether multimorbidity is increasing in the population. You can define multimorbidity in a number of ways: you can count the number of conditions that are diagnosed, or, perhaps more interestingly, count the number of body systems that are involved in illness. Often, a diagnosis, or two diagnoses, might relate to the same body system. But in both cases we have really quite substantial levels of multimorbidity. I cannot remember the numbers that Marcus cited, but in the English Longitudinal Study of Ageing something like two-fifths of the 50-and-older population are classified as multimorbidity in their diagnosis. This is increasing to about 50% in more recent cohorts. Something like 15% of the 50-and-older population have more than one body system involved in disease.

This is increasing to about 20% in more recent cohorts, so we are seeing those increases.

To add to the multi-morbidity question, we also need to think about the other body systems. We quite often think about cardiovascular disease, respiratory disease, endocrine problems and so on, but we should also think about musculoskeletal conditions; mental health, crucially; and we have already mentioned cognitive decline. So we need to think about the range of systems that can be involved and the range of ways in which people's lives can become limited in later life.

Professor Marcus Richards: Perhaps I might add to the issue of well-being apparently improving in later life—at least in early old age. This originally came about as a result of a study by Oswald and Blanchflower—Blanchflower as in the government economic adviser. They put together information from multiple cohorts to build a composite age picture. There are problems with that, because the circumstances of people studied in old age at one time may have changed, so you are not necessarily comparing like with like.

But, as James said, it seems to be broadly holding up with the longitudinal studies. It is an extremely complicated issue, though, partly because we worry a little about response bias. —If you will forgive the jargon, socioemotional selectivity theory suggests that, as we get older, we stop trying to attain goals such as generating wealth and achieving status, and we move towards trying to maintain mental stability, so we will sometimes underplay negative things.

So there could be underreporting. Also, the scales that we use to assess emotionality in old age may not necessarily capture what is important. We have not been very good at capturing loneliness, for example, and that has become a hot topic now.

Q16 **Baroness Manningham-Buller:** I think that, rather as with Lord Ridley, you have answered quite a lot of the question I was going to ask about the social and behavioural determinations of healthy ageing. We have heard from Professor Whitty about some of these. Obviously, gender, vocation, ethnicity and education were mentioned in particular, you just mentioned wealth, and Lady Walmsley mentioned air quality. Do you think there are gaps in understanding the social determinants of healthy ageing that we are not studying and that we would benefit from studying to understand a fuller picture than we have now?

Professor Marcus Richards: I think that Professor Nazroo will answer this better than me, but we do not know nearly enough about racial and ethnic differences in health risk. From my own perspective in dementia risk and mental health studies, my Unit has custody of the SABRE—Southall and Brent Revisited—study, directed by Nish Chaturvedi. That is showing complex ethnic differences in outcomes, but we need far more research. Again, the challenges are formidable; for example, different ethnic groups' understanding of and familiarity with study conventions and test material.

Professor James Nazroo: As Marcus guessed, I have written "ethnicity" next to that question. One of the areas in which I do my research is ethnic inequalities. Before I turn to ethnicity, perhaps I might give a more general response.

When we begin to unpick the dimensions of area that are important, we gain a reasonably good understanding of the patterning of outcomes by socioeconomic characteristics, area deprivation and factors such as that, as well as pollution. There is a growing literature around pollution and around other dimensions of area deprivation.

From a science point of view, of course, we are interested in mechanisms: trying to unpick the mechanisms that link the deprivation or the socioeconomic to the outcomes. That science is underdeveloped. From a policy point of view, you might think it might not be so important. We know the patterning; we know the areas that are vulnerable; we know where we can begin to make interventions. Understanding the mechanisms helps us understand what kinds of interventions might be valuable. As I mentioned briefly earlier, some of the things that people do beyond work—the roles that they fulfil and the returns they get from them—are very important and explain some of the socioeconomic inequalities that we see. Volunteering is an example.

The big gap is the one that Marcus just mentioned, which is around ethnicity and ethnic inequalities. The work that I and a few others have done in this field has shown that ethnic inequalities in later life in terms of health and other outcomes are dramatic. The health of a 40 year-old Pakistani or Bangladeshi person is equivalent to that of a 70 or 80 year-old white British person. We have some data that describe these findings—I have just drawn on them—but basically, we have a huge gap in data in the United Kingdom on the health and well-being outcomes of older ethnic minority people.

Baroness Manningham-Buller: Is there any analysis or interpretation as to why that is so?

Professor James Nazroo: Yes. The simple explanation, of course, is related to the various forms of disadvantage that ethnic minority people face. Disadvantage is not consistent across different ethnic groups. That ethnic differences increase as people get older is probably driven by some accumulation effect of disadvantage, but these are very limited data. As I said, we have very little data in the UK to examine ethnic differences in equality in health in later life. For the data sources that we have, particularly the early birth cohorts, there were very few ethnic minority people to be sampled. A study such as the English Longitudinal Study of Ageing samples at a population-representative level. In the older segments of our sample, some 3% or 4% of the sample is ethnic minority—not enough numbers to be able to do any meaningful analysis of ethnic difference.

Typically, we would boost a survey to obtain high enough numbers of participants to analyse, but this is very expensive to do and, as Marcus said, we need to tailor our instruments to the biographical and cultural

specificity of ethnic groups. It is a challenge, but it is an important gap in data in the UK.

Dr Stuart Ritchie: Perhaps I may add a methodological point. It is not just that there are certain types of data that we are not looking at; it is that are certain types of analysis that we cannot do in these cohort studies, such as really understanding causal factors. We find correlations in these cohort studies, but they are just observational studies. They can generate hypotheses which can then be tested and we can draw on them, but we must bear in mind that most of the results that we take from them are correlational and not causal.

Anything that we talk about that is a relationship in our cohort between one variable and another—not even the specific risk factors that we have talked about here—is subject, like any epidemiological finding, to enormous reverse causation and confounding problems where it could be something else that is causing it; A could be causing B, or B could be causing A. There are some new methods in epidemiology that use genetics to try to tease apart the causal pathways between variable A and variable B. I suspect that we should be doing more of that and less of the observational epidemiology, although, obviously, the observational epidemiology is extremely important to generate those hypotheses in the first place.

Professor James Nazroo: I would slightly, but not entirely, disagree with that and say that there is some movement towards understanding causal processes that we can make with observational studies.

Dr Stuart Ritchie: Sure, yes. The genetic method that I mentioned, Mendelian Randomisation, is one of those.

Q17 **Baroness Young of Old Scone:** If you were the Government, knowing what you know from your cohort studies, what would you say were the priorities for public health messages? Are they having any impact and what could be done to make them have more impact?

Dr Stuart Ritchie: Perhaps I can start with a slightly more pessimistic message. If you look across all the findings from our cohort and from many others, and from reviews of cohort studies and so on, you see that in the majority of cases—for instance, for cognitive ageing, which is obviously my specialty—there is not just one factor that we should be doing a big public health campaign about. Many different factors seem to add up to make the differences between individuals in terms of their cognitive abilities and cognitive decline.

Perhaps the message that I would take away—we have written about this in our cohort—is the idea of marginal gains, as we talk about in sport. Instead of there being one thing that you can change, change lots of different factors, whether it is to do with education, smoking, physical fitness and many other aspects. Change many aspects rather than one thing. It sounds like an obvious point, but any focus on one factor will always be incomplete. If we read some of the studies, we see that they are written up as if there is just one thing that we are interested in, and they do not look at the entire spectrum of variables, multiply adjusting

for lots of different variables and the relations between them. Many of Marcus's studies build up complex patterns of different variables, which is what we should be doing rather than just correlating one factor—diabetes or whatever it happens to be—with cognitive abilities, which is what often happens in literature.

Professor Marcus Richards: The work that we do with the birth cohorts shows us that our lives are linked throughout the entire life course and that there is no one period of a life course that is necessarily more important than another. Sometimes, an intervention will have to be followed right through the years.

If I had to pick one thing or policy-relevant issue as a focus for public health intervention, it would be access to education. That is of course a political topic now, with increased discussion over the years about bringing back selective education. That was a big focus of the 1946 birth cohort in the years of James Douglas, the person who founded it: who went to what kind of school and why, and what the consequences were.

I mentioned education in the context of its probable role in the declining prevalence of dementia, but perhaps I may give a more technical example of how we see that working. We looked at the relationship between education and later cognitive function in the 1946 birth cohort and compared it with that in the 1958 birth cohort—the next youngest one. That relationship was much stronger in the younger cohort. Why? Because in the intervening 12 years the Government had raised the minimum school leaving age from 15 to 16, resulting in a huge increase in the proportion of children leaving school with at least some qualifications.

We can use that kind of cohort comparative work to track the effects of policy. So that is one I would particularly focus on. Educational gradients are observed in a wide variety of health-related outcomes, so any educational policy is likely to have profound impacts on health and wealth.

Baroness Sheehan: So education over physical activity?

Professor Marcus Richards: I would not like to prioritise; both are highly important. If I were forced to choose, I would say that investment in education has a wider range of consequences.

Q18 **Baroness Young of Old Scone:** Professor Nazroo, I have one last question about your study. I cannot find it now in the evidence, but there was something about end-of-life interviews, but the concept fascinated me. How do you get an end-of-life interview?

Professor James Nazroo: Could I answer that question after I have answered your initial question, if that is okay, just to avoid being distracted?

On recommendations for where policy could focus, you have three academics in front of you and probably 10 views between us. I would

bring this back to one of the surprising findings that I mentioned earlier, which is that, despite the increases in life expectancy, although these might be stalling, younger, more recent cohorts have worse health than more distant cohorts. That appears to be driven by the poorer health that is occurring among the poorer segments of our population.

So to deal with the current challenges that we face with older populations and to maximise opportunities for older people, we should focus on addressing the question of inequality and the more deprived segments of our population. That means focusing on the opportunities that might be there for them, and so thinking about transitions—how people retire and whether they retire in positive or negative ways—retirement policies, and later-life work where it is rewarding and engaging. That is more important than pay, although pay is of course very important. It means also focusing on localities, so thinking about housing, green space and transport within localities and about the opportunities that a locality provides for an older citizen to engage in a range of volunteering and other types of activities that give them return and reward.

In all of that, if we focused on the more deprived, we get a very big hit. That requires both central government policy on retirement and later-life work but also local government activity in dealing with green space, transport, housing, volunteering, supporting volunteering, and things such as that. Education is also crucial.

Q19 **Baroness Young of Old Scone:** Some of things that all three of you have been saying have indicated that interventions at a much younger age are pretty important. Is that a piece of public policy that is being picked up?

Professor James Nazroo: This is where a lot of the argument has been placed so far, but I am arguing, as I think Marcus also did, that it is not just one point in life that matters; it is across the life range that matters. Investments in later life are also very important, and the kinds of things that I talked about earlier, including investments in education and educational opportunities for people in their 50s and older, are very important. It is also about shifting people off negative trajectories and using things such as the retirement transition as an opportunity to shift people off negative trajectories.

On end-of-life interviews, we follow our participants for as long as they allow us to and until they die. Obviously, we interview them at some point before their death, but we also ask our participants to nominate somebody who we can interview if they are not available or if they have died. At that point, we interview someone as close to them as we possibly can, who then tells us about the things that happened in the period leading up to their death. Of course, this is very important, because, for example, use of NHS services becomes very concentrated in the period leading up to death.

There are also things such as the ways in which people deal with their assets and how they plan to deal with their assets, and so on. We collect

that kind of information from an informant after the death of the participant.

Q20 **Lord Kakkar:** I want to turn to the funding of these very large longitudinal cohorts. How are they funded? How are you certain about the security of funding? How do you find funding for additional analyses not envisaged at the time when the cohorts were established? What would the consequence be if that funding were not available or were less certain?

Professor James Nazroo: The English Longitudinal Study of Ageing is funded from two sources. One is from the United States National Institutes of Health. They fund us primarily because of the scientific value, but also because that scientific value allows comparison between the United States and the United Kingdom. They pay for approximately half the costs of running the study.

The Chair: Do they have access to your data?

Professor James Nazroo: The data are made publicly available to any academic through the UK Data Service, which I will return to in a moment.

A second source of funding is government departments, primarily the Department for Work and Pensions and the Department of Health. The Department for Transport has also contributed regularly, and other departments have contributed on and off. They pay for the other half of our costs. The Economic and Social Research Council has contributed money to the running of the study over time.

This is money for the running of the study; we have to bid for renewal every four years—so for every two waves of data collection. Obviously, if we fail, the study ends. So far, the quality of the study has been deemed to be high enough for funding to be continued, but we do not have any core funding as such—it is this four-yearly cycle of bidding.

The data are publicly available. Other people also bid for funding to use the data, as do we. That money comes from a variety of sources. The research councils are a prime source of funding for analysis. Smaller charities such as Age UK commission relatively small pieces of work. I have done some work for the Pocklington Trust, a charity concerned with visual impairment. Those are small studies.

Professor Marcus Richards: The 1946 birth cohort has been continuously funded by the Medical Research Council for many years. The younger cohorts have historically been funded by the ESRC, reflecting more of a social science focus. On top of that, we are all encouraged to generate our own funds to buy out that core funding. Independent external researchers will often bring their own funds to conduct a set of analyses. Typically, that funding comes from charities and foundations.

I should emphasise that this core funding is by no means guaranteed. For the MRC, our funding is renewed every five years. We go through what is called a quinquennial review. It is a process with extremely sharp teeth.

If the sub-committee decides that a programme is underperforming, it will stop the funding for the programme leader and close it down. If it decides that it does not like the look of a whole unit, it will close a whole unit down—both of these have occurred. We therefore have to justify that funding at every stage and make a strong case and, in doing so, update what we are doing—transitioning from mid-life to relevant work to older age.

The data from those cohorts are mostly publicly available. The ESRC-funded cohorts are simply downloadable if one shows academic bona fides. The MRC cohort has about the same data-sharing access as Biobank. It is a managed collaboration, but we have made access to that progressively easier over the years.

Dr Stuart Ritchie: Funding for the Lothian birth cohorts has come in the main from Age UK, to which we are extremely grateful. It has been wonderfully supportive over the years. For each new wave of the study, we make a new application to continue the project. So far, we have been successful with that. As you have just heard, the funding we receive is not assured and we keep having to apply for new funding. We have also had funding from several research councils, mainly the Medical Research Council but some others. As for other sources, we have just received a grant from the National Institutes of Health in the US, specifically its National Institute on Aging.

In answer to your question about what would happen if we did not get funding, the Lothian birth cohort is unique because of the early-life data that we have. Some of the other birth cohorts are not quite as old but have just as large an amount of data. If we lost funding for any of these cohorts, it would be a huge tragedy. Some of them are the jewels in the crown of UK scientific, medical and epidemiological research, and it would be tragic to lose track of these people and let those data come to nothing. We have been working as hard as we can to make the strongest case to continue these studies for as long as possible and will do so in future.

Q21 **The Chair:** What contribution can cohorts such as yours make to the Government's grand challenge on healthy ageing?

Professor James Nazroo: They provide fundamental information for those grand challenges in order to understand how populations are ageing, the implications of that and how the various complex dimensions of ageing interrelate. This is the scientific evidence that underpins those grand challenges.

The Chair: Have any of you been asked to contribute to it?

Professor James Nazroo: The English Longitudinal Study of Ageing provides evidence. Yes.

Dr Stuart Ritchie: We have not been as far as I am aware, but we would be happy to if we are asked. It is likely that our study has been used because it is all published in the literature and freely available and so on.

The Chair: Thank you very much indeed for helping us today; it has been most useful.